PLAINTIFF'S EXHIBIT
WRG-1617

INSULATION INDUSTRY HYGIENE RESEARCH PROGRAM



A COOPERATIVE RESEARCH PROGRAM TO ELIMINATE HEALTH HAZARDS IN THE INSULATION INDUSTRY

15191468

MOUNT SINAI
MSM
SCHOOL OF MEDICINE
OF THE CITY UNIVERSITY
OF NEW YORK

INSULATION HYGIENE PROGRESS REPORTS

FROM THE INSULATION INDUSTRY HYGIENE RESEARCH PROGRAM



E. Cuyler Hammond, Sc.D. Director, Department of Statistics and Epidemiology, American Cancer Society, NYC. Statistical consultant.



Harry Heimann, M.D. Formerly, Director, Division of Occupational Health, United States Public Health Service, Washington, D.C. Epidemiological Research Staff.



Duncan A. Holaday, M.A. Came to the IIHRP after serving as Chief, Western Field Station, U.S. Public Health Service, Salt Lake City. Industrial hygiene and engineering.



Kingsley Kay, Ph.D. Formerly Senior Scientific Consultant in Occupational Health to the Canadian government, Ottawa. Toxicology and industrial hygiene.



William J. Nicholson, Ph.D. Recruited to the IIHRP from the Watson Laboratory, Columbia University, where he was senior research biophysicist. Head of field studies of the program, and editor of the Insulation Industry Hygiene Reports.



William Reitze, B.S. Field investigator in industrial hygiene. Recently retired from the program after making important contributions. Mr. Reitze has rejoined Johns Manville as Manager of Accident Prevention and Industrial Health.



Arthur Rohl, Ph.D. Research mineralogist. Dr. Rohl comes to the IIHRP from the Department of Mineralogy of Columbia University. He is responsible for examination and analysis of dust samples.



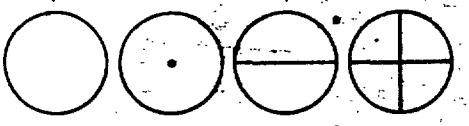
Robert J. Schnitzer, M.D. Formerly, Head of Chemotherapy Laboratories of I.G. Farben and of Hoffmann-LaRoche. Heads Biological Laboratory research into techniques of dust inactivation.



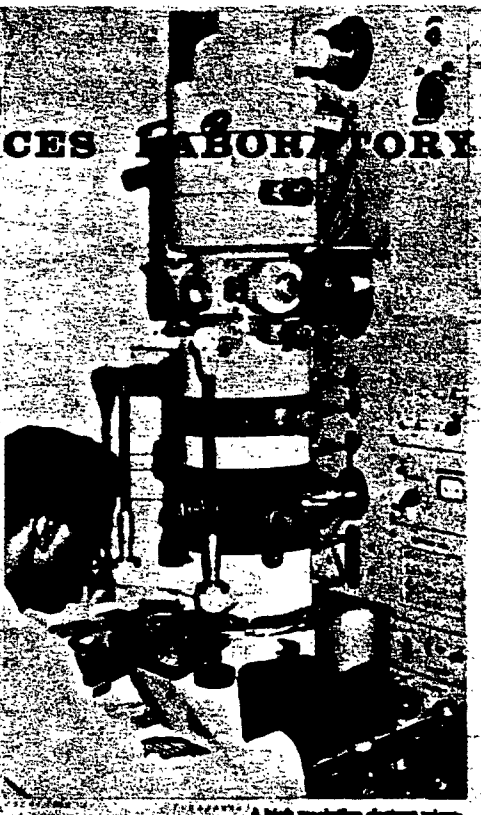
Irving J. Selikoff, M.D. Director, Environmental Sciences Laboratory and head of Medical School's Division of Environmental Medicine. Formerly, President, New York Academy of Sciences. Director of IIHRP.

