Ban on Asbestos Diaphragms in the Chlorine-related Chemical Industry and Efforts toward a Worldwide Ban

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The EU Directive 1999/77/EC, prohibiting new applications of chrysotile, exempted diaphragms used in electrolysis to produce chorine and caustic soda in existing chlor-alkali plants until they reach the end of their service life, or until suitable asbestos-free substitutes become available, whichever is sooner. There is no technical justification for extending this exemption after January 2008, when it is scheduled for review. Economic interests should not take precedence over the social and environmental costs imposed by the asbestos production required for this industry. The EU Scientific Committee on Toxicity, Ecotoxicity and the Environment should not further delay the necessary decision on a total and immediate worldwide ban of the mining, manufacturing, and all uses of asbestos. *Key words*: asbestos; EU directive; chlor-alkali industry.

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The European Union adopted Directive 1999/77/EC[1] on July 26, 1999. It prohibited new installations of parts and materials incorporating chrysotile asbestos in Member States' territories after January 1, 2005. The only exception was for diaphragms used as a permeable medium in electrolysis* to produce chlorine and caustic soda in existing industrial plants.

This decision was based on the fact that risk of exposure would be "extremely" low, and that more time would be needed to develop suitable substitutes for such a safety-critical application. The Commission will review this exception before January 1, 2008, after consulting the EU Scientific Committee on Toxicity, Ecotoxicity and the Environment.

The release published on the European Commission website,[1] titled "The European Commission bans White Asbestos," particularly caught our attention by categorically saying:

> All forms of asbestos are proven carcinogens. . . . They can cause asbestosis (serious scarring of the lung), lung cancer and mesothelioma (cancer of the pleura—i.e. the lining of the lung). Therefore five of the six types of asbestos were already banned in the EU in 1991. In the case of white asbestos, which is now used in asbestos cement products, it has taken more time to develop suitable substitutes which are less dangerous to human health . . . [and further] The only exception to the ban is for chrysotile in diaphragms which are used for electrolysis in certain chlorine plants. The diaphragms are a special case because **they are the only current use of chrysotile asbestos for which it is not technically possible to substitute without creating a safety problem** (i.e. a risk of explosion). On the other hand, the risk to

Figure 1—Locations of chlorine-production plants, January 2005. Source: Euro-Chlor.

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*Ionic separation by passage of electric current through a conductive solution. In chlor-alkali electrolysis the conductive media is the brine, and byproducts are hydrogen gas, sodium hypochlorite, hydrochloric acid, and dichloroethane (EDC), among others.

Figure 2—Industrial chlor-alkali plants in Western Europe. Source: Euro-Chlor. (See Table 1.)

human health and the environment from this use of chrysotile **is extremely low because it is undertaken in a closed system on-site**. Diaphragms are not marketed. This derogation will be reviewed (on the basis of an independent scientific risk assessment) both during the planned general review of the directive in 2003, and again specifically in 2008.

There are feasible alternatives today, which are already in use, such as non-permeable ion-exchange membrane technology, Na (sodium), HCl, which effectively replaces either the asbestos-permeable diaphragm or the mercury-cell process, and other technology still widely used in electrolytic separation of chlorine and soda, but the reasons for this "unique exception" are bound to economic interests involved in the removal of asbestos in such industrial plants and to the strong and powerful lobby made up of producers before the Commission. The chlor-alkali industry in Western Europe produces about 20 million tons a year, 11.5 million tons as chlorine.[3]

TABLE 1 Industrial Chlor-alkali Plants in Western Europe*

Country	No. on Map	Site	Capacity (000 tons)
France	11	Pont de Clairx	240
	12	Fos	150
	14	Lavera	175
Germany	28	Stade	890
	34	Rheinberg	200
The Netherlands	52	Delfzijl	125
Norway	57	Rafnes	136
Poland	59	Bydgoszcz	60
	60	Wloclawek	197
Total			2173

*The total number of diaphragm units is 9. Source: Curo-Chlor.

