Asbestos Information Association/North America

22 East 40th Street
New York, N. Y. 10016
212-689-3378

January 30, 1973

Gentlemen:

As mentioned in my memo of January 17, attached are two documents concerning the Bill introduced by Congressman Dominick Daniels to repeal the Federal Metal and Nonmetallic Mine Safety Act and to transfer standard setting and enforcement responsibilities for U.S. mining operations, including asbestos, to OSHA. The two documents are (1) an excerpt from the Congressional Record of January 11, and (2) an analysis of the situation by our government affairs consultants.

In recent weeks, we have received a sizable number of newspaper clippings concerning a recent paper by Dr. Mearl Stanton of the National Cancer Institute on fiber size being the main determinant in the causation of mesothelioma in test animals. Both the UPI and Los Angeles Times articles on the study (a copy of the latter is attached) contained the statement that "asbestos is second only to cigarette smoking as a cause of lung cancer." We are trying to track down the source of this comment (it is unlikely that it came from Dr. Stanton himself). The L.A. Times attributed it to the Institute, the UPI story did not. On the other head, a story (also attached) from the Occupational Health and Safety Letter did not use the quote at all. In any case, attached is a copy of Dr. Stanton's paper as presented at the Lyon Conference last October. Far from being a damaging study, Dr. Stanton's research indicates that electron size asbestos fibrils are of little or no concern in the causation of cancer. Since it is fibrils of this size that are being found in community air, in drinking water, beverages, drugs, wine, beer, etc., his findings could prove a valuable weapon in defending attacks in these areas.

Also enclosed is a copy of an article from the December issue of Occupational Hazards magazine, consisting of an interview of Dr. Selikoff on various occupational health topics, including asbestos. Mike Isser of Cunningham & Walsh contacted the magazine on behalf of the Assocation, and they agreed to do an article on the efforts being made by the asbestos industry

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to comply with the OSHA standards. Arrangements will be made within the next few weeks for a writer from the magazine to interview both me and an environmental control expert from the industry. We will keep you informed on the progress with this article.

The final item enclosed is a clip from the Occupational Health and Safety Letter concerning an automatic asbestos fiber bag opening device recently developed by Johns-Manville. The announcement was made in a speech by E. M. Fenner at a safety conference in Olympia, Washington, late last year, and was publicized in a press release put out on behalf of the Association by Cunningham and Walsh.

Sincerely,

Matt

Matthew M. Swetonic
Executive Secretary

Enclosures

A 19544

Statement by Rep. Dominick V. Daniels (D-N.J.) introducing HR 1720, a bill to repeal the Federal Metal and Nonmetallic Mine Safety Act.

SAFETY AND HEALTH IN METAL AND NONMETALLIC MINES

(Mr. DOMINICK V. DANIELS asked and was given permission to extend his remarks at this point in the RECORD and to include extraneous matter.)

Mr. DOMINICK V. DANIELS. Mr. Speaker, I am today introducing legislation to repeal the Federal Metal and Nonmetallic Mine Safety Act because, paradoxical as it may sound, that is the best way to promote health and safety in these mines. The effect of the repeal is not to leave metal and nonmetallic miners without the protection of Federal safety law; rather it is to make them subject to the Occupational Safety and Health Act of 1970, a much stronger and more effective statute than the Metal and Nonmetallic Mine Safety Act.

The Metal and Nonmetallic Mine Safety Act was a forward-looking, progressive piece of legislation when it was enacted, and I am proud to have been a member of the subcommittee that developed it. But we have now had 6 years of experience under that act, and we have also—through the enactment of the Federal Coal Mine Health and Safety Act of 1969 and the Occupational Safety and Health Act of 1970—acquired a great deal more experience in writing safety and health legislation.

The Select Labor Subcommittee's hearings last year demonstrated at least two major weaknesses in the Metal and Nonmetallic Mine Safety Act—and my bill is designed to correct both of them. The first weakness is in the administering agency.

We placed enforcement of safety and health responsibility in the Bureau of Mines because we thought that its technical expertise in mining operations made it the logical agency to protect the worker's safety and health. But we were wrong. The Bureau of Mines' basic charter is to promote production and that, we have found, is inconsistent with rigorous enforcement of safety laws. Safety and maximizing production are not always consistent goals—and the Bureau of Mines has shown that workers will not be adequately protected while their lives are in the hands of an agency that is "production first" oriented.

The failure of the Bureau's enforcement program is evident from the figures. The injury frequency rates have not declined in the industries subject to this act, while experience under the Longshore Safety Act, administered by the Department of Labor, demonstrates conclusively that a well enforced safety law will bring injury rates down.

The most appalling evidence of the ineffectiveness of the Bureau of Mines program in the metal mining area is the disaster at the Sunshine Silver Mine in Kellogg, Idaho, in May 1972. The interim report of the independent hearing examiner on that disaster is a tragic indictment. Let me just quote a few sentences from his report:

> It is evident that a large number of deaths and the magnitude of the disaster are a direct result of inadequate safety standards, industry-wide poor safety practices, the lack of training of the miners in the event of a disaster, and the fact that no one expected a disaster of this magnitude to occur. Further, not only are some standards inadequate, but they have been diluted and rendered ineffective by interpretation.

We will not have a vigorous enforcement program in this industry until we transfer responsibility to the Department of Labor. That is what my bill does, and it insures that the Department of Labor will have sufficient experience in the mining field by transferring to that Department the personnel in the Interior Department who have been engaged in the administration of the law.

We have, as I said before, learned much about the relative efficacy of different enforcement procedures in occupational safety and health laws. The Occupational Safety and Health Act of 1970 is the distillation of that experience. It improves in many ways the procedures of the Metal and Nonmetallic Mine Safety Act, and I am attaching to my statement a memorandum outlining the weaknesses of that act which are improved in the Occupational Safety and Health Act.

Mr. Speaker, death and injuries in the mines are not inevitable. Effective safety and health laws effectively administered can make a difference. It is time that the metal and nonmetallic miners of this country received the protection that they deserve—and that my bill will provide.

I include the following:

WEAKNESSES OF PUBLIC LAW 89-577—FEDERAL METAL AND NONMETALLIC MINE SAFETY ACT

STANDARDS

There are no mandatory interim standards.

There is no time limit within which permanent mandatory standards must be set.

The Secretary of Interior is bound by formal rule-making procedures which can often be lengthy.

Under a state plan, standards do not have to be at least as effective as the federal ones.

There is no provision for a variation in standards and for the employees to be informed of one.

There are no emergency temporary standards.

There is no general duty to cover unique circumstances where no standards have been promulgated.

