Johns-Manville JM

PLAINTIFF'S EXHIBIT

SH-1657

A Condensation of Environmental Facts On

ASBESTOS and HEALTH

Presented at a Series of Customer Seminars by

JOHNS-MANVILLE CORPORATION

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INTRODUCTION

With respect to asbestos and health -- at Johns-Manville we firmly believe that while it is dangerous to pretend there is no environmental problem and do nothing, it is equally as dangerous to pretend the problem is so great that total abstinence is the only cure. When it comes to asbestos fiber and the health problems that can result from its improper use, both apathy and abstinence are extremes no one can afford.

Between the time any environmental health problem is identified and the time a cure or final solution is found, there is always a period of prevention and control. That is the period in which we find ourselves now with asbestos fiber. It may well be that prevention and control will be the final answer.

OVERVIEW

Asbestos is used in some 3,000 products daily throughout the world. It has become almost indispensable in our modern society.

Asbestos is the name given a family of fibrous minerals which have occurred naturally in our environment for as long as our planet has existed. Characteristically, asbestos fibers are resistant to extremes of heat and cold, are flexible, lightweight and durable.

There are four commercially significant varieties in use today. One variety, chrysotile asbestos, accounts for 97% of all the fiber used in the United States. The other commercial forms are crocidolite, amosite and anthophyllite. It is important to remember that the latter three forms differ from chrysotile physically and chemically as well as in use.

Products containing asbestos are in our homes, schools, factories, offices, hospitals, theaters, spacecraft, and more. There is no one material that can outperform asbestos economically or in quality of performance in the majority of these applications. Indeed without asbestos, many products could not even be made nor do the job for which they were intended.

Johns-Manville recently completed the expenditure of $75 million to expand mining and milling facilities at its Jeffrey Mine in Quebec, Canada. However, asbestos fiber is so much in demand today that even this significant expansion will not enable J-M to meet all the demands of all of its customers at the present time. The company expects to achieve that goal soon, but has found the demand for fiber setting a faster pace than was expected.

THE HEALTH PROBLEM

For the past 50 years, from the first indications that there were health problems involving workers who inhaled too much asbestos dust, Johns-Manville has led the industry in working to solve those problems. For many years, along with other companies, J-M has been active in asbestos health research in the U.S. and abroad. The industry has funded and encouraged a great many studies, and has worked with Federal, State and Local governments to eliminate dust problems and set appropriate exposure standards.

What was learned from these research and engineering studies was not always pleasant. Frankly, no industry likes to learn that because of a lack of knowledge not just on its part, but on the part of the medical/scientific community, labor and government, the health of some employees had been unknowingly endangered in the past. However, it is to the industry's credit that it did not hide from the facts once they were known.

Again, Johns-Manville assumed a leadership position in cleaning up plant and mine facilities . . . in controlling the occupational hazards that had been identified. When equipment did not exist to control a particular situation, J-M developed it. Some of the equipment and systems developed and in use within J-M today are also being used by other industries with similar needs.

The corporate policy of Johns-Manville is simple and everyone in the organization lives by it:

> "It is our Company's policy to equip our plants for the highest degree of personal safety . . . provided it is technically possible and economically feasible to do so.
>
> When technology is not available . . . or when it is not feasible economically from a competitive standpoint to make these installations . . . we will elect to discontinue a particular operation rather than knowingly endanger the health or life expectancy of a single employee."

The people of J-M know, however, that living by that policy within the confines of their own facilities is not enough. They believe it is their responsibility to see to it that J-M customers and their employees are also made aware of potential hazards and how to control them.

MEDICAL ASPECTS

Asbestos can cause health problems if improperly used or handled. When a person is subjected to high levels of airborne asbestos dust in the air, serious health problems can result. But, if a person is protected - if normal, prudent, dust control systems are installed - a person's health can be protected and he or she will be able to work with asbestos fiber without danger.

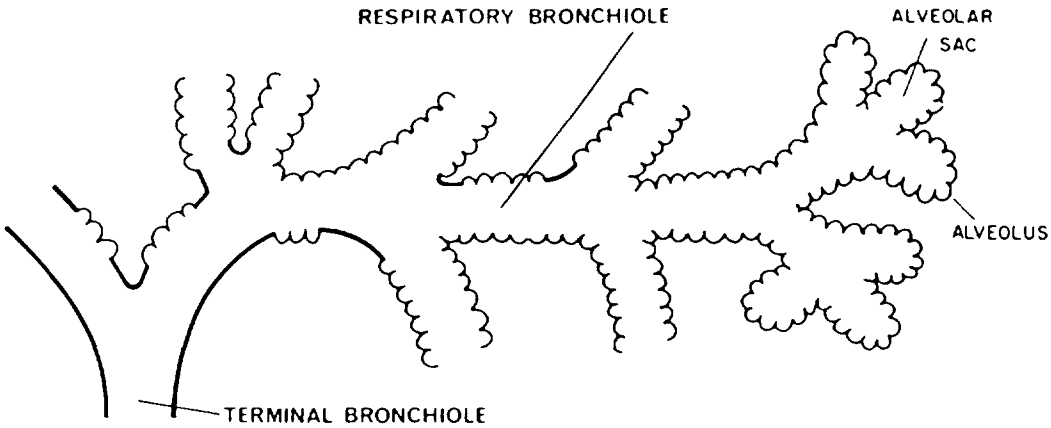
Just about everything has a dose relationship when it comes to health, and asbestos is no exception. Every product we use in our factories or in our homes is potentially dangerous — whether it is asphalt or asbestos used in our industrial processes, or flour or table salt used in cooking at home. They are all potentially dangerous substances if improperly used.

BUILT-IN DUST DEFENSES

All the air we breathe enters through the nasal passageways into the trachea. The trachea separates into two main passageways called the bronchi. The bronchi in turn get smaller as they go down the bronchial tree, dividing into smaller passages until they reach the bronchioles. These smaller and smaller air passageways finally terminate in a portion of the respiratory system known as the alveoli. (Figure 1).

While the trachea, bronchi, and larger bronchioles are visible to the naked eye, the smaller air passageways and the alveoli are only visible with the aid of a microscope.

Figure 1
Anatomical Sketch of Air Passageways



It is in the bulb-like structures called the alveoli that the important action takes place as far as our respiratory system is concerned. The alveoli are encapsulated with minute capillaries - blood vessels - and it is here that the oxygen and carbon dioxide are exchanged. There are 750 million alveoli in the normal human lung, and several million could be destroyed without any adverse effect upon a person's normal respiration.

In a sense, the human body has its own "garbage collection" system, which begins with the small hairs in the end of our nose. These are pre-filters - they prevent larger asbestos particles from entering the respiratory system.

