GLOBAL IMPACT OF ASBESTOS: THE ENVIRONMENT

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Presented at international conference: *Health, The Environment and Justice*
Venice, Italy, November 23-24, 2006

Setting the Scene

Between the beginning of the 20th century and the 1940s, world production of asbestos rose by 2000%. Output grew steadily, peaking at 4.8 million tonnes (mt) in 1977. Despite a slight downturn, annual production remained at over 4 mt until 1991.[1] In 2004, 2.2 mt of asbestos were mined. Dr. Jukka Takala, Director of InFocus Programme SafeWork at the International Labour Organization, estimated that there were 100,000 work-related asbestos deaths worldwide every year; he wrote:

> "The global figure is growing as more people will die from (asbestos) cancer as communicable diseases are reduced…reductions (in asbestos-related deaths) will take place maybe only after 2020 if China and India introduce quickly measures against asbestos."

Dr. Takala's figure of 100,000 deaths is often quoted in articles about asbestos. Unfortunately, what many people fail to appreciate is that this figure only relates to occupational asbestos exposure. Studies undertaken in South Africa, the UK, Italy, Spain, Poland and Canada detail the impact of environmental asbestos exposures on local populations. Regrettably, this source of contamination has produced and continues to produce many asbestos victims. This paper will discuss environmental asbestos exposures experienced by communities in both producing and consuming countries, as well as hazardous asbestos contamination liberated during natural and man-made disasters.

Producing Countries: Canada, Brazil and Kazakhstan

Canada

Canada has been mining chrysotile (white asbestos) for more than 100 years. In the process, billions of dollars have been earned by asbestos stakeholders; the Canadian nickname for chrysotile is "white gold." The hidden cost of this production can be measured by the many Canadian lives lost due to occupational and para-occupational asbestos exposures. Unfortunately, no one knows how many deaths there were as there is no Canadian protocol for the collection of cancer or asbestosis data. The consequences of environmental asbestos exposures and the impact on the environment have also not been quantified. According to Daniel Green, the Scientific Advisor to the Sierra Club of Canada:

> "The concentration of asbestos mining and production in the province of Québec resulted in environmental contamination. In 1970, asbestos fiber airborne emissions in Québec were 13,325 t.[2] Tests of non-filtered surface water of a lake in Thetford Mines showed 172 $\times 10^6$ fibres/litre; this is more than three times the amount of contamination which was responsible for the outcry

> over the use of asbestos filters in the processing of French wines some years ago…"

In a paper published in October 2005, Historian Jock McCulloch described the situation in one asbestos-producing community:

> "The Quebec mines polluted the environment and had an intrusive impact upon communities that were dependent upon them for employment…(In 1949) Burton Le Doux, interviewed miners and their families and described the deplorable conditions under which they lived and worked (in the village of East Broughton)… The western side of the village was inundated with asbestos from the mill and there was dust in all the houses…
>
> Le Doux also found that the environmental exposure from the waste dumps was such that whole families were afflicted with respiratory illness…
>
> Over the next 20 years, there was some improvement in working conditions in Canada's mines. When T&N's company physician Dr. J. F. Knox visited Thetford in December 1946… he noted that none of the new houses or the schools had been 'positioned with the idea of avoiding dust blown off the encircling (asbestos) dumps.' He was particularly concerned that fiber from the 250 tons of waste dumped each day at Bell Mine was blown over the district."[3]

In one 40 km by 3 km area in Quebec there are in excess of 30 tailings dumps. Houses are often close to the dump sites and asbestos-contaminated waste material is widely used for landscaping. Air sampling conducted in 26 domestic residences in Thetford in 2003 found that 15 samples out of 28 taken (54%) had a concentration of chrysotile fibres higher than the AHERA[4] criterion.

