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ASBESTOS IN DEVELOPING COUNTRIES: MAGNITUDE OF RISK AND ITS PRACTICAL IMPLICATIONS

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Abstract. In developing countries, aggressive marketing of chrysotile asbestos continues as a result of restrictions on its use being imposed by the developed countries. In the Asian continent, China and India are emerging as the major users of asbestos. There is enough evidence to link chrysotile with pulmonary fibrosis and lung cancer in humans, even at low levels of exposure, hence the need to apply the Precautionary Principle for phasing out its use globally. Due to poor occupational health and safety systems in developing countries and difficulties in early detection of pulmonary malignancy related to asbestos, the statistics remain sketchy. This is hampering efforts to create pressure on policy makers and to counter the propaganda of the asbestos industry. The International Labour Office believes that more than 100 000 deaths a year occur from asbestos-related disease. In the view of studies published in Europe and Australia, the number of deaths due to such malignancies will peak around the year 2020 and could be anywhere between half a million to a million. That means more than a million deaths will occur in developing countries. At about the same time when asbestos-related deaths start to decrease in developed countries, their number will begin to rise in developing countries. This presents a major challenge to the international scientific community.

Key words:
Chrysotile, Mesothelioma, Developing countries

INTRODUCTION

Despite technical difficulties, the process of replacing asbestos with safer materials is well worth a try in developing countries, to stop further release of asbestos into the environment. Aggressive marketing of asbestos is continuing in these regions after shrinkage of the market due to restrictions and bans imposed on the use of asbestos in many developed regions where its use is down to insignificant levels [1]. Notwithstanding the production and use of asbestos in developing countries is still a contemporary issue. There is huge gap between the perceptions of producers and users on one hand, and the scientific community on the other. A leading asbestos-based cement products manufacturer in India, in a document presented to the Indian Ministry of Environment and Forests [2], quoted Peter Elms as saying: "Reviewing the current evidence published and unpublished, it seems likely that chrysotile uncontaminated by tremolite may not have caused any mesothelioma even at high cumulative life-time exposures" [3]. The document further contains several scientific references supporting such erroneous assertions. The industry continues to assert that mesothelioma affecting chrysotile-exposed workers was caused by its contamination with amphiboles. The suggestion that there may exist a threshold level of exposure to asbestos below which no carcinogenicity is evident has been regarded as entirely

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speculative and not based on facts and as such there is no room for relaxation of public health controls on chrysotile asbestos [4]. Reviews of a number of studies on workers exposed to asbestos have established incontrovertibly that chrysotile asbestos causes cancer of the lung, malignant mesothelioma of the pleura and peritoneum, cancer of the larynx, and certain gastrointestinal cancers [5]. A 25-year longitudinal study of 515 male asbestos plant workers exposed only to chrysotile asbestos in Chongqin, China, found no evidence in support of the "amphibole contamination" hypothesis. Further, the study demonstrated that exposure to uncontaminated chrysotile asbestos may be related to an increased risk of lung cancer to an extent comparable with that caused by mixed-type asbestos and that exposure to pure chrysotile can also cause lung cancer [6]. Though the most dire predictions of an epidemic of asbestos related disease due to very low levels of exposure to asbestos, largely chrysotile, may not have materialized, it is premature to liberalize current instance from the public health point of view and regard chrysotile as less hazardous. In the intervening period, scientific inquiry and debate may continue until the biological effects of all mineral fibers are understood [7].

RISKS ASSOCIATED WITH ASBESTOS USE

The magnitude of the risks arising from continued asbestos use have now been well documented with Peto's study predicting that a quarter of a million men in western Europe will die of asbestos-related cancer in the next 35 years. Peto et al. [8] estimate that mortality from mesothelioma, mostly resulting from past asbestos exposure, will increase from 5000 a year in 1998, to 9000 in 2018.

RISK OF ASBESTOS USE IN DEVELOPING COUNTRIES

Its high tensile strength, chemical and thermal stability, high flexibility, low electrical conductivity, and large surface area make asbestos a cost-effective commercially viable material, and the asbestos industry is in an upbeat mood in India. At the same time the local scientific community has started challenging the asbestos industry. In a recently convened international symposium in New Delhi to discuss the phasing out of asbestos use, delegates urged the Indian government to close mining and milling of asbestos in India and provide medical follow-up and compensation to the affected workers [9].

