ASBESTOS: A Consumer Fact File

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1977

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
December, 1986

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CHAPTER I

INTRODUCTION

Today's news is full of the evils in the environment. DDT poisoning and the ills described by Rachael Carson in Silent Spring have given way to headlines of PCB, dioxin, acid rain and a vast group of pollutants that have the potential to permanently poison nature. It seems at times that virtually everything is ready to destroy us either by cancer or other terrible diseases. This study presents factual information on another potentially significant hazard that, while present for eons, has just recently been recognized. The significant difference between asbestos and other substances being viewed as a problem is that asbestos comes from the environment itself. To call it a pollutant then becomes a difficult play on words.

Rather than using scare tactics, scientific ease, inexplicable formulas, and chemical equations, this paper will be a grass roots consumer guide and fact file to asbestos.

By understanding what asbestos is, its history of use, recognizing products consumers use containing asbestos, and noting the health risks related to asbestos the reader can determine his or her contact with asbestos. Next, by presenting documented environmental levels, current regulatory policy and estimates of consumer risk, the reader will come away with a basis to make decisions on how asbestos will be consumed. It is not the intent of this study to promote the use or nonuse of asbestos and its related products but rather provide a consolidated guide for consumers to make rational user decisions.

This study was generated after performing preliminary research on asbestos related materials in 1977. Data collected by the author was presented to the Vermont Environmental Protection Agency office when levels of asbestos found in automotive brake repair facilities showed levels in excess of prescribed standards of that time. Review of available material in 1977 showed no nonoccupational hazards related to asbestos. Now, years later, a mass of publicity and the bankruptcy of Johns Manville, the major U.S. supplier of asbestos products, renewed curiosity. Preliminary review of literature showed that much has been written in the last ten years on asbestos. None of the writings reviewed were consumer related and appeared to either be formatted in magazine expose or in scientific jargon in texts and related reports. This study is intended to consolidate information for the consumer. Use of formulas and scientific notations will be minimized as much as possible while retaining accuracy of the study.

Assumptions

The assumptions of this study include the following.

1. That the author has interpreted and translated scientific material to a level that is generally understandable.
2. That the data from sources represents the current scientific opinions of the recognized experts in the field of asbestos study.
3. The concensus opinion of experts concerning asbestos is accurate and their material is not biased in a factual sense to either protect or condemn manufacturers.

Limitations

This study is limited by the following factors:

The author, while an Environmental/Systems Engineer, does not have the medical and scientific skills to fully analyze the positions of the expert writing reported in this study. During the conversion of measurements used in scientific journals, reports, and writings, the author has used rounding procedures. The effect changes the actual data but should simplify the data to understandable units of measure.

Research Questions

The research sought to answer the following questions:

1. What is asbestos?
2. What is the history and scope of its movement into consumer goods?
3. What consumer goods is asbestos used in?

4. What are ambient levels in air, water, food and drugs?
5. What are the major health risks associated with asbestos in the areas of air, water, food and drugs?
6. What are current regulations, policy concerning asbestos, and actions to correct asbestos contamination?
7. What is the outlook for the consumer?

Statement of the Problem

There is a need to present to the average consumer a consolidated review of asbestos, its uses and potential hazards in an understandable format. The purpose of this report was to review scientific and technical material and produce a consolidated package detailing the history of asbestos, its uses in consumer goods and explanation of hazards present. The building of a consumer fact file, which currently does not exist, was the main priority for this study.

There has been tremendous upheaval in asbestos regulations, court cases, and changes in the way consumers and government view the use of asbestos. Consumers have been giving only surface details of problems and in many instances, the information is overly technical or overly simplified reducing its use as a consumer decision making tool. As a result, consumers do not have access to a consolidated source of asbestos related information.

DEFINITIONS (Michaels 1978)

ASBESTOS BODIES: Microscopic fibers found in the lungs of people who have been exposed to asbestos particles in the atmosphere. Their presence does not necessarily denote that a person has asbestosis which is the disease produced by asbestos inhalation.

ASBESTOSIS: A non-malignant, progressive, irreversible lung disease caused by the inhalation of asbestos. Astestosis develops slowly and is detectable by a combination of clinical, radiographic (x-rays) and lung function tests. In the early stages, there is uncertainty about diagnosis. The characteristic symptoms are progressive breathlessness and an unproductive (chronic) cough. Asbestosis has been a recognized industrial disease since 1930.

PLEURAL CALCIFICATION: A thickening and or hardening of the surface of the lungs that may occur after exposure to asbestos dust. Pleural calcification is normally a warning sign of one of the other asbestos related diseases of more serious nature.

MESOTHELIOMA: A malignant tumor of the lining of the lung or more rarely the abdominal cavity. Mesothelioma is usually associated with blue asbestos (crocidolite), but has also occured among workers exposed to other types of asbestos. The duration of exposure required to cause mesothelioma may be brief and the appearance of the disease can occur some considerable time later.

LUNG CANCER: Characterized in cancerous tissue formally referred to as a tumor. A tumor being an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of normal tissue. Malignant tumors are those with the power to invade adjacent tissues and spread to other parts of the body. Benign tumors do not have this power.

FIBER: A fiber used in Purity Regulations consists of fiber at least 5 micrometers long with a length to width ratio of at least 5 to 1 (Levadie 1984).

CHAPTER II

REVIEW OF LITERATURE

Asbestos Defined

Standard references published over the past 50 years list six forms of commercial asbestos. (Levadie 1984) Webster defines asbestos as "any of several grayish amphiboles or similar minerals that separate into long, threadlike fibers" (Webster 1982). Amphilbole being a group of rock forming minerals composed largely of silica, calcium, iron and magnesium (Rasato 1959). With the exception of slight variations in the different types of asbestos, the fibers are light and feathery - yet exhibit high tensil strength and are so soft and flexible that they can be spun; woven, or felted as cotton fibers. The major recognized physical characteristic is its ability to withstand heat. The six major asbestos minerals are Chrysotile, Amosite, Crocidolite, Anthophyllite, Tremolite, and Actinolite (Bragg 1978). Table I shows a breakout of asbestos types and provides the only reference to chemical formulas that will appear in this study (Zielhuis 1977).

TABLE I

Varieties of Asbestos (Zielhuis 1977)

