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Philippe Huré

Chief, Department of Chemical and Biological Risks
National Research and Safety Institute
France

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Introduction

There is a clear scientific consensus that asbestos in all its varieties (amphiboles or chrysotile) is a proven carcinogen in humans, even at low doses.

Asbestos in its various mineral forms is a natural substance existing on all continents, with many remarkable chemical and physical properties. It has been known since ancient times, and was used extensively in the twentieth century for purposes as varied as protecting buildings and ships against fire, strengthening plastics, constructing sheeting and pipes from asbestos-cement, reinforcing road surfaces and making fireproof cord, gaskets, brake linings and heat-protective clothing, to name just a few of its possible applications.

The industrial use of asbestos began about 140 years ago, posing a serious health risk from the inhalation of fibres released into the air. This risk exists at all stages of the process: mining, preparation, transport, processing, installation, normal use, machining, removal, demolition and waste management. Over 200 million tonnes of asbestos are estimated to have been used throughout the world during this period; the quantity of asbestos mined and processed globally every year is still estimated at between 2 and 3 million tonnes.

Today, the large-scale use of asbestos which accompanied the rapid industrial development of the twentieth century has created a health crisis on an international scale and is directly responsible for tens of thousands of deaths throughout the world, in both asbestos-producing and asbestos-importing countries. The devastating health effects of asbestos appear several decades after exposure. Hundreds of thousands of deaths from cancer will inevitably occur over the coming decades, mostly due to occupational exposure, but also to domestic and environmental exposure to asbestos.

The general realization of the serious risks of working with asbestos led more and more countries to adopt increasingly strict measures to protect workers from the mid-1970s onwards, and then to restrict and ban its use. Since the 1990s, repeated recommendations from health-related international organizations have aimed at the replacement of asbestos by less dangerous technologies or substances. More and more States have decided to impose a total ban on all forms of asbestos, with some temporary exceptions for the few cases where substitution still presents some technical difficulties.

1. A few dates and figures

The term "asbestos" is used to denote various forms of naturally-occurring, crystalline, fibrous silicate which have been used industrially and commercially. There are two distinct families of asbestos:

- the amphibole family, whose five best-known varieties are anthophyllite, amosite, crocidolite, actinolite and tremolite;
- the serpentine family, including chrysotile, the most common variety which accounts for around 95 per cent of all the asbestos used throughout the world.

Asbestos mining, which has been practised since ancient times, became more widespread in the second half of the nineteenth century, particularly in Canada, South Africa and Russia. Other major deposits are situated in Brazil, Zimbabwe, China, Italy, Colombia, Greece, India, United States, Australia, Germany and France.

From a historical point of view, the use of asbestos by man has been demonstrated as far back as ancient Egypt, where it was used for making shrouds for the Pharaohs. In Finland, asbestos fibres have also been found in paleolithic pottery. The Greek historian Herodotus (fifth century B.C.) speaks of fireproof shrouds used to hold the ashes of cremated corpses. Charlemagne is said to have possessed a tablecloth made of asbestos, which he tossed into the fire at the end of a meal to impress his guests. Marco Polo speaks of a "fossil substance" used by the Tartars to make fireproof clothing. Later, in France, the Emperor Napoleon became interested in asbestos and encouraged experiments being carried out in Italy. The oldest asbestos mines were found in Crete, Cyprus, Greece, India and Egypt. In the eighteenth century, 20 asbestos mines were recorded in Europe, the largest being the one at Reichenstein in Germany. On the American continent, mining began in Pennsylvania as early as the end of the seventeenth century.

However, industrial mining did not really develop until after 1860, driven by the Italian and English textile industries and following the discovery of major deposits in South Africa, North America and Russia.

Around 1900, the amount of asbestos mined throughout the world was approximately 300,000 tonnes per year. Asbestos mining continued to expand from the beginning of the industrial age until 1975, a record year, when almost 5 million tonnes of asbestos were mined, processed and sold in the form of various asbestos-containing products. After 1975, the health risks associated with the inhalation of asbestos dust were well-known in all the industrialized countries, and the quantity of asbestos used throughout the world declined steadily to around 3 million tonnes in 1998.

The largest deposits of chrysotile are in the Ural Mountains in the Russian Federation. The countries of the former USSR, China, Canada and Brazil are still the world's major producers of asbestos. Canada remains the largest world exporter, despite a considerable decline in production over the last twenty years.

Countries are now building up or expanding their economies by strengthening their asbestos mining or processing industries and finding new markets. Consequently, the total world

production of asbestos, which had declined since the mid-1970s because of reduced consumption in the industrialized countries, has begun to rise again over the last few years.