Whereas developed countries are gradually moving to ban chrysotile asbestos, the developing countries are not sure how to handle this challenge. Many in the medical fraternity work in collusion with the asbestos industry. The industry is using aggressive strategies to market its products and organizing meetings for "Strengthening Responsible Use" [10]. The asbestos industry in developing countries is opposed to a ban and threatens those who want to put forward a scientific viewpoint highlighting the dangers of continued chrysotile use [11].

The concern now is that industries that are heavily regulated in the industrialized world due to their harmful environmental and health impacts are migrating to the developing world. The asbestos industry is an example. Production of asbestos is being transferred from developed countries to countries such as Brazil, India, Indonesia, Pakistan, and Korea. Asbestos use is on the wane in industrialized countries and the surplus produce is being exported to Angola, Argentina, India, Mexico, Nigeria, Thailand, and Uruguay [12].

The asbestos production trends in developing countries are shown in Table 1.

The growing use of asbestos in developing countries is a matter of concern since the International Labour Office (ILO) estimates that between 610 000–635 000 deaths are caused annually by work-related cancers. The asbestos component of this figure may be as high as 100 000, including lung cancer and mesothelioma, assuming that the world labor force is about 2.7 billions [13].

Developing countries are now fast replacing the developed ones in the production and use of asbestos. Brazil occupies the fifth position in world asbestos production and consumption, after Russia, Canada, Kazakhstan, and China. Brazil produces 237 000 tons of asbestos per year and exports about 70 000 tons to Japan, India, Thailand, Nigeria, Angola, Mexico, Uruguay, and Argentina. Since

Table 1. Asbestos production in developing countries (values in metric tons)*

Country	1995	1996	1997	1009	1999
Argentina**	300	446	400	380	350
Brazil**	170 000	170 000	170 000	170 000	170 000
China**	263 000	293 000	288 000	314 000	300 000
India	25 065	23 215	25 051	18 751	20 000
Iran**	4500	4500	4500	4500	4500
Swaziland	28 570	26 014	25 888	27 693	28 000
Zimbabwe	169 256	165 494	144 959	123 295	135 000
South Africa	88642	57 120	49 986	27 195	20 100
Egypt	427	1836	2000	2000	2000

* From US Geological Survey, Year Book, 1999.
** Estimated value.

25% of the deaths have no defined cause, it is impossible to estimate the cancer mortality rates or the lung cancer and asbestosis prevalence associated with asbestos exposure [14]. This is true for almost all developing countries; it is difficult to establish the diagnosis of occupational diseases that frequently get unreported. Partly legislation is to blame for not keeping pace with changes but staying where it was 30 years ago, despite the expansion of industry. Asbestos-related disease does not figure on the list of conditions compensated for work-relatedness in 1999 in Thailand [15].

In Morocco, a large number of employees of small informal workshops (mechanics, sheet-iron workers, body shops, brake filters, makers of dental prostheses and jewelry, plumbers, etc) use asbestos. About 150 firms import 8500 tons of asbestos annually, mainly from Canada. Importation and sales of asbestos products are not subject to any form of approval or authorization by the government [16].

A country like India with well developed institutions and a long history of legislation still does not accept mesothelioma as a notifiable disease (occupational disease) under The Factories or The Dock Workers (Safety, Health and Welfare) Act [17,18]. India has a thriving asbestos-based industry and imports asbestos from Canada and other countries, but the dock and factory workers remain outside the orbit of the law. Only the Mines Act, and the rules made thereunder, accept mesothelioma as a notifiable disease [19].

The hazards of asbestos used in construction in developing countries are largely unappreciated. The building industry operates without much regulation and is difficult to supervise because the workers are unskilled, migrant in nature, and possessed of limited bargaining power due to low levels of literacy and poor socio-economic conditions [20]. Waste disposal issues are not high on the agenda in many developing countries and asbestos-containing waste may be treated like ordinary waste and disposed of without due care, creating a serious risk to health and safety. In Taiwan a problem was created when asbestos product manufacturers dumped their waste in their backyards, or in the form of regular household garbage [21].

POSITION OF INTERNATIONAL ORGANIZATIONS

The International Agency for Research on Cancer's (IARC) summary on the carcinogenic effects of asbestos mentions that occupational exposure to chrysotile, amosite, and anthophyllite asbestos, and to mixtures containing crocidolite, results in an increased risk of lung cancer, as does exposure to minerals containing tremolite and actinolite and to tremolitic material mixed with anthophyllite and small amounts of chrysotile. Mesothelioma has been observed after occupational exposure to crocidolite, amosite, tremolitic material, and chrysotile asbestos [22].

The WHO Environmental Health Criteria document 203 on chrysotile asbestos clearly recognizes that "exposure to chrysotile asbestos poses increased risks for asbestosis, lung cancer and mesothelioma in a dose-dependent manner" [23].