Herve Rousseau and his family live on a farm in Thetford. Directly across from the Rousseau home is a 300 foot mountain of asbestos tailings; one surveyor estimated that there are millions of tons of tailings on this site. Half a mile from the Rousseau property is the abandoned Flintkote property, which consists of a large pit and an enormous and unstable pile of tailings; there are no warning signs or fencing to keep out the public. An analysis of soil samples taken from this site revealed a chrysotile content of 10%. In September 2003, Herve was informed by an independent asbestos specialist that his home was too contaminated for human occupation. Readings of 289.8 structures per mm^2 were more than four times the maximum US levels for re-occupying buildings after asbestos abatement (US level: 70 structures per mm^2)[5]. Photographs of mountains of asbestos tailings taken by industrial hygienist John Van Raalte in Thetford, document the existence of an environmental disaster in the mining region; no warning signs or security measures to prevent public access to contaminated areas are visible.[6]

What is the effect of the environmental asbestos contamination in the mining region? According to the seventy-six page report *Epidemiology of the Diseases Caused by Exposure to Asbestos* that documented 832 cases of pleural mesothelioma in Québec between 1982 and 1996:

> "For men, only some parts of the United Kingdom, Australia and the Netherlands had rates significant higher than in Québec. For women no country surpassed Québec."

It is believed that the death rate among Quebec women is largely due to environmental asbestos exposures.

Brazil

Data from 2003, the latest year for which we have figures, showed that Brazil is now the 5th largest chrysotile producer in the world. Chrysotile mining began in Brazil at the Poções mine in Bahia in 1939. Mining operations, which continued at this 700 hectare site until 1967, have left widespread environmental contamination. There are no data quantifying the incidence of asbestos-related disease amongst local people living in close proximity to the Poções or Minaçu chrysotile mines or the Jaramataia, Itapira or Virgolândia anthophyllite mines in Alagoas, São Paulo and Minas Gerais, respectively.

Homeless people now live in and around the site of the derelict anthophyllite mine in Itapira in São Paulo State. A sample of ore which came from this area was analyzed in 1999 by the U.S. laboratory MVA Inc. which found:

> "Fibrous material was evident on the surface of the ore sample. Polarized light microscopy analysis showed that the sample was composed of asbestiform and blocky fragments of orthoamphibole (anthophyllite) with a platy to fibrous non-asbestos mineral (talc)). Some of the talc fibers were intergrown with the anthophyllite fiber bundles. Clearly over 50% and probably over 70% of the sample consists of anthophyllite. SEM-EDXA analysis and ATEM analysis confirmed the high numbers of asbestiform anthophyllite fibers in the sample."[7]

Kazakhstan

In 2000, Kazakhstan was the world's 3rd biggest exporter of chrysotile.[8] Asbestos is a growth industry in Kazakhstan. In 1999 and 2001, the Kustanayasbest Asbestos Mining and Concentration Plant in Almaty, Kazakhstan extracted, processed and sold 109,000 tonnes and 200,000 tonnes of asbestos, respectively. On September 14, 2001 the Kustanayasbest Plant announced plans to "extract, process and sell 200,000 tonnes of asbestos in 2001, which exceeds the five-year development plan by 10,000 tonnes." If the company's objectives were achieved, production levels would have almost doubled in four years. Increasing production results in increased asbestos waste. There are no regulations for asbestos production, consumption or disposal; thousands of tons of asbestos waste are routinely dumped within the city limits.

Consuming Countries: UK, Japan, Poland

UK

Nestled in the Spodden Valley of Rochdale, England is the 100 acre site of the former Turner Brothers Asbestos (TBA) factory.[9] The world's first asbestos mill, which began operations in 1879, grew into the largest asbestos textile factory in the world; the processing of asbestos on this site continued for 115 years. Production levels at Rochdale increased throughout the 1960s and well into the 1970s. According to a company publication, TBA was producing 2,250,000 yards of asbestos cloth and 5,500,000 miles of asbestos yarn a year.[10] This scale of asbestos manufacture led to the creation of substantial amounts of contaminated waste and debris. A TBA document from 1957, describing the factory's asbestos dust filtration system, noted:

> "the total weight of dust recovered in the filter rooms weekly is about 15,000 lbs., all of which is dumped to waste."

Additional routes for contamination of the environment existed. Until the early 1960s, the large hessian sacks of asbestos which arrived at the rail depot in Shawclough were transported to the factory and were dropped down a concrete chute into the mill. Residents described how as children they played on dusty bales of raw asbestos in the railway sidings; the whole area was a haze of dust with accumulated fibers hanging off what were known as "the asbestos trees."[11]

In May 2004, the local newspaper announced that the former TBA site had been sold and that the new owners were a building consortium which intended to build 650 homes and a children's nursery on the derelict site. On May 13th security fencing was erected and shortly afterwards bulldozers arrived and forestry contractors begun work. Residents alerted their neighbours to the fact that the Turners' site was being dug up with no environmental assessment and no attention paid to its asbestos contamination. The community, many of whom had worked at the factory or lost loved ones who had been TBA employees, was concerned about the hazards which this ill-considered development could cause.

