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NOTES ON THE HISTORY OF ASBESTOS FIBRE

INSTITUTE OF OCCUPATIONAL AND ENVIRONMENTAL HEALTH MONTREAL, CANADA

Prepared by the Staff of:

CANADIAN JOHNS-MANVILLE COMPANY, LIMITED

ASBESTOS FIBRE DIVISION

Asbestos, Québec,
November 9, 1967.

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The earliest historical references made to asbestos fibre, deal with its uses, rather than the method of mining or the specific mineralogical types involved. In some instances, such as in the case of the initial known use of asbestos fibre in cloth making, it is reasonable to infer that a long and flexible asbestos fibre was required, and that its mining was probably akin to a relatively small scale manual surface cobbing operation.

However, as the ingenuity and the technological progress led to more and more uses of asbestos fibre, the diversity of the types of fibre suitable for production has grown accordingly.

In the historical outline below, the uses of asbestos fibre are first described, followed by brief chronological notes on the discoveries of asbestos deposits.

USES OF ASBESTOS FIBRE

Asbestos Cloth or Textiles

Most authorities agree that asbestos fibre was first used as far back as 2,000 years ago when the Greeks, Romans, Chines and Egyptians used the fibre for making simple fabrics and textiles such as cremation sheets, lampwicks, hats and shoes.

In 1712, asbestos was found in the Ural district of Russia, and during the reign of Peter the Great, a factory was established to produce textiles, gloves, etc. The beginning of the asbestos textile industry took place in Italy about 1806, with the manufacture of threads, some papers and asbestos suits. The earliest manufacture of asbestos textiles in the United States appears to have occurred sometime between 1895 and 1900. In about 1909, Bell Asbestos Company and the United Asbestos Company amalgamated, and in 1928, these amalgamated again with Turner Brothers to form the present Turner-Newall Company which is perhaps the largest asbestos textile producer in the world.

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Asbestos Paper

Asbestos paper has been reported as an ancient art, but in the year 1750, a piece of paper not consumed by fire was described in the literature. In 1765, an asbestos cardboard was being manufactured and sold commercially in Germany and in 1806, asbestos tissue paper was being produced in Italy. The earliest U.S. production appears to be around 1878, when asbestos paper was produced at Baldwinsville, Massachusetts.

Thermal Insulations

check Magnani patent for accuracy of this

Possibly the first insulation containing asbestos was a material consisting of asbestos fibre and silicate of soda as developed in the United States in 1886. In the United States asbestos insulating cements were developed about 1870.

Roofing

In 1868, asbestos was first employed in the United States as a roofing material to provide improved fire resistance.

Packings and Gaskets

The use of asbestos in packings and gaskets in the United States dates back to at least 1870, when asbestos was combined with cotton, saturated with grease and twisted into a rope packing of desired diameter. The use of asbestos textiles as packing started in about 1880.

Asbestos-Cement Industry

"Origin and rise of the asbestos-cement industry are permanently connected with the name of Ludwig Hat schek, even though artificial stones were being produced already from asbestos and cement before he applied for his patent on the 30th day of March 1900. The by-patents applied for after this date were numerous. It is a fact, however, that there was no decisive improvement in the manufacture of asbestos-cement base boards, excepting the new invention of Dr. Magnani. Only a certain progress was made in the production of pressure pipes, but this was also incited by L. Hatschek. The Mazza process is cited for example, because it was invented by a close friend of Hatschek's.

"Until today those fundamental inventions have held their ground.

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"The basic idea expressed in Hatschek's patent application was 'to manufacture asbestos-cement, respectively artificial stone and slate slabs from fibrous materials and hydraulic binding agents'.

"The process is distinguished by the fact that a mixture of hydraulic binding agents, fibrous materials, and water is formed into boards by a circular sieve cylinder machine. During the process the fibres are placed parallel to the boards' plane, and they are enveloped profoundly and uniformly by the binding agents. By further pressing or forming, the boards may be shaped as desired.

"Similar processes developed by Osterhld and Schmidt were quite unsuccessful, so that after lengthly lawsuits concerning his patent, the process developed by Hatschek was the only one still in use. After expiration of Harschek's patent, most people applied his wet dressing method.