The World Trade Organization verdict of 2001 upheld the rights of the member states to ban chrysotile asbestos and acknowledged that chrysotile is an established carcinogen

with no safe levels of exposure. "Controlled use" is not an effective alternative to a national ban [24].

The Collegium Ramazzini has stated that asbestos has been responsible for more than 200 000 deaths in the US, and it will cause millions more deaths worldwide. The profound tragedy of the asbestos epidemic is that all illnesses and deaths related to asbestos are entirely preventable [25].

The continued use of asbestos in developing countries may well trigger an epidemic of mesothelioma and lung cancer in the future as is now being experienced in Europe and Australia.

To date, Australia has had the world's highest reported incidence of malignant mesothelioma, with one of world's most complete national surveillance systems in operation since 1980. Australia has had 6329 cases of mesothelioma from 1 January 1945 to 31 December 2000. Currently 450–600 cases are notified annually in a population of 20 million. This high incidence of mesothelioma is related to high past asbestos use, of all fibre types, in a wide variety of occupational and environmental settings [26].

INDIA: A LEADING DEVELOPING COUNTRY

Despite its pro worker slant, India has behaved in an incomprehensible way regarding the importation of asbestos. Prior to March 1992, the import duty on foreign fibre was 110%, whereas in April 1992, the duty was brought down to 80%, a reduction of 30%. This was further reduced to 50%, a reduction of another 30%. This brought down the landed cost of imported asbestos by 25-30%. This may have been done under the influence of asbestos industry [27].

The domestic production of asbestos in India has decreased due to large scale imports from Canada. Several states in India have asbestos-based industrial units. Asbestos as a raw material is imported without any warning but finished products are exported describing them as hazardous. The health and safety in the work place is abysmally poor [28].

Despite high exposures, widespread use of asbestos and few occupational health and safety measures in force, there are no reported morbidity and mortality figures available from the Indian Labour Ministry. Only one case of asbestosis was reported during a five-year period (1978–1983) [29] (Table 2).

Table 2. Occupational illness distribution in India, 1978–1983*

Notifiable diseases	Cases
Benzene poisoning	10
Nitrogen fumes	1
Chromium poisoning	9
Toxic jaundice	5
Halogen poisoning	10
Dermatitis	3
Toxic anemia	2
Pneumoconiosis	11
Asbestosis	1
Byssinosis	62
Hearing loss	4
Lead poisoning	3
Bronchitis	1
Acid fumes	2
Silicosis	1
Chromium-induced nasal perforation	15
Unspecified	51
Total	191

*Derived from [29].

India is a high consumer of asbestos and most of the products manufactured are consumed domestically (Table 3, Fig. 1).

OCCUPATIONAL HEALTH AND SAFETY IN THE INDIAN ASBESTOS MINING AND MANUFACTURING SECTOR

Epidemiological studies and occupational health surveys conducted by the National Institute of Occupational

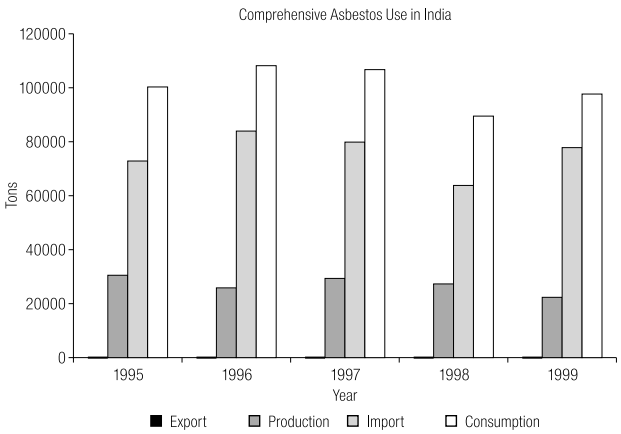

Fig. 1. Comprehensive asbestos use in India. Derived from [27].

Table 3. Annual mining, import, export and use of asbestos in India, 1995–1999 (values in tons)

Year	Export	Production	Import	Consumption
1995	151	28 326	70 171	98 346
1996	14	23 844	81 924	105 754
1997	275	27 180	77 498	104 403
1998	282	25 537	61 474	86 729
1999	264	20 111	76 094	95 941

Health (NIOH) of Indian mines have found lung impairment and radiological abnormalities in asbestos milling workers (54.8%) and miners (19.5%) [30].

