

Monsanto

MEDICAL DEPARTMENT

FILE - ASBESTOS - I H FILE

PLAINTIFF'S
EXHIBIT

MON-193

Two thousand years ago when the first use of asbestos was recorded, it was a sacred object, a curiosity of kings and nobles, a magic mineral. The Greeks, who used asbestos for the wicks of their temple lamps were enthralled when flames did not consume it, but burned unceasingly. Amazed, they called it asbesta, which meant the "unquenchable," the "inextinguishable."

I. What is it?

Asbestos is a term which refers to a group of more than 30 mineral substances, all of which are silicates and which share the common property of having a fibrous structure.

Their formation in nature requires a common geological principle of the right host rock, basic structural features and ideal conditions of temperature and pressure. Only six are of economic significance and the most important ~~asbestos~~ ~~asbestos~~ ~~asbestos~~ as shown below.

% of world production

Chrysotile (white)	93.0%
Crocidolite (blue)	3.5%
Amosite (brown)	2.4%
Anthophyllite	} 1.1%
Tremolite	
Actinolite	

These six fibers possess different properties of flexibility, length, texture, tensile strength, acid resistance, spinnability and resistance to heat which render them more or less suitable for various uses.

Asbestos has been termed the 20th century mineral since the world consumption has increased over a thousand fold since 1900. By far the greatest increase has occurred since World War II. The present world production exceeds 3 million tons annually.

signify disability.

3. Cancer of the Lung in Persons with Asbestosis

The first official recognition of the existence of a possible relationship between lung cancer and asbestos was contained in the 1947 annual report of the Chief ~~Inspector of Factories for Great Britain~~ (Dr. E. R. A. Maroneth) published in 1949. Since that time, statistical studies by Richard Doll have proven an association between the two conditions and have demonstrated an increased incidence of lung cancer in persons with asbestosis. Similar reports from other countries give support to the British studies. To date, there is insufficient statistical evidence available to indicate whether this is true of all types of fiber or whether it is associated with all uses of asbestos. Further intensive studies are currently underway in many countries including Canada.

4. Mesothelioma of Pleura or Peritoneum after CROCIDOLITE Exposure

In 1956 it was first suspected in Kimberley, South Africa, that there might be an association between exposure to the Cape Blue fibers and this rare tumor of the lining tissues of the chest and abdomen. By 1962, one hundred and twenty-one cases had been discovered of whom 110 occurred in persons either working or living in the area where crocidolite is mined. A similar study in London, England revealed that 51 of 83 persons who died with this tumor were in some way associated with an asbestos factory in which crocidolite was handled.

Whether or not these tumors are due to the fiber itself is not clear. There appears to be an association but further research will be needed before the matter can be clearly understood.

To date, there has been no significant data which would indicate an association between either chrysotile or amosite and mesothelioma. Intensive studies concerning a possible association are presently in progress in Canada, the U.S.A., Great Britain and several other countries.

B. Quantitatively

In the last few years, asbestos has been recognized as one of the most hazardous of air contaminants in the

workplace. Employees exposed to asbestos include an estimated 100,000 insulation workers, 50,000 workers in manufacturing products, 60,000 using end products and uncounted thousands in construction. Labor unions have pushed for stricter standards governing its usage, and the Occupational Safety and Health Administration has listed it as one of five target health hazards in a new program aimed to control health hazards in the workplace.

The first case of asbestosis was not diagnosed until 1900, 22 years after asbestos was mined on a large-scale basis. The victim, a British textile worker, had inhaled the asbestos dust stirred up by the carding machine he had operated for 14 years. Ten other men had been his co-workers in the carding room. All died before their thirtieth birthdays.

Since the recognition of asbestosis 72 years ago, the disease has been widely studied the world over, from the mines of South Africa to the mills of Quebec. Today, experts believe that asbestosis is one of the most debilitating of the pneumoconioses - lung diseases caused by dust inhalation. Erupting 20 to 30 years after the exposure period, the disease exhibits no warning symptoms to mark its early stages. Many studies have uncovered cases of the disease in which the exposure was relatively light and did not continue over an extended period of time.