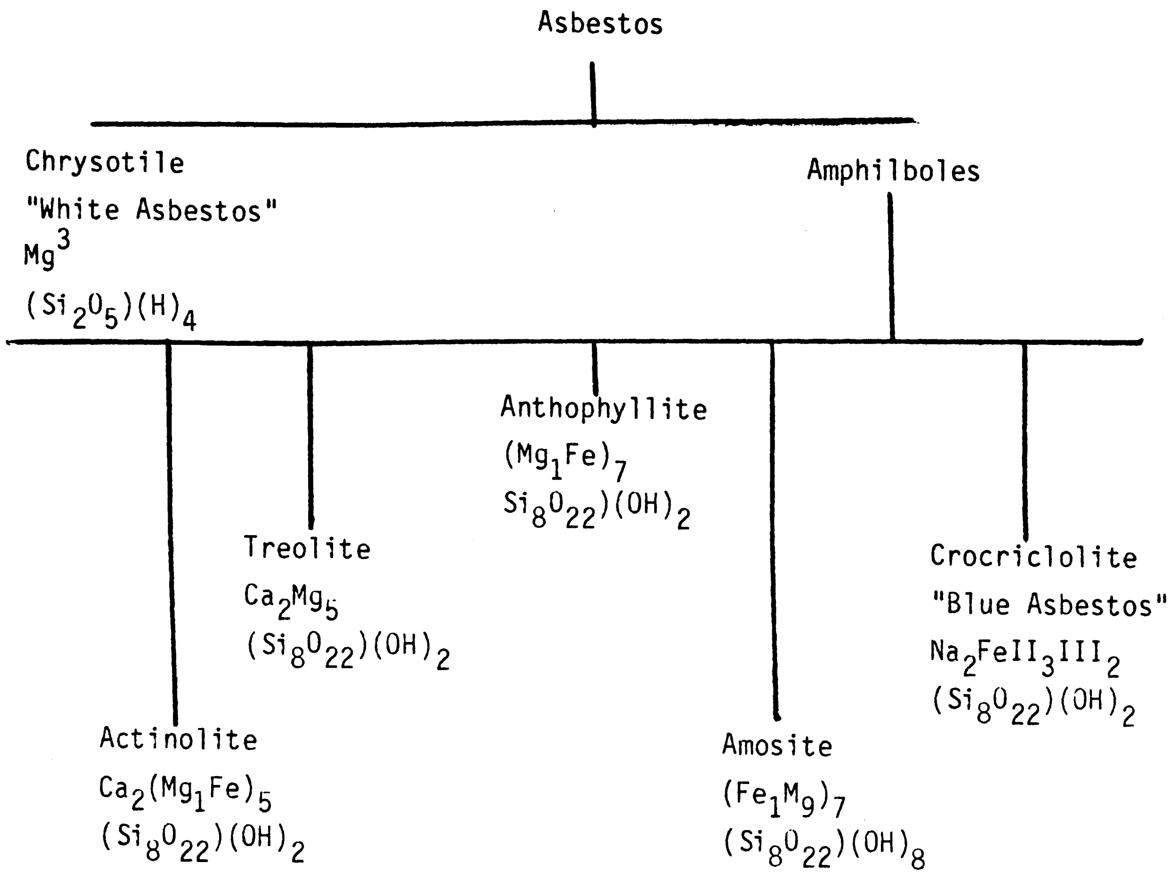

Table II is presented to show similarities and differences of the various types of asbestos. Again, resistance to heat is the main unique trait which is associated with asbestos.

TABLE II

(Zielhuis 1977)

Characteristic	Chrysotile	Crocilolite	Amosite	Anthophyllite	Tremolite	Actinolite
Color	White	Blue	Grey to Brown	White to Grey	White to Grey	Pale to Dark Green
Decomposition Temperature (°C)	450-700	400-600	600-800	600-850	950-1040	620-960
Resistance to Acid	Poor	Good	Fair	Good	Very Good	Good
Resistance to Bases	Very Good	Good	Good	Very Good	Good	Good
Texture	Flexible, Silky	Flexible to brittle	Brittle	Brittle	Brittle	Brittle
Producing Countries	USSR Canada China Rhodesia USA Italy S. Africa Switzerland	S. Africa	S. Africa	Finland USA	USA Italy	None

*Table extracted from journal of Asbestos, England.

History of Asbestos Use

While the general use of asbestos in international commerce dates only to the late 19th Century, its use in human culture goes back to at least 2500 B.C. Archealogical studies show that the inhabitants of Lake Juojarvi region of East Finland knew how to strengthen earthenware pots and cooking utensils with anthophyllite asbestos. This asbestos probably came from the areas that have been commercially exploited in recent times. Until recently, however, most other uses of asbestos were trival, such as its fabrication into such curiosities as cremation cloth, table cloths, lamp wicks and purses (Levadie 1984). There seems to be some confusion on the origin and exact meaning of the word "asbestos" (Michaels 1979). As mentioned by Wyers (1949), one form of the Greek word signifies "unquenchable", and the perpetuity of the flame given by wicks containing the material would justify the appellation. (Sielkoff 1978). At some time, the idea of indestructability became incorporated in the connotation, but this seems not to have been part of the original etymology (origin of the word). An oft-repeated story speaks of the astonishment displayed by Charlemagne's (768-814 BC) guests, less instructed than him on ancient wonders, when their host threw a table cloth into the fire and recovered it unharmed. Astonishment took a somewhat less gratifying turn in an episode related by Jones (American Textile Institute 1967) in which a Canadian laborer, throwing his homemade socks onto the fire and retrieving them to be worn again, was so credited with occult powers that he was forced to leave the village and start elsewhere with less panache (American Textile Institute 1967). Even well into the last century, asbestos could not be regarded as a product of commerce unless one includes such endeavors as the small industry developed in Russia during the rule of Peter the Great, in which chrysotile "white asbestos" from the Urals was used for a short period of time in the production of textiles (Michaels 1979).

It was not until 1850 that commercial production can be said actually to have been attempted. Between 1850 and the outbreak of the Franco-Prussian War in 1876 a succession of Italian manufacturers advanced the techniques of making asbestos paper and cloth, but they were not markedly successful in getting their products adopted (indestructibility of Banknotes did not appeal to the Bankers of the time) (Selikoff 1965).

Shortly after the early failures of the 1870's, the market for asbestos products rapidly changed probably for three reasons: the need for insulation for the new steam technology, the formation of an international trading company of Italian and English entrepeneurs, and the reopening of the vast chrysotile resources in Quebec Province, Canada. The supply for the first time was ample, and the market was ready (Michaels 1979).

The 1880's brought a rapid development of the asbestos industry. The reopening of the asbestos deposits of Northern Italy combined with the Thetford deposits of Canada provided ample supply for growing industrial use. The new mines of Canada were worked on a large scale, while the prospectors were busy exploring for the mineral in the mountains of the surrounding country. Villages sprung up like mushrooms in a country physically speaking one of the roughest. The population, comprising before the beginning of mining operations only a few scattered families, increased to several thousands and the whole country showed all the evidences of industrial activity and prosperity. By 1890, the asbestos industry was full blown, with hundreds of applications being introduced. By the turn of the century, deposits were being exploited in South Africa and Russia as well as Italy (Levadie 1978). A sketch of the development of manufacture of asbestos is graphically presented by Table V. The beginnings and scope of its use in consumer products also becomes evident (Berger 1963).

United States Production

As in Canada and other producing countries, 90-95 percent of all asbestos mined in the Unites States is chrysotile (Hendry 1965). The earliest record of discovery of asbestos in the United States is the listing for Vermont in the U.S. Geological Survey for 1861. The deposit is said to have been rediscovered in 1899 by a lumberman working for Judge E. M. Tucker on the north side of Belvidere Mountain. B. B. Blake located asbestos on the opposite (Eden) side about (1901) (Selikoff 1978). These chrysotile deposits are at the southern extremity of the asbestos belt running through Quebec. The northern site was worked until 1915, when the Eden site became the producer. The Vermont deposits until the early 1980's constituted the mainstay of production in the United States. The two sites have been jointly operated since 1944.

Deposits of chrysotile were discovered near Globe, Arizona in 1903. Until 1960, the Arizona deposit ranked second in the United States. During and immediately after World War I attempts were made to develop mines in Northern California to meet military demands and build a supply of asbestos for a strategic reserve stock (Bureau of Mines 1956). The mining of chrysotile asbestos continued to expand until the 1980's with California mines accounting for 65 percent of total output (Sullivan 1969). Other deposits were developed in North Carolina, Arizona, Vermont, Georgia, and Maryland. The United States has continually been a major importer of asbestos with inhouse production varying from 2.5 - 5% for worldwide production (Michaels 1979).