"After 60 years of trial, asbestos-cement as a building material became the main support of the whole building industry. A great progress was made in the manufacture of asbestos-cement pipes by applying the wet dressing method, especially in producing pressure pipes, which made it possible to construct large pipe lines, water supply and pneumatic tube installations. Today, they are already proceeding to manufacture pressure pipes with a diameter of 1,000 mm.

"In 1929, Dr. Magnani applied for a patent, covering the manufacture of asbestos-cement joint fitted pipes. Soon thereafter, he applied for a patent for his asbestos-cement sheet making machine.

"During the last years, the asbestos-cement industry has expanded immensely throughout the world. The consumption of asbestos in the free part of the world is today, about 2 million tons a year.

"Consequently over 10 million tons of asbestos-cement products are produced every year. The total sales of the abestos-cement industry in Germany exceeded in 1954 - - 500 million DM. The products of the asbestos-cement industry range from slate slabs, corrugated sheets, sewage and pressure pipes, to flower boxes and garden chairs. A leading English company, for example, is manufacturing more than 4,000 different articles of asbestos-cement.

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"Constructions without any parts made of asbestos-cement are almost unthinkable in the modern construction industry".

Excerpt from : "Asbestos-Cement Machinery"
by : H. Hiendel

Brake Linings

Brake linings containing asbestos cloth were first manufactured in about the year 1907 or 1908. Rigid molded linings were developed in the early 1930's.

Flooring

Asbestos asphalt tile was apparently first produced in the United States in the 1920's. Although it was first made in the 1930's, vinyl asbestos tile was not fully commercialized until about 1948.

The uses of asbestos fibre are listed in the Appendix "A".

DISCOVERY AND MINING OF ASBESTOS DEPOSITS

Amosite

Amosite was discovered in 1907 near Penge in Transvaal, South Africa. Limited tonnages were produced there in 1910. In 1916, the Egnep (Pty) Ltd.(*), and Amosa (Pty) Ltd. (**), companies were registered to develop these deposits. In 1925, these companies were purchased by Cape Asbestos Company, Ltd. Four separate mines belonging to Cape Asbestos Company are currently in production : Penge, Streatham, Weltevreden and Kromellenboog.

In addition, a number of small properties produce a limited amount of amosite and crocidolite in Malips Drift-Chuniesport Area.

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(*) The Egnep Company takes its name from Penge spelled backwards.
(**) The name "Amosite" was derived from the Amosa Company i.e. Asbestos Mines Of South Africa.

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Crocidolite

Crocidolite was reportedly first found in Australia. Subsequently, sometime between 1803 and 1806, crocidolite was found near Prieska in the Orange River Valley, in South Africa. No attempt was made to explore the possible utility of crocidolite until 1891, when Francis Oates formed a group called the Cape Mineral Syndicate. Two years later, the Syndicate established a London Company to undertake mining as well as manufacturing and incorporated it in 1893 as the "Cape Asbestos Company, Ltd." At the time, the company was manufacturing thermal insulation in Italy.

In 1948, Cape Blue Mines (Pty) Ltd. purchased all the assets and mining rights of the Cape Asbestos Company's Blue crocidolite mining activities.

Small deposits of crocidolite were also discovered in Australia (Hamersley Ranges, 1937 and Wittenoom Mine 1946), and in Bolivia (1940-1950).

A number of crocidolite mines is listed in the Appendix "B".

Chrysotile

The initial ancient uses of asbestos fibre, were most likely utilizing the amphibole variety of fibre. The island of Cyprus and the Aosta Valley in the Italian Alps were the first sources of this material.

The first reference to the chrysotile variety of asbestos fibre is found in connection with the discovery in the Des Plantes River region, between the villages of St. Joseph and St. Francis in Quebec, Canada. In July 1877, chrysotile asbestos was found in Thetford and Coleraine. Mining operations commenced in 1878 when 50 tons of chrysotile was produced by the King brothers in Thetford.

In 1879, Danville Asbestos and Asbaltic Company began operations. It later became Jeffrey Mine of Canadian Johns-Manville Company, Limited.