A group called Save Spodden Valley was formed to prevent the haphazard redevelopment of the site.[12] The Group maintained that town councillors and civic authorities had been misled about the presence of asbestos on the site. In the planning application submitted in December 2004 for the proposed construction, the developers reported that "no asbestos had been found in heavy rubble at the site;" there was, they said, "a notable absence of asbestos at the site."[13] Jason Addy, spokesperson for Save Spodden Valley, called this "a wilful omission." He has since been proved right:

> "Independent tests that have just emerged, conducted in April 2005 by the Institute of Occupational Medicine (IOM) in Edinburgh, confirm that 4 of the 32 samples taken were positive for asbestos. One sample was 23 times higher than the threshold for Hazardous waste (2.3% asbestos – the statutory limit is 0.1% asbestos content by weight). In addition, the Government's Health and Safety Laboratory (HSL) tests in April 2005 indicated up to 1% of the asbestos traces in 3 of 8 samples taken on crushed asbestos factory rubble on the site. In total this confirms 8 positive test samples for asbestos throughout the development site. This figure does not include asbestos confirmed at known dumps to the north of the site where there are no plans to build."[14]

Japan

Amagasaki in Hyogo Prefecture in south-western Japan is an industrial town of 460,000 people. The production of asbestos-cement pipes was a local industry. During the Summer of 2005, it was revealed that Amagasaki residents, whose only exposure to asbestos was environmental, have succumbed to asbestos-related diseases in large numbers; the incidence of mesothelioma, an asbestos cancer, is 9.5 times higher than the national average among people who lived within 500 meters of Kubota Corporation's defunct asbestos-cement pipe factory.[15] Researcher Dr. Norio Kurumatani from Nara Medical University reported: "The closer people lived to the plant the higher risk they carry of dying (from mesothelioma)." In their research, Dr. Kurumatani's team established that of 55 mesothelioma patients who lived close to the Kubota factory, 46 had contracted the disease from environmental exposure.[16] Another Amagasaski plant produced asbestos-cement pipes at a site owned by the Kansai Slate Corporation. Although the company moved its operations to Kakogawa in 1973, Amagasaski residents who were environmentally exposed to asbestos prior to then are also at high-risk.

The environment in Amagasaki remains polluted with asbestos. During the autumn of 2004, 150 tons of asbestos-contaminated soil was found at the former site of the Kirin Brewery Company's Amagasaki factory. The company said that the 150-square meter patch of soil, 50 centimeters thick, and one meter underground, was discovered at the site of a former waste-water processing facility. In 2001, a large volume of asbestos-contaminated soil and waste was found nearby at the Kubota Corporation's Kanzaki factory. It is believed that this contamination was caused by the leakage of asbestos-contaminated water from the factory. A kilometer away in Nagasu, scraps of asbestos pipes were found buried at another Kanzaki factory. According to a company spokesperson, both incidents were reported to the Amagasaki municipal government and the asbestos-contaminated soil and waste were properly disposed of.

Poland

The small town of Szczucin, Poland has achieved international notoriety for its high levels of environmental asbestos contamination. In a paper presented in 2004 by Dr. Neonila Szeszenia-Dabrowska, she explained that the asbestos industry in Szczucin had been an integral part of the community:

> "Asbestos has been a way of life here since the asbestos cement factory opened. Mothers knitted sweaters for children from asbestos cloth. The cloth was used for rugs and slipcovers. Many residents routinely kept piles of asbestos handy for little projects around the house. The piles would often be left uncovered sending dangerous fibers aloft with every gust of wind."[17]