2. Asbestos, the miracle substance

Asbestos possesses exceptional properties of inflammability and protection against heat, a mechanical resistance identical to that of steel at an identical fibre size, the capacity to be spun and woven, good compatibility with most chemicals (plastics, solvents, cements, bitumen, asphalt) and high resistance to acids or bases (according to variety). We thus find applications of asbestos which are directly derived from one or more of the above properties.

The wide range of properties of asbestos and its low cost make it unique among materials and have led to the use of this naturally-occurring mineral on a very large scale for an extremely wide range of applications. It would be pointless to try and make a list of the countless products and materials manufactured using asbestos which have been, or still are being, used throughout the world.

These products have been used in an enormous range of devices: ovens, kilns, cooking and heating stoves, irons and ironing boards, work surfaces, plumbing fixtures, refrigerators, water heaters, motors and alternators, vehicles (brakes, clutch, gaskets), railway components, ships, aeroplanes, electrical equipment and components used in civil engineering (e.g. sewerage systems) and buildings (roof tiles, elevator doors, fire dampers, seals, partitions, etc.).

All these products and materials, in which the asbestos is often very difficult to detect, are liable to release asbestos fibres as a result of an impact, vibration, friction, maintenance work or removal from the site; they expose people to the serious and insidious risk of inhaling asbestos fibres, in both the workplace and the home.

There are tried and tested substitutes, adapted to local conditions, for all uses of asbestos, including asbestos-cement, in particular:

- alternative technologies which do not use asbestos (replacing asbestos-cement roof tiles with metal sheeting or other traditional roofing materials, for example);
- materials known to be less dangerous than asbestos which can be substituted for it in a product (e.g. replacing asbestos with locally-produced vegetable fibre or cellulose in asbestos-cement for the construction of sewerage systems or roofing tiles) by adapting tools and manufacturing techniques).

3. The international consensus on the dangers of asbestos is unequivocal

The diseases caused by asbestos were all first described many years ago. The main ones are as follows.

- Asbestosis, a non-cancerous lung disease which, for many years, was classified with silicosis, suffered by coal miners. Asbestosis is a serious pulmonary fibrosis which occurs after several years of exposure, when the dose retained in the lungs becomes sufficiently high. It presents a reduction in respiratory capacity which may increase with time, even after exposure has ceased.
- Bronchopulmonary cancer, which occurs after a latency period which may be as long as fifteen or twenty years; it is responsible for more victims than any other disease caused by exposure to asbestos.
- Pleural plaques, a condition characterized by localized thickening of the pleura.
- Mesothelioma, a cancer of the pleura which may occur a very long time (several decades) after exposure. It is a rapidly developing disease (several months to several years) which is invariably fatal: at present, it is considered to be specific to exposure to asbestos. Mortality from mesothelioma in men in the industrialized countries has increased by approximately 5-10 per cent annually since 1950.

Regular epidemiological studies of the occupational history of asbestos victims clearly demonstrate the universal presence of diseases associated with asbestos in various industrial occupations. Workers in all forms of mining and processing and industries which use asbestos or asbestos-containing materials (construction, ship and automobile repairs, metallurgy, textile industry, mechanical and electrical engineering, chemicals, agriculture, etc.) are affected by these serious diseases on a large scale as a result of past exposure.

In France, the French National Institute of Health and Medical Research (*Institut national de la santé et de la recherche médicale* (INSERM)) has found that the number of people dying from asbestos-related diseases was around 1,950 in 1996 (1,200 from bronchial cancer and 750 from mesothelioma). Recent statistics confirm these estimates. In France, it is predicted that the number of deaths will increase every year, reaching a peak around 2020 – corresponding to exposure during the 1970s and 1980s when asbestos usage was at its highest – and will then decline. A recent study (Peto, 1999)¹ indicates that, in six countries of Western Europe (France, Germany, Italy, Netherlands, Switzerland and United Kingdom), a cumulative figure of 200,000 mesothelioma deaths may be expected over the period 1995-2029. The number of mesothelioma cases is said to be closely correlated with the quantities of asbestos imported into a country. When we extrapolate these figures to the whole of Western Europe and add

¹ Peto, J. et al. 1999. "The European mesothelioma epidemic", *British Journal of Cancer*, Vol. 79, No. 3/4, pp. 666-672.

deaths from bronchopulmonary cancer, around 500,000 cancer deaths will be caused by asbestos by 2029. As for Australia, it has one of the highest incidence rates for mesothelioma in the world.

Health-related international organizations are putting out more and more messages, intended both to confirm the serious risk of cancer associated with activities which expose people to asbestos fibres of all types and to encourage the abandonment of all uses of asbestos. In particular, the following action has been taken.