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In Russia, after the initial discovery and limited manufacturing in the early 18th century, the exploitation of the Ural deposits became dormant until 1860. Systematic extraction commenced in 1885 in Alapajevsk and in a large deposit in Asbest, located 90 miles north east of Sverdlovsk in the Middle Urals.

Chrysotile was also discovered in Southern Africa in 1896 (Carolina District), in 1905 (Shabani and Kaapsche Hoop) and in 1907 (Mashaba). Production commenced in 1908 in Mashaba.

With the advancement of the exploration methods, and prompted by the growing demand for asbestos fibre, discoveries have been taking place in practically every part of the world : North and South America, Africa, Europe, Asia and Australia.

A list of chrysotile mines is shown in the Appendix "B".

Acknowledgement:

We are particularly indebted to -
Dr. E.L. Mann, Chief Geologist,
Mr. W.C. Streib, Research and Development Manager

whose research and assistance made the preparation of this paper possible.

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APPENDIX "A"

USES OF ASBESTOS AND ASBESTOS PRODUCTS

USES OF RAW ASBESTOS

Yarn
Thread
Wick packing
Rope packing
Felt
Paper (plain and corrugated)
Rollboard
Millboard
Insulating wire
85% Magnesia pipe covering, blocks and locomotive lagging
High temperature insulation (moulded) (various types)
Compressed sheet packing
Compound for encasing of motor windings
Moulded composition for electrical and other purposes
Moulded brake lining and brake blocks
Automobile bodies and railway sleepers (moulded composition)
Filler in Plastics
Flooring
Pottery and sculpture
Asbestos Cement Products, viz:
- Shingles, siding, tile
- Wall tile and flat sheets
- Corrugated roofing and sheathing
- Decorative panels
- Insulated board
- Floor tile backing
- Pipes
- Miscellaneous articles, such as ventilators, flower pots, louvres, etc.

Asbestos cement for insulation of boilers
Roofing cement
Furnace cement
Plaster and stucco
Paints, varnishes and fillers
Sprayed asbestos (acoustical)
Filling for asbestos mattress insulation
Insulation of batteries (loose fibre)
Insulation of walls and floors (loose fibre)
Insulation in underground conduits (loose fibre)
In foundations to resist shock
Packing for explosives or other materials
Wadding in cartridges and timing devices
Filter fibres and filter pads
Platinized asbestos fibre for filtering
Coating for welding rods
In cheese making (on which to place spores)
Sewer pipe
Asphalt Floor Tile
Automobile body undercoating

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USES OF ASBESTOS YARN

Cloth
Tape, electrical and other
Brake lining
Clutch facings
Packing - valve stem, braided and other
Gas mask filters
Gaskets and gasket cloth
Tubing
Wick for oil burning apparatus
Rope
Twine or sewing thread
Stocking for lead cable
Electric fixture wire covering
Electric cable covering
Tying gas mantles
For spark plugs
Edges for hair felting
Steam hose
Fire-retardant hose

USES OF ASBESTOS CLOTH

Packing - sheet, high pressure, folded or wound
Brake lining, folded and stitched
Clutch facings
Gaskets
Asbestos insulation mattresses
Substitute for canvas on insulation where temperatures are high (lagging cloth)
Clothing, viz:
- Suits
- Helmets
- Gloves and mittens
- Aprons
- Leggings
- Berets

Draperies
Hangings for firestops
Blankets for fire fighting
Blankets in electrolyzer cells
Bags and diaphragms (in oxygen producing)
Mailbags
Awnings
Rugs
Theatre curtains
Theatre scenery
Floor lining in theatres
Portable motion picture booths
Motion picture screen
In acoustical treatment
In acetylene Welding
Gun grips
Asbestos faced wipers in commutators
Facing for dryer felt
Filtering (fruit juices, acids, etc.) beer
Filter in dust collectors

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(Uses of Asbestos Cloth - Continued)