There is no distinction in the standards between gassy and nongassy mines.

ENFORCEMENT

Inspections

The inspector is required to visit each mine only once per year.

There is no prohibition against advance notice of an inspection.

There is no provision for the employee representative to accompany the inspector.

There is no provision for the employees to get the results of an inspection.

There is no requirement for an inspector to *reinspect* to determine if an employer has corrected a violation of a standard.

Penalties

There are no mandatory penalties.

There are only *permissive civil* penalties:

(1) if the Secretary of Interior *chooses* to bring a civil action for failure to correct a violation of a standard;

(2) if the Secretary of Interior chooses to bring a civil action in the District Court for failure to abide by a reporting requirement;

(3) if the Secretary of Interior *chooses* to bring a civil action for an employer's refusal to permit an inspection or for interference with an inspector.

There are permissive criminal penalties if:

(1) the *Secretary of Interior* wishes to bring an action for refusal to comply with a withdrawal order in cases of *imminent* danger causing death or serious physical harm;

(2) or refusal to comply with an order of debarment.

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MINE SAFETY AND HEALTH

Policy Developments

Metal and Non-Metallic Mine Safety: Congressman Dominick Daniels (D-N.J.), chairman of the House Select Subcommittee on Labor, has introduced legislation which would strip the Department of the Interior of its responsibility for the Metal and Non-Metallic Mine Safety Act of 1966. Daniels' bill would transfer this responsibility to the Department of Labor's Occupational Safety and Health Administration.

Such action has long been favored by organized labor, particularly the United Steelworkers, who have most of the metal and non-metal mines under contract. The Steelworkers demanded the transfer of responsibility last year following the Sunshine Silver Mine disaster which killed 91 miners. During the oversight hearings held on the disaster by Daniels' subcommittee, Steelworkers legislative director, John Sheehan, said that the Department of Interior's Bureau of Mines was too cozy with the private mining interests to adequately enforce the law. In commenting on the disaster, Steelworkers President I.W. Abel demanded that "Congress act to shift responsibility for enforcement of metal and non-metal mine safety to the Occupational Safety and Health Administration. . . "

The mechanism of the Daniels' bill which would effect the transfer is the repeal of the Metal and Non-Metallic Mine Safety Act, thereby placing the mines under the jurisdiction of the Occupational Safety and Health Act. The bill ensures that the Department of Labor will have the necessary expertise in the mining field by transfering to OSHA the Bureau of Mine's personnel who have been engaged in the administration of the mine safety act.

On the day he introduced his bill (HR 1720) Daniels stated that "The Bureau of Mines basic charter is to promote production and that, we have found, is inconsistent with the rigorous enforcement of safety laws. . . the Bureau of Mines has shown that workers will not be adequately protected while their lives are in the hands of an agency that is 'production first' oriented."

The bill has a high priority with Daniels, and his subcommittee can be expected to hold hearings sometime during the spring, if not sooner. According to a subcommittee spokesman, the bill will probably be the second order of business following the committee's work on public service jobs and manpower policy. Since the subcommittee has not yet organized itself, this time schedule may change over the next few weeks.

Forecast/Assessment

GRC expects a similar bill to be introduced shortly in the Senate and it will probably be initiated by Sen. Harrison Williams (D-N.J.), chairman of the Senate Labor and Public Welfare Committee. There is a good possibility that this legislation will pass during the 93rd Congress.

Scientist says chemical make-up not to blame

Asbestos-fibre size 'cancer-causing'

By HARRY NELSON

Asbestos causes cancer because the fibres are of a certain microscopic size, not because of the chemical composition of the asbestos, a National Cancer Institute scientist has reported.

Very fine fibres of asbestos, glass or sapphire caused a high incidence of cancers in experimental rats, but coarse fibres or powdered material of the same composition rarely caused cancer, according to Dr. Mearl F. Stanton.

Dr. Stanton reported that cancer-causing fibres were about one-hundredth as thick as an eyelash and less than one-tenth as long (between one-half and five microns in diameter and 80 microns long).

Asbestos fibres have been strongly linked with a type of human cancer called mesothelioma which affects the membranes lining the lungs and abdomen. This type of cancer is rare in the general population but very common among asbestos workers.

Asbestos is second only to cigarette smoke as a cause of lung cancer, according to the National Cancer Institute.

Stanton, whose research was done at NIC's laboratory of pathology, presented results of his rat studies at a conference on the biological effects of asbestos held in Lyon, France. His coworkers were Mrs. Constance Wrench and Miss Eliza Miller.

Several months ago Stanton reported on studies in which asbestos-covered glass mesh pads were implanted directly against the membrane lining of rats. The membranes later were examined for cancer at the site of asbestos exposure.

The three chemically distinct types of asbestos (crocidulite, chrysotile and amosite) were used in the experiments. Also tested separately were two metals which commonly contaminate asbestos and fine particles of silica, the major constituent of asbestos.

The rats exposed to the asbestos-fibre-coated glass had high rates of mesothelioma — 58 to 75 per cent of the 450 rodents in the study.

The rate of cancer production by various asbestos samples did not depend on the presence or absence of impurities. Neither of the two metals which commonly contaminate asbestos produced any cancers, and the fine particles of silica produced only one mesothelioma among 48 rats.

Stanton concluded that neither the chemical composition of asbestos nor the presence of impurities could account for the cancer-causing potential.

When asbestos fibres were ground to very short submicroscopic lengths, the cancer rate was less than half that in rats exposed to natural-length fibres.

The glass-mesh pads without asbestos did not cause cancer, but when the glass was treated to reduce it to small fibres about the size of asbestos fibres mesothelioma did occur.

None of 150 rats exposed to two samples of fully pulverized asbestos, non-fibrous aluminum oxide or two samples of glass with large fibres have so far developed any cancer, Stanton said.

"We know that asbestos fibres cause cancer in man," he said. "We have no evidence on whether other kinds of fibres will also prove hazardous (in man)."

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Occupational Health & Safety Letter, January 8, 1973

NEW STUDY DEMONSTRATES MECHANISM OF ASBESTOS EFFECTS:

The carcinogenic activity of asbestos is due entirely to its fibrous structure, regardless of the chemical composition of the fibers, according to a scientist of the National Cancer Institute.

Dr. Mearl F. Stanton of NCI's Laboratory of Pathology reported on his asbestos study in laboratory rats at a conference in Lyon, France, on the biological effects of asbestos.

The series of experiments was undertaken to test the ability of various fibrous and non-fibrous substances to cause cancer of the pleura. Results showed that very fine fibers of asbestos, glass or sapphire caused a high incidence of pleural cancers in the rats, while coarse fibers or powdered material of the same compositions only rarely caused cancer.

The carcinogenic fibers were between one-half and five microns in diameter and less than 80 microns long (less than one-hundredth as thick as an eyelash and under one-tenth as long, says NCI).

He and his colleagues used surgical methods to implant asbestos-covered glass-mesh pads directly against the pleura of rats. The pads remained in place until the rats were autopsied; then the pleural membranes were examined for cancer at the site of asbestos exposure.

High rates of mesothelioma, ranging from 58 to 75 percent, were found in 450 rats treated with asbestos fibers, regardless of which of three chemically distinct types of asbestos (crocidolite, chrysotile or amosite) were used. The rate of cancer production by various asbestos samples did not depend on the presence or absence of impurities, and neither of two common metal contaminants of asbestos tested separately produced any cancers.

Treatment with fine particles of silica, the major constituent of all types of asbestos, caused only one mesothelioma among 48 rats. Thus, Dr. Stanton said, neither the chemical composition of asbestos nor the presence of impurities could account for its carcinogenic potential.

In one experiment, a sample of asbestos was ground to reduce its fibers to submicroscopic size and very short lengths. This treatment reduced cancer incidence in test rats to less than half the rate in rats exposed to natural fibers of asbestos. The glass-mesh pads alone did not cause cancer, but mesotheliomas occurred in rats exposed to glass that had been treated to reduce it to small fibers, making it comparable to asbestos in size.

At the Lyon conference, Dr. Stanton described more recent studies designed to test whether particle size and shape are the critical factors in causing this type of cancer. In these experiments, rats were exposed by the same technique as before to particles of asbestos, glass or aluminum oxide of many different sizes and shapes. After two years, fibers of all three materials have been found capable of causing high rates of pleural cancer in rats.

Two standard samples of asbestos, two of very fine fibrous glass, and a sample of fine sapphire (aluminum oxide) "whiskers" caused cancer in more than half of the 150 rats that have been autopsied so far. Lower rates of cancer, between 5 and 40 percent, occurred in rats treated with either long, thick fibers or short, thin fibers of glass or asbestos. None of the 150 rats exposed to two samples of fully pulverized asbestos, non-fibrous aluminum oxide, or two samples of glass with large fibers have so far developed any cancer.

"We know that asbestos fibers cause cancer in man," said Dr. Stanton. "We have no evidence on whether other kinds of fibers will also prove hazardous. It's rare to find other substances with fibers the same size as asbestos, and few people are known to have been exposed to them. But the results in animals suggest that it would be judicious to avoid inhalation or ingestion of any finely particulate fibrous material."

A 19548

BIOLOGICAL EFFECTS OF ASBESTOS

LYON, October 2-5, 1972

Paper 43A

Some Aetiologic Considerations of Fiber Carcinogenesis

Mearl F. Stanton

(With the technical assistance of Constance Wrench & Eliza Miller).

A 19543

SOME AETIOLOGIC CONSIDERATIONS OF FIBER CARCINOGENESIS

by

Mearl F. Stanton

(with the technical assistance of Constance Wrench and Eliza Miller)

The Laboratory of Pathology, National Cancer Institute, Bethesda, Maryland, U.S.A.

SUMMARY

Various structural forms of asbestos, fibrous glass, and aluminum oxide have been tested for carcinogenicity on the pleura of rats. Preliminary results indicate that all three materials when composed predominantly of durable fibers between 0.5 and 5 microns in diameter and lengths of less than 80 microns are more carcinogenic than fibers smaller or larger than these dimensions or non-fibrous materials of similar composition. The carcinogenicity of asbestos, glass, and aluminum oxide is primarily related to its structure rather than to physicochemical properties.

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The exogenous agents which contribute to the cause of cancer generally fall into 1 of 3 major groups; ionizing radiation, chemicals, and viruses. There is a wealth of speculation as to how the members of these groups act to induce cancer, but the mechanisms of their action remain unknown. Asbestos is of particular interest as a carcinogen because it has attributes of two of these groups. In all its forms, asbestos contains chemicals that are carcinogenic under certain conditions. At first hand, the various metallic ions or the polycyclic hydrocarbons that are either inherent, or acquired through processing would seem the best explanation for asbestos carcinogenicity. On the other hand, asbestos particles that are within the dimensional range of viruses are abundant in all forms and conceivably these submicroscopic particles could act in a fashion similar to viruses, whatever that may be.

However, there is reasonably good evidence that neither of these attributes are related to the carcinogenicity of asbestos. The evidence for this conclusion can be summarized as follows:

1. There is no indication that any of the asbestoses are contaminated sufficiently with known carcinogenic hydrocarbons to account for their carcinogenicity, and rigorous extraction of those hydrocarbons present in asbestos does not affect its carcinogenicity for the pleura of the rat (Wagner, J.C. et al. 1970).
2. Variations in inherent metallic content of various types of asbestos are great, yet these various types of asbestos show only slight differences in carcinogenicity (Harrington, J.S., 1965; Timbrell V., 1970; Wagner J.C. et al. 1970B; Stanton et al.. 1972).

3. Finely particulate metallic nickel, stainless steel, or non-crystalline silicon dioxide applied to the pleura of the rat are not sufficiently carcinogenic to account for the carcinogenicity of asbestos through mill contamination (Stanton et al. 1972).
4. Reduction of fiber size by partial pulverization of asbestos, a process which increases contamination by metallic particles and increases the number of submicroscopic fibrils in asbestos, reduces its carcinogenicity (Stanton et al. 1972).
5. Hand-cobbed crocidolite ore, hand milled without metallic contamination, is equal in carcinogenicity to machine-milled crocidolite (Stanton et al.1972).
6. Non-asbestiform fibers such as fibrous glass are increasingly carcinogenic as they approach the size range of milled asbestos fibers (Stanton et al.1972).

One therefore must consider that the structural features of asbestos may be the critical factor in its carcinogenicity and it is toward this hypothesis that we have directed our attention. If the structural features of asbestos are important, then it follows that similar fibers, if sufficiently durable, should also induce tumors and on this reasoning we have based a large series of experiments. These experiments are still in progress; only preliminary results of part of them are available at this time. For this reason interpretations are limited.

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The interpretations of tumor incidence are reasonably conservative and may need to be revised upwards in the final calculations. The analysis of fiber distribution by size is admittedly crude and subject to considerable error, but again we have tried to be conservative in our interpretation.

Materials and Methods:

Various specimens of crocidolite, chrysotile, fibrous glass, and fibrous aluminum oxide were applied by open thoracotomy to the left pleural surface of 30, 11- to 14- week-old, female Osborne-Mendel rats at a single standard 40 mg dose level by a method previously described (Stanton et al., 1969). The single unique aspect of these experiments is that all test materials were applied to small 45 mg fibrous glass pledgets prior to application. The glass pledgets are composed of large-diametered fibrous glass which when intact has no apparent carcinogenicity in itself. We use it simply as a convenient and accurate means of uniformly applying the test material to a wide surface area of the pleura. The test materials are listed in tables 1-4. The UICC standard reference samples of crocidolite and chrysotile A have been previously described (Timbrell V. 1970). These samples were treated by grinding in a stainless-steel ball mill (Spex model 5000) to produce the three pulverized samples, and the crude fibers were stripped by hand from hand-cobbed ore specimens, with an attempt to retain bundles of fibers as long as feasible without contamination by extraneous mineral. This processing was previously described (Stanton et al.1972). The fibrous glasses were obtained from both the Owens-Corning Fiberglas Corporation, Toledo, Ohio, and the Johns-Manville Research and Engineering Center, Manville, New Jersey.

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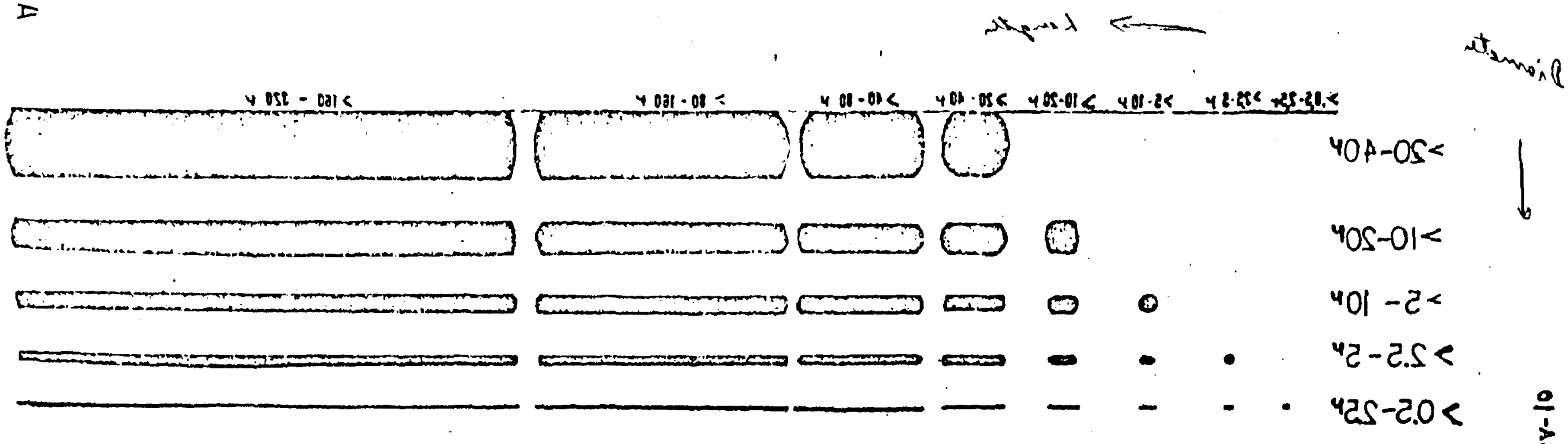

Text-Figure 1. Graphic illustration of the categories of size used to classify particles in the test samples. Illustrated particles represent mean dimensions.

TABLE 1

MESOTHELIOMA INCIDENCE IN RELATION TO DISTRIBUTION OF FIBERS BY SIZE

HIGH INCIDENCE GROUPS (>50% MESOTHELIOMAS)

Diameter ↓ / Length → μ		>.5 → 2.5	>2.5 → 5	>5 → 10	>10 → 20	>20 → 40	>40 → 80	>80 → 160	>160 → 320
> 20-40	CROCIDOLITE								
> 10-20	UICC								
> 5-10	////			1			11	22	
> 2.5-5			1	<1	1	3	3	17	11
> .5-2.5		3	5	7	4	4	2	1	4
> 20-40	CHRYSOTILE								
> 10-20	UICC								
> 5-10	////			11					
> 2.5-5			4		4				
> .5-2.5		8	15	14	11	17	7	5	3
> 20-40									
> 10-20	AAA GLASS CRUDE FIBER								
> 5-10	////								
> 2.5-5			1					3	7
> .5-2.5		<1	<1	1	2	2	5	13	65
> 20-40									
> 10-20	AAA GLASS SEPARATED								
> 5-10	">10x1μ" ////								
> 2.5-5			1			3			
> .5-2.5		8	3	6	17	18	10	23	12
> 20-40									
> 10-20	ALUMINUM OXIDE				4	4			
> 5-10	WHISKERS ////			3	1	4	8		26
> 2.5-5			1	1	1	5	2	12	6
> .5-2.5		<1	<1	1	2	5	4	4	6

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TABLE 2

MESOTHELIOMA INCIDENCE IN RELATION TO DISTRIBUTION OF FIBERS BY SIZE
MODERATE INCIDENCE GROUPS (40-25% MESOTHELIOMAS)

Length μ → / Diameter ↓	>.5 – 2.5	>2.5 – 5	>5 – 10	>10 – 20	>20 – 40	>40 – 80	>80 – 160	>160 – 320
CROCIDOLITE CRUDE FIBER //								
>20-40								42
>10-20								22
>5-10							1	10
>2.5-5							2	12
>.5-2.5	<1	<1	<1	1	2	2	3	2
CHRYSOTILE LONG FIBER ///								
>20-40								
>10-20								20
>5-10								16
>2.5-5		2					10	12
>.5-2.5	4	2	1	4	2	7	6	14
AAA GLASS SHEARED FIBER ////								
>20-40								
>10-20				17				
>5-10			4					
>2.5-5		4	2	2	11	9	8	
>.5-2.5	7	2	4	9	10	2	1	8
AAA GLASS SEPARATED ">10x3μ" ///								
>20-40								
>10-20				2	4			
>5-10			1	1	15	10		
>2.5-5		3	2	9	22	9	8	10
>.5-2.5	<1	<1	<1	1	2	<1	<1	<1
>20-40								
>10-20								
>5-10								
>2.5-5								
>.5-2.5								

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TABLE 3
MESOTHELIOMA INCIDENCE IN RELATION TO DISTRIBUTION OF FIBERS BY SIZE
LOW INCIDENCE GROUPS (20-5% MESOTHELIOMAS)

Length → µ / Diameter ↓	> .5 ↓ 2.5	> 2.5 ↓ 5	> 5 ↓ 10	> 10 ↓ 20	> 20 ↓ 40	> 40 ↓ 80	> 80 ↓ 160	> 160 ↓ 320
	CROCIDOLITE PARTLY PULVERIZED ///							
> 20-40								
> 10-20								
> 5-10								
> 2.5-5								
> .5-2.5	54	20	17	9				
> 20-40								
> 10-20								
> 5-10								
> 2.5-5								
> .5-2.5								
	AAA GLASS PARTLY PULVERIZED ///							
> 20-40								
> 10-20								
> 5-10			<1	2		16	32	
> 2.5-5		4	4	2	8	6	4	8
> .5-2.5	1	2	3	2	2	1	1	3
	AAA GLASS SEPARATED "<5x1µ" //							
> 20-40								
> 10-20								
> 5-10				13				
> 2.5-5		4	10	13				
> .5-2.5	23	11	13	11	2			
> 20-40								
> 10-20								
> 5-10								
> 2.5-5								
> .5-2.5								

A19557

TABLE 4

MESOTHELIOMA INCIDENCE IN RELATION TO DISTRIBUTION OF FIBERS BY SIZE

ZERO INCIDENCE GROUPS (NO MESOTHELIOMAS)

Length → μ / Diameter ↓	>.5 – 2.5	>2.5 – 5	>5 – 10	>10 – 20	>20 – 40	>40 – 80	>80 – 160	>160 – 320
CROCIDOLITE FULLY PULVERIZED ↓								
> 20-40								
> 10-20				20				
> 5-10			14					
> 2.5-5		26						
> .5-2.5	40	<1						
CHRYSOTILE FULLY PULVERIZED ↓								
> 20-40					30			
> 10-20				28				
> 5-10			25	5				
> 2.5-5		5	2	<1				
> .5-2.5	3	<1	<1	<1				
COMMERCIAL GLASS WHOLE FIBER ↓								
> 20-40								47
> 10-20								24
> 5-10								21
> 2.5-5						<1	<1	7
> .5-2.5						<1	<1	1
AAA GLASS SEPARATED "<5x3μ" ↓								
> 20-40								
> 10-20					29			
> 5-10			6	2	4			
> 2.5-5		5	9	20	14	2		
> .5-2.5	3	2	3	1	<1			
ALUMINUM OXIDE NON-FIBROUS ↓								
> 20-40					28			
> 10-20				31	19			
> 5-10			10	4				
> 2.5-5		5	1					
> .5-2.5	2	<1						

A 19550

We are particularly indebted to the latter Institution for the size separation of fibrous glasses, which were carried out through a series of millings and sedimentation of exceptionally fine-diametered glass fibers. All of the glasses were of the usual borosilicate type with mineral oxide contents previously recorded (Stanton _et al_. 1972). The non-fibrous aluminum oxide and aluminum oxide whiskers were commercial products obtained from the Artech Corporation, Falls Church, Virginia. These are single crystal fibers that are more than 99.5% pure Al_2O_3. The method of counting fibers was previously described (Stanton _et al_. 1972). Samples of the materials suspended in Formvar were air-dried on glass slides and photographed at 1000 magnifications. From the photographs, 1000 consecutively counted particles were assigned to the 30 ranges of dimension indicated in text-figure 1. Assuming that the particles in a given range were normally distributed around the mean size of that range, the total mass of all particles could be calculated, and the percent of the total mass occupied by particles in a given range or size compartment are the figures tabulated in tables 1-4. In the tables, the first entry of each row and ½ the second entry in each row consist of particles that are non-fibrous. The plus figures below the designated specimen indicate the extent of pleural fibrosis most commonly observed in the rats of each experiment. The rats are being observed for 2 years following application. All dead or sick rats are necropsied and histologic sections taken from the site of treatment and any other abnormal lesion. There is a limit to how precisely one can interpret results in terms of tumor response, because rats die at various times and from various causes during the 2-year period.

A 19550

Nevertheless, from the present rates of mesothelioma development we can estimate the final incidences of mesotheliomas in broad terms of whether the incidence will be high (i.e., $>$50%; table 1), moderate to low (i.e., $<$40% but $>$5%), or negative(table 4).

Results and Conclusions:

The data are arranged in 4 tables according to our preliminary estimates of mesothelioma incidence. In table 1 are the 5 specimens that have yielded a tumor incidence greater than 50%. These are the UICC standard reference samples of crocidolite and chrysotile A, two samples of very fine fibrous glass with diameters of 3 μ or less, and the aluminum oxide whiskers. All of these samples are composed almost entirely of fibers, and further have in common a predominance of fibers below 5 μ in diameter. The Al_2O_3 fibers are of particular interest because they are totally different from asbestos and glass, both in internal structure and chemical composition, yet their size distribution is remarkably like that of UICC crocidolite. However, one-third of the fibers are slightly longer and thicker than the crocidolite fibers and, since the density of Al_2O_3 is greater than asbestos, approximately one-sixth as many fibrous particles are present. The Al_2O_3 fibers are very durable and do not fragment to submicroscopic fibrils as crocidolite does. Whether this persistence of optically visible Al_2O_3 fibers relates to increased carcinogenicity remains to be seen.

Tables 2 and 3 list the 7 samples of asbestos and glass which fell in the middle ground of carcinogenicity. These materials may prove more carcinogenic than we predict at present, but all show a lesser carcinogenic response than those of table 1. These groups show no single outstanding difference in fiber distribution from those of table 1.

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Both extremes in the dimensional ranges of fibers are represented. For example, the two crocidolite samples show similar incidences of mesotheliomas, but one is composed almost entirely of long, large-diametered fiber bundles while the other has less than half as many fibers all of which are short and small in diameter. One explanation for this result is that fragmentation of fibers in vivo may play a role. The distributional array of fibers in the glass specimens would strongly indicate that carcinogenicity is decreased if fibers exceed 2.5 µ in diameter.

Finally, table 4 lists 5 samples including asbestos, glass, and Al_2O_3 which thus far have not yielded mesotheliomas. Except for the whole-fibered commercial glass, which is the type used as a vehicle in all experiments, none of these experiments with non-fibrous materials have progressed sufficiently to assure that no mesotheliomas will occur. However, the expected incidence in the remaining 4 groups is far lower than the materials in tables 2 and 3.

If one analyzes the experiments in terms of individual types of material, some additional points are evident. Comparisons of the 4 samples of crocidolite (sections 1 of tables 1-4) indicates that none of the 3 extremes in fiber distribution yield as high an incidence of mesotheliomas as the more evenly distributed UICC standard reference sample. Either progressive pulverization to non-fibrous form by optical standards or preservation of the test sample in large bundles of fibers clearly reduces carcinogenicity.

In considering the 3 samples of chrysotile (sections 2 of tables 1, 2, and 4), it is again apparent that the presence of

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particles smaller than 0.5 x 1.5 μ (i.e., the clumps and masses of submicroscopic fibrils represented in the distribution of fully pulverized chrysotile) decreases carcinogenicity and that fibers with diameters of more than 2.5 μ and lengths of more than 80 μ reduce carcinogenicity.

In considering the 8 glass samples (sections 3 and 4 of tables 1-4) conclusions are not as easy. It is apparent that samples composed over 90% by weight of fibers with diameters of 2.5 μ or less are the most carcinogenic and as this diameter is exceeded by more and more fibers carcinogenicity is reduced. Length does not seem critical here since the crude AAA fibrous glass applied virtually intact yielded more mesotheliomas than the same glass reduced to shorter lengths (section 3 of table 1 vs. sections 3 in tables 2 and 3). However, reduced carcinogenicity in the glass samples may have resulted simply from reduction of the fibers to a non-fibrous form or to fused masses of glass of greater than 5 μ in diameter. Final conclusions on this interesting series of sized glass fibers must await more accurate tumor-incidence figures. Nevertheless, it is certain that in the pleura of the rat, fibrous glass of small diameter is a potent carcinogen.

Finally, the contrasting results with the fibrous and non-fibrous forms of Al_2O_3 reemphasize the importance of structure to carcinogenicity. These exceptionally pure, inert fibers composed of materials foreign to asbestos and glass seem to carry the same carcinogenic hazard for the pleura as asbestos and glass.

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It would therefore seem that carcinogenicity is in some way related to the presence of a durable particle of fibrous configuration in the dimensional range of optical recognition but presumably very near the limit of this range, and that carcinogenicity of asbestos, glass, or Al_2O_3 has little relation to the chemical composition of these substances or their potential contaminants.

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Science center's 1973 targets in occupational health

In 1972, a surge of activity in occupational health was triggered by the Occupational Safety and Health Act. 1973 should prove an even more eventful year. In this exclusive interview, Dr. Irving J. Selikoff, a prime mover in occupational health, outlines his plans for the year ahead.

by Richard J. Snider Jr., Assistant Editor

Dr. Selikoff, in 1972 your study on asbestos workers provided impetus for the development of a permanent OSHA standard on asbestos dust. Will you be completing a study of comparable importance next year?

Yes, one on coal tar pitch and asphalt, which should have extensive application, notably among roofers and steelworkers. It is a mortality study, similar to the one we did with the asbestos workers. We drew on data covering all 18,000 members of the Roofers' Union and charted cause of death in 3,000 consecutive deaths that took place from 1959 to 1971.

We're also doing a study with the cooperation of the Printing Pressmen's Union on inks and oil mists which may be completed by the end of next year. Of course, there are others.

Tell us a little about them. What subjects do they cover?

We are studying the health effects of pesticides and detergent enzymes with the International Chemical Workers', titanium with the Oil, Chemical, and Atomic Workers' and the Painters' Union, polychlorinated biphenyls with the Papermakers' and Union, cotton dust and carbon disulphide with the Textile Workers' Union, cement and adhesives with the Tile Setters, epoxies with the Painters' Union, a bone disease called caisson disease with the Tunnel and Caisson Workers', and lead and other substances with the Typographers' Union. We will also be continuing our studies on asbestos with the Asbestos Workers' and the Tapers' Union.

Dr. Irving J. Selikoff joined the faculty of Mt. Sinai in 1941 and continues his tenure in the Medical School as a professor of medicine and community medicine. In 1955, he received the Albert Lasker Award from the American Public Health Association for his studies on tuberculosis. When Mt. Sinai formed the Environmental Sciences Laboratory in 1963, Dr. Selikoff was appointed director.

Doctor, what are your thoughts on the present permanent standards for asbestos promulgated recently by OSHA of 5 fibers longer than 5 micrometers long per cubic centimeter of air, dropping to 2 fibers in 1976?

I call it the 20-million-fiber standard. That is how many asbestos fibers a worker can inhale during a workday if the air contains 5 fibers per cubic centimeter. The Job Safety Law requires OSHA to assure as far as is practicable that no worker

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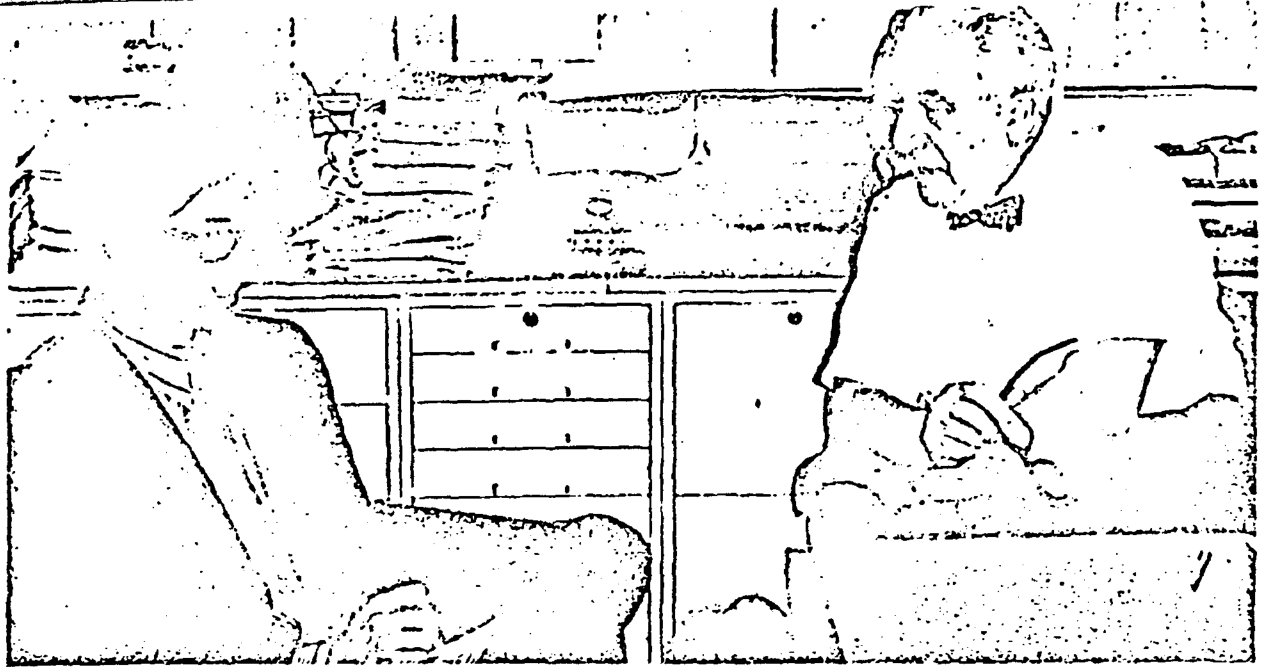

Dr. Irving J. Selikoff (right) discusses his health targets for 1973 with Occupational Hazards' assistant editor Richard Snider in his office at the Environmental Sciences Laboratory in New York.

suffers ill health from his work environment. This has not been done under the present OSHA standard.

Our study indicates that, if past experience is an index and if the situation remains the same 95,000 of the 250,000 asbestos workers in the United States today will die of occupationally related cancers. Before the standard drops to 2 fibers in 1976, perhaps another 100,000 new workers will have been exposed to asbestos dust. If there is no change we can expect that 25,000 of them will die of occupationally related cancers. All of these deaths are unnecessary.

There is a 20-year or greater lapse between the first exposure to asbestos and the onset of asbestos-induced cancer. If we want to control this disease in the year 2,000, we must start now.

The case, however, is still not closed. The Industrial Union Department of the AFL-CIO has filed petitions and briefs in the U. S. Court of Appeals in Washington D.C. to contest the standard.

How does it happen that so many of your studies are done with labor unions?

All our studies are clinical, that is, based on workers who are exposed to the agent we are studying; and all our studies are epidemiological, that is, based on large populations of exposed workers. This is where the labor unions can make a significant contribution to the study of occupational medicine. The labor unions are large; built-in control populations allow the study of a broad spectrum of health effects from exposure to a substance. The unions cover a large geographical area. A company usually concerns itself only with its own employees, and is thus often limited in population and geographical range.

The unions have long-term health information about their members, including workmen's compensation records, post retirement health information, and death certificates. Companies, on the other hand, usually have records for only as long as the worker was employed by the company. Union records, in some cases, go back as far as the Civil War, thus enabling us to trace the health effects of new materials and new processes from the very first day thy came into use in the workplace.

The unions are usually able to follow a substance in process from raw materials to finished product, a process often spread over many companies and industries.

Cooperation from the workforce is sometimes essential for a successful study. Working with the labor union can usually guarantee that cooperation.

Finally, and perhaps most importantly, we work with the labor unions because this is where the action is. The initiative for the study of hazardous substances in the work environment is coming more and more often these days from labor leaders.

Are the workers as enthusiastic as the labor leaders? Isn't there considerable conservatism on their part, a disinclination to cost company management such large sums of money that their jobs might be at stake?

Yes, many of them feel that way, and I understand their position. For older workers, leaving the job does not mean leaving the dust. They carry it with them in their lungs. For them, the potential gain is limited, and their job is precious. For many younger workers, especially those working in small communities, there might be no other jobs available to them. I can understand why such workers might choose a steady job over good health and a longer life. This is not conservatism but realism.

According to the law, however,

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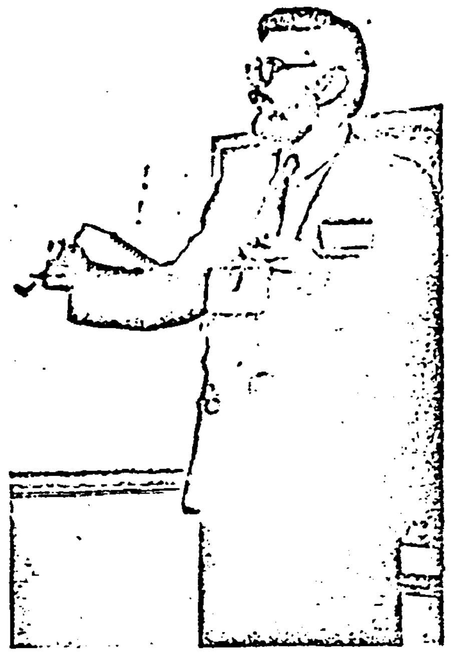
Dr. Arthur Rohl, research minerologist at the Environmental Sciences Laboratory, identifies mineral particles with a polarizing microscope.



Environmental engineer Duncan Holaday demonstrates a Geiger counter.

employers are required to provide a workplace free from recognized hazards. Workers should not have to choose between health and a job.

Besides your health hazard studies, do you cooperate with unions on any other projects?

Yes, we conduct courses, educating workers to recognize, avoid, and eliminate the hazards in their workplace.

In 1971, we ran a 5-day course on occupational health hazards for 75 trade union representatives. We ran a course for 50 shop stewards in the Textile Workers Union of America on occupational health hazards in the manufacture of viscose fiber and film. Later this month, we'll begin the first of three scheduled courses on occupational health hazards in the asbestos industry. Each course will be attended by 50 shop stewards. The course will be given in New York this month, and later, it will be given in St. Louis and Los Angeles.

Does industry ever participate in your occupational health projects?

We work with industry whenever we can. Johns-Manville Corp. cooperated with us in our study of asbestos. The Printers' League is cooperating in the study we are conducting with the Typographers' Union.

Industry experts are often featured lecturers or panelists in our health hazard education courses. Johns-Manville supplied lecturers for a graduate course on asbestos which we ran for doctors at Mt. Sinai. FMC Corp. helped us in the course we ran on viscose fiber and film for the Textile Workers'.

Industry is also a source of some funding. One student on our staff doing research on asbestos is supported with a Ford Motor Co. grant.

What are the other sources of your funding?

They are many: Our Environmental Sciences Laboratory has a budget from Mt. Sinai Hospital. We also get funds from the National Institute for Occupational Safety and Health, the National Institute for Environmental Health Sciences, the Environmental Protection Agency, the Department of Air Resources and Health Research Council in New York City, the American Cancer Society, business, and labor unions.

Mrs. Samuel Rosen demonstrates audiometry at a Mt. Sinai conference.

Dr. Selikoff makes his point with one union leader attending a conference.