15191469

ENVIRONMENTAL SCIENCES LABORATORY

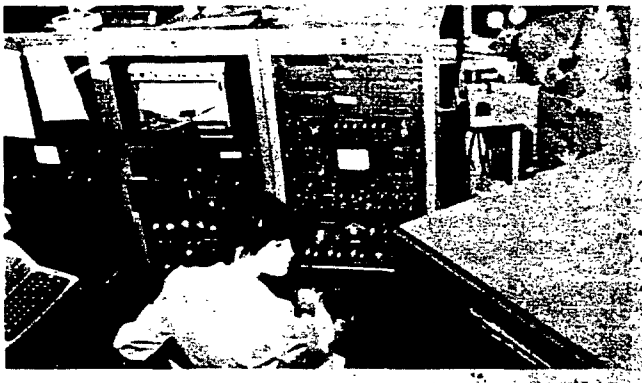


A wide variety of highly sophisticated electronic equipment is utilized by the staff of the IIHRP at the Environmental Sciences Laboratory of the Mount Sinai School of Medicine.



A high resolution electron microscope will reveal the presence of the tiniest particle. It is capable of magnifying images [illegible] times.

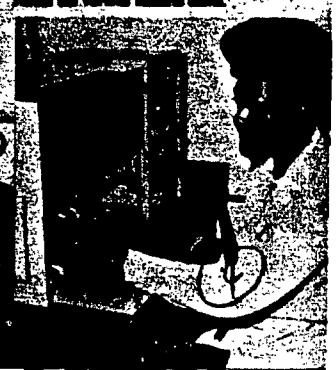
An electron microprobe analyzer will provide chemical analysis of material weighing only one trillionth of an ounce.



A polarizing light microscope can be used to identify some of the relatively large particles found in the air on construction sites and in lung tissues.

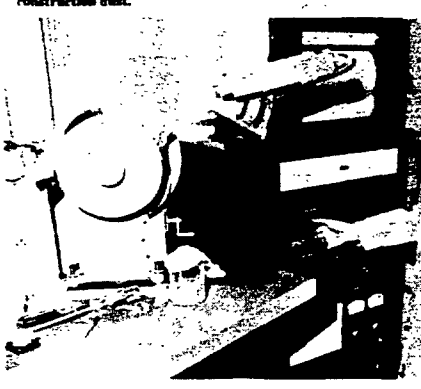
A low-temperature activated oxygen ashes used in the processing of lung tissue prior to mineralogical analysis. The ashes removes the tissue and organic material to reveal the various mineral dusts.

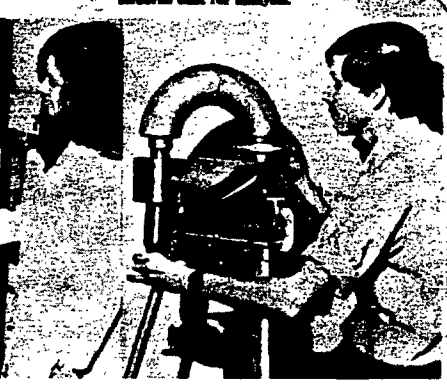




X-ray diffraction equipment provides information on the specific minerals present in samples of construction dust.

A high volume air sampler used to collect room or environmental airborne dust for analysis.

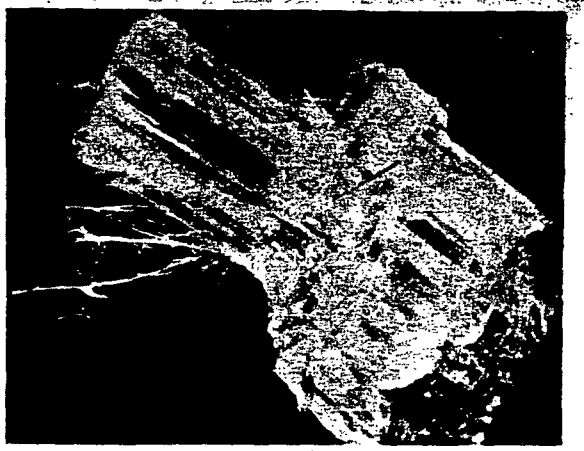




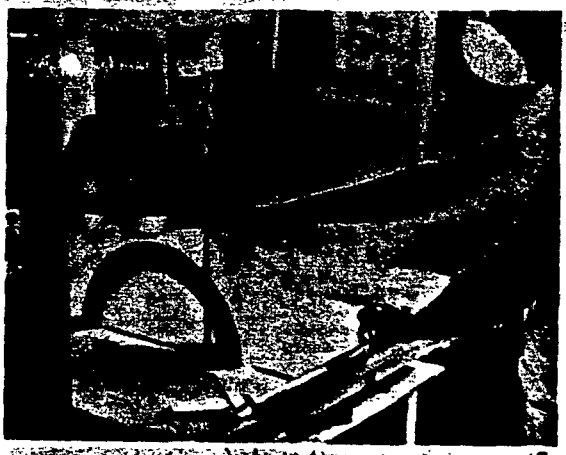
A high speed computer to assist scientists in the analysis of particles found in the lung and in air.