Additionally, the inner nasal passageways down into the smallest bronchioles are lined with cilial cells. These whiplike structures along the passageways sweep unwanted particles up from the lower depths of the bronchioles to the passageways of the upper respiratory system so they can be removed by expectoration. Cilial cells are coated with a layer of mucous which captures the dust particles.

ASBESTOS-RELATED DISEASES

Asbestosis is a non-malignant fibrotic lung condition which may be caused by excessive inhalation of asbestos fibers over a long period of time. It is one of several diseases classified as pneumoconioses, such as:

1. Siderosis - caused by inhalation of fumes or dust containing iron particles.
2. Silicosis - caused by inhalation of free silica or quartz dust.
3. Byssinosis - caused by inhalation of cotton fiber dust.
4. Anthracosis - commonly known as black lung disease, caused by inhalation of coal dust.
5. Asbestosis - caused by inhalation of asbestos dust.

These are all pneumoconioses. They are non-malignant, non-cancerous, pulmonary abnormalities.

Although asbestosis can occur anywhere in the lungs, it usually occurs in the lower lobes, and both lungs usually are affected.

Another disease that has been linked to asbestos, to smoking and a few other substances, is bronchogenic cancer. While it can occur anywhere in the lungs, it usually develops at the major junctions of the bronchioles - in the central part of the bronchial tree.

Bronchogenic or lung cancer is caused by many agents, including asbestos. One of the leading causes of bronchogenic cancer among both asbestos workers and the general public is cigarette smoking.

The third asbestos-related disease is called mesothelioma, an extremely rare form of cancer which affects the lining of the pleural (lung) cavity or the peritoneal (abdominal) cavity.

Mesothelioma is by far the most serious of the three diseases because at this point in our knowledge, once it is diagnosed, it is inevitably fatal -- there is no known treatment. Death usually occurs within 18 months after diagnosis.

Mesothelioma is not caused solely by asbestos. In fact, there are now more cases of mesothelioma listed in world medical registries in which asbestos has not been involved than there are cases in which it has been involved.

BIOLOGICAL REACTIONS: ASBESTOSIS

When an asbestos fiber is inhaled into the body and it is not captured and eliminated by the normal cleansing mechanisms, two different actions can occur. It can be encapsulated with iron-rich protein -- in which case it is then referred to as an "asbestos body" or "ferruginous body." Or, it can remain in a naked state -- uncoated.

If the fiber is encapsulated and becomes a ferruginous body, it is, for all intents and purposes, harmless. On the other hand, if the fiber remains in a naked state in the lung, then an almost uncontrolled growth of cells may begin, resulting in the formation of collagen, or scar tissue. When collagen forms in the lungs, it alters the normal tissue so that it no longer functions properly.

When this biological reaction occurs, the body's vital capacity is greatly reduced. Lungs cannot hold as much air as they did previously because a portion of the alveoli has been rendered inoperative. With vital capacity thus reduced, the oxygen-carbon dioxide exchange function within the lung is altered, and the overall effect is poor ventilation and labored breathing, which are signs of asbestosis.

Biological changes such as these can be detected by x-ray. Another physical symptom which is characteristic of asbestosis is rales. Rales is an unusual sound produced in the chest cavity, which a physician can hear with the aid of a stethoscope.

It should be noted that rales also can be caused by bronchitis, the common cold or by pneumonia.

One other physical symptom of asbestosis which might occur is clubbing of the fingertips. Why this occurs still is a mystery, although some scientific investigators believe it is related to the alteration in the oxygen-carbon dioxide exchange within the lungs

LUNG CANCER AND MESOTHELIOMA

The biological mechanisms involved in development of bronchogenic cancer and mesothelioma are not yet understood. Like other forms of cancer, there are many mysteries still to be unlocked.

FIBER DIFFERENCES PLAY KEY ROLE

Asbestos fibers are not identical - there are both physical and chemical differences in the four commercially significant varieties. Of these, chrysotile (white fiber) is the most widely used, and is mined principally in Canada and Russia. Crocidolite (blue fiber) is mined largely in Africa, as is amosite (brown fiber). The fourth type, anthophyllite, comes from Finland and sees limited use, principally in plastic reinforcement.

TYPES OF ASBESTOS

	1972 World Production (Tons)	Color	SI	MG	FE	Sources
			Composition			
Chrysotile	4,000,000	White	40	38	2	U.S.S.R. Canada S. Africa U.S.A. Italy
Crocidolite	150,000	Blue	50	--	40	S. Africa (Cape) Australia
Amosite	110,000	Brown	50	--	40	S. Africa (Transvaal)
Anthophyllite	12,000	White	58	29	6	Finland

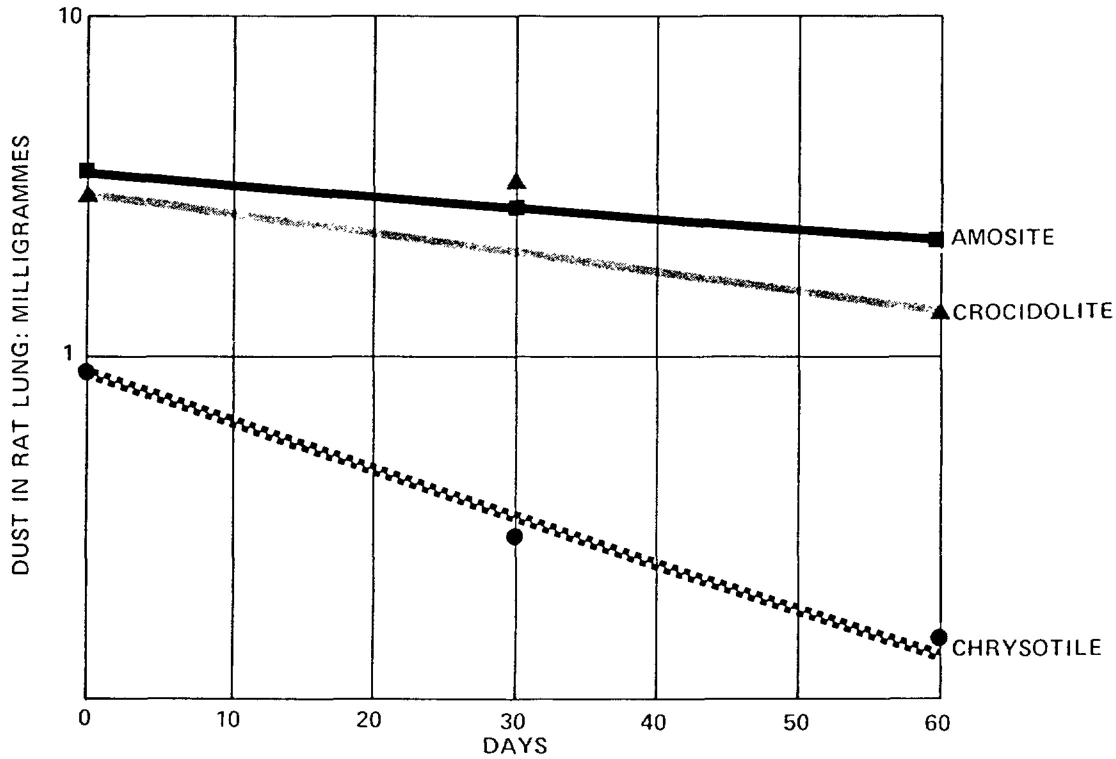
Chemically, the major differences in fibers are in their magnesium and iron content. Chrysotile contains 38% magnesium, while crocidolite and amosite have virtually none. On the other hand, crocidolite and amosite are rich in iron, while chrysotile has little. However, it is the physical differences in fibers that appears to be of most significance in biological reactions.