TABLE III (Selikoff 1978)

Asbestos Production 1878-1953

YEAR	PRODUCTION (Tons)	TOTAL VALUE $	AVERAGE VALUE (Per ton in $)
1878	50	00	00
1879	300	19,500	65.00
1880	380	24,708	65.00
1890	9,860	1,270,210	128.82
1900	21,408	719,416	33.60
1910	86,605	2,667,829	33.60
1920	179,891	14,749,048	81.99
1930	242,113	8,390,164	34.65
1940	345,581	15,620,006	45.20
1950	875,844	65,854,568	75.23
1951	973,198	81,584,345	83.83
1953	929,339	89,254,913	96.04

Worldwide production increased through 1978 with improvements in mining operations and increased product usage. In 1978 product of major producers were listed as shown in Table IV (Lavadie 1984).

TABLE IV

World Asbestos Production in 1978 (Lavadie 1984)

Fiber	Location	Production in tons
Chrysotile	Canada	1,620,000
	USA	93,000
	Brazil	100,000
	USSR	2,582,000
	Zimbabwe	210,000
	S. Africa	118,000
	China	210,000
World Chrysotile Total		5,317,000
Amosite and Cricidolite	S. Africa	281,000
TOTAL		5,598,000 Tons

TABLE V (Michaels 1978)

Events in the Development and Manufacture of Asbestos

YEAR	EVENT
1857-1880	First lustings (flat sealings, packings) based on asbestos in England.
1866	First waterglass bonded molded asbestos material for heat insulation.
1868	Research and development of asbestos published by Mr. Johns.
1868-1869	First United States use of asbestos in roofing felt and cement.
1866-1876	Start of systematic textile processing in Italy.
1878	John's first real factory (United States).
1882	Mattison got idea of substituting asbestos for hemp in insulation (U.S.).
1890	Beginning of textile processing Quebec Asbestos in the U.S..
1893	First spinning of crocidolite by Cape Asbestos Co..
1896	Fabrication of first woven Brake Bands in England.
1899	Wet machine process of making asbestos cement developed by Hatschek in Austria.
1903	Production of Asbestos cement in the U.S..
1904	Flat asbestos-cement board manufactured in U.S..
1906	Asbestos first used in brake linings.
1911	Asbestos technology exported from U.S. to Japan.
1918	Molded clutch facings developed.
1928	First asbestos pipe making machines imported into U.S..
1931	Technique for spraying asbestos developed in England.
1934	Amosite felt developed for turbine insulation.
1934-1946	Marked developed of protective asbestos clothing during World War II.
1944	Spraying of asbestos on deckheads and bulkheads on British and

U.S. ships.

1945	Multiflex material consisting of asbestos fibers with coating of resin introduced for air ducts.
1946	Asbestos filters built for water, beer, wines etc..
1947	Asbestos-cement pipes widely used because of steel shortage.
1950	Massive amosite sections replace 85% of building insulation.
1963	Spraying of asbestos discontinued in England.
1967	Asbestos incorporated in a wide variety of plastics paints, rubber and asphalt.
1971	Bulk handling system for fiber developed.
1972	70% of worlds output used in asbestos cement.

CHAPTER III

ASBESTOS IN CONSUMER PRODUCTS

The Beginnings

Machines for the production and use of power that was introduced in the industrial revolution furnished an immediate stimulus to the asbestos industry during the close of the 19th century in their need for packing and insulation (Battles 1971). On the American scene, a Mr. Johns read of asbestos in the Encyclopedia Americana as early as 1859, and began manufacturing some asbestos products in 1868. Because of its resistance to extremes in temperature, its ability to strengthen other materials, and its ease to work into a multitude of woven products, its use quickly broadened. In 1874, Mr. Johns developed a pipe covering made from layers of felts, paper and asbestos. World War II provided a tremendous boost in the demand for asbestos and multiplied the uses in spectacular fashion. A shortened process history of asbestos appears in Table V (Rosato 1959).

Trade associations, such as the Asbestos Textile Institute in the United States established the periodical Asbestos in 1919. This led to the publishing of the first Asbestos Fact Book which continues to date (Rice 1968). In 1967, Johns-Manville took five pages of a brochure mearly to list the names of their products (Johns-Manville Co. 1967). By the mid-1970's such lists became so long as to pass comprehension. For general purposes, practice has had to revert to short lists of principle types of products. Thus, for the year 1978, the asbestos containing products list was given as in Table VI (Asbestos Fact Book 1970).

TABLE VI

Asbestos Products: (Asbestos Fact Book 1970)

Raw Asbestos: yarn, thread, felt, rope packing, wick packing, plain or corrugated paper, rollboard, millboard, insulating wire, 85% magnesia pipe covering, blocks, high temperature insulation, compressed sheet packing, molded composition for electrical and other purposes, molded brake linings, brake blocks, etc., filler in plastics, flooring, pottery, rubber, asbestos cement, shingles, siding and tile, asbestos cement wall tile, flat sheets, corrugated roofing, roof sheathing, panels, insulating board, floor tile backing, pipes;, boiler insulation, roofing cement, furnace cement, acoustical sprayed asbestos, insulation of walls, floors, mattresses, conduits, in foundations to resist shock, filter fibers and filter pads, sewer pipe, asphalt floor tile, and automobile body undercoating.

Asbestos yarn: Cloth, tape, brake linings, cloth facings, packings, gas mask filters, gaskets, tubing, wicks, rope, twine, sewing thread, wire covering, cable covering, steam hoses, fire retardant shielding.

Asbestos cloth: Sheet packing, brake linings, clutch facings, gaskets, mattresses, clothing, gloves, mittens, aprons, leggings, draperies, hanging baskets, mail bags, awnings, rugs, theater curtains, theater scenery and floor lining in theaters, motion picture screens, acoustical treatment, filters, linings, paddings, medical equipment, fire shields, sand bags, conveyor belts, airplane fittings, ironing board covers, etc.

Asbestos felt: Acoustical work, noise insulation, and piano padding.

Asbestos tape: Wicks, belts, insulation, winding coils, underground cables, and glass manufacture.

Asbestos paper: Air cell and other pipe coverings, boiler jackets, asbestos felt roofing, gaskets, wicks, tubes, wire wrapping, hot air pipe wrapping, stove linings, linings of various other equipment, filters, in chemistry and physics in many ways, automobile exhausts, baking sheets, table pads and mats, air ducts, etc.

Asbestos mill board: Stove housings, heaters, safes, garages, motion picture booths, drycleaning machines, garbage incinerators, ovens, fire-proof wallboard, ceilings, gaskets, fire doors, table mats, stove mats.

Asbestos cement flat sheets and wall board: Interior sheathing, partitions, exterior sheating, siding, various building uses, laboratory table tops, switch boards, cabinets, panel boxes, motor casings, electrical apparatus, etc.

Asbestos cement pipes: For carrying water, sewage, gas and special liquids, as well as conduits for electrical light wires, etc.

Asbestos composition material: Insulation, heating, cord insulation, electrical wire insulation, lampsockets, switch parts, resistant mountings and other electrical uses, as well as underground insulation, flooring and various plastic and rubber uses.