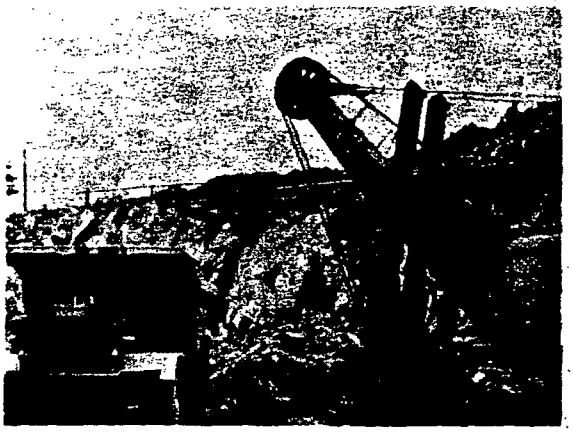
15191470



ASBESTOS ORE FROM A CANADIAN OPEN PIT CHRYSOTILE MINE.



THE FIBERS ARE USED IN INSULATIO MATERIAL AND DURING APPLICATN BECOME DIVIDED INTO THEIR INDIVIDUA FIBRILS.



2



THE FIBERS AND FIBRILS CAN EASILY BECOME AIRBORNE.

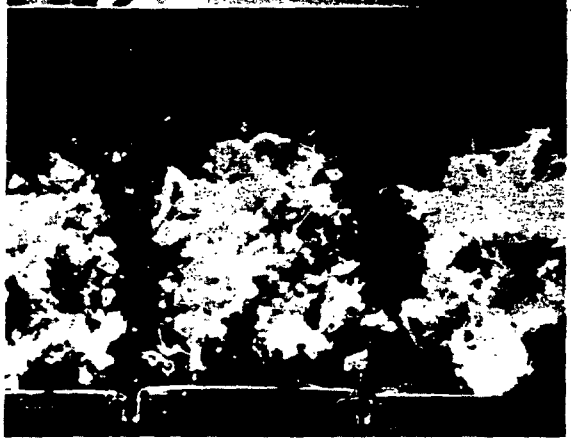
HERE THEY ARE SHOWN MAGNIFIEI 15,000 TIMES.

6

3



THE ORE IS CRUSHED AND THE ASBESTOS FIBERS ARE OBTAINED BY AIR SEPARATION, IN A MILL.



4

7

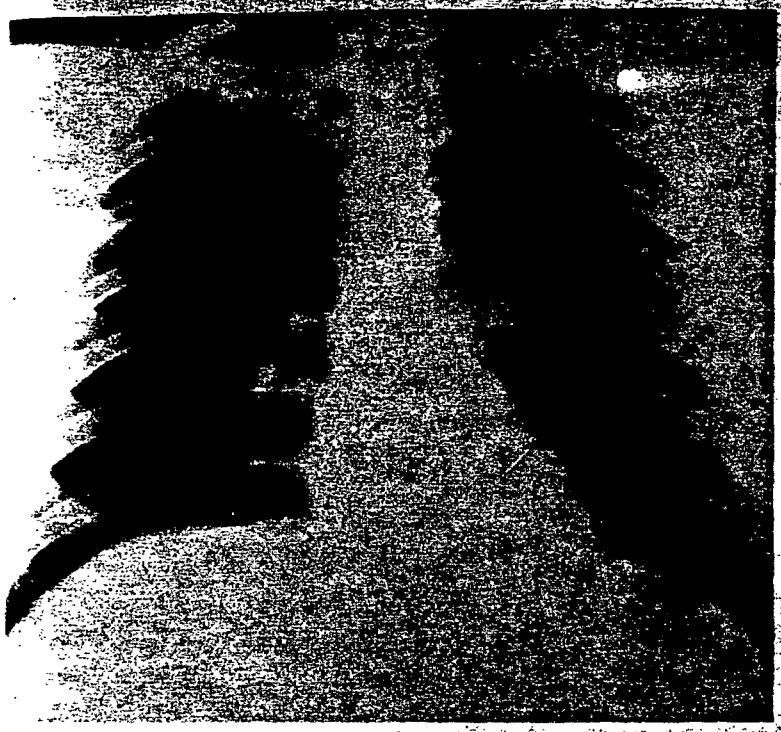




WHEN INHALED THEY READILY ARE TRAPPED IN THE LUNG.