Recent studies, such as those conducted by the Mount Sinai School of Medicine and the National Research Council, have produced some disturbing statistics on the mortality rates of workers using asbestos. Dr. Irving J. Selikoff of the Mount Sinai School of Medicine discussed the implications of these studies: "At present, one in every five deaths among insulation workers is due to lung cancer, one in ten to cancer of the pleura or peritoneum, one in ten to scarred lungs of asbestosis." Since insulation workers receive relatively light exposures to asbestos compared to some other occupational groups, these results are even more somber. If working conditions are not significantly altered, asbestos exposure can lead to 17,000 deaths from lung cancer, 10,000 deaths from cancer of the pleura and peritoneum and 10,000 deaths from asbestosis, according to projections by Dr. E. Cuyler Hammond of the American Cancer Society.

III. How it is Used.

Occupational exposures occur in the cement-asbestos industry in which shingles and siding, water and sewer pipes and insulation boards are produced; in the insulation trade; in the manufacture of brake linings; the weaving of asbestos cloth, fiber and cord; the manufacture of numerous types of filters; the insulation of electric wire and cable; the manufacture of certain paints; the making of floor tile and gaskets; the production of moulded plastic products and in the spraying of structural steel framework for acoustical purposes and the spraying of insulation on turbines in plants where electricity is produced. In addition, since this substance is so extremely useful, numerous lesser uses exist.

Workers in many occupations encounter serious asbestos exposures. Among the establishments most likely to have asbestos risks are those manufacturing asbestos textiles, valve packings, asbestos sheets, brake linings, boiler blankets, building materials and appliance cords.

Plasterers who spray an asbestos mix on the steel foundations of buildings have heavy exposures to asbestos. A thermal insulation and fireproofing agent, the asbestos mix prevents the steel from buckling in case of fire. Plasterers can apply it without interrupting construction activities, and the asbestos mixture hardens in eight hours without cracking or shrinking. Not only steel buildings, but ships and boats are treated in this manner.

Brake mechanics must also cope with significant levels of airborne asbestos. Valuable because of its resistance to heat and its ability to withstand abrasive force, chrysotile asbestos makes up 50 percent of brake lining material. However, the friction breaks asbestos fibers away from the fabric. Many mechanics remove the asbestos fibers that have accumulated around the brake drums and assemblies with a compressed air hose. This produces a cloud of asbestos dust around the mechanic and anyone in his working area. Alternate cleaning methods are needed; for example, a vacuum cleaning device reduced the hazard in recent tests in England.

Insulation workers are the largest single occupational group to handle asbestos on the job. Their exposures, however, are relatively light. In most types of insulation, asbestos is used primarily as a binding agent and makes up only 15 percent of the material. Then, too, insulators working with asbestos on a daily basis are encouraged to take precautions: good housekeeping measures, tools equipped with local ventilation

systems, and respirators for dusty work are safety precautions stressed by their union.

When insulation workers install materials containing a high percentage of asbestos, they often use a water spray on the cloth while unrolling it or uncovering it. Some insulation workers even cut asbestos on disposable tarpaulins in order to allow the excess material to be discarded without stirring up dust. This eliminates the need to sweep up insulation debris after a job. Usually a dusty process, sweeping is discouraged because it holds a risk for the workers still on the construction site.

Bricklayers, carpenters, sheet metal workers and boiler makers also install insulation at various times, but often they fail to take the precautions used by workers who handle asbestos on a daily basis.

IV. The Permissible Levels of Exposure

A. Presently

CONCENTRATION - Fibers/milliliter greater than 5 microns in length			
Exposure Time	Without Respiratory Protection	218 Approved Respirator	Type Continuous Flow Airline Respirator
8 hours	Up to 5	Up to 25	Greater than 250
Shorter periods of exposure	Up to 10	Up to 50	Greater than 250

B. ~~Asbestos~~ - OSHA Requirements

On this date, the ~~Permissible Exposure Limit (P.E.L.)~~ (T.W.A.) for an ~~8-hour workday~~ ~~of 5 fibers per milliliter of air greater than 5 microns in length~~ The ceiling concentration is retained at 10 fibers per milliliter of air greater than 5 microns in length with no time restriction, provided the T.W.A. is not violated.

Compliance with future exposure limits prescribed by the previous paragraph may not be achieved by the use of respirators or shift rotation of employees except

during the time period necessary to install the engineering controls and to institute the work practices required to comply with the 2 fiber standard.