Oil filter sack (in automobiles)
Protectors for gas bags in balloons
Oven insulation
Lining in motors
Lining of laboratories, cooling chambers and other rooms
Lining of automobile footboards
Padding for laundry presses and mangles
Padding prison cells
Wrapping oil tanks and oil lines in engines
In various medical test apparatus
Umbrellas and shields (protecting firemen)
Sand bags (for pressing hats)
Conveyor belting
In hay curing to preserve aroma and color
In cheese making to control temperature
Insulation against noise and vibration (especially in air planes)
Fittings for airplanes
Ironing board covers

USES OF ASBESTOS FELT

In acoustical work
Protection of underground pipe
On paper machines
Noise insulation
Padding in pianos

USES OF ASBESTOS TAPE

Wick for oil burning apparatus
Belts for conveying hot glass or other articles
Pull strings for ovens
Insulating locomotive steam pipes at bends, etc.
Insulating armatures
Winding coils
Winding buss bars
Insulating underground cables
Laboratory uses, such as insulation for flasks, test tubes, retorts; tie straps in diffusing materials
In glass manufacture for wrapping tines of forks to take bottles from ovens;
Insulating electric wires on planes and ships

USES OF WICK PACKING

As packing
For wiping of wire, armor plate or galvanized materials

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USES OF ASBESTOS PAPER

Air cell and other pipe coverings
Boiler jackets
Asbestos felt roofing
Asbestos built-up roofing
Asbestos protected metal roofing
Baskets, plain and metallic
Wick in oil burning apparatus
Tubes in electrical industry
Wrapping of electrical wire
Wrapping of hot air pipes
Linings of
    Stoves
    Heaters
Linings of
    Filing cabinets
    Cartridges
    Soldiers' helmets
    Carpets
    Auto mufflers
    Radiator covers
    Drum controllers
    Cookers
    Electric appliances
    Armored car roofs
    Motors
In enameling ovens to catch drip
Insulation of ovens and dry kilns
Diaphragm in electrolytic cell
Tank covers
Reinforcing aluminum foil for insulation
Filtering
In window glass machinery to guide hot sheets; to shield hot glass from flying fragments
In welding and other processes for protection from heat
In annealing (crumbled paper)
In chemistry and physics in many various ways
Reinforced with cotton thread for automobile tops
Covering of rockwool blankets which must be sewed
Wrapping of wires and cables
Insulating exhausts on automobiles
Baking sheets
Table pads and mats
Construction of air ducts or lining of paper ducts

USES OF ASBESTOS MILLBOARD

Linings of
    Stoves and heaters
    Safes
    Garages
    Motion picture booths
    Electric switch boxes
    Dry cleaning machines
    Garbage incinerators
    Hoods of automobiles
    Bottoms of brooder stoves

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(Uses of Asbestos Millboard - Continued)

Ovens and dry kilns
As fireproof wallboard
Ceiling over boilers, smoke stacks, etc., for fire protection
Gaskets, plain and metallic
Paddles in glass mills
Washers in electrical apparatus
Tent shields and stove pipe rings
In metal clad doors (between outside metal and wood core)
Table pads and mats
Stove mats

USES OF ASBESTOS-CEMENT FLAT SHEETS AND WALLBOARD

Interior sheathing (of factories, refrigerator rooms, etc.)
Partitions, movable and fixed
Exterior sheathing (half-timber effect)
Brick-type siding
Portable buildings
Roofs and sides of small buildings
Semi-portable motion picture booths
Fireproof layer on insulated board
Fire protection around engines
Lining of fireless cookers
Backing for dies (in moulding glass)
Brake shoes for elevators
Hoods over machines or vats (from which vapor rises)
Mounting of test instruments and gauges
Laboratory table tops
Switch boards
Cabinets and panel box work
Insulators between phases and on arc deflectors
Electric motor casings
Spark arresters
Miscellaneous uses in electrical apparatus
Lining for bleaching and other tanks and vats
Backgrounds and cut-outs for window displays
Blackout or bombproof board Well, it's good for something.