8

15191471



NORMAL CHEST X-RAY

NORMAL CHEST X-RAY

Most x-rays of pipecoverers appear normal for at least ten years, or longer. Indeed, one of 20 has a clear x-ray even after 40 years of work. We do not know why there are these differences among individuals. Cigarette smoking tends to result in somewhat more scarring than would otherwise be the case, but asbestosis may occur even in the absence of cigarette smoking.

A normal appearing film does not insure that there is no scarring; the x-ray sometimes does not show fine scars, especially the diffuse variety characteristic of asbestosis. In such instances, respiratory function tests may demonstrate some change, especially after exercise. However, by and large, a normal x-ray is a very satisfactory finding in an insulation worker and is a distinct advantage.

MINIMAL ASBESTOSIS

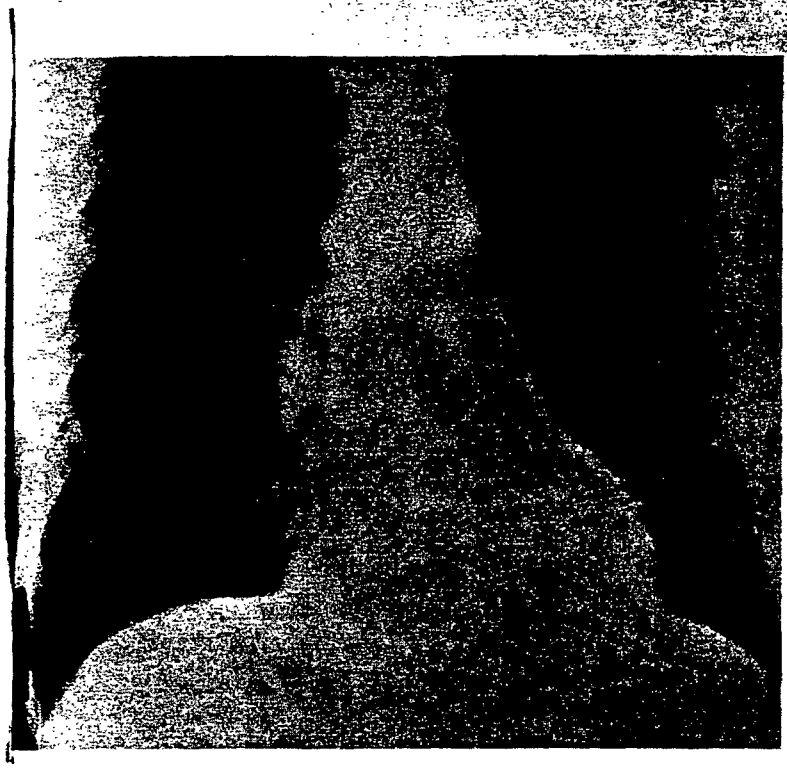
Fine lines, indicative of scarring, begin to appear. Often, as here, they are neither extensive nor very dense. The scars tend to appear in the lower portions of the lungs, on both sides, and are frequently irregular or reticular. As a rule, there is more to be found in the lung than can be seen on x-ray, which may "underread" the situation. Sometimes, only the covering of the lung (the pleura) is involved and the lung itself is entirely or largely spared. When this happens "pleural plaques" are seen on the x-ray. These may become calcified.

The appearance of these x-rays is not absolutely specific: other diseases sometimes give similar findings. Yet when they occur in an asbestos worker, the diagnosis can usually be made with considerable confidence, especially by an experienced physician. Lung biopsy is rarely necessary and should not be undertaken lightly.

EXTENSIVE ASBESTOSIS

The scarring is much more intense and is present in much of the lung. The pleurae, too, are involved in many cases.