Fibers of crocidolite and amosite are very harsh and rod-shaped. Chrysotile, on the other hand, is wool-like in appearance, tending to curl.

Because of these physical differences, the rod-like fibers of crocidolite and amosite are more

Figure 2

DUST ELIMINATION RATES



The weight of asbestos dust in rats' lungs after 30 days' exposure to dust clouds of similar respirable mass concentration and the subsequent loss of dust over the next 58 days. Each point is the mean of 8 rats (Equal numbers of male and female.)

likely to pass through the bronchial passageways unimpeded, while the wavy chrysotile fibers are more likely to impinge on the side of passageways where they are captured by the mucous lining of the cilial cell system and escalated up and out of the respiratory system.

Thus, the physical characteristics of a fiber are extremely important in relation to its biological reaction. In order to cause pulmonary disease, a fiber or particle must penetrate deeply into the lungs. In order to do this, the particle must be below 3½ microns in diameter - although the length may vary considerably.

Scientific studies of fiber characteristics support the contention that chrysotile fibers are less likely to penetrate deeply into the lungs than the other fibers.

In one study, a group of rats was exposed to crocidolite, another to amosite, and another group to chrysotile. At the end of 30 days, some of each group of rats was sacrificed and the amount of fiber in their lungs measured. The remainder of the rat groups were sacrificed and analyzed 30 days and 60 days later. The results showed that chrysotile was more readily cleared from the lungs than either amosite or crocidolite. (Figure 2).

Also significant is a comparison of studies by three different researchers.

In one study, Dr. Irving J. Selikoff of Mount Sinai Hospital, New York City, studied 632 asbestos insulation workers, men who cover pipes and boilers with asbestos insulation materials. These workers were exposed to chrysotile, amosite, crocidolite and numerous other solvents and dusts.

The second study was done by Dr. Molly Newhouse in England and involved factory workers exposed to three different types of asbestos, but not the mixed dust and other materials to which the insulation workers also were exposed.

The third study was done by Dr. J. Corbett McDonald, head of the Department of Epidemiology at McGill University in Canada. It involved 9,981 Canadian miners and millers exposed only to Canadian chrysotile asbestos.

3 ASBESTOS STUDIES

	Asbestos Insulation Applicators (Dr. Selikoff)	Asbestos Factory Workers (Dr. Newhouse)	Chrysotile Miners and Millers (Dr. McDonald)
No. of Men Studied	632	4,806	9,981
No. of Deaths			
All Causes	380	436	2,143
Lung Cancer	72 (19%)	42 (10%)	97 (4%)
Mesothelial Tumor	22 (6%)	20 (5%)	3 (0.1%)

In analyzing the rate of lung cancer and mesothelioma in these different groups, the higher rates of disease appear in those groups of people exposed either to all three types of asbestos and other materials, or all three types of asbestos alone. Conclusions drawn from these studies tend to substantiate theories that Canadian chrysotile produces fewer cases of mesothelioma and lung cancer than other types of asbestos fiber.

DOSAGE STANDARDS

Much discussion has surrounded the establishment by the U.S. Government of dosage standards for asbestos dust inhalation. However, numerous studies have shown there is a dosage - or threshold level - for inhalation of asbestos, below which there apparently is no significant increase in disease.

Dr. McDonald performed a number of studies in this area. In one, he surveyed almost 10,000 Canadian miners and millers of asbestos in Quebec's eastern townships. Two separate

Figure 3
Dosage Study: Dr. J.C. McDonald

Radiographic Changes – Prevalence rates % standardized for age and years in industry
Males aged 36-65 at time of radiograph

	Dust Group						
mpcf - years	10	10-	100-	200-	400-	800+	
fibres ml years	23	23-	230-	460-	920-	1840+	Average
THETFORD MINES							
Irregular Small Opacities - 1/0+	1.8	3.3	6.3	8.7	12.0	17.2	7.6
- 2/1+	0.0	0.2	2.2	0.9	2.4	9.2	2.0
Pleural Thickening - Grade 1+	2.4	4.6	6.5	5.8	8.3	10.5	6.4
- Grade 2+	1.3	0.7	0.8	1.2	1.3	2.0	1.1
ASBESTOS							
Irregular Small Opacities - 1/0+	6.4	3.7	6.3	5.0	6.8	7.0	5.1
- 2/1+	0.0	0.4	1.5	0.8	0.6	3.9	0.8
Pleural Thickening - Grade 1+	2.9	2.6	3.0	3.0	4.7	5.8	3.2
- Grade 2+	0.0	0.6	1.0	0.5	1.4	0.7	0.7

groups were used: One at Thetford mines and the other at J-M's Jeffrey Mine. The results of Dr. McDonald's study are almost identical for the two groups. (Figure 3).

Using both the number of years of exposure and the exposure level itself, McDonald's work clearly illustrates that the ill effects of asbestos exposure are not seen until the exposure level exceeds 20 to 40 fibers per cc. It is only at the higher levels of exposure that significant health changes are detectable. (Figure 4).

The latent period for asbestosis ranges from 15 to 20 years. Bronchogenic cancer has a latent period of 20 or more years, and for mesothelioma, the usual latent period is 25 to 35 years. Thus, it is important to remember that the disease being seen today in some long-time asbestos workers is the result of exposures many years ago, when dust control systems were not as effective as they are today. Furthermore, these exposures occurred before the medical-scientific community, labor or government realized the nature of the asbestos health problem.

DUST CONTROL: HOW EFFECTIVE?

An indication of how effective dust control systems can be in reducing the risk of asbestos-related disease was documented early in a British study.