The Szczucin asbestos-cement plant used 305,000 tons of chrysotile (white asbestos) and 65,000 tons of crocidolite (blue asbestos); between 1959 and 1996, the plant's emissions totalled 3.2 tons of crocidolite and 14.3 tons of chrysotile. Locally, asbestos waste was widely used in roads, farmyards, paving, houses, farm buildings and tool sheds; mounds of asbestos waste were situated in residential areas and fine-grain asbestos waste was spread on farmland. The total volume of asbestos waste and contaminated soil in the area has been estimated by the Institute of Environmental Protection as 0.8 - 1.0 million m^3:

- roads – 330,000 m^3 (65.5 km)
- farmyards – 8.6 hectares
- driveways – 28.6 hectares

Not surprisingly the incidence of mesothelioma amongst former workers and local residents is high. In the period 1987-2003, there were 55 cases of pleural mesothelioma in Szczucin: 28 cases among factory workers and 27 among local inhabitants. In 2000-2003, there were 28 cases of pleural mesothelioma; the incidence of mesothelioma in this community is 125 times that of the general population in Poland. The local death rate from lung and gastric cancers is also high, as is that from non-cancerous respiratory diseases. Over the period 1975-1996, the age at death from lung cancer of Szczucin female inhabitants decreased by ten years.

Disasters:

The Great Hanshin-Awaji Earthquake 1995

The fall-out from asbestos material contained in buildings destroyed in the Great Hanshin-Awaji earthquake, one of the worst earthquakes in recent years, was the subject of a paper presented in 2004.[18] Atmospheric monitoring by the Environmental Agency (Japan) after the earthquake showed an increase in ambient asbestos concentration in the stricken zone; a diffusion model was used to assess how much of this contamination was due to sprayed-on asbestos insulation/fireproofing present in earthquake-damaged buildings at 16 sampling points. The scientists estimated that prior to the earthquake there had been 3,740 tons of sprayed-on asbestos stock in the affected buildings; the quake liberated 26.4 kg of asbestos into the environment. Experiments revealed that demolition without pre-removal of asbestos caused the highest levels of asbestos emissions into the surrounding areas; asbestos removal costs accounted for 68-94% of total demolition costs.

The World Trade Centre 2001

The attack on the World Trade Center in NY liberated tons of asbestos into the atmosphere. While the Environment Protection Agency (EPA), under immense pressure from the federal government, gave the City an all-clear soon after the attack, respected scientists[19], hired by unions, tenant associations and New York politicians, reported dangerous levels of asbestos contamination in apartments and offices near ground zero. In December 2001, a study by the New York City Department of Health and the Agency of Toxic Substances and Disease Registry announced that 13% of residential dust samples contained greater than 1% asbestos by weight; the amount found in other samples of surface dust was up to 4% by weight.

Dr. Cate Jenkins, an environmental scientist who had worked for the EPA for 22 years, is worried:

> "If people continue living and working in places that still have dust in the carpets, furniture, drapes and heating and cooling system, these fibers will continue to be resuspended… The elevated risk could be from around one-in-a-thousand extra cancers to maybe as high as one in 10."[20]

Concluding Thoughts

If we have learned anything from the tragic asbestos legacy, it is that the impact of hazardous asbestos exposures continually exceeds predictions.[21] The legacy of asbestos consumption is: ill-health, death, contaminated infrastructures, polluted land and major public health problems. While forty countries have adopted national asbestos bans, consumption of this hazardous substance is increasing in many developing countries.

The use of asbestos was banned throughout the European Union as of January 1, 2005, but despite this ban we are left with major environmental and public health problems resulting from decades of widespread and uncontrolled asbestos use. To minimize future hazardous exposures, there is a need for standardized means to measure asbestos contamination in the environment and a certification scheme for asbestos removal companies. Addressing these concerns, the Brussels Declaration, adopted at the *European Asbestos Conference: Policy, Health and Human Rights,*[22] acknowledged that:

> "Asbestos products in European homes, commercial buildings and infrastructures and asbestos waste in our environment continue to cause unprecedented levels of diseases and mortality."

The Brussels Declaration called on the European Parliament and the European Commission to take action to prevent future hazardous exposures; it recommended:

- "rigorous enforcement of EU and national health and safety asbestos legislation…
- introduction of guidelines for measuring asbestos soil contamination;
- research on safe methods for treating asbestos waste…
- the 2003 (EU) Directive should be strengthened by eliminating the concept of "sporadic and of low intensity exposure". No exposure to asbestos is safe…
- finances from the European Social Fund should be made available to support the clean-up of asbestos contaminated areas."[23]

A well-funded scientific approach will be needed to ensure that future generations of Europeans do not suffer the same fate as those whose health and lives have already been sacrificed to asbestos.