There is incomplete correlation between the amount of scarring seen on x-ray and the respiratory difficulty a person might have, or the extent of the abnormalities found on the pulmonary function tests. The x-ray may be grossly abnormal, yet the individual has no difficulty in breathing. Conversely, serious shortness of breath may be present without impressive changes in the chest x-ray. One cannot predict from the x-ray alone.

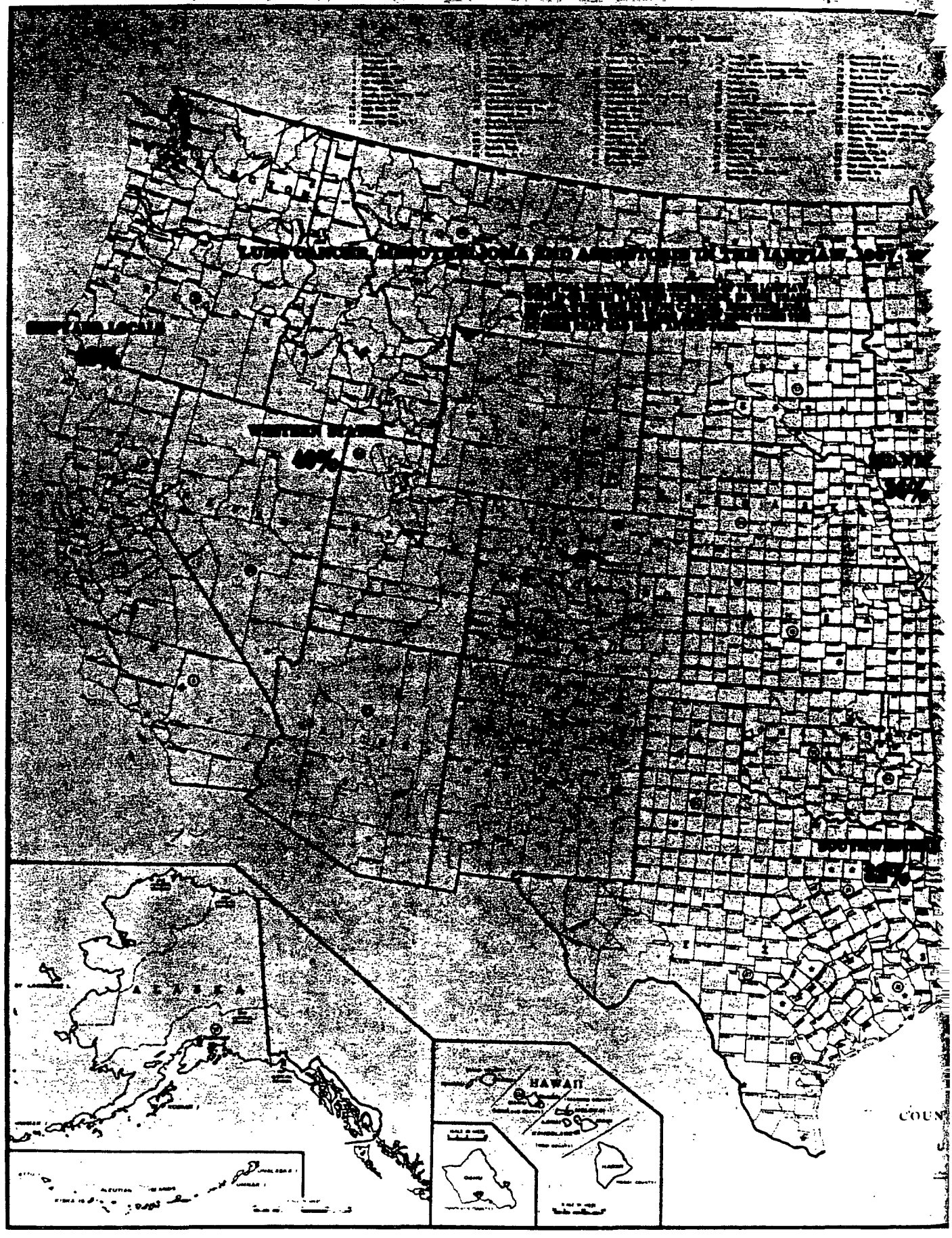


MINIMAL ASBESTOSIS



EXTENSIVE ASBESTOSIS

15191472



15191473


CANADA
OUTLINE MAP
OF THE
UNITED STATES
OFFICIAL TERRITORIAL MAP
ASBESTOS WORKERS INTERNATIONAL

15191474

LUNG CANCER

X-ray examination is at present the only efficient way to diagnose the presence of lung cancer, at least in time for successful treatment. However, such diagnosis may be somewhat more difficult in asbestos workers, since the lung scarring which is often also present, may obscure the cancer shadow.