Note: At present, the most widely used definition of asbestos in the United States is taken from the notice of proposed rule making for "Occupational Exposure to Asbestos" published in Federal Register 9 October 1975, by the U. S. Occupational Safety and Health Administration (OSHA). In this notice, any product containing one or more of the various types of asbestos is also defined as Asbestos.

With this list in mind it now becomes important to understand how much asbestos can be found by percentage in various consumer goods. Table VII gives industry norms for asbestos content of ten categories of products (Zielhuis 1977).

TABLE VII

Asbestos Products and Asbestos Contents (Zielhuis 1977)

		Approx. Asbestos Content % by weight	Asbestos Fiber Type
1.	Asbestos - Cement building Products	10 - 15	C A (Cr)
2.	Asbestos - Cement Pressure Sewage & Drainage Pipes	12 - 15	C (Cr) A
3.	Fire-resistant insulation boards	25 - 40	A C (Cr)
4.	Insulation products including spray	12 - 100	A C CR
5.	Jointings and packings	25 - 85	C (Cr)
6.	Friction Materials	15 - 70	C
7.	Textile products not included in (6)	65 - 100	C (Cr)
8.	Floor tiles and sheets	5 - 7 1/2	C
9.	Molded plastics and battery boxes	55 - 70	C (Cr)
10.	Fillers and reinforcements and products made thereof (felts, millboard, paper, filterpads for wines and beers, underseals, mastics, adhesives, coatings, etc.)	25 - 98	C (Cr)

Explanation of Asbestos fiber types:

A = Amosite
C = Chrysotile
Cr = Crocidolite

From this list of products it becomes obvious that virtually everyone is using an asbestos containing product, or has been a user in the past. Without going into brand names, some surprising uses of asbestos are contained in various industrial processes.

Asbestos, for example, is found to be used in what would seem to be totally unrelated applications to those listed in Table VI. For years the tobacco industry used asbestos as an agent to promote superior ashing characteristics (Davis 1972). Sources today state that asbestos is no longer used in tobacco processing. Talc, which is an asbestos related product, is commonly used in cosmetics, the meat packing industry, general food processing and as an ingredient in plastics and rubber (Berger 1976).

The scope of asbestos in products can also be illustrated by isolating its prevalence in three major environmental areas: water, air, and food products. This is, of course, above and beyond its presence by percentages in consumer goods outlined in Table VII.

CHAPTER IV

EXPOSURE LEVELS

Asbestos in Water

The first generally regarded baseline study on exposure levels in water was first published data orginating from Cunningham and Pontefract. In 1971, their study dealt with asbestos in drinking water, in melted snow and river water in Canada as well as beveridge content analysis. Note should be made that at the time only chrysotile fibers could be detected by state of the art means. This is an important restriction as many varieties of asbestos can occur in water, crocidolite is a common ingredient of asbestos pipes. The data revealed 1 to 11 million chrysotile asbestos fibers per liter in drinking water, soft drinks, vermouth, port, sherry and beer. River water contained more asbestos fibers than water passed through a city filtration system, and melted snow contained higher amounts than river water. The data obtained is given in Table VIII (Zielhuis 1977).

The next major study in 1973 by Sargent repeated the results of this preliminary study and a survey of 30 of 300 water systems in Vermont was performed. In 17 of 23 systems asbestos was found. Six samples were noted as containing no asbestos visually present. Both the studies by Kag in (1973) and September (1974) by the EPA had similar results. Conclusions showed an estimate that 90% of tapwater had concentrations of 1-3 million fibers per liter.

Apart from special cases of asbestos pollution, if one assumes that a person drinks two liters per day of water, that over a 70 year life time, the total intake of asbestos would be somewhere between .05 and .3 grams. Each microgram (1/1/1000 of a gram equaling 1 million fibers). The EPA in April 1986 listed its water standard at a maximum of 7.1 million fibers/liter. From a consumers stand point as a water user it can be expected that virtually all drinking water sources have asbestos present (Zielhuis 1977).

TABLE VIII (Zielhuis 1977)

Asbestos Fibers in Beverages and Water

Sample	Source	Number of fibers/ liter in millions
Beer	Canadian 1	4.3
Beer	Canadian 2	6.6
Beer	U.S.A. 1	2.0
Beer	U.S.A. 2	1.1
Sherry	Canadian	4.1
Sherry	Spanish	2.0
Sherry	South African	2.6
Port	Canadian	2.1
Vermouth	French	1.8
Vermouth	Italian	11.7
Soft Drink	Ginger Ale	12.2
Soft Drink	Tonic Water I	1.7
Soft Drink	Tonic Water II	1.7
Soft Drink	Orange	2.5
Tap Water (F)	Ottawa	2.6
Tap Water (N)	Toronto	4.4
Tap Water (F)	Montreal	2.4
Tap Water (N)	Beauport	9.5
Tap Water	Asbestos	8.1
Tap Water (N)	Thetford Mines	172.7
Melted Snow	Ottowa	33.5
River Water	Ottowa River at Ottowa	9.5

F = Filtered
N = Nonfiltered

Along with Canadian studies, referenced in Table VIII (Cunningham and Ontefract 1975) reported between 1.8 and 11.7 million fibers per liter. During the preparation of certain French wines, powdered asbestos may be mixed directly with the wines. In another study, between 13.1 and 24 million fibers were found (Nehman, Planthlolf 1974). They concluded significant concentrations of asbestos were contained in all liquid food stuffs. Sources for the asbestos were listed as background water supplies and asbestos filters to remove sediments during initial processing stages (Michels 1978).

Asbestos fiber filters also have been used in the processing of drugs including antibiotics and blood plasma. Since 1975 the U. S. Food and Drug Administration has disapproved their use in preparing parenternal drugs (not orally ingested) and antibiotics. (Code of Federal Regulations, Title 21, Section 133). Asbestos filters may be used, however, in the manufacture of non-parenternal drugs and their ingredients. Talc (which may contain asbestos) is commonly used in the manufacture of capsules and tablets.

Asbestos in Air

With asbestos being generally accepted in water, it would follow that asbestos would also be present in the air (Selikoff 1978). The bulk of asbestos as related to environmental exposure has been performed on air samples. Asbestos fibers enter the atmosphere from a wide variety of sources extending from weather and distribution of natural deposits of asbestos-bearing materials, to operations from the ultimate disposal of asbestos containing materials. This often includes manufacturing facilities for asbestos containing products, construction sites employing asbestos insulating, fireproofing, and structural materials, as well as asbestos mining and milling sites (Bergen 1963). Other situations with exposure potential include the use of roads with asbestos bearing gravel or paving, humidifiers charged with water containing levels of asbestos, talcum powders, paints containing asbestos, and brake discharges. While asbestosis is widely used in 3000 products; the opportunity to inhale fibers from the ambient air constitutes the greatest source of atmospheric exposure for the population at large. Because most studies are regional, data has been taken from several reports to show the range and levels of airborne asbestos (Michaels 1979).