V. What must be done and when to meet OSHA regulations

A. Clothing and Change Rooms

The employer shall provide and require the use of special clothing, such as coveralls or similar whole body clothing, head coverings, gloves and foot coverings for any employee exposed to airborne concentrations of asbestos fibers which exceed the ceiling level prescribed in paragraph IV-B.

At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph IV-B, the employer shall provide change rooms for employees working regularly at the place.

The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

Laundrying of asbestos contaminated clothing shall be done so as to prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph IV-B.

Any employer who gives asbestos-contaminated clothing to another person for laundering shall inform such person of the requirement to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph IV-B.

Contaminated clothing shall be transported in sealed impermeable bags or other closed, impermeable containers and labeled in accordance with warning paragraph. (See section VH-2b)

B. Control Procedures

Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation and dust collection, shall be used to meet the exposure limits

prescribed in paragraph IV-B.

Local exhaust ventilation and dust collection systems shall be designed, constructed, installed and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1971.

All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph IV-B, such as, but not limited to, saws, scorers, abrasive wheels and drills shall be provided with local exhaust ventilation systems in accordance with ANSI Z9.2-1971.

Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph IV-B unless the usefulness of the product would be diminished thereby.

~~When the use of water is not feasible, the use of other methods, such as the use of high speed cutting tools, shall be employed to prevent the release of airborne asbestos fibers in excess of the limits prescribed in paragraph IV-B of this section.~~
When the use of water is not feasible, the use of other methods, such as the use of high speed cutting tools, shall be employed, without being either cutters, or sanders, or grinders, to prevent the release of airborne asbestos fibers in excess of the limits prescribed in paragraph IV-B of this section.

Employees engaged in the spraying of asbestos, the removal or demolition of pipes, structures, or equipment covered or insulated with asbestos and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph IV-B of this section and with special clothing in accordance with paragraph V-A.

In work situations where the methods prescribed to gain engineering control are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph IV-B or in emergencies respirators may be used.

Where both respirators and personnel rotation are allowed by this subparagraph and both are practicable, personnel rotation shall be preferred and used.

Where a respirator is permitted by this paragraph, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior or the National Institute for Occupational Safety and Health, Education and Welfare.

A reusable or single use air purifying respirator or a respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (B) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

A full facepiece powered air purifying respirator, or a powered air purifying respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (B) of this section, when the ceiling or the 8 hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (B) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

C. Medical Requirements

1. General

The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

2. Preplacement

The employer shall provide or make available to each of his employees, within 30 days following

his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV).

3. Annual Examinations

thereafter, ~~annually~~, and at least annually thereafter, ~~annually~~. Such annual examination shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV).

4. Work Assignment

No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status and rate of pay he had just prior to such transfer, if such a different position is available.

5. Examination on Termination

The employer shall provide, or make available within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease and pulmonary function

tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV).

6. Recent Examinations

No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

7. Records

Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

D. Monitoring

1. Initial Determination

Within ~~the scope of this section~~ of this section, every employer ~~shall determine whether the exposure of his employees to asbestos is below the limits prescribed in paragraph IV-B of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program.~~ is below the limits prescribed in paragraph IV-B of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program.

2. Personal Monitoring

Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8

micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

Samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph IV-B of this section.

3. Environmental Monitoring

~~Samples shall be collected from each of the work environment which are representative of the air breathed by the employees.~~ Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

After the initial determinations required, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph IV-B.

4. Observation

Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

5. Monitoring Records

a) Records Required

Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 3 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either.

b) Employee Access

Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this paragraph, which indicates the employee's own exposure to asbestos fibers.

c) Employee Notification

Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph IV-B shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

E. Records

This record keeping requirement for the various aspects of asbestos exposure are listed with the appropriate section; Exposure, Medical etc.

It is recommended anything that is involved with the use of asbestos or steps to protect any employee be recorded in a log. This should include but not be limited to; exposure information, location of and type of medical exams and records, respiratory program, clothing program, system of warning signs, waste disposal and others.

F. Respirator Program

A respirator program shall be established in accordance with the requirements of the American National Standards Practices for Respiratory Protection, ANSI Z88.2-1969.