Figure 4

Dosage Study: Dr. J.C. McDonald

Mortality Study – Equivalent average death rates/1000

Deaths to December 1969

Males Born Between 1891 - 1920

	Dust Group					
mppcf - years	⊲ 10	10-	100-	200-	400-	800+
fibres/ml years	⊲ 23	23-	230-	460-	920-	1840+
All causes	365	355	354	313	323	395
Cancer of bronchus, trachea, lung	10.3	13.1	13.4	15.5	21.4	32.1
Abdominal Cancers	18.0	13.6	18.7	11.6	26.3	28.7
Pneumoconiosis	1.6	1.5	0.8	4.9	4.9	23.6

Dr. John Knox, then Medical Director for Turner Brothers Asbestos Company, Ltd., in England, studied workers employed over various periods of time in one TBA plant in Rochdale. There was no dust control at this facility prior to 1933, when primitive dust control equipment was installed.

Dr. Knox divided his study group three ways: those who had over ten years work experience in the plant prior to installation of dust control equipment; those who had some exposure prior to 1933 when dust control began, but less than ten years total exposure; and those who had no exposure at all prior to 1933, and had only worked in the plant under dust control conditions. All of the people in the three groups had at least 30 years of exposure, with or without controls.

Comparing the death rate of these three groups to the standard mortality tables (available from the British government and showing expected death rates for certain segments of the general population), Dr. Knox was able to analyze the effects of dust control.

In the group with the heaviest exposure, Dr. Knox found that while ten deaths would be the norm, in reality there were 15. In group two with only some heavy exposure, about eight deaths would have been expected, but there were only six. In the last group, which had worked in the plant only after dust control equipment was installed, the expected number of deaths was five, but only two were recorded. (Figure 5).

Dr. Knox' study is a dramatic illustration of the effectiveness of dust control, proving that the lives of employees can be protected even by the use of the simplest kinds of equipment.

SMOKING AND ASBESTOS

Another important point that resulted from medical studies is that smoking and asbestos do not mix. In his study, Dr. Selikoff found that all but one of the cases of bronchogenic cancer were

Figure 5

Dust Control Study: Dr. John Knox

Distribution of Deaths with Exposure Before 1933
Standardized for Time since Completing 20 years' Employment and Age

Exposure Before 1933 (yrs)	Distribution of Lung Cancer Deaths		Distribution of Other Deaths With Asbestosis		Distribution of Other Deaths Without Asbestosis	
	Observed	Expected	Observed	Expected	Observed	Expected
Over 10 (Group 1)	15	9.8	17	11.38	16	16.91
Up to 10 (Group 2)	6	8.41	5	8.07	12	12.98
None (Group 3)	2	4.78	0	2.55	13	11.12
All Groups	23	23.00	22	22.00	41	41.01
Test of Significance of Trend	$x^2 = 6.70$ $n = 1$ $P = 0.01$		$x^2 = 9.63$ $n = 1$ $P = 0.002$		$x^2 = 0.52$ $n = 1$ $P = 0.47$	

among asbestos workers who also smoked cigarettes. Those asbestos workers who did not smoke cigarettes had no greater rate of bronchogenic cancer than the normal, non-smoking population.

Based on these hard facts about the co-carcinogenic effect of smoking and asbestos dust inhalation, Johns-Manville and other asbestos companies strive to discourage smoking among employees who work with asbestos. (Figure 6).

LOCKED-IN AND NON-LOCKED-IN

While it is evident that excessive asbestos dust inhalation can be harmful, this risk is confined almost exclusively to the occupational setting.

Asbestos products in general use may or may not pose a dust problem, depending on their composition and handling.

Basically, asbestos products fall into two groups - the "locked-in" products and the "non-locked-in" products. In the non-locked-in products, one must be concerned with the generation of dust. However, in those products in which the asbestos is locked-in by chemical, physical or thermal means, there is little cause for concern since the normal use of these products will not release significant amounts of asbestos fiber into the air.

While we know today that asbestos can cause health problems if proper steps are not taken

Figure 6

Smoking Study: Dr. I.J. Selikoff

Expected and Observed Deaths Among 17,800 U.S and Canada Asbestos Insulation Workers
January 1, 1967 – December 31, 1971*

	Total		No History of Cigarette Smoking		History of Cigarette Smoking	
No of men Jan. 1, 1967	17,800		2,066		9,590	
Persons-Years of Observation	86,300		10,163		46,615	
	Expected Deaths	Observed Deaths	Expected Deaths	Observed Deaths	Expected Deaths	Observed Deaths
Cancer All Sites	144.09	459	19.92	33	79.58	265
Lung Cancer	44.42	213	5.98	2	25.09	134
Pleural Mesothelioma	–	26	–	2	–	17
Peritoneal Mesothelioma	–	51	–	9	–	29
Cancer of Stomach	6.62	16	0.95	1	3.60	8
Cancer of Colon, Rectum	17.51	26	2.52	4	9 53	14
Cancer of Esophagus	3.21	13	0.44	0	1.80	7
Asbestosis	–	78	–	4	–	45
All Other Causes	661.54	555	92.67	36	356.67	286
Total Deaths	805 63	1,092	112 59	73	436.25	596

to reduce exposure, we also know that exposures can be controlled and that there is a safe level of exposure.

Most members of the world medical-scientific community believe that the levels established by the U.S. Government Department of Labor's Occupational Safety & Health Administration to limit asbestos exposure are safe levels, and that asbestos-related diseases are preventable if proper dust control measures are taken.

OSHA STANDARDS FOR OCCUPATIONAL ASBESTOS EXPOSURE

As 1974 began, the asbestos industry learned that the Occupational Safety and Health Administration standard for occupational exposure to asbestos was under review. Revised regulations are expected in late 1974.

Current standards for asbestos exposure include these five major categories:

1. Standards: For airborne asbestos fiber concentrations in the workplace.
2. Monitoring: Method of determining whether or not dust standards are being met.
3. Methods of Compliance.
4. Medical.
5. Labeling.

STANDARDS

Present OSHA standards for asbestos exposure call for a maximum of:

> "Five fibers greater than five micrometers in length per cubic centimeter - 8-hour time-weighted average concentration and,
>
> Ten fibers greater than five micrometers in length per cubic centimeter - ceiling concentration.
>
> Effective July 1, 1976, the time-weighted average concentration standard becomes two fibers greater than five micrometers in length per cubic centimeter."

In all cases, the standards refer to fibers greater than five micrometers in length that can be seen by phase contrast light microscopy at approximately 430X magnification.

These and other similar standards are generally referred to as Threshold Limit Values (TLVs).

TLVs refer to airborne concentrations of substances and "represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect." - - - American Conference of Governmental Industrial Hygienists.

MONITORING

To determine whether or not a workplace meets the required standards, a system of monitoring is required.

The asbestos standards require that:

> "Within six months of publication of the regulations (June 1, 1973), every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine where every employee's exposure to asbestos fibers is below the prescribed limits."

Monitoring usually is done by the membrane filter/personal air sampler technique. It requires that an employee wear an air sampler, which can be obtained from a number of manufacturers.