As can be seen in Figure 1, the most recent data[4] provided by companies show 85 industrial chlor-alkali plants in Western Europe, distributed among 20 countries, including Switzerland and Norway. Nine of these companies (Figure 2 and Table 1) use asbestos-diaphragm technology,[3] representing 17.4% of the total production of chorine in 2004, versus 33.1% by membrane; 47% by mercury, and 2.5% by other processes. Germany continues to be the biggest producer of chlorine in Europe,[4] with 48.9% of production, followed by France (16.1%), and Belgium and The Netherlands (15%), as can be seen in Figure 3.

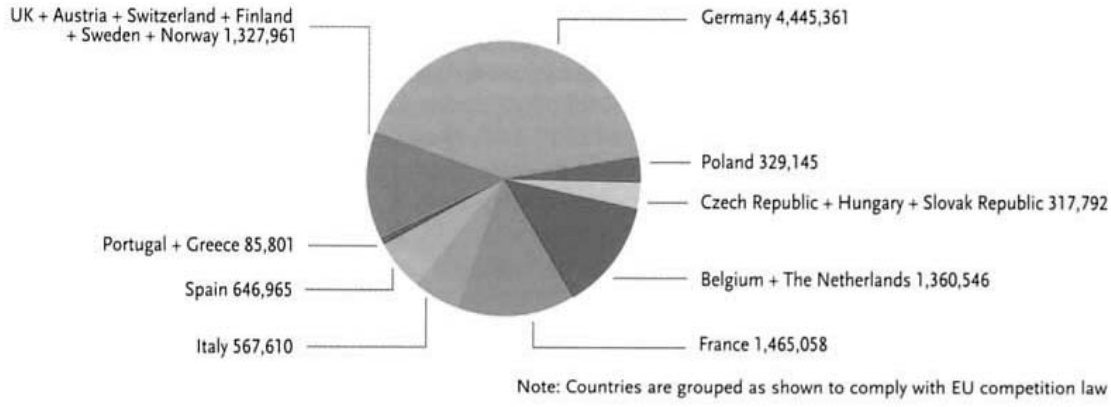

Figure 3—European chlorine production in 2004 (tonnes). Source: Euro-Chlor.

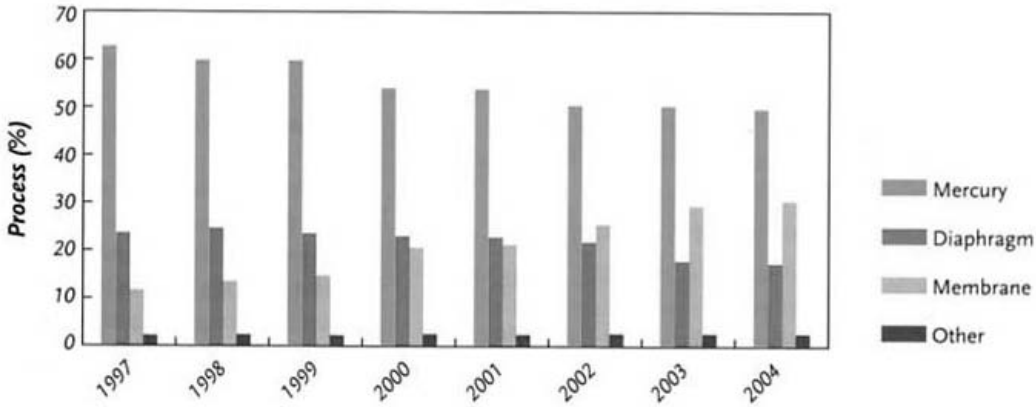

Figure 4—Evolution of chlorine routes by process. Source: Euro-Chlor.