TABLE IX (Michaels 1979)

PLACE	1970 POPULATION	SAMPLE SIZE	CONCENTRATION (Ng/M3)		REFERENCE
			Average	Range	
Berkeley, CA	116,716	4	6.8	2.1 - 12	Nicholson 1975
Boston, MA	641,071	1	5.0	--	Nicholson 1975
Chicago, IL	3,366,957	1	24	9.5 - 200	Nicholson 1975
Dayton, OH	243,601	7	6	.4 - 11	Heffelfinger 1972
Frankfort, KY	21,356	3	.08	0.2 - .15	Heffelfinger 1972
Houston, TX	1,232,802	4	5	4 - 6	Heffelfinger 1972
Los Angeles, CA	2,816,061	2	43	--	Murchio 1973
New York City, NY	7,867,760	10	13		Nicholson 1975
Brooklyn, NY	2,601,852	3	19	6 - 39	Nicholson 1973
Pittsburg, PA	520,117	3	4	2 - 8	Selikoff 1972
Philadelphia, PA	1,948,609		70	45 - 100	Selikoff 1972
San Francisco, CA	715,674	2	25	8.7 - 68	Nicholson 1975
Seattle, WA		2	20	10 - 30	Nicholson 1975
Washington, DC	756,510	4	21	1.6 - 40	Heffelfinger 1972

The results of asbestos research has led most experts to conclude the existence of a strong potential for direct or indirect exposure from asbestos in the general public. (U.S. News 26 March 84).

The E.P.A. in establishing its standards made note of crude estimates of the annual amounts of asbestos inhaled from the ambient atmospheres for United States urban population. The current estimate is that 55-60 tons are emitted yearly to the atmosphere (Bragg 1978).

TABLE X

Inhalation of Asbestos From Ambient Air (Bragg 1978)

PROPORTION OF URBAN POPULATION CONSUMING (%)	ATMOSPHERIC CONCENTRATION FIBRES* / M^3	NG/M^3	ANNUAL INHALATION	NG.
50	5,000	20	27.4	110
25	7,500	28	41.1	158
10	10,500	40	57.5	220
5	12,500	48	68.4	268
1	16,000	64	87.6	350
Rural Populations	---	.01-.1	___	.05-.5

* Fibers assuming 250 fibers per Nanogram (NG.) of asbestos.

The current standard for asbestos at 5 fiber per cubic meter greater than 10 microns (millionth of a meter) falls into the 10% area listed in Table X. Nanogram equals one billionth of a gram.

ASBESTOS IN FOOD AND DRUGS

After air and water one final major source for consumer ingestion of asbestos comes from food and other products taken internally. Reports on the asbestos content of food are rare. It is possible that surveys have been made with negative results but if so, they do not seem to have published extensively. The Food and Drug Administration of the United States Department of Heath Education and Welfare examines food for foreign material and has published information on such items as glass particles, and water insoluble inorganic residues; asbestos as such is not mentioned (Eisenberg 1974). Approximately one pound of talc is used in the processing of 100 pounds of coated rice and tremolite (asbestos) has been found in the coating residues up to a concentration of 15%. Current regulations merely urge manufactures to investigate all means of eliminating the use of asbestos (Davies 1965). In 1969-70 samples of widely used parenternal drugs were examined at Mount Sinai for their asbestos content and seven were found to have concentrations significantly greater than the distilled water used in reconstitution. Table XI gives the data of asbestos concentrations found. It was noted in the study that even with the stringent standards for purity in the medical industry asbestos was almost universally found. One can conclude the same for all consumable products (Selikoff 1978).

TABLE XI

Concentrations of Asbestos Found in Drugs (Selikoff, Lee 1978)

Drug	Sample Size	Concentration of Asbestos (Nanograms/Gram)
Sodium Ampicillin A	6 g	750
Sodium Oxacillin A	6 g	1,167
Sodium Ampicillin B	6 g	417
Sodium Ampicillin C	6 g	125
Cortico Tropin	240 units	220 ng
Insulin Suspension	480 units	489 ng
Oxytocin	60 units	440 ng
Tetracycline HCL	3 g	103
Oral		
Aspirin A	19	120
Aspirin B	19	140
Aspirin C	19	150
Bottled Water	500 ml.	605 ng
Large Volume Parenternals		
Sterile Water	1000 ml.	190 ng
Normal Saline	1000 ml.	330 ng
Ringers Sol USP	1000 ml.	1450 ng
Ionosol MB in PS-W	1000 ml.	550 ng
10% dextrose	1000 ml.	463 ng
10% fructose	1000 ml.	100 ng
Jonosol B	1000 ml.	215 ng

The intake of asbestos in water, air, and food are well documented. Levels in air are now monitored extensively as are those of water. Levels in food groups are just now being examined. Man through contact with a wide range of asbestos products and the earths atmosphere have made the product of significant importance (Michaels 1979).

CHAPTER V

MAJOR RISKS TO ASBESTOS EXPOSURE

Physiological Effects

The adverse biological effects were observed as early as the First Century. The growing concern over general air pollution and particular air pollution specifically, has resulted in the demonstration of evidence of asbestos fiber in the lungs of up to 50 percent of the urban population of the U.S. and other industrialized countries. Because of such findings which have proven to be biologically active the scientific community has established that asbestos related diseases are a serious modern hazard. (Sielkoff 1970)

Pulmonary, asbestosis, pleural calcification, lung cancer, and pleural and peritoneal mesothelioma can result from exposure to asbestos (Selikoff 1967). Other afflictions include asbestos bodies, asbestos warts and a gamit of other forms of cancer. It has been scientific contention that it is reasonable to assume that biological effects of asbestos exposure to the general public can be extrapolated from occupational exposure studies, since this area has been so extensively observed (Selikoff 1967). Table XII gives the results of a typical occupational exposure study of increasing x-ray abnormalities versus asbestos exposure.

TABLE XII

Roentgenolic Changes in Asbestos Insulation Workers (Selikoff 1967)

ONSET OF EXPOSURE	NUMBER	PERCENT NORMAL	PERCENT ABNORMAL
40+	121	5.8	94.2
30-39	194	12.9	87.1
20-29	77	27.2	72.8
10-19	379	55.9	44.1
0-9	346	89.6	10.4
Total	1117	51.5	48.5

These results and data from a host of others show similar trends. With this type of progressing biological effect in mind, investigations were conducted considering the many invasive steps that occur with asbestos exposures. The particle size and shape appear to be the factors controlling whether mineral particles enter and remain in the lung or are removed from the lung after entering. Particles such as asbestos fibers that have diameters greater than 5 micrometers cannot enter the lungs bronchial airways; those having smaller diameters do. Particles have diameters less than 1.5 micrometers can penetrate to the smaller bronchials and even to the alveolar sacs (the smallest section of the lung which transfers oxygen to the blood) (Wagner 1965).

Timbrells study (1965) of respirable fibers in the respiratory system revealed staged penetration through the network of nasal hairs, which act as a filter in primary repiratory protection.

TABLE XIII

Penetration of Fibers Through Nasal Hairs (Timbrell 1965)

Lenth of Fibers Micrometers	Percent of Penetration through Nasal Hairs		
	1st stage	2nd stage	3rd stage
.05	100	100	100
.5	75	57	42
1.0	53	24	11
1.5	31	10	3
2.0	26	5	1
2.5	20	3	
3.0	17	2	
3.5	14	1	

It was established that most asbestos dust tended to accumulate in the alveoli after passing the respiratory bronchials in all tests (Wagner 1965). Short fibers less than .5 micrometers had been ignored as risks because of their half life in the lungs of 20 to 90 days, and removal by a process known as phagocytosis (Borow 1973). Recent studies have shown that fibers smaller than those listed in federal standards can cause fibrotic lesions in the lung. Still another study supports this point when it found that asbestos fibers too small to be seen under the microscope will produce asbestos (Holt 1986). It now appears any number or size of asbestos fibers can be hazardous.