The personal air sampler draws workplace air onto a filter which collects the particulates and fibrous dust in the air. This filter is then placed under a microscope and the number of fibers counted. After the count is complete, the actual fiber concentrations, expressed as fibers per cubic centimeter of air, are calculated by formula.

METHODS OF COMPLIANCE

It is expected that future asbestos standards will place a greater emphasis on methods of compliance than the present ones. However, the present standard does include an important section on engineering controls. It states that "engineering controls such as, but not limited to, isolation, enclosure, exhaust ventilation and dust collection shall be used."

This rule is a logical requirement for any dust generating process, regardless of whether or not it contains fiber, since any dust in sufficient quantity is potentially hazardous.

Two good reference works on designing dust control systems are:

1. American National Standards Institute, ANSI Z9.2-1972.
2. "Industrial Ventilation" by the American Conference of Government Industrial Hygienists.

MEDICAL REQUIREMENTS

Present medical standards require that "the employer shall provide initial and annual comprehensive medical examinations to each of his employees engaged in occupations exposed to air borne concentrations of asbestos fiber."

NIOSH (National Institute for Occupational Safety and Health, a Division of the Department of Health, Education and Welfare) has recommended in its criteria for occupational exposure to asbestos, that for the purpose of medical surveillance, "the term exposed to asbestos will be interpreted as referring to time-weighted average exposures above one fiber per cc or peak exposures above five fibers per cc."

The intent of the NIOSH recommendation was to eliminate the need for medical examinations when an employee's exposure was below one-half the TLV.

LABELING

Present standards require that:

"Caution labels shall be affixed to all 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, no airborne concentrations of asbestos fibers in excess of the prescribed limits will be released."

The required wording of the label is:

C A U T I O N

Contains Asbestos Fibers
Avoid Creating Dust
Breathing Asbestos Dust May Cause
Serious Bodily Harm

EPA STANDARDS FOR AIRBORNE ASBESTOS EMISSIONS

The Environmental Protection Agency on April 6, 1973, published in the Federal Register national emission standards for three hazardous air pollutants - asbestos, beryllium, and mercury.

The EPA standard for asbestos is unique because it contains no emission standards or numbers. Instead, the regulations are written around "NO VISIBLE EMISSIONS."

A visible emission is defined as any emission which is visually detectable without the aid of instruments and which contains asbestos particulate material.

An asbestos-using manufacturing plant that has no visible emissions is automatically in compliance. If, an asbestos-using plant has visible emissions but they do not contain asbestos particulate as determined by microscopic examination, the operation also is in compliance. However, if an asbestos-using plant does have asbestos-containing visible emissions, then control devices must be installed. In this case, the standard requires that a fabric bag filter be used in all cases except where the character of the emissions would render such a filter unsuitable. In that case, a high-energy wet scrubber must be used.

There are several exceptions from coverage under these EPA standards. One of the most important is field fabrication. The apparent reasoning in this instance is that if field fabricating operations conform to OSHA asbestos standards, possible airborne emissions to the atmosphere will be satisfactorily controlled.

J-M FIBER HANDLING SYSTEMS

Johns-Manville Corporation produces and sells more than 775,000 tons of asbestos fiber each year from four mines. The largest of these is the Jeffrey mine, located about 100 miles east of Montreal in Asbestos, Quebec, Canada. Jeffrey's production is in excess of 650,000 tons annually.

An indication of J-M's confidence in the future of asbestos fiber is apparent from the recently completed expenditure of $75 million to relocate and modernize crushing, drying and concentrating facilities at Jeffrey, and to expand mining operations.

Each day, six days a week, some 35,000 tons of ore are hauled to the Jeffrey crusher, and more than 100,000 tons of waste rock and overburden are hauled to the waste dump.

The objective of the J-M Asbestos Fiber Division always has been to deliver fiber to customers in a form and a manner that creates no dust problem for the customer's employees.

BULK FIBER HANDLING SYSTEMS

One new method of shipping asbestos fiber is the bulk tank car, which was developed by J-M in conjunction with the Ford Motor Co. and Procor in Oakville, Ontario. J-M has been successfully shipping short asbestos fiber grades in the bulk tank car for the last three years.

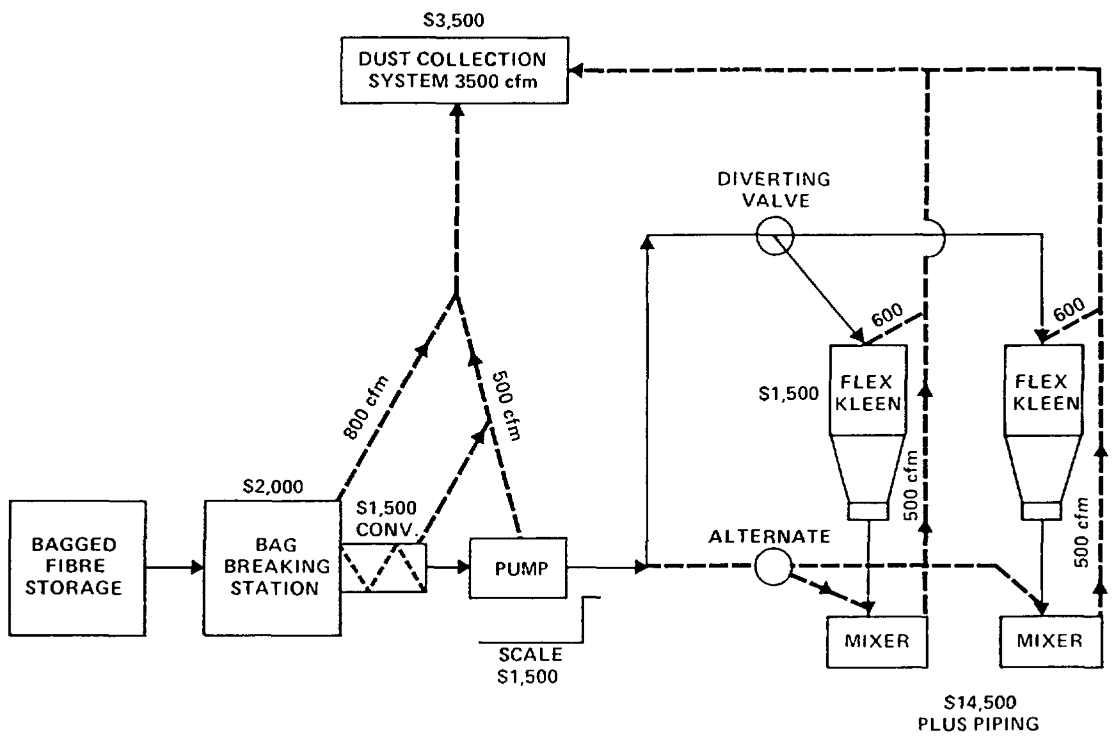
Approximately $150,000 was spent by Canadian Johns-Manville in development of this new car

Each of the six bulk tank cars now supplying Ford holds 55 tons of asbestos fiber. The car is loaded at the mine by pumping fiber into the seven compartments. At the receiving location, air is pumped into the car to "fluidize" the fiber and cause it to flow into storage silos.