It is evident from Figure 4 that, although the use of asbestos diaphragms has been reduced in European industrial plants, being replaced especially by non-permeable ion-exchange membrane, the asbestos substitution has been slower than the necessary and desired. In 1996, the asbestos diaphragm representedion exchange membrane technology, such replacement has been much slower than desirable, since in 1996 use of asbestos corresponded to 24% of the total chlorine production; in 2000, 23%; in 2003, 18%; and currently, 17.4%.[3–5] Keeping this pace of phase-out, it would require another 24 years for the total elimination of asbestos diaphragms in the European production of chlor-alkali, which is unacceptable, making a mockery of the statement in the EU Commission release[2] and in EU Directive 1999/77/EC.[1]

CHLOR-ALKALI IN BRAZIL

In 2004, Brazil produced effectively, 1.2 million tons of chlorine million tonnes of chlorine and 1.3 million tons of caustic soda in eight industrial plants. Of this production, 72% was based on asbestos-diaphragm technology, 23% on mercury, and 5% on membrane (Figure 5).[6] Three companies,: Braskem (Trikem), Dow Brasil, and Carbocloro (Oxy Chem/Oxypar), produce chlor-alkali through asbestos diaphragm technology accounting for 72% of Brazilian chlorine production.

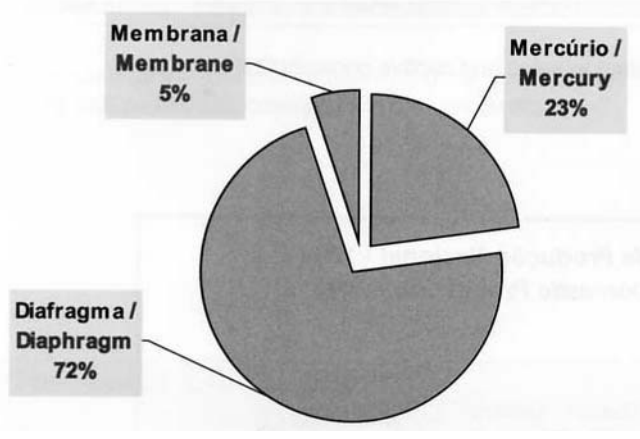

Figure 5—Production by process in Brazil, 2004. Source: ABICLOR.[6]

The Brazilian chlorine-soda industry consumed 128 tons of chrysotile asbestos in 2003.[7] Its importance in current discussions on the ban of asbestos in Brazil is, therefore, much more political than economic, since the chlorine-soda industry is a strategic business sector, strongly influencing the ruling political class and its decisions. Proof of this is Law 9976/2000,[8] which regulates the production of chlorine. It is clearly aimed to protect the business as it exists. Article 2 states: "it is maintained the current technologies in use in the country to produce chlorine by the electrolysis process" and in Article 3 states, "it is forbidden to install new plants for producing chlorine by the electrolysis process using technology based on mercury and asbestos diaphragm." In other words, Law 9976/2000 guarantees ad infinitum the current situation on use of asbestos or mercury, without major changes in existing plants.

Without political debate and social pressure, any change must be blocked indefinitely, since Brazil is the fourth largest world producer of asbestos, with 252,000 tons mined in 2004, representing 11.1% of the total asbestos mined worldwide, following Russia (39.5%), Kazakhstan (15.8%), and China (15.4%), and producing more than Canada, which, until recently, was one of the

TABLE 2 Production of Chlorine in Brazil in 2004

Company	Share in Production (%)	Installed Capacity (10^3 t)
Aracruz	1.8	21.0
Braskem	34.4	464.6
Carbocloro	20.5	252.8
Dow Brasil	30.0	415.0
Igarassu	2.3	28.0
Nexen Química	3.2	35.2
Pan-Americana	2.3	27.8
Solvay Indupa	5.5	115.7
Total	100.0	1,360.1

Source: ABICLOR.[6]

Figure 6—Blending asbestos with resin and water.

world largest producers and exporters.[9] From a position of being a modest exporter of raw fiber in 1997 (63,164 tons), Brazil has, since 2003, increased its exports to 65% of its production (163,620 of 250,000 tons) in 2004, especially to Thailand (31.4%), India (18.2%), Indonesia (14.2%), and Iran (11.5%), among others.[9]

The risk of exposure to asbestos in the chlor-alkali industry is not lower than the risks in other activities, already prohibited by Directive 1999/77/EC since July 26, 1999, and by Brazilian municipal and regional laws,† based on a two-decade experience of the Labor Inspectorate that led us to the conclusion that there is no technical reason to justify such a deferral after January 2008.