A considerable advantage is to be able to compare the suspicious markings with the same area on previous x-rays, to see if there has been any change. Therefore, regular periodic x-rays are essential for pipe coverers. For those with more than twenty years in the trade, even once a year is sometimes not often enough, especially if there is a history of cigarette smoking. Every six months would be better. At most, there would be a little waste of time and money, but there could be the saving of a life.

The lung cancers in asbestos workers are, as a group, to a certain extent, different than the usual cancers. Two-thirds are in the lower portions of the lung (where more scarring is seen on x-ray, also); ordinarily, only one-third are found here. But, apart from such minor variations, they can be diagnosed and treated in the usual ways. The important thing in early diagnosis, if we are to hope for a cure.

MESOTHELIOMA

The lining of the chest and the lining of the abdomen is the "mesothelium". Therefore, when neoplasm affects this tissue, it is labeled "mesothelioma".

Such tumors generally spread across the whole lining surface. This fact determines their x-ray appearance — they show a diffuse shadow lining the whole chest, encasing the lung. Usually, they are on one side only, and may be accompanied by fluid in the chest ("pleurisy" or "pleural effusion"). When the lining of the abdomen is affected, fluid may again be found, causing swelling.

X-ray is very efficient in demonstrating the presence of mesothelioma in the chest (pleural). It is so far of little help in diagnosing abdominal (peritoneal) mesothelioma.

Early progress has been made in developing chemicals and drugs to treat these cancers and it is hoped that additional research will help provide a cure. Therefore, early x-ray diagnosis will be a great help in creating the best possible circumstances for treatment.



LUNG CANCER

MESOTHELIOMA

15191475

STATISTICS

MORTALITY STATISTICS OF INSULATION WORKERS, 1943-1971

Exposure to insulation dusts usually does not produce disease until many years after beginning work — 20, 30 or more years. The experience of members of Locals 12 and 32 is therefore of interest.

On January 1, 1943, there were 632 members in these locals. Seven died young, before reaching twenty years from onset of their work. The fate of the remaining 625 men has been studied, and is summarized in the following table:

Expected and observed deaths among 625 members of Locals 12 and 32, Jan. 1, 1943 - Dec. 31, 1971

	Expected	Observed
Total deaths	288.5	423
Cancer deaths	52.2	189
Lung cancer	11.4	84
Pleural mesothelioma	*	8
Peritoneal mesothelioma	*	24
Cancer of stomach, colon, rectum	12.5	41
All other cancers	28.3	32
Asbestosis	*	33
All other causes	236.3	234

The IIHRP is grateful to the Department of Statistics of the American Cancer Society for undertaking the extensive statistical analyses needed to provide these data. Expected deaths are based upon U.S. National Office of Vital Statistics annual rates for U.S. white males, taking age and year into account.

*U.S. death rates not available, since these are rare causes of death in the general population.

STATISTICS

Six years ago it was not known whether the Locals 12 and 32 experience was unique or to be found throughout the country. Therefore, research was undertaken to investigate this question.

On January 1, 1967, there were 17,800 men registered in the International. By December 31, 1971, 1,092 had died.

EXPECTED AND OBSERVED DEATHS AMONG 17,800 MEMBERS OF THE IAHFIAW IN THE UNITED STATES AND CANADA, JAN. 1, 1967 - DEC. 31, 1971

	(12,681 members) Before 20 years		(5,119 members) After 20 years	
	Expected	Observed	Expected	Observed
Total deaths	178.94	211	626.69	881
Cancer deaths	26.31	51	117.78	408
Lung cancer	7.03	22	37.39	191
Pleural mesothelioma	*	2	*	24
Peritoneal mesothelioma	*	3	*	48
Cancer of stomach	0.97	1	5.65	15
Cancer of colon, rectum	2.51	3	15.00	23
Cancer of esophagus	0.44	1	2.77	12
All other cancers	15.36	19	56.97	96
Asbestosis	*	3	*	73
All other causes	152.63	157	509.91	400

COMMENTS

Lung cancer is the most serious health hazard of insulation workers. It may be responsible for one in five of all deaths among them. However, generally it does not occur until more than 20 years have passed from onset of work.