There are many varieties of storage silos that can be used, and various makes of fiber pumps are available.

Figure 7

PROTOTYPE
IN-PLANT ASBESTOS FIBRE HANDLING SYSTEM



Advantages of the bulk tank car system are: No handling of bags and thus no contact with fiber by employees; lower handling costs; and simplified monitoring of dust levels. However, the system does have limitations, such as the tonnage that can be loaded into a car, depending on the length and openness of the fiber. In addition, the capital investment is about $100,000 and does not appear practical unless a customer's usage exceeds 2,000 tons annually.

IN–PLANT FIBER HANDLING SYSTEM

An in-plant fiber handling system has been developed and tested at Jeffrey Mine. It includes a bag-breaking station and fiber pump, which conveys the fiber to mixers or weigh hoppers. The entire system requires approximately 3,500 cubic feet of air, and costs about $14,500 plus piping. (Figure 7).

Aside from the fiber pump developed at Jeffrey, there are other items of equipment on the market that can be used to transport fiber. One is the Vanco Blower, which has been used at Jeffrey to move 100 pounds per minute of Group 7 fiber 35 feet vertically and 2,000 feet horizontally, with the entire operation under dust control.

Another Jeffrey development is the automatic bag opener, which opens paper or polyethylene bags, dumps the contents and deposits the empty bag, all under dust control. It requires 800 cubic feet per minute of aspirating air, and costs from $9,900 to $12,500, depending on various controls.

Fairmount Engineering, Inc., Hackettstown, N.J., has developed a bag opener at a quoted price of $8,500.

According to J-M calculations, the entire cost of an in-plant fiber handling system including a Vanco blower, automatic bag opener and a bag baler, is approximately $30,000, plus the cost of ducts. (Figure 8).

FIBER PACKAGING

At present, J-M is supplying asbestos fiber to the domestic market in three types of packages: Standard kraft multiwall paper bag; six mil polyethylene film bag, and the pulpable kraft multiwall bag.

The pulpable bag was developed for use in the asbestos paper industry so that both bag and contents could be dumped into a hydropulper or vat, thereby eliminating the need for opening the bag. In the same way, the polyethylene bag is used in the asphalt paving industry, and in limited cases in the floor tile industry, where both the bag and contents are dumped into the pug mill or mixer.

Of course, this concept is limited to suitable bag materials and the compatability of the bag composition with the product formulation.

SHIPPING

J-M makes available to customers several alternatives in fiber shipping. Unitized loads can be shipped on a cardboard deck sheet or a wooden pallet, with all bags glue-locked to reduce shifting and damage. Palletized units also can be covered by shrink polyethylene film to prevent damage and dust generation during shipment.

An added measure instituted by J-M to insure improved condition of asbestos shipments upon arrival is the assigned rail car.

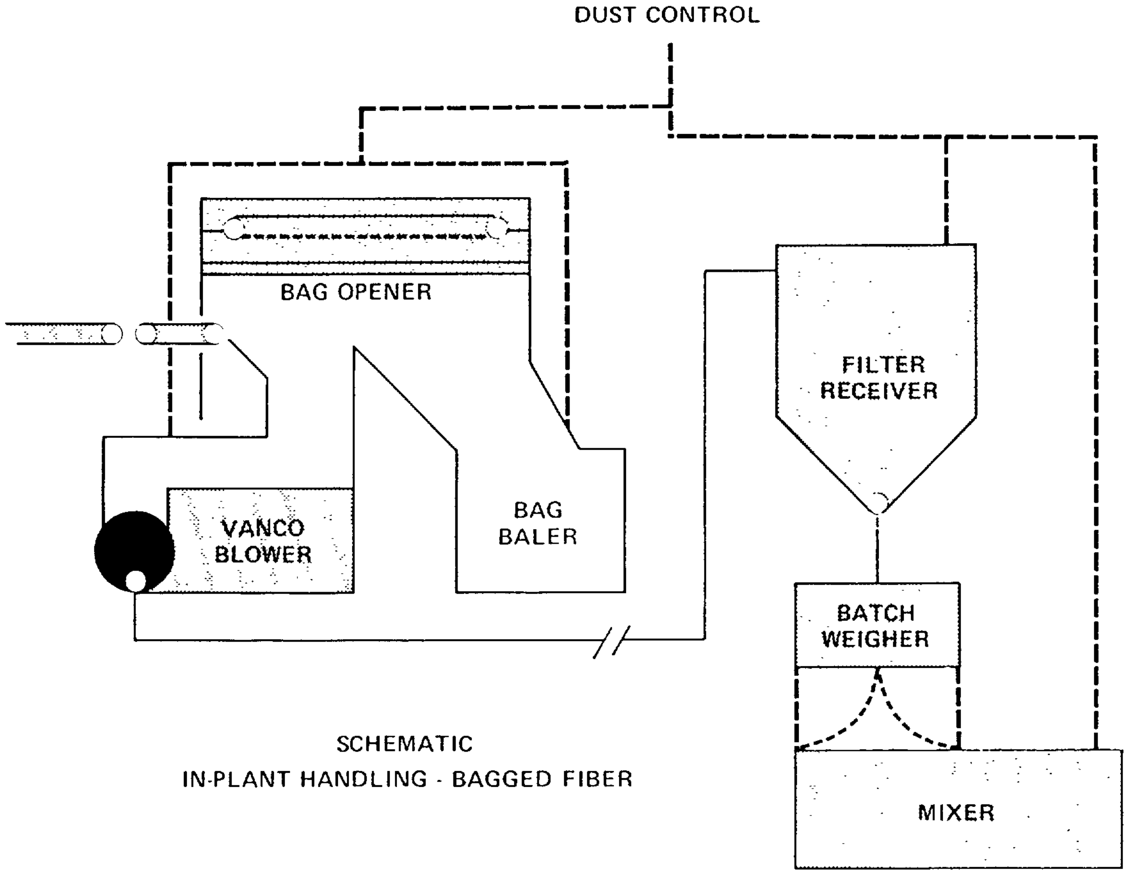
Over the past 18 months, 450 rail cars - each 40 feet long with double doors - have been in assigned service to J-M plants in the U.S.

Palletized material in the assigned cars is kept secure by the use of inflatable dunnage (two to a car), placed between pallets in the doorway area to keep them from shifting during transit.