Figures 6–8 illustrate the circumstances that led us to urge the prohibition. These situations were observed during workplace inspections at three Brazilian producers of chlorine using the asbestos-diaphragm separation process:

CONCLUSION

Economic reasons should not take precedence over social and environmental costs imposed by continuing use of asbestos in chlor-alkali industry. Canada has reduced its production of asbestos by two thirds during the past 15 years, from 685,627 tons[10] in 1990 to 200,000 tons in 2004.[11] The remaining market, in areas such as the chlor-alkali industry, will be supplied in the future only by mining countries such as Brazil, Zimbabwe, Russia, China, and Kazakhstan, if policies to end use of the asbestos diaphragm are not adopted. In these countries, redemocratization processes are either too recent or too incipient and fragile to be a deterrent, lacking efficient health protection policies for workers and social control. In many developing countries the EU's asbestos ban is considered a benchmark. For the health of European workers as well as the health of global workers, it is vital that the EU asbestos ban be extended to every industrial sector, including the production of chlorine. The EU Scientific Committee on Toxicity, Ecotoxicity and the Environment should take urgent steps to end the existing derogation on the use of asbestos diaphragms in the chlor-alkali industry. By decreasing global demand for asbestos, this step could undermine the global asbestos market and thus hasten the day when asbestos is no longer

†Six Brazilian States (Mato Grosso do Sul, São Paulo, Rio de Janeiro, Rio Grande do Sul, Pernambuco, and Mato Grosso) have approved laws prohibiting the use of chrysotile asbestos in any form. Two of these states (São Paulo and Mato Grosso do Sul) had their laws withdrawn by the Supreme Court. Seventeen municipal laws either totally or partially prohibit the use of chrysotile asbestos.

Figure 7—After immersion and impregnation, worker "brushes" asbestos diaphragm surface in order to smooth it, wearing an improper respirator.

Figure 8—Collection of solid waste from immersion bath to final disposal in landfill.

mined in socially and environmentally vulnerable developing countries.

An immediate worldwide prohibition of production, marketing, and all uses, without any derogation for asbestos, is long expected, completely justified, and absolutely necessary.[12]

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Comment

Giannasi highlights the continuing impediments to effectively banning all uses of asbestos. The WHO, the IARC, and the ILO have documented the hazards of exposures to any asbestos, including chrysotile. Although more than three dozen countries, including the members of the European Union, now ban the use of all forms of asbestos, corporate interests continue to find ways to predominate over global efforts to protect workers' health. As Giannasi documents, chlorine can be produced without exposing workers to asbestos, and many industries use more worker-friendly forms of production. However, pressures to use asbestos diaphragms persist even though their use is neither advisable nor necessary. Improper respirator usage, as documented in this paper, demonstrates the fallacy of the concept of "controlled use" of asbestos, an industry-propagated myth repeatedly used to condone asbestos exposures of workers, especially in developing countries, where use of chrysotile is greatest. Safer substitutes work as well as asbestos, with less risk to workers. Since asbestos causes more workplace-related cancers than any other material, a total ban on its use, including this last vestige of special use, is appropriate. When this issue is recognized and settled, additional pressures can be put on industries in Canada, Russia, China, and elsewhere to stop placing their workers at risk, and to stop putting at risk millions of others who work with or are eventually exposed to this carcinogen.

—Arthur L. Frank, MD, PhD