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[1] Virta RL. *Worldwide Asbestos Supply and Consumption Trends from 1900 to 2000*. USGS Survey.
[2] At one time 10 of the 13 Canadian chrysotile mines which were operational were in Quebec. According to Historian Joch McCulloch: "They included the Jeffrey Mine, which was the largest open-pit asbestos mine in the world."
[3] McCulloch J. *Mining and Mendacity, or How to Keep a Toxic Product in the Marketplace*. Int J Occup Environ Health 2005;11:398-403.
[4] AHERA: Asbestos Hazardous Emergency Response Act.
[5] This is the clearance limit for public housing for indoor air in the US.
[6] The ink was hardly dry on John Van Raalte's report when a spokesperson for the Pro-Chrysotile Movement (Le Mouvement ProAmiante Chrysotile) condemned the testing methods used as "inappropriate" and warned the population of Thetford Mines and Asbestos to be "on their guard" against troublemakers sent to their area by the American branch of Ban Asbestos. [Echantillonnage clandestin de l'air by Danie Blais, December 19, 2003, Courrier Frontenac.] Mr. Van Raalte, a Certified Industrial Hygienist with 18 years of experience and a Master's Degree in Environmental

Health/Industrial Hygiene from the University of Cincinnati, followed strict U.S. guidelines for sampling and analysis.

[7] Report of Results: MVA Project 3416.

[8] Data from 2003, shows that Kazakhstan produced 353,000 t and exported 60,000 t, making it the 4th biggest chrysotile exporter. Its domestic consumption of the asbestos produced nationally (13.8%) is the third highest in the world after Russia (20%) and China (17.9%).

[9] Within a few short years of its formation in 1920, Turner & Newall Ltd. became the UK's largest asbestos group and was referred to as the "Asbestos Giant."

[10] T&N publication: *The First Fifty Years 1920-1970*.

[11] The dire occupational and environmental conditions at this site have been reported in a number of books including: *Asbestos Killer Dust* by A. Dalton, *Magic Mineral to Killer Dust* by G. Tweedale and *Asbestos: Medical and Legal Aspects* by B. Castleman.

[12] Website: http://www.spodden-valley.co.uk

[13] *Residents not told about asbestos*. August 12, 2005. Website: http://news.bbc.co.uk/

[14] *Were Councillors and the BBC misled over asbestos test results*. August 12, 2005. Website: http://www.spodden-valley.co.uk

[15] The Kanzaki plant had produced asbestos-cement water pipes containing crocidolite and chrysotile from 1954 to 1975 and asbestos construction materials (mainly roofing and outer wall materials for domestic houses) containing chrysotile from 1960 to 2001.

[16] *Death Rate from Rare Cancer 9.5 times Higher Near Plant*. August 25, 2005. The Japan Times website: http://www.japantimes.co.jp/

[17] *Asbestos as an Environmental Hazard – the Example of the Szczucin Community* was the title of the paper presented by Dr. Neonila Szeszenia-Dabrowska on May 11, 2004 at the conference: *Asbestos Issues in Poland*, held in Lodz, Poland.

[18] Terazono A. *Asbestos Emission Caused by Buildings Demolition in the Great Hanshin-Awaji Earthquake.* Presented at the Global Asbestos Congress 2004, Tokyo, Japan.

[19] Eric Chatfield and John Kominsky used electron microscope technology and modern fiber counting protocols; the EPA's measurements were taken using twenty year old methods of collection and measurement.

[20] Kazan-Allen L. *Asbestos Fallout from September 11*. January 2002. Website: http://www.ibas.btinternet.co.uk

[21] Pinheiro A, Antao VCS, et al. *Malignant Mesothelioma Surveillance*. Int J Occup Environ Health 2004;10:251-255.

[22] The European Asbestos Conference was held in Brussels on September 22 & 23, 2005; see website: http://www.ibas.btinternet.co.uk

[23] Kazan-Allen L. *European Asbestos Conference: Policy, Health and Human Rights*. September 2005. Website: http://www.ibas.btinternet.co.uk