The company's experience with assigned cars and inflatable dunnage has been excellent - the condition of arrival of shipments has been greatly improved.

A limited number of assigned cars are available for test shipments to customers. If, after a trial shipment, a customer decides this method is suitable, it will take approximately six months to acquire the necessary cars and dunnage.

Figure 8



SCHEMATIC
IN-PLANT HANDLING - BAGGED FIBER

NEW CONCEPTS

J-M's experimental work on improved asbestos fiber handling systems is continuing in two directions.

One new concept is the high density fiber block, which measures 9" x 12" x 16" and has a density of 100 lbs. per cubic foot. The blocks are dust free and consume less space in shipment than normal pressure-packed bags.

The second new concept is pelletized fiber. Using a Sprout-Waldron pelletizing machine, asbestos pellets have been produced at Jeffrey Mine with Group 7 fiber, using water as a binder. Pellets have a loose density of 65 pounds per cubic foot and lend themselves well to shipment in closed hopper cars, bags and other types of containers. They are largely dust free.

Aside from these new developments and concepts, the Asbestos Fiber Division is anxious to work closely with any of its customers in the development of a fiber handling system to meet individual requirements.

DUST CONTROL THROUGH ENGINEERING

Because Johns-Manville has been in the business of handling asbestos fiber and controlling asbestos dust for many years, the company has developed much expertise that may be valuable to companies with similar problems.

Some of the systems developed by J-M to control asbestos dust exposure in its own operations may be adaptable to other companies, or they may be viewed as concepts to work from.

While use of the assigned cars with double doors and inflatable dunnage has greatly reduced the dust problems associated with damaged railroad shipments, there are four basic rules that should be followed in any asbestos unloading operation.

1. Upon arrival of a shipment, check to determine if any loose fiber is on the bags or floor. If there is, the area should be vacuum cleaned before unloading.

2. Immediately seal any broken or torn bags before unloading.

3. For manual unloading, clean pallets should be used, and after use, the pallets should be vacuum cleaned or washed with water.

4. All broken bags, after resealing, should be taken directly to the point of usage and not placed into inventory.

J-M's experience with adherence to these simple housekeeping measures has been a marked reduction in fiber counts taken during unloading operations.

In-plant storage of asbestos should be geared to preventing bag damage and the resultant generation of dust. Plastic covers can be used for long-term storage, and corner protectors can be placed around pallets stored in a warehouse to prevent damage by plant vehicles.

Bag opening devices which protect personnel from dust during opening and feeding operations can bring about dramatic reductions in workplace fiber counts. There are several types of bag opening devices designed for particular needs, from simple to sophisticated. Some of these systems also include a bag disposal section and bag baler to further prevent dust generation.

DESIGNING DUST CONTROL FOR THE JOB

If a manufacturing operation generates dust, adequate dust control facilities should be designed and installed. It is important that employees be protected from asbestos dust just as they should be protected from excessive heat and noise, fumes, toxic chemicals and other materials.

J-M has developed specialized, yet simple, dust control systems for many diverse operations, from machining of Transite asbestos-cement pipe and heavy duty brake blocks to shingle punch presses.

Two principles are important in designing dust control systems for particular operations: Duct sizes should be a minimum of 4 to 5 inches in diameter with air duct velocities of 4,000 to 4,500 feet per minute; and face velocities across the work station should be 200 to 250 feet per minute.

Cloth collectors are efficient systems of dust control, and are in use in many J-M plants. Such systems can be scaled up or down to meet particular needs. However, it is important that the air to cloth ratio be no more than 3 to 1 for a shaker type collector.

One of the largest cloth collectors in the world is located at J-M's Jeffrey Mine in Quebec. This system encompasses the entire top floor of a 12-story building, and is under negative pressure. There are 80,000 bags in this collector, with thirty-two 350-hp motors driving fans that generate 5 million cubic feet of air per minute. This sophisticated system has helped J-M keep dust counts in all work stations in the fiber mill at or below five fibers per cc, with most below 2 fibers per cc.

In fact, of 943 J-M asbestos fiber work stations in the U.S., 860 or 91% of them are at or below five fibers per cc as of January 1, 1974, and 545, or 58% are below two fibers per cc.

Personal protective equipment is being used in those areas not yet below the five-fiber standard, although the company is currently working on all stations to bring them below the present five-fiber TLV and to the two fiber standard due to go into effect on July 1, 1976.

This reduction in fiber counts at J-M will be accomplished by: improved housekeeping, improved methods, changes in processes, and installation of improved dust control facilities.

SOME DUST CONTROL PRINCIPLES

J-M's 30 years of experience in handling asbestos fiber and developing effective dust control systems is available to J-M customers.

The following recommendations are designed as guides for those in need of dust control facilities, and should be viewed as principles to work from, not equipment one must have in order to solve a particular problem:

1. A good job of industrial housekeeping usually is the first step. An industrial vacuum cleaner should be used in areas where dust may be generated. If a plant already has dust control facilities, it is recommended that a vacuum cleaning system be used as a take-off from the present dust system by installation of a booster fan and a small cyclone. J-M will provide a typical layout and schematic of such a system.

2. If asbestos fiber is used in an operation and there are no dust control facilities, chances are there is a dust problem - and probably a two-fold one. One would be exposure of employees to asbestos dust (OSHA) and the other would be exhausting asbestos dust-laden air out of the building (EPA).

   It is not advised that a customer who has an operation without dust control make an industrial hygiene survey, since this only will provide numbers for a need that is obvious. Instead, it is recommended that the customer arrange for an engineering survey which will result in a report with schematics and recommendations on how to correct dust problems inside and outside the plant. The survey should be adequate enough to provide cost estimates on the installation of a proper and effective dust control system.

3. Johns-Manville conducts engineering surveys on a fee basis, along with a number of other reliable engineering firms. Additionally, J-M is equipped to handle the purchasing and installation of dust control facilities on a turn-key basis if desired. There are many reliable firms providing similar services and J-M recommends a review of all before making a decision.

4. The most appropriate times for an industrial hygiene survey are:

   a. If you already have dust control facilities, an industrial hygiene survey will determine how well your facilities meet OSHA standards.

   b. After installation of dust control facilities, an industrial hygiene survey should be part of the installation agreement to establish the reliability of equipment and compliance with standards.

The Environmental Control Systems Department of Johns-Manville, located in Denver, Colorado is ready to work with J-M customers to ensure the safest possible work environment for all people handling asbestos fiber.

FACING TOMORROW'S CHALLENGES

Much has been learned about asbestos-health problems in a short period of time, due mainly to the initiative of the asbestos industry in facing a complex problem.

Many new facts were learned about asbestos and health at a major meeting on the subject held in October 1972 in Lyon, France. It was there that a majority of scientists from all over the world who were actively studying the biological effects of asbestos met, under sponsorship of the International Agency for Research on Cancer, a division of the World Health Organization. There were 130 participants from 20 countries at the meeting.