- In 1977, the World Health Organization (WHO) stated that all forms of asbestos, including chrysotile asbestos, are carcinogenic, following the classification of asbestos in group 1 (substances known to be carcinogenic to humans) by the International Agency for Research on Cancer.
- In 1986, the International Labour Office (ILO), in Convention No. 162² adopted by the International Labour Organization (ILO), recommended that legislators should, wherever possible, arrange for the "replacement of asbestos or of certain types of asbestos or products containing asbestos by other materials or products or the use of alternative technology, scientifically evaluated by the competent authority as harmless or less harmful".
- In 1996, WHO stated that, where safer substitute materials for chrysotile were available, they should be considered for use.
- In 1998, WHO reaffirmed the carcinogenic effect of chrysotile asbestos, particularly the risk of mesothelioma, continued to call for substitutes to be used and recalled the very wide distribution of risk among a very large number of groups of workers.³

WHO also stated that no threshold had been identified below which asbestos dust did not incur the risk of cancer.

4. The international situation today

Many countries have opted for a complete ban on the use of this dangerous substance, deciding to stop the risk spreading through their territory in order to protect future generations. They include most of the Member States of the European Union (all of which must ban all uses of asbestos by 2005) and a growing number of other countries (Iceland, Norway, Switzerland, New Zealand, Czech Republic, Chile, Peru). Other countries are considering the dangers of asbestos, e.g. Australia and Brazil, where the decision to ban a substance may be taken at regional level.

² Asbestos Convention, 1986 (No. 162), Article 10(a), International Labour Office, Geneva.

³ United Nations Environment Programme/World Health Organization/International Labour Organization. 1998. *Chrysotile asbestos*, Environmental Health Criteria Series, No. 203, World Health Organization, Geneva.

Some countries have considerably reduced the applications in which asbestos is used, restricting them to a few cases (particularly asbestos-cement) where they have declared that they have introduced sufficiently strict rules to protect workers' health (e.g. United States, Canada) and can control the methods used for working with asbestos. What real follow-up is there of workers' exposure to asbestos during additional activities (e.g. maintenance or removal)? What control can we expect over domestic exposure to asbestos products, do-it-yourself activities and monitoring of waste at the end of a product's useful life?

In 2001, the World Trade Organization (WTO) settled on appeal a dispute between Canada and the European Union concerning France's ban on asbestos. WTO stated that France was justified in ceasing imports of a carcinogenic substance into its territory in order to protect the population's health. The ban on asbestos was deemed to be compatible with international trade regulations. WTO also confirmed the carcinogenicity of chrysotile asbestos in humans.

5. Compensation for disease: An economic time-bomb

The cancers caused by past exposure to asbestos are extremely serious and disabling; they are generally fatal. The cost of caring for the victims and the total costs resulting from these diseases are so high that they are now seriously destabilizing the systems of compensation for occupational diseases in some countries, obliging the State to provide financial compensation or reducing certain enterprises to bankruptcy.

Countries which have used asbestos, whether or not they have taken the step of banning this dangerous substance, are now faced with the obligation of arranging compensation for the victims and making financial arrangements for them. The amount of this financial settlement and the impact it will have on the country's economy will depend both on the amount of asbestos used and on the choices the country has made about social protection for its workers.

The few recent studies of the health impact of the industrial use of asbestos all show a close correlation between the number of people suffering from asbestos-related diseases in a country and the country's level of asbestos use over the previous 20-30 years. Thus, using asbestos now imposes a burden on a country's economy for over 30 years, bequeathing to future generations the responsibility for compensating victims and the financial burden of caring for them.

All the industrialized countries which used asbestos extensively in the second half of the twentieth century, without exception, have seen an explosive increase in the number of disease claims following asbestos exposure in the 1970s. The existing compensation systems for occupational diseases in these countries have been in financial difficulties for several years purely because of these claims; this disproportionate effect is due both to the seriousness of each case, which means a high unit cost for dealing with each one, and the swiftly increasing number of claims. Additional compensation systems, with their own financing, seem to be

needed everywhere. In the long term, these countries face the difficulty of deciding precisely what the total cost of compensation for these diseases will be and how long the phenomenon will last. Although studies predict – very approximately – the provisional annual number of malignancies, there is no formula for calculating the financial impact of the other, benign, diseases connected with exposure to asbestos (e.g. pulmonary fibrosis, pleural plaques), which affect far more people than cancer does. All countries which use asbestos will eventually and inevitably have to pay the enormous bill resulting from the health and economic impact of asbestos exposure.

In many countries, associations have been set up to organize the victims' dealings with the administration and to defend their interests, especially improving the financial aspects of their care. Very often, these associations advise victims to take legal action as individuals against their employer, on the grounds that the employer has not adopted appropriate protection measures, even though the risk was well known and national legislation provided for protection measures; such legal cases have become very frequent and, in most of them, the victim wins and obtains financial compensation from the enterprise. More and more cases are also brought against the State, claiming that it took too long to lay down regulations to protect the health of workers or the public from asbestos, even though the serious risks connected with asbestos had been confirmed by health-related international organizations.