G. Housekeeping

All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers. With their disposition, there would be no excessive concentration.

H. Warning Signs

1. Work Area Signs

a) Posting

~~Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.~~ Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

b) Specification & Detail

The warning signs required shall conform to the requirements of 20" x 14" vertical format signs specified in section 1910.145(d) (4) of the OSHA Standards. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

<u>Legend</u>	<u>Notation</u>
Asbestos	1" Sans Serif, Gothic or Block
Dust Hazard	3/4" Sans Serif, Gothic or Block
Avoid Breathing Dust	1/4" Gothic
Wear Assigned Protective Equipment.	1/4" Gothic
Do Not Remain In Area Unless Your Work Requires It.	1/4" Gothic
Breathing Asbestos Dust May Be Hazardous To Your	14 point Gothic

Spacing between lines shall be at least equal to the height of the upper of any two lines.

2. Product Label

a) Where required

Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph IV-B of this section will be released.

b) Specifications and Detail

The caution labels required shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers

Avoid Creating Dust

**Breathing Asbestos Dust May Cause
Serious Bodily Harm**

I. Waste Disposal

Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, ~~equipment, and asbestos-contaminated clothing~~, (is handling, storage, processing, disposal or transportation) ~~equipment, and asbestos-contaminated clothing~~ prescribed in paragraph IV-B shall be collected and disposed of in ~~asbestos-contaminated bags or containers~~ or other ~~asbestos-contaminated bags or containers~~. These bags or containers shall be buried in an approved sanitary landfill.

VI. How to Monitor

A. Equipment

~~Remove the sampling pump from the pump and the adapter~~
(37 mm, 0.8 u pore size). Face cap is removed and filter used open face during sampling. Sampling rate: ~~approximately 0.1 m³/min.~~

- 1) The sampling pumps should be:
~~either~~ either Micronair or C 115 Pump; see attached Literature.

~~Gravimetric~~ Gravimetric Sampling Kit; see attached literature.

- 2) The filter should be:
~~This is a pre-packed field monitor.~~ This is a pre-packed field monitor.

- 3) An adapter will be needed to connect the field monitor to the tubing from the pump. This is ~~an adapter.~~

Millipore address is Millipore Corporation,
Bedford, Massachusetts 01730.

- 4) Before purchasing equipment, it may be helpful to contact the Industrial Hygiene section of the Medical Department for advice.

B. Sampling Technique

1. Follow the instructions that come with your pump and fully charge it's batteries.
2. Connect the tubing to the pump and the aerosol adaptor to the tubing. Remove the red plug from the field monitor and insert the adaptor. Remove clear plastic section which contains the blue plug.
3. Place sampler on man. Attach the pump to his belt. Attach field monitor to collar of shirt so that it is as close as possible to the man's breathing zone.

4. Start sampler and record time. Set sampling rate at 2 liters per minute.

At end of sampling period, make sure sampler is running at a rate of 2 liters per minute then turn off and record time.

5. Keep detailed log of all jobs workmen perform while they were wearing sampler.

C. Evaluation of Sample

1. All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 x (magnification) (4 millimeter objective with phase contrast illumination).
2. Send the filter to ~~XXXXXXXXXX~~ at the ~~XXXXXXXXXX~~ of the Central Research Department or ~~XXXXXXXXXX~~ for analysis. Also send a copy of your ~~XXXXXXXXXX~~ and ~~XXXXXXXXXX~~. We will return a fiber count to you.

By sending the sample to the microscopist of C.R.D., you are assured of getting accurate counts. The actual procedure is much more complicated than described in the preceding paragraph. Most plant laboratories are not equipped to perform this analysis.

D. Calculations

1. Fiber Count
You will receive from John Pairing a Total fiber count. This is the total number of fibers on the face of the membrane filter. This is the count you need.
2. Amount of Air
 - a. You have recorded the flow rate in liters per minute.
 - b. You have recorded the sampling time in minutes.
 - c. Multiply the flow rate (L/M) times the sampling time (minutes M) times 1000 (cc/liter).

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3. Fiber Concentration

Divide the fiber count (1) by the amount of air (2).
This will give you fiber concentration in fibers per
cc of air. Compare with standards in section IV.