In a report issued following that meeting, the group's Advisory Committee on Asbestos Cancers reported:

. . . There is no evidence of lung damage by asbestos to the general public.

. . . There is no evidence of an increased risk of cancer resulting from asbestos fibers present in water, beverages, food, or in the fluids used for the administration of drugs.

. . . There is no detectable lung cancer risk above normal when occupational exposures have been low . . . and these occupational exposures have almost certainly been much greater than the amount of asbestos to which the general public has been exposed.

. . . There is evidence from population studies that a considerable number of mesothelioma cases have no known association whatsoever with exposure to asbestos.

More came out of that meeting such as the incriminating evidence against cigarette smoking as a very probable co-carcinogen, and the clear differences in risk with the type of fiber and nature of exposure.

In total, it is now known that asbestos-related health risks are almost exclusively confined to the occupational environment . . . that the effects of excessive inhalation of asbestos are both time and dose related . . . that there are exposure levels that will not result in any increased risk of disease . . . and that the disease being found today among some long-time employees is not an indication of present day conditions; rather, it is a result of conditions existing decades ago when neither industry, government or the medical/scientific community knew much about the health effects of asbestos and even less about the proper means for their control.

THE J-M ENVIRONMENTAL AFFAIRS DEPARTMENT

In its continuing effort to provide the widest field of knowledge on asbestos and health, J-M has established an Environmental Affairs Department. As part of the department's services, various types and forms of information are made available to J-M customers and other interested parties.

A series of reports on asbestos and health problems is available free by filling out the order form (Figure 9) and returning it to the J-M Service Center with the proper code number. The printed materials available as of January 1974 are:

1. **Asbestos . . . A Family of Minerals** - describing the characteristics of the four commercially significant varieties of asbestos (EA-4P-376).

2. **Report of the Advisory Committee on Asbestos Cancers to the Director of the International Agency for Research on Cancer** - outlining the major conclusions from the 1972 meeting in Lyon, France, of respected researchers from all over the world who were studying the biological effects of asbestos. (EA-1P-374).

3. **Asbestos and Health** - discussing the occupational health risks from asbestos dust and what J-M and the industry has done to eliminate or control them. (EA-3P-375).

4. **Questions and Answers on Asbestos and Health** - providing answers to the most commonly asked questions about the biological effects of asbestos. (EA-10P-3711).

5. **Asbestos-Cement Water Pipe and Health** - discussing the results of studies to determine if drinking water that has passed through asbestos-cement water pipe poses any health risks (EA-12P-3711).

6. **Asbestos: No Risk to the Public** - reviewing asbestos health research to determine if there is any risk to the public from the use or manufacture of asbestos products. (EA-8P-3711).

Other material available includes:

7. **What Every Employee Should Know about Asbestos** - a pocket-size employee guide to asbestos and health, including the responsibilities of both employer and employee in providing a safe working environment. (EA-13L-3711).

8. **Recommended Safety Practices for Handling Asbestos Fiber** - an easy to read and follow list of accepted procedures for unloading, storage, handling, and transporting of asbestos fiber as well as use of protective equipment and disposal of waste material. This information is available on a two-color 11" x 14" poster on heavy gauge laminated cardboard (order EA-9P-3710) or in leaflet form (Order EA-11P-3711).

An extensive medical library on asbestos-health studies is open to interested parties. To acquire copies of specific medical studies or for more information on additional material available through the Environmental Affairs Department, write or call:

Walter A. Cooper
Director, Environmental Communications
Johns-Manville Corporation
Greenwood Plaza (4-North)
Denver, CO 80217
Telephone: 303/770-1000, Extension 2969

BIOGRAPHIES

This report was condensed from presentations made by the people listed below to Johns-Manville customers, in a series of seminars begun in 1973.

F.J. (JACK) SOLON, JR., Vice President, Environmental Affairs. He earned a Bachelor of Science degree in Chemistry from the University of Notre Dame, and studied at the Wharton Graduate School, University of Pennsylvania. He joined J-M in 1961. He has been Vice President for Advertising and Public Relations and prior to his present assignment, was Vice President, Corporate Relations.

WILLIAM B. REITZE, Corporate Manager, Accident Prevention and Industrial Health. He earned a B.S. degree in Bio-Chemistry from Wagner College and has done graduate work in Physiology at the Columbia University Medical School. His experience includes many years of physiology and toxicology research. Prior to joining J-M in 1969, he was Senior Industrial Hygienist for the New Jersey Department of Health. As part of J-M's participation in the Insulation Industry Hygiene Research Program, he was loaned to Mount Sinai School of Medicine as Chief of Field Studies and Industrial Hygiene.

EDMUND M. FENNER, Director, Technical Relations, Environmental Affairs Department. He is a graduate of Worcester Polytechnic Institute, Worcester, Mass. with a B.S. degree in Mechanical Engineering. A registered professional engineer, he joined J-M in 1940. He previously was Director of Environmental Control for J-M. He is Vice-Chairman of the Task Group on Naturally Occurring Inorganic Fibers of the American Society of Testing Materials; Chairman of a subcommittee of the American National Standards Institute; Chairman of the Technical Committee of the Asbestos Information Association/North America, and is a member of several professional and civic organizations.

NOEL W. HENDRY, Vice President of Johns-Manville Sales Corporation and General Sales Manager for the Asbestos Fiber Division. He earned a Bachelor's degree in Engineering from the University of British Columbia and a Master's degree in Geology from the California Institute of Technology. He had extensive experience in mining and exploration before joining J-M in 1949 as Senior Mining Engineer. He also served J-M as Senior and Chief Geologist and Exploration Manager before assuming his present responsibilities.

DONALD E. HILLIER, Director of Environmental Engineering. A graduate of the University of Michigan with a degree in Mechanical Engineering, he joined J-M in 1944 as chief industrial engineer. He has held a number of production engineering positions with the company. His present responsibilities include direction of all J-M environmental control and environmental engineering activities.

Figure 9

ENVIRONMENTAL AFFAIRS DEPARTMENT

INSTRUCTIONS TO RELEASE INVENTORY -- CRD 1095

TO: BILL EDMONDS
J-M SERVICE CENTER
1601 23RD STREET
DENVER, COLORADO

SHIP TO: (PRINT)

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QUANTITY	FORM #	DESCRIPTION (IF NO FORM NO)

SPECIAL INSTRUCTIONS: ______________________

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X43301 88 728
X43301 88 705

ISSUED BY: ______________

DATE: ______________

RELEASE # ________

THIS FORM FOR ENVIRONMENTAL AFFAIRS DEPARTMENT USE ONLY.

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EA-19P-475

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