USES OF ASBESTOS CEMENT PIPES

For carrying of water, sewage, gas and special liquids
As gas vent pipes
Conduits for electric light wires, etc.
Purlins, rafters, trusses, etc., for wartime buildings

USES OF ASBESTOS COMPOSITION MATERIAL

Insulation compounds
Heater cord insulation
Electric wire insulation
Lamp sockets, rheostat backings, switch parts, arc deflectors resistance mountings and other electrical uses
Underground insulation
Flooring
Phonograph records, buttons and other small objects made of plastic
Sealing of percussion caps in large cells

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APPENDIX "B"

CROCIDOLITE MINES

SOUTH AFRICA

	Mine	Company	
Near Botswana	Pomfret Mine		
Kuruman (North)	Heuningvlei		
Kuruman :	Riries	Central Asbestos Co.	
	Orcadia	" "	
	White Rock	" "	
	Mount Vera	" "	
	Asbes	" "	
	Bretby	" "	
	Greyling	" "	
	Eldoret	" "	
	Khoretsi	" "	
	Whitebank	Kuruman Cape Blue Asbestos (Pty) Ltd	
	Kuruman East	" "	
	Millsite	" "	
	Bestwell	" "	
	Newstead	" "	
	Bosrand	" "	
	Depression	Wandrag Asbestos (Pty) Ltd.	
	England	Wandrag Asbestos (Pty) Ltd.	
	Langley		
	Mansfield		
Danielskuil	Warrendale	Consolidated Blue Asbestos Corp. (Cape Asbestos (Pty))	
	Mimosa	"	
	Owendale	KCB Asbestos (Pty) Ltd.	
	Ouplaas	" "	
	Schietfontein		
	Hurley		Closed
	Klipvlei		Closed
	Crawley		Closed
	Billinghurst		Closed
	Grasmere		Closed
	Oudeplaats		Closed
	Doornfontein		Closed

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APPENDIX "B"

CROCIDOLITE MINES

SOUTH AFRICA	Mine	Company	
Near Botswana	Pomfret Mine		
Kuruman (North)	Heuningvlei		
Kuruman :	Riries	Central Asbestos Co.	
	Orcadia	" "	
	White Rock	" "	
	Mount Vera	" "	
	Asbes	" "	
	Bretby	" "	
	Greyling	" "	
	Eldoret	" "	
	Khoretsi	" "	
	Whitebank	Kuruman Cape Blue Asbestos (Pty)Ltd	
	Kuruman East	" "	
	Millsite	" "	
	Bestwell	" "	
	Newstead	" "	
	Bosrand	" "	
	Depression	Wandrag Asbestos (Pty)Ltd.	
	England	Wandrag Asbestos(Pty)Ltd.	
	Langley		
	Mansfield		
Danielskuil	Warrendale	Consolidated Blue Asbestos Corp. (Cape Asbestos (Pty))	
	Mimosa	"	
	Owendale	KCB Asbestos (Pty) Ltd.	
	Ouplaas	" "	
	Schietfontein		
	Hurley		Closed
	Klipvlei		Closed
	Crawley		Closed
	Billinghurst		Closed
	Grasmere		Closed
	Oudeplaats		Closed
	Doornfontein		Closed

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South Africa (continued)

	Mine	Company	
N.W. of Griquatown	Blackridge		Closed
Nierkerks Hope	Naauwpoort		
	Elandsfontein		
Prieska	Kliphuis	Cape Asbestos	
	Erfrust		
	Glen Allan		
	Buisvlei		
	Stofbakkies		
	Carn Brae		
	Geduld		
	Brimitsa		
	Klein Naauwte		
	Enkelewilgeboom		
	Orange View		
	Naauwgekneld		
	Dikberg		
	Prieskas Poort		
	Asbestos Reefs		
	Lovedale		
Koegas	Koegas	Koegas Asbestos Mine	
	Westerberg		
	Bultfontein		Closed
	Nauga		Closed
	Geelbeksdam		Closed
	Pypwater		Closed
	Leelykstaat		
	Stilverlaat		
N.E. TRANSVAAL			
Chuniespoort-Penge	Ass. African Mines	Cape Asbestos	
AUTRALIA			
South Australia	Robertstown		
	The Flinders Range		
	Arkaba		
	Shaggy Ridge		
	Umberata		
	Mt. Lyndhurst		
	Truro		
	Cawell		
	Oodla Wirra		
	Orrooroo		

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Appendix "B"

Australia (continued)

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	Mine	Company	
Western Australia			
Roebourne-Nullagine Hammersley Ranges Area	Wittenoom		Closed
	Yampire Gorge		
	Bee Gorge		
	Dales Gorge		
	Marra Mamba		
	Bindi Bindi		
BOLIVIA			
Chapare Prov.	Marta	Philadelphia Concession	Closed
	Elena		
	San Francisco	Tejada	"
	Tres Amigos	Tejada	
	Carolina		
		Wormald Limitada	
		International Mining Co.	
		Subsidiary: W.R. Grace & Co.	
	El Limbo Area	Bolivian Cement Company	
	Palmar-Minillo Area		

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Appendix "B"

CHRYSOTILE MINES

NORTH AMERICA

		Mine	Company	
Canada				
Baie Verte, Nfld.			Advocate Mines Ltd.	
Beauceville, Que.			Golden Age Mines	Closed
East Broughton, Que.			Carey Canadian Mines Ltd.	
Robertsonville	"		National Asbestos Mines	
Thetford Mines	"		Flintkote Mines Limited	
"	"		Bell Asbestos Mines Limited	
"	"		Asbestos Corporation Limited	
King Beaver	"		King Beaver Mine	
"	"		Consolidated	
"	"		Bennett-Martin	
"	"		Johnson Company (Thetford)	
Black Lake	"	British-Canadian	American Asbestos Company	
"	"		Glasgow- & Montreal	
"	"		United	
"	"		Manhattan	
"	"		Dominion	
"	"		Standard Asbestos Company	
Vimy Ridge	"	Normandie	Asbestos Corp. Limited	Closed
Coleraine	"	Belmina	Asbestos Corp. Limited	Closed
Black Lake	"	Maple Leaf		Closed
"	"	B.L. Consolidated Pits	Union Asbestos	Closed
Pennington Dyke	"	Pennington Pit		Closed
		Federal Pit		Closed
		Kitchener		Closed
		Broughton Pit		Closed
		East Broughton		Closed

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North America (continued)

		Mine	Company	
(Canada)				
Black Lake Area	"		Anglo Canadian	Closed
			White's Asbestos Co.	Closed
			Reed's Mine	Closed
			Murphy's Mine	Closed
Vimy Ridge	"	Penhale	Asbestos Corp. Ltd.	
Ungava		Asbestos Hill	Asbestos Corp. Ltd.	
Thetford Mines	"	Thetford	Johnson's Co.	
Black Lake,	"	Megantic	Johnson's Asbestos Co.	
"	"	Lake Asbestos	Lake Asbestos of Que.	
St. Remi	"	Norbestos	Nicolet Asbestos Mines Ltd	
Asbestos	"	Jeffrey	Can. Johns-Manville	
Matheson, Ont.		Munro	" "	Closed
Reeves Twps. Ont.		Reeves	Johns-Manville Mining & Trading C	
Garrison Twp. Ont.		Bird-Ginn		
Brompton Lake, Que			Brompton Lake Asbestos Co.	
Warden Twp., Ont.			Hedman Mines	Closed
Kilmar, Que.			Can. Refractories Ltd.	
Harker Twp., Ont.			Lightvol Mines Limited	
McCool Twp.	"		Young Davidson Mines Ltd.	
Northern B. C.		McDame	Cassiar Asbestos Corp.	
Yukon		Near Dawson City	Clinton Creek	
"			Caley	
Northern B. C.			Letain	
(United States)				
Vermont			Reburoid Corp.	
Maryland		Burnsville	Powhatan Mining Co.	Closed
Arizona				
Salt River		Phillips	Asbestos Mfg. Co.	
Cherry Creek Basins		Regal & Chrysotile	Jaquays Mining Corp.	
Globe, Gila County		Lucky Seven	Metate Asbestos Corp.	
California				
		Copperopolis	Pacific Asbestos Corp.	
		Coalinga	Coalinga Asbestos Co.	
		Joe 5 Mine	Union Carbide Corp.	
		Rover Pit & Santa Cruz	Atlas Minerals Corp.	
			Napa Co. Asbestos (Clute)	
		Phoenix Mine	Asbestos Mining Co.	

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North America (continued)

Mexico Monterey	Mine	Company	
SOUTH AMERICA			
Venezuela	Tinaquillo	Amveco	
"	El Tigre		
"	La Montanita	Turner & Newall	
"	Los Teques		
	El Zamuro		
	La Esperanza		
Colombia	Morro Norizal		
	Manizales-Caldes		
Brazil	Minas Gerais	Correigo de Virriata (Eternit Do Brazil)	
	Morro Velho	Dialma Dutra	
	Querimadas	Piabas	
Chile	Valdivia	Corrall	
AFRICA (Southern Africa)			
Rhodesia			
Shabani	Shabani	African Ass. Mines (Pty) Ltd, Rhodesian and General	
	Birthday	Asbestos (Turner & Newall)	
"	Nil Desperandum	Asbestos Mining Co. (T&N)	
Mashaba	Gath Mine	" "	
"	Kings Mine	" "	
"	Empress	"	
"	Boss	Asbestos Investment Pty Ltd	
Belingwe	Vanguard	Eternit G roup	
Filabusi	Pangani	Eternit Group	
"	Norma	Eternit Group	
"	Croft		
Umvukwe	Ethel		
Bechuanaland	Lobatsi	Marlime Asbestos Corp.	
"	Mashaneng		
Swaziland	Havelock	New Amianthus Mines (T&N)	
South Africa			
Barberton	Msauli		
"	New Amianthus Mines		Closed
"	Munnik Myburgh		Closed
"	Sunnyside		Closed
"	Sterkspruit		
"	Stolzburg		
"	Doyershoek		
"	Barbeton Chrysotile Mine		
"	Kalkkloof		

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Africa (Continued) Southern Africa	Mine	Company	
Barbeton	Congo-Vaal Asbestos Mine		
"	Carolina Asbestos Mine		
"	Badplaas Asbestos Mine		
"	Elandshoek Asbestos Mine		
Algeria	Machèria Deposit		
Morocco	Bon Azzer		
	Asbar		
	Bon Affroh		
	Sirova Mountains		
EUROPE			
Cyprus	Amiandos on Mt.	Cyprus Asbestos Mines Ltd.	
	Troodos	Cyprus Cement Co. Ltd.	
Italy	Balangero (Torino)		
	Aosta Susa Tasascon	United Asbestos Co. Ltd.	
Corsica	Canari		
	Olmeta Cape Corse	Eternit Group	Closed
Yugoslavia	Stragari		
	Korlaca-Belci		
	Rujiste		
	Bogoslovak		
	Petrovo-Selo		
	Goc		
	Stava Toplice		
	Picelj Mine in Kapaonik Mtns.		
Spain	Malaga		
U.S.S.R.			
Middle to Southern Urals			
Alapajevsk	Bazhenovo	North-Proletariat Mines	
Asbest -90miles	Novabest		
N.N.E. of Sverdkovsk	Asbestovski		
	Krasnouralsk		
	Nevjansk		
	Reshevsk		
Urals	Miass-Chakalov/Orsk		
Near Turkestan Kazakhtan			
Turkey			
Asia			
China	Antung Dist. Chi-an and Chuang-Ho Hsiens		
	Pao-tou Hsien, Suiyuan Province		
India	Hasan, Mysore		
	Madras Dist., Cuddapah		
Japan	Subsidized Mining		
	S.W. Honshu Dist.		

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Appendix "B"

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AUSTRALIA

	Mine	Company
West Australia	Pilbara: Sherlock	
	Nunyerry	
	Lionel	
	Soansville	
	Cooqlegong	
South Australia	Cowell	
	Hawker	
Queensland	Rockhampton	
	Kilkivan	
New South Wales	Baryulgil	Asbestos Mines Pty Ltd.
	Gordonsbrook	
	Woodsreef	White Asbestos Pty. Ltd.
	Barraba	Ampol-Petroleum Ltd.
	Broken Hill	
Tasmania	Asbestos Point	
	Zeehan	
New Zealand		
South Island	Mount Arthur	

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