Mesothelioma of the chest or abdomen is very rare in the general population; approximately 1 death in 10,000. Among pipecoverers, it is increased more than 700 times, accounting for 7% of all deaths.

Gastro-intestinal cancer is also increased in frequency but not to the extent as lung cancer or mesothelioma. It is found two or three times as often as anticipated.

Asbestosis — scarred lungs — was responsible for approximately 7% of deaths. There is no cause for asbestosis other than the inhalation of asbestos dust. Each of these deaths was therefore work-related.

*U.S. death rates not available, since these are rare causes of death in the general population.

15191476

CIGARETTE SMOKING



CIGARETTE SMOKING

Cigarette smoking and insulation work do not mix.

Research has shown that lung cancer occurs against a background of cigarette smoking:

1. LOCALS 12 AND 32:

On Jan. 1, 1963, there were 370 members of Locals 12 and 32 who had entered the Union before 1943.

	87 never smoked cigarettes	283 had a history of cigarette smoking
Total deaths by Dec. 31, 1971	35	133
Expected deaths of lung cancer*	1.26	3.31
Deaths of lung cancer Jan. 1, 1963-Dec. 31, 1971	1	41

2. ALL LOCALS, U.S. AND CANADA:

There were 17,800 men registered in the International on Jan. 1, 1967. 11,656 completed questionnaires recording their smoking habits.

	2,066 never smoked cigarettes	9,590 had smoked cigarettes
Total deaths by Dec. 31, 1971	73	596
Expected deaths of lung cancer*	5.96	25.09
Deaths of lung cancer Jan. 1, 1967-Dec. 31, 1971	2	134

*Based on U.S. death rates, U.S. National Office of Vital Statistics.

Calculations indicate that asbestos workers who smoke cigarettes have eight times the chance of dying of lung cancer, compared to other cigarette smokers of the same age who do not work in this trade.

Asbestos workers who smoke cigarettes have 92 times the risk of dying of lung cancer, compared to similar men, who neither work with asbestos nor smoke cigarettes.

We have not found significant trouble with pipe or cigar smoking.

In the absence of cigarette smoking, we have not found lung cancer to be a very serious problem among asbestos workers.

Cigarette smoking is not the whole story, however. Mesothelioma and asbestosis occur even without smoking, as does cancer of the stomach, esophagus, colon or rectum. Therefore, dust control is essential.

Two things do not belong in pipe-coverers' lungs:
INSULATION DUSTS AND CIGARETTE SMOKE.

15191477

DUST COUNTING

Asbestos dust levels in insulation work are determined by taking air samples during the different jobs of an asbestos worker. A small, battery operated pump draws air through a special filter mounted in a collecting unit worn on the collar of a workman. The collecting unit and filter which collects the fibers and particles in the air, are taken back to the laboratory for analysis. Because they are easier to measure, only those fibers longer than five microns (about 1/5000 of an inch) are counted; smaller ones are known to be present but are not counted.

The asbestos dust concentration allowed by the new asbestos standard is 5 fibers (longer than 5 microns) per milliliter of air averaged over an 8 hour day. (A milliliter of air is about a thimbleful). Since you breathe approximately 8,000,000 milliliters of air in a working day, the standard permits you to inhale 40,000,000 fibers daily. Moreover, there can be 100 fibers shorter than 5 microns for every one longer than 5 microns. Thus, one could say we have, at this time, a 4 billion fiber asbestos standard.

In actual fact, the numerical value of the standard is of limited value. To monitor dust levels in insulation work is an insurmountable task. For example, the Department of Labor has about 50 industrial hygienists to monitor over 4,000,000 workplaces for dust and toxic chemicals. Most State Departments of Health have even lesser capability for monitoring. The route to a safe work environment is not dust counting, but implementation of mandatory safe work practices and safe materials.

A An IIHRP industrial hygienist collecting dust sample during insulation work in a power house.

B Dust counting is performed in the Environmental Sciences Laboratory using a phase contrast microscope.