Asbestosis

Pulmonary asbestosis, a diffuse fibrosis in the lower lobes of the lung, is a common disease among asbestos workers. This apparently progressive and irreversible disease generates slowly and is often underestimated because it is not readily apparent on x-rays (Selikoff 1978). Varying directly with the concentration and length of exposure, asbestosis can occur as early as 1-3 years in asbestos workers, and cause death as early as 10 years from initial exposure (Michaels 1979). Most commonly, the symptoms were observed in workers in 20 to 40 years, with death following in 2-10 years.

It was found that illness and death can occur long after exposure to concentrations not producing immediate effects and, once established, asbestosis progresses even after dust exposure ceases. Studies concerning crocidolite and amosite asbestos fibers also revealed a serious health hazard from industrial use when investigators found the total number of deaths from cancer and asbestosis were more than double the expected rate (Selikoff 1972) (Solomon 1970).

Pleural Calcification

The Parieta Pleural (walls) of the lung is often affected by bilateral calicification resulting from exposure to asbestos. Simply put the walls of the lung become hardened as an internal defense mechanism. Seilkoff (1972) noted that the frequency and importance of pleural calcification as a roentgenological sign of asbestos exposure was noted as early as 1955 by Jacob and Bohlig. Table XIV indicated the extent of x-ray diagnosed pleural calcification as related to onset of exposure. The increase with 20 or more years of asbestos exposure was significant (Michaels 1978).

TABLE XIV (Kivilvoto 1960)

Pleural Calcification Among Asbestos Insulation Workers

Years of Exposure	Number	Percentage Normal	Percentage Calcification
40+	121	42.1	57.9
30-39	194	65.4	34.5
20-29	77	89.6	10.4
10-19	379	98.0	1.1
0-9	346	100	0.0
Total	1,117		

In a survey of 6,312 adults inhabiting a Finnish commune containing an asbestos mine, 499 cases of pleural calcification were diagnosed by x-ray. In comparing this commune to another that contained 70 cases of pleural calcification, Kivilvoto (1960) suggested that the cases resulted from localized environmental asbestos exposure. These findings were refuted by several Russian studies that found children in outlying areas suffering from asbestos related diseases. Sielkoff (1978) points out that background water, or product usage were causes of the asbestos related ills.

Cancer of the Lung

Cancer of the lung is often found as complicated by some other asbestos related malidy. Asbestos has been clinically proven to cause cancer in a number of studies sited by scientific experts. Asbestos diseases are similar with respect to clinical latency but a person must live longer to contract lung cancer (Selikoff 1967). Associations between exposure to asbestos and lung cancer range from 7.5 percent to 50 percent for asbestos workers. The current EPA study is designed to protect 98% of workers exposed to the maximum safe rate for a normal worklife time (Michaels 1978). The significant problem with analyzing lung cancer and its association to asbestos is the latent period between exposure and evidence of carcinoma, dose time relationships, potential significance of asbestos bodies, and the level of exposure necessary to induce a malignant tumor (Brand 1958). The scientific community have also summarized three basis hypotheses that have been advanced as to why asbestos is carcinogenic:

a. The fibers act as a physical irritant which induce a tumor after 20 to 30 years of constant irritation. Note no amount of fibers are listed. One fiber can lead to a cancerous tumor (Sielkoff 78).

b. The fibers contain small amounts of other known carcinogens such as nickel, chromium, and benzo (a) dyrene, which lung tissue absorbs from the asbestos fibers. The basic premise is that airborne fibers can act as vehicles for other carcinogens present in the air by carrying them into the lungs (Levadie 1984).

c. The fibers accumulate in the lungs and are immobilized as asbestos bodies that can disintegrate after 20 to 40 years, resulting in free particles to cause asbestosis and cancer of the lung (Levadie 1984).

Asbestos Bodies

With improved research techniques in the 1970's the discovery of asbestos has been detected in the lungs of one-half of the urban population. This surprising fact is the single most distressing evidence that asbestos is a severe health hazard (Kates 1978).

Utidyian (1968) defined an asbestos body as a structure with clubbed ends and a reddish-brown color. The shaft was described as segmented or beaded and hooked on the end. The asbestos body is 3 to 5 micrometers in diameter and 20 to 100 micrometers in length. The iron content of most asbestos fibers is generally attributed for producing the reddish color.

The asbestos bodies found in the lung generally contain asbestos however they can be produced from ceramic aluminum silicate, glass fibers, and silicon or fiberglas fibers, in addition to asbestos. Since the number of asbestos bodies found in any individual is small it is difficult to derive a quantitative estimate of these bodies in the lungs of the general public. The one study where a significant sample was attained showed that 47 percent of the lungs would contain two or more asbestos bodies. It should be noted that those cases where one asbestos body was found were not listed (Michaels 1979).

Pleural and Perontoneal Mesothelioma

Mesothelioma is a tumor which lines the surface of the lungs and gradually grows through the wall causing an open sore. Until 1960 Mesothelioma was virtually unknown. The size of this problem is highly questioned by the scientific community. The major study now used as a base line shows length of exposure to asbestos to not be a factor for contraction of the disease. Several agencies studying Mesothelioma mention that while not as large a problem in relation to other asbestos related diseases the number of cases reported has increased five fold in the past 5 years (Borow 1973).

Estimates of Mortality in the United States

Air

Here the scientific community is split. Broadeur (1985) blames the split on those working for the government and the asbestos industry keeping asbestos out of the lime light and those representing clients in law suits. The following information on both sides is presented to show potential risks as well as the rift in the scientific community.

On 11 September 1978, Joseph Califano, then Secretary of the U.S. Department of Health, Education and Welfare, gave a major speech at the American Federation of Labor/Congress of Industrial Organizations (AFL-CIO) National Conference on Occupational Safety and Health, in which he described how the federal government was assisting in discovering and preventing occupational disease. One of his statements was that 17% of all cancer deaths in the United States each year for the next 30 to 35 years will be associated with previous exposure to asbestos. This translates to 67,000 cancer deaths per year due to asbestos. The Califano speech was based on a study prepared by several medical scientists of the National Institute of Health. Dall and Peto reviewed the documents and stated, "Those estimates of total risk were so grossly in error that no arguments based even loosely on them should be taken seriously." The estimates listed below demonstrate scientific upheaval on the asbestos issue (Levidie 1984).

Year	Source Estimate	
1978	National Health Institute	67,000/year
1980	Seilkoff	20,000/year
1976	Hogan and Hoel	10,000/year
1981	Bragg	12,000/year
1977	U.S. Bureau of Statistics	522 from 1967-1977

It is truly unfortunate that the government estimate is so inadequate. When the major manufacturer Johns Marvilles' own expert estimated asbestosis and cancer rates to be 23,000 per year in 1981 the government position appears to be suspect. Comparative studies on occupational exposure confirm the governments eroneous data (Brodeur 1985).

Water and Food

If there is a battle over the dangers of asbestos in ambient air then there is a war over the dangers to asbestos in water and food stuffs. To start asbestos content is not well established and the United States has no regulation concerning the content of asbestos in food or water (New York Times Magazine 13 April 1986).

The possibility of biomedical effects from ingestion of asbestos, as distinct from inhalation was not given much attention until 1973. During this year public water supplies taken from western Lake Superior were discovered to be severely contaminated with asbestos fibers. The source was traced to some 67,000 tons of waste tailings from an asbestos mill at Silver Bay, Minnesota. The scope of this contamination will not become fully understood for 20 to 30 years (Michaels 1979).