Another study of asbestos in the milling process found asbestos levels higher than the Indian standard for chrysotile asbestos of 2 fibres per cm^3 (Table 4). The highest fibre levels recorded were 33 times higher than the prescribed threshold limit. This came after an earlier study where the investigators had recommended process improvement and other measures to control exposure to asbestos [31].

Sporadic cases of mesothelioma get reported in India without linking them to asbestos exposure. Five cases of mesothelioma were diagnosed in rural community. Those diagnosed were associated with sugar-cane farming but the authors did not ascertain if there was any environmental or occupational exposure to asbestos [32].

In another case series, 15 cases of primary pleural mesothelioma were detected on histopathological examination of 76 239 surgical biopsies, of which 234 were pleural specimens, giving an incidence of 0.02% and 6.4%, respectively. The authors lamented the late reporting of the cases, which created difficulty in establishing a diagnosis and differentiating them from cases of primary lung adenocarcinoma or metastatic tumor [33].

The asbestos issue was much publicized in India when the Indian Supreme Court intervened in 1995 by delivering a historic judgement to protect asbestos-exposed workers. In its verdict the court decided that the provisions of the ILO Convention No. 162 on asbestos be implemented in all workplaces. Despite such interventions, health records of workers are generally not maintained, workroom monitoring for determination of asbestos exposure is seldom performed, and the permissible limits of exposure continue to be high [34].

CONCLUSIONS

The asbestos debate may continue for some time to come, but successful interventions have already been made by the developed countries to prevent further exposures either by severely restricting all forms of asbestos use or by placing a ban on its use. The focus now shifts to developing countries where the asbestos industry is down, but not out. The industry continues to harp on about a "controlled use" approach to prevent exposure and protect workers. This is highly unlikely, given the fact that there are serious shortage of trained manpower in all disciplines of occupational health in developing countries. According to WHO,

Table 4. Operation-wise average fiber concentration in processing plants in Rajasthan [27]

S. No.	Operation	Average fiber concentration (f/cc)	8 h exposure concentration (f/cc)	Annual exposure concentration (f/cc)
1	Feeding	2.69	2.37	1.94
2	Bagging	6.42	5.65	4.63
3	Carrying	2.83	2.49	2.04
4	Miscellaneous			
	– Office	0.20	0.18	0.14
	– Rest room	0.75	0.66	0.54
	– Outside plant	0.61	0.54	0.44

only 5–10 % of workers in developing countries, and 20–25% of workers in industrialized countries (with a very few exceptions), have access to occupational health services, in spite of an evident need at almost every place of work. This would imply that it is virtually impossible to practice "Controlled Use" due to technical constraints [35].

From the projections by Peto [8] that some 250 000 workers will die in Europe over the next 20 years because of past exposure to asbestos and that an equal number may die of lung cancer, a total of half a million deaths will occur in Europe due to asbestos-related malignancies. Further, if the deaths related to asbestos in North American and in other developed countries are added, the figure may be close to a million. These will peak around year 2020 and would then start declining. The ILO believes that more than 100 000 workers die every year due to asbestos-related malignancies. This means that some 2 million workers will die of asbestos-related cancers by 2020. If the deaths likely to occur in developed regions are subtracted, it will still mean that more than a million will die of mesothelioma and lung cancer in developing countries. These may be crude estimates but they give some indication of the scale of tragedy that has already started to unfold in developing countries. Paradoxically, when asbestos-related deaths start declining in some 20 years from now in Europe and Australia, the developing countries may begin to experience a rise in such deaths due to exposures occurring after 1980 when asbestos consumption started to rise in developing countries.

This is unacceptable given the fact that such deaths are entirely preventable, like other occupational diseases. There is no reason to be complacent and wait. Global action is required to apprise developing countries of this impending danger. The challenge before us is how to convince policy makers to integrate science into policy making. They should be urged to embark upon precautionary measures to phase out all forms of asbestos use. This is the only way they can prevent a human disaster of unimaginable proportions. It is time for India to work towards attaining the goal stated in the National Mineral Policy, which is to minimize the adverse effects of mineral development on the forests, environment and ecology, through appropriate preventive measures; and to ensure that mining operations are conducted with due regard to the safety and health of all concerned [36].

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countries had already reached a constant level before the health effects of asbestos were widely debated. Because of its specific technical properties, asbestos has found an extremely large variety of applications (in about 3000 different products). In the future, legislative restrictions and the success in finding substitutes for asbestos in fibre-cement, brake-linings, insulation and many other applications will most probably lead to declining asbestos consumption in the above-mentioned countries. Asbestos emissions occur during processing. When air filtration is used, the dust emissions fro