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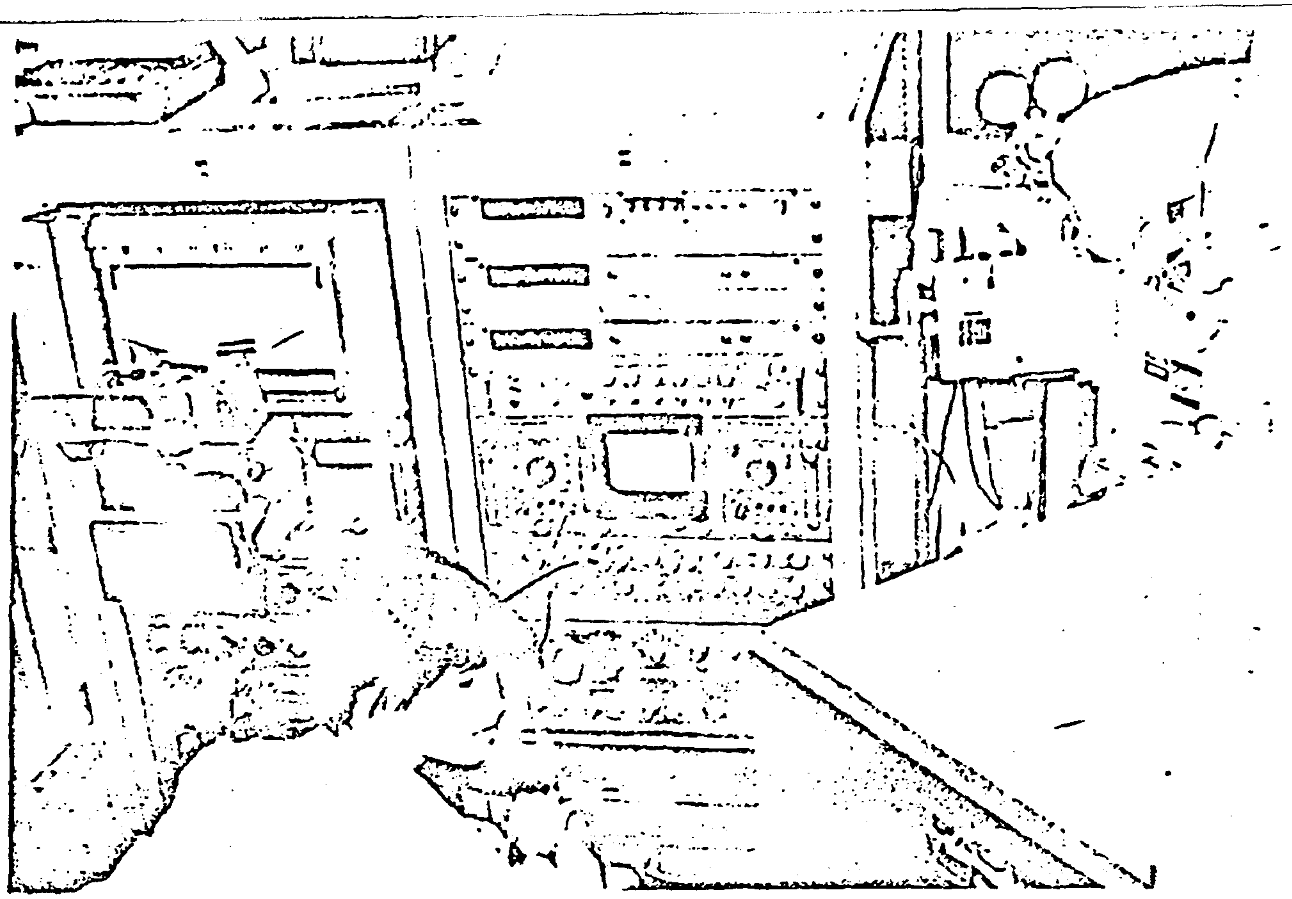

Research minerologist Anne Mackler operates the electron microprobe analyzer. Mt. Sinai's Environmental Sciences Laboratory is one of the most extensively equipped in the country.

Our costs this year were approximately $800,000. In 1973, that figure will probably rise to $1 million.

Are some funding sources, such as the labor unions, drying up?

No, I see no indications of that. The labor unions have never been a major source for funds, and I don't think they should be.

We're not hurting for funds. If a study is important, funds are usually forthcoming. Our primary need is manpower. There are so many studies so urgently needed, but so few hands to tackle them.

How large is the staff here at the Environmental Sciences Laboratory?

We have 49 scientists on our staff.

Are you doing anything to attract people?

Next year, we hope to begin a residency program to train doctors specializing in occupational medicine. The doctors chosen will spend one year in residence with a major labor union where they will come to grips with real life problems of workers and learn to speak their language. Candidates have already been lined up for the AFL-CIO, Textile Workers', Oil, Chemical and Atomic Workers. The residency will be supplemented with classroom work and ward, laboratory, and field training under the supervision of Dr. Harry Heimann of our staff.

How would you rate the performance of NIOSH in occupational health?

Very high. I know many of the men working at NIOSH. They are well qualified and do excellent work. Unfortunately, they are tied down by underfunding.

The recommendations attached to your study on asbestos played up the importance of engineering controls. I take it you have some reservations about the efficacy of threshold limit values and instrumentation for enforcement of OSHA health standards?

I do, indeed! When you consider that there are only 44 industrial hygienists on OSHA's staff and that they have to cover 4 million workplaces, you suddenly appreciate that it's mere idle chatter to talk about TLV's and instrumentation for enforcement.

We asked 11,000 members of the Asbestos Workers Union if they had ever observed a dust count being taken in their workplace. Averaging the total response revealed that workers had observed only 1 dust count for every 20,000 manhours worked, meaning the individual worker had seen a dust count being taken only once every ten years.

I think we need less discussion about dust counts and more discussion about engineering controls. I am confident that industry's resourceful engineers will find some means of control if industrial top managements will give them that assignment.

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AUTOMATIC BAG OPENING STATION FOR ASBESTOS FIBER DEVELOPED:

Johns-Manville Corp. has reported the development of a completely automatic fiber bag opening station to protect workers from the hazards of asbestos dust.

The development was announced by Edmund M. Fenner, corporate director of environmental control for J-M but representing the entire asbestos industry at the 23rd annual Governor's Industrial Safety Conference in Olympia, Wash.

He explained that J-M is currently testing the design of the station. When it is fully developed, bags of raw asbestos fiber will be cut open and disposed of, with the fiber being removed and introduced into the manufacturing process without exposing any employee to significant levels of asbestos dust.

Fenner spoke of the importance of effective dust control systems, as well as regularly scheduled industrial hygiene surveys and properly planned plant/equipment maintenance programs.

Asbestos fiber is widely used in the manufacture of floor tile, asbestos-cement pipe, brake linings, clutch facings, roofing, siding and flooring, insulation, textiles, paper, felts, plastics and fireproof clothing. Nearly 750,000 tons of asbestos are consumed each year, according to the Asbestos Information Association/North America.

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