Two final areas of concern have surfaced in the past year. It has been a long held belief that asbestos pipe was not a source of asbestos contamination. In a swift move the EPA proposed a ban on asbestos-cement and four other common asbestos products. According to the Association of Asbestos-Cement Pipe Producers in Arlington, VA, 400,000 miles of pipe are already in use in this country. Even the hard data presented by the asbestos industry which withstood the challenges of high asbestos water levels in Florida, California, Connecticut and Minnesota have crumbled in light of recent events (Michaels 1979). In March 1986 Woodstock, New York, samples showed total counts of more than 300 million asbestos fibers per liter. The EPA standard is 7.1 million fiber per liter. The source was traced to a section of asbestos cement pipe 1700 foot long which was installed in the 1950's. All data presented on cement pipe shows data on leaching of asbestos ending after 20 years of continuous use. No data past 20 years of use is available. Risk to humans is not established by the EPA and the 7.1 million fibers per liter is now being questioned in light of data concluding that a five fold increase in colon and digestive cancer can be expected in asbestos rich intake areas (New York Times Magazine 13 April 1986).

Another blow to old stable data has recently be found in New York. Asbestos used in break linings has been thought to be destroyed as a result of extreme heat during normal use. Samples taken at toll booths on the N.Y. Thruway show levels 10-60 times higher than background levels (Newsweek 3 February 1986). Another area to be concerned with has come fold. Seilkoff (1978) estimated 20,000 brake repairmen and automative shop workers would contract asbestos related diseases in 1978. His proposal was dismissed in subsequent government reports, the same sources that have refuted his claim of 20,000 annual deaths due to airborne asbestos.

The risk to asbestos while an arguable exercise can be placed into perspective by remembering some basic issues. First, millions of tons of asbestos has been processed into consumer products. Millions more have found their way into our food, water, and air. It was not until March 1973 that an asbestos standard was established for ambient air. It has subsequently been revised and will probably be revised again in the next 12 months. With exposure and lag times in disease diagnosis, we are for all intensive purposes in the infancy of diagnosis of a potentially huge health hazard (U.S. News 27 January 1986).

CHAPTER VI

Asbestos Policy Review

The history of asbestos regulation and policy had its beginnings in 1946. The first asbestos standards came as suggestions from the American Conference of Governmental Industrial Hygenists (ACGIH) which suggested a safe standard of 177 particles of asbestos per cubic centimeter of air. The 177 particles were established as the Threshold Limit Value (TLV) and used a method of counting particles of any size with a microscope and a simple counting procedure (Light Microscopy). In 1970 a limit of 12 fibers longer than 5 micrometers (UM) per mililiter of air was proposed. The proposal to count fibers over 5 um in length was based on the following considerations (Bragg 1978).

1. It greatly simplified counting and minimized error between different observers.
2. It was believed that most environmental asbestos had a similar size range, and very roughly a similar proportion of the different sizes.
3. Asbestos diseases were believed to be mainly associated with the breakup of asbestos bodies containing fibers 10 um and upwards. We now know that the second and third beliefs have lost most of their validity.

On May 29, 1969, these voluntary recommendations were given legal sanction by incorporation under the Walsh-Healy Act, as it applies to contractors for the U. S. Government (Levadie 1984).

When the Federal Occupational Safety and Health Act became effective in April 1970, this Walsh-Healy standard was adopted by the Secretary of Labor for all workplaces as an interim standard (Selikoff 1978). On November 5, 1971, the Secretary was requested by the AFL-CIO to issue an emergency standard covering the industrial use of asbestos, and a temporary emergency standard was initiated on December 7, 1971 (Levadie 1984).

The emergency standards were based on an 8 hour time-weighted average of dust for a 40 hour work week. The (TLV) was five fibers per cubic centimeter (cc) greater than 5 micrometers (UM) in length, but permitted up to ten fibers/cc for up to 15 minutes in about an hour for up to 5 hours in an 8-hour day (Federal Register 1971).

In the meantime, the Department of Health, Education, and Welfare's (DHEW) National Institute for Occupational Safety and Health (NIOSH), pushed (OSHA) to establish a still lower limit of 2 fibers, longer than um, with a 15 minute ceiling value of 10 fibers (NIOSH Reprot 1972). The Emergency Standard of 1971 remained in effect until October 9, 1975 when the (NIOSH) standards were implemented (Selikoff 1978).

The last regulatory action came in a letter dated December 15, 1976, the Director of NIOSH transmitted the Agency's study on "Reexamination and Update of Information on the Health Effects of Occupational Exposure of Asbestos" to DHEW and OSHA recommending that the standard be reduced by 50%, based on the lowest concentration at which asbestos fibers can be reliably monitored. This recommendation received adverse comment from the industry, as might be expected. A proposed standard by OSHA has not yet been implemented as of September 1986 (Levadie 1984).

Ambient Air

Instead of specifying air concentrations that must not be exceeded, as was done in the occupation standard, the EPA regulations require that either there be no visible emissions from listed asbestos operations, or that the emissions be cleaned of particulate asbestos material by specified methods. The operations to which the regulations apply are listed under categories of asbestos mills, manufacturing (with nine subcategories), and spraying. States and political subdivisions are permitted to adopt and enforce any additional emission limiting regulations provided that they are not less stringent than the Federal requirement (Levadie 1984). Full details appear in the Federal Register of October 14, 1975. The bottom line is that there is no set ambient air standard as of September 1986. It should be noted that other nations have established standards at the proposed OSHA standard and only the States of Illinois and New York have established set emissions standards (Zielhuis 1977).

Water and Food

The following paragraph summerizes the Food and Drug Administrtion policy from a report dated March 14, 1975.

The Food and Drug Administration in conjunction with other agencies is planning extensive experiments to determine if long term exposure to ingested asbestos fibers represents a definitive hazard to human health. As noted,until this study is completed or other data becomes available, the Comissioner has determined that a prohibition of the use of asbestos-containing filters in the processing of food and beverages, and the use of asbestos-containing talc as a food or food additive in drugs or drug ingredients (other than the parenternals), is unwarranted due to lack of sufficient data. In the interim, manufacturers of food and drugs are urged to investigate all means of eliminating the use of such filters and talc, and to keep the Food and Drug Administration informed about changes in formulation and processing of this type (Brodeur 1985). As of September 1986 no standard for either food or drugs has been established and is not mentioned on lists of materials to be analyzed during FDA inspections.

Water standards were developed on November 13, 1985. The standard is set at a maximum of 7.1 million fibers/liter.

The preable to the standard cites that the evidence is very strong that asbestos is related to gastrointestinal cancer (New York Times Magazine 1986).

The standards as listed put extreme pressure on the asbestos related industries of the United States. The final settlement by Johns Manville (now effectively out of the asbestos business) on asbestos related claims and punitive damage suits shows some idea of the scope of the potential problem (Brodeur 1985).

Trust Establishment (initial)	$846.5 million
Stock	50% of Outstanding Shares
Preferred stock	30% of Outstanding Shares
Yearly Contribution	75.0 million for 21 years
Other	20% of annual profits for 21 years if needed

Total Estimated Payout $2.5 Billion

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to present a consumer guide or fact file to asbestos. By presenting its history, its use in consumer products, its recognized effects, and regulatory policy the reader can make decisions on it's danger. The information presented was extracted from review of scientic journals, reference materials, and converted to the most readable format possible. Use of this fact file will inform and consolidate current information for consumer use.