C A typical view, in the microscope, of airborne dust collected during insulation work.



A

B

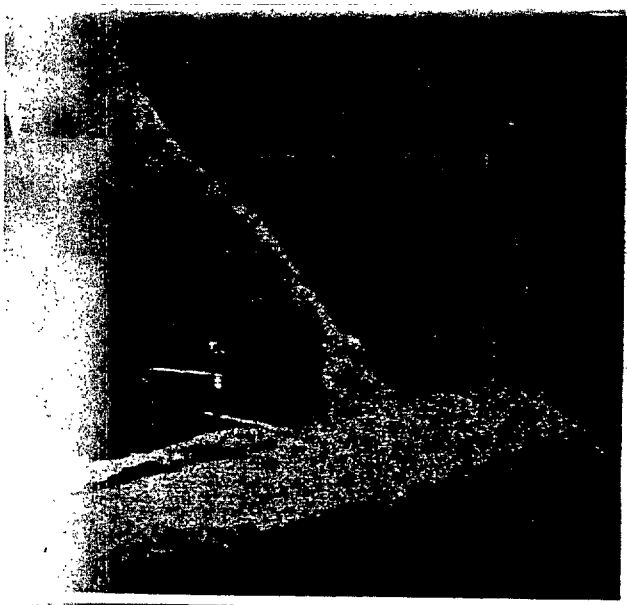


C



15191478

POOR WORK PRACTICES PRODUCE DUST



Cutting pipe covering with no dust control on a band saw.



Asbestos debris awaiting collection on job site.



Dumping dry asbestos cement into a trough prior to mixing with water.



Dust generated by cutting with a hand saw. The dust on the workman's shoes can be brought from work to contaminate his home.



Hand mixing of dry asbestos cement.



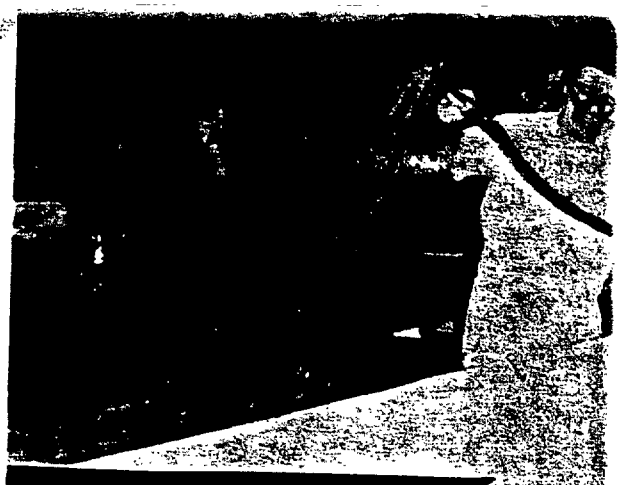
A broken bag of asbestos cement used as the bottom step of a ladder.

15191479

GOOD WORK PRACTICES



Wetting materials prior to cutting.



A portable vacuum cleaner with adequate dust filtration should be used to clean up loose dust.



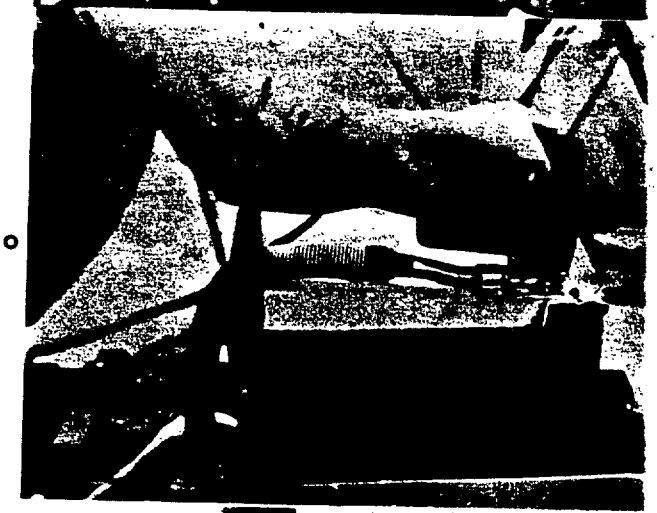
The use of a high velocity collector on band saws virtually eliminates airborne dust.



A downