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Asbestos and asbestos waste management in the Asian-Pacific region: trends, challenges and solutions

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ABSTRACT

With of the rapid economic development of the Asian-Pacific region during the past several decades, asbestos products have been used, and asbestos waste generated, in large quantities, while issues of occupational hazards and environmental risks have not been given adequate attention. In order to better understand the asbestos management situation in this area, this study selected 13 countries that consumed more than half of the global quantity of asbestos in 2011; researched information on asbestos production, consumption and import; compared data from developed and developing countries in the region; and predicted the amount of asbestos waste that would be generated in the Asian-Pacific from 2013 to 2022. Then, related aspects such as regulations and authorities, occupational exposure and follow-up medical care, asbestos waste treatment, awareness-raising activities and possible substitutes for asbestos, were discussed and analyzed. Asbestos waste, at an estimated generation of 48.8 million tons, should be efficiently disposed of or recycled with new technologies and treatment facilities in the region. What't more, the governments of these countries should take action to regulate the mining and processing of asbestos or asbestos-containing products, set up and equip medical facilities for asbestos-affected communities, search for asbestos substitutes, raise public awareness, and seek international cooperation for asbestos waste management. The article is specifically intended to be used as a basis for the development of new strategies and policies for asbestos waste management, and for investments in new waste treatment facilities, for decision makers at all levels of government and in private industries in the region.

1. Introduction

Asbestos—a general term applied to certain fibrous minerals of two configurations: chrysotile (derived from serpentine minerals) and amphibole—is a naturally occurring mineral with long thin fibers. All of the asbestos used in the world today is chrysotile, also known as white asbestos. Because of its great tensile strength, poor heat conduction, non-biodegradability and relative resistance to chemical weathering, asbestos is widely used throughout the world, particularly as a building and insulation material (Offices of WHO and UNEP in Beijing (2008)), and over 3000 different types of commercial products contain concentrations of asbestos (Harris and Kahwa, 2003).

The rapid economic development of the Asian-Pacific region has led to the wide use of asbestos in construction and other industries there, a situation exacerbated by the lack of cost-effective alternatives and the relatively low public awareness of the dangers of asbestosis. The lack of adequate personal protective gear for workers in asbestos production and related manufacturing industries has resulted in an alarming number of asbestos-related disease cases, in varying degrees (Felten et al., 2014). Furthermore, although end-of-life products containing asbestos are hazardous waste that needs to be treated in an environmentally sound manner, such wastes are often stacked in open fields, exposed to air, without effective protective procedures. Many middle- and low-income countries still use asbestos, following a pattern set decades ago by higher-income countries (Giang et al., 2010). Some Asian countries, such as Japan and Korea (Republic of), have already instituted asbestos bans; but other countries, including Burma, China, India, Indonesia, Iran, Malaysia, Nepal, Pakistan, Philippines, Thailand and Vietnam, continue to produce and use asbestos and related materials and products; in particular, India and China

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remain heavy users. Currently, however, the Asian-Pacific region is facing more and more outside pressure for dealing with diseases related to asbestos.

Many recent studies have focused on the importance of banning asbestos production, asbestos exposure, and asbestos-related diseases, while offering no specific path for how to achieve that goal—i.e., how this region can resolve these problems and apply environmentally sound management to the existing asbestos waste (AW) to reach these desirable targets. So far, no comprehensive study of the asbestos and AW management situation in the Asian-Pacific region has been performed. This study, therefore, attempts to fill that gap, using thorough investigation techniques and face-to-face information exchanges; comparing potential policies, regulations, and treatment facilities; and engaging labor, producers, and government regulators. It attempts to determine the challenges and difficulties in AW management, and to propose suggestions for future actions to establish environmentally sound management (ESM) of AW at the national and regional levels.

The remainder of this document is organized as follows: Section 2 is a review of the literature of opinions on asbestos and AW; Section 3 describes the methods used for data collection, analysis, and discussion; Section 4 is a framework incorporating six critical points that can be used to help address the asbestos management problems in the region; Section 5 contains the main conclusions; and Section 6 states the future work.

2. Literature review

Whereas asbestos and asbestos-containing materials (ACM) have been used for over a millennium, evidence for respiratory diseases associated with occupational and environmental exposure to asbestos fibers has led to diminishing demand for products containing the fibers (Malcolm, 2013). Asbestos has been classified as a known human carcinogen, Group I, by the International Agency for Research on Cancer (IARC) (IARC, 1987; WHO, 2006). According to World Health Organization (WHO) data (WHO, 2010), more than 107,000 people die annually from asbestos-related diseases including lung cancer, mesothelioma and asbestosis resulting from occupational exposure (Deng et al., 2009; Wang et al., 2013; Ndlovu et al., 2013), with an average latency for cancer as long as 20–30 years, and a median latency of 22.8 years (95% confidence interval (CI) 16.0–27.2 years) (Frost, 2013). In June 2006, the 95th General Conference of the International Labor Organization (ILO) endorsed a resolution concerning asbestos, requesting to actively promote a global ban for all types of asbestos and asbestos-containing materials (ACMs) in all member states (ILO, 2006). Referring to findings of numerous research studies, some experts have appealed to countries to cancel asbestos mining and abandon the production and use of ACMs (Ramazzini, 2010; Aguilar et al., 2013; LaDou et al., 2010), but there are also experts from organizations such as the Chrysotile Institute (2011) urging the safe and responsible use of chrysotile for its beneficial characteristics such as affordability, durability, ability to withstand extreme temperatures, and resistance to rust (Talha, 2009). Out of the 143 countries that consumed asbestos between 2003 and 2007, 44 have now banned asbestos (Bahk et al., 2013).

Many recent studies (Aguilar et al., 2013; Courtice et al., 2012; Breysse et al., 2005) have focused on banning asbestos production, and on eliminating asbestos exposure (Swiątkowska et al., 2014; Bianchi and Bianchi, 2012) and asbestos-related diseases (Nielsen et al., 2014; Noonan et al., 2014; Nishimura et al., 2013). There are also researchers who have performed research on AW treatment and recycling (Chan et al., 2000; Gualtieri et al., 2008; Yanagisawa et al., 2009), and on asbestos removal (Fenoglio et al., 2001).

3. Methods

Many researchers have evaluated waste management performance, using tools including SWOT (Strength Weakness Opportunity Threats) (Yuan, 2013), life-cycle analysis (LCA) (Siti et al., 2013), or broad survey methods (Samuel et al., 2014; Yong et al., 2010; Gavin, 2000). Also, researchers have done real-life case studies with model building, application, and simulation to predict different scenarios as well as the effectiveness of alternative management solution strategies (Wu and Chau, 2006; Zhao et al., 2006; Chau, 2007). The analysis presented in this paper is based on a broad survey of literature reviews, questionnaires, and seminars, about asbestos and AW management in a number of Asian-Pacific countries (identified in Fig. 1). Survey data supporting the analysis were derived from multiple sources including governmental reports, waste management regulations, and literature reviews.

After a wide investigation on the situation in the region, we designed a new survey to evaluate the present challenges and difficulties in handling AW at the national and regional levels, including the following aspects: regulations, outright legal bans, delegation of regulatory authority, planning, import and export, labor issues, human health, asbestos substitutes, awareness programs et al. Combined with the management requirements, we designed a list of points for the questionnaires (Table 1). The questionnaires were distributed as e-mails or faxes to people in charge of AW management in their countries. Responses to the survey were gathered, classified, analyzed, and compiled, in preparation to being discussed at the seminar. Fourteen delegates from 6 countries—including China, Japan, Nepal, Malaysia, Pakistan and the Philippines—and 12 delegates from international organizations—including the Secretary of the Basel, Rotterdam and Stockholm Conventions (BRS Secretary), WHO, ILO, UNEP, Basel Convention Regional Centre for Asia and the Pacific (BCRC Beijing), BCRC-SEA (for South-East Asia), and BCRC Iran (in Tehran)—participated in this workshop. Delegates from regional countries were invited to make presentations on present AW management status in their own countries, and both the questionnaires and future plans for AW management were discussed in depth.

4. Results and discussion

Current regulatory practices in the region cannot by themselves reduce the impacts of AW. New, more effective waste management policies and techniques need to be developed to address the challenges.

4.1. Production and consumption of asbestos

In 2013, the world produced 1.94 million tons of asbestos, with Russia accounting for 46.92%, China 18.96% and Brazil 13.06% (Fig. 2). While these statistics show a decreasing tendency since 2011, there are still about 200 million tons of asbestos stored worldwide, about 100 times the total production quantity in 2013. In 2011, the world consumed about 2.03 million tons of asbestos (Fig. 3), and 61.5% of that total was consumed in the Asian-Pacific region (United States Geological Survey (USGS) data), of which China accounted for 30.5% and India 15.4%.

During the period of 1920–2003, 135 countries around the world that have used asbestos at least for short periods of time, accumulating 181 million tons of used asbestos (USGS). Commercial exploitation, with little thought for environmental consequences, increased over the twentieth century, to accommodate globalization and the demands of the world's burgeoning cities (Becklake et al., 2007). From 1998 to 2007, the countries in the Asian-Pacific region consumed about 9.76 million tons, about