Findings

The following facts were derived from findings of this study in relation to the Studies Research questions.

1. Asbestos in not a single element but a classification of minerals that are easily made into fiber products. It has superior heat resistive properties and is in various locations in the United States and abroad.
2. Asbestos has been cronicled since 2500 B.C. and in the writings of all major cultures. The first asbestos in the United States was found at the turn of the century. With the industrilization

of the U.S., the need for asbestos grew and the industry flourished.

3. Asbestos is used in over 3000 consumer related products. Content varied from small quantities of 5% in tile to 100% in sprayed insulation. Additionally, it is used directly and indirectly in the manufacture of food, beverages, and drugs. In addition asbestos has been found in virtually all ambient air and water which for this study are classified as consumer goods.
4. The major health risks associated with asbestos are related to ingestion by air, water, and food. The main asbestos related diseases include asbestosis, pleural calcification, mestheloma, absestos bodies, and cancer of the lung. While danger to humans has been well documented estimates of mortality vary greatly.
5. The current regulations are related to air, water, food and drugs and do not focus on other generally recognized consumer products. The water standard established in 1985 in 7.1 million fibers per liter, the standard for workplace environment is 2 fibers longer than 5 micrometers with a 15 minute ceiling value of 10 fibres. No standard in measurable units exists for ambient air as of September 1986. No standard exists for Food and Drugs except parainternals) as of September 1986.

Conclusions

The following conclusions are solely based on the authors' interpretations of information gathered during this study.

After studying the body of scientific knowledge that has been accumulated concerning asbestos, some consumers might suggest that asbestos products be taken off the market. Since the uses of asbestos are surprisingly diverse and in many cases critical to the makeup of the products, this would undoubtedly be as foolish as to advocate no control of any air or water contaminant.

The present society has existed in a convenience and leisure atmosphere where immediate comfort was desired at any cost without regard to future consequences. Smoking is given to substantiate this statement. Society has often subjected itself to many by-products of progress which, as in the case of exposure to asbestos, were statstically shown to be detrimental to the public health. In general, society has found difficulty in learning from the mistakes of those exposed and often it has had to come fact to face with a disaster in order to realize the existance of a hazard.

The frequency of asbestos exposure to the general population has been established in several national surveys. Results of exposure by asbestos workers and experimental animals have also been well established. It was because of this established link with asbestos and a host of diseases that this study is important to consumers. The fact that asbestos has been found in 50 percent of lung tissue of the American population was to say the least surprising. The scope of the use of asbestos estimated a 3000 products the presence in most air sampling and water sampling was also unexpected.

Reviewing the relatively scant data available on ambient air and food hazards are disturbing. With no standard for ambient air or food combined with documented hazards and reliance on industry for internal control there is a gap in consumer protection. If standards for water are set at 7.1 million fibers per liter and food stuffs are not inspected even though they contain water, the standard is questionable and highly limited.

There is great argument in the scientific community over the overall risk due to asbestos exposure. Some studies appear to be conclusive in verifying hazard while others show the opposite.

It appears that the government is going to hedge on the entire issue based on current regulatory inaction. The saving grace may come from the Bankruptcy Settlement of Johns-Manville totaling $2,500,000,000. As the largest producer now out of the asbestos market, surely the other manufactures will follow and gracefully retire from the market. Substitute materials have already begun to enter the market and will inevitably take over for asbestos.

After reviewing many articles in periodicals there seems to be as much confusion expressed as in related in scientific journals. The bottom line appears to be that people are exposed to asbestos while engaged in work, recreational activities, residences, or educational activities. The greatest portion of the population has not been subjected to asbestos by mining, production, or application directly, but has been exposed to ambient air, water, food and consumer products 24 hours a day, seven days a week.

The first major studies on asbestos came in the mid 1960's. Since then the asbestos hazard as well as its product usage has been generally kept from the general public. Only recently have severe pollution problems come to light. The Bankruptcy settlment of Manville has opened the door for massive law suits and exposure of the problem.

There needs to be a great deal of research conducted on asbestos and its hazards. Consumers need to be made aware of what levels they are being exposed to, what products contain asbestos and be given information to allow them to decide when and how asbestos goods should be used. Appendix I provides a list of sources for additional asbestos related information. Asbestos may be another hazard that is so imbeded in our way of life that it cannot be removed. At any rate, the damage for the next 30-40 years has already been done. Consumers must be given an opportunity to use or avoid asbestos on a conscious level and use the facts as they are to make sound user decisions.

The author would recommend the followings actions to clarify the asbestos issue:

1. Asbestos standards be established on the best available data and enforcement of those standards be made manditory by the EPA.

2. The FDA should add asbestos to its list of inspected impurities and make judgment as to purity based on reasonable standards.

3. Asbestos containing materials should be marked as such and hazards and disposal suggestions placed on those products.

4. A survey of municipal water supply piping should be made in light of Woodstock, New Yorks documented leaching program.

5. Asbestos removal contractors should have a standardized liscencing or qualification process to eliminate untrained workers from creating more severe problems than existed before removal.

6. Disposal of asbestos by-products and used bulk construction materials should have safety standards to regulate how and where they are deposited.

7. The Center for Consumer Studies retain asbestos related data as outlined in sources in Appendix A.

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APPENDIX A

Sources of Asbestos Related Information

1. Asbestos Information Association/North America

   Materials: Brochures on work practices, fact books, reprints of scientific articles, conference proceedings, and films; reference library.

   Address: 1745 Jefferson Davis Highway
   Arlington, VA 22202
   (703) 979-1150

2. Johns-Manville Corporation

   Materials: Brochures on work practices, health effects, films, slides, video tapes, bulletins, reports, reprints of scientific articles.

   Address: Health, Safety and Environmental Department
   Ken-Caryl Ranch
   Denver, CO 80217
   (303) 770-1000, extension 2969

3. National Institute of Occupational Safety and Health, U.S. Department of Health, Education and Welfare

   Materials: "Criteria Document" on asbestos; reports of occupational disease research and related investigations.

   Address: Robert I. Taft Laboratories
   4676 Columbia Parkway
   Cincinatti, OH 45226

4. National Safety Council

   Materials: Reprints of articles, safety data sheets, reference library.

   Address: 425 North Michigan Ave.
   Chicago, IL 60611
   (312) 527-4800

5. Occupational Safety and Health Administration, U.S. Department of Labor.

Materials: OSHA Standards (air, water,)
Subpart Z. Sec. 1910.1001, Asbestos
Brochures on OSHA Standards

Address: Occupational Safety and Health Administration
U.S. Department of Labor
Washington, DC 20210

Sources of Published Education Materials

1. American Medical Association
535 North Dearborn Street
Chicago, IL 60610 (312) 751-6000

2. American Public Health Association
1015 18th Street N.W.
Washington, DC 20036 (202) 467-5000

3. Center for Science in the Public Interest
1757 S. Street N.W.
Washington, DC 20009 (203) 332-4250

4. Consumer Federation of America
1012 14h St. N.W. Suite 901
Washington, DC 20005 (202) 737-3732

5. Consumers Union
256 Washington St.
Mount Vernon, NY 10550 (914) 664-6400

6. Scientists Institute for Public Inf.
49 East 53rd St.
New York, NY 10022 (212) 688-4050

7. State Bureau of Mines