The following data, from Germany, France and the United States, show the economic scale of the problem.

- In the Federal Republic of Germany, between 1980 and 2003, asbestos-related occupational diseases caused over 12,000 deaths. In 2002 alone, there were almost 1,000 deaths. In 2001, the costs of medical care and financial compensation for victims and their dependants amounted to 290 million euros. In Germany alone, 20,000 additional deaths are expected to occur by 2020; the cost to the accident insurance funds (*Berufsgenossenschaften*) will be several billion euros.
- In France, there are 2,000 deaths caused by asbestos every year, and this figure is expected to rise to 3,000 per year by 2020. In 2001, the government was obliged to set up a special scheme to deal with this problem, publicly financed from both social security funds and the State budget, to compensate victims and finance early retirement for victims or other former workers of enterprises which had been identified as using asbestos. In February 2004, the French Government published a report entitled "Financial impact of compensation of victims of asbestos for the current year and the next twenty years". In the report, the cost of caring for asbestos victims is estimated, with reservations due to the newness of the system and the incompleteness of the available data, at between 27 and 37 billion euros for this 20-year period (i.e. between 1.3 and 1.9 billion euros per year). For 2003 alone, the cost is estimated at 600 million euros for the compensation fund

(including 137 million euros for social security, which covers about half of all workers in France) and 515 million euros to finance early retirements.

- Almost 20,000 cases of asbestosis were reported in the United States between 1990 and 1999. In that country, compensation for occupational asbestosis is obtained by taking legal proceedings against the employer or manufacturer. By 2000, over 600,000 people had sought to enforce their rights before a court and, at present, almost 50,000 people every year lodge a complaint connected with an asbestos-related disease. Six thousand enterprises which have been indicted may have to pay compensation. United States insurance companies have stated that, as at 2000, they have had to pay out 21.6 billion US dollars for cases brought in connection with exposure to asbestos. In addition, 32 billion US dollars were paid out by the enterprises which had been prosecuted. Twenty-two enterprises have been unable to meet their obligations and have gone bankrupt. Compensation claims are expected to increase to 200-265 billion US dollars.

How can we use these experiences today to help us decide how this risk can be handled better throughout the world?

6. From the economic argument for using asbestos to the health argument for banning it

If the experiences of a number of highly industrialized countries over the last 10 years show that it is now technically possible to abandon asbestos completely, any attempt, even a partial one, to find substitutes for this dangerous substance presents many obstacles to any country wishing to enter upon this path. What are the constraints, what is at stake and what are the costs?

If a country is to abandon asbestos, it will need to find solutions for all three of these interconnected problems:

- it must try to reduce, and later eliminate, this serious risk in order to protect current and future generations;
- it must care for the victims of asbestos-related diseases, which may result from exposure a very long time before;
- it must introduce the risk-reduction measures needed to deal with the exposure which will inevitably result from the presence of asbestos in buildings, industrial or domestic machinery, vehicles or other products.

All countries have to face this global menace, and no country can pretend to ignore it. Every State has a responsibility to face up to the health disaster on its territory resulting from the past and present use of this dangerous substance; every State has a moral obligation to dispose of its own asbestos and take responsibility for the consequences.

Some activities which carry a serious risk of exposure to asbestos (e.g. decommissioning of old ships) tend to take place in countries where labour costs are lowest. Such activities represent an important economic issue for these countries. Although health protection regulations are displayed at the decommissioning sites, the health conditions there seem to be appalling and the regulations governing waste disposal are non-existent. How can the world be made aware of this serious problem of risk transfer and deal with it in a sustainable manner?

Although it is the duty of the most highly industrialized countries to inform others of the existence of risk, the way in which each country will see the problem will be highly dependent on its own history, geographical situation and level of social, industrial, economic and cultural development. The process of consideration within each State will certainly be influenced both by the priority accorded to this risk compared with other issues which are also considered priorities and by a set of criteria connected with the country's networks, trade, main industries and domestic stocks of asbestos and its substitutes.

- How do these various parameters affect policy choices about the protection of workers' health?
- What importance should be accorded to the national industrial base for asbestos processing in the country, the availability and local cost of some of the raw materials to make asbestos substitutes and the economic and social cost of the industrial conversion required to move over to substitutes?
- Can an industrial producer and exporter of asbestos speak clearly to its clients about information, risk evaluation and assistance?
- What are the last remaining barriers preventing the complete abandonment of this highly dangerous substance?
- How can we share the collective knowledge about the protection of people's health from the serious risks of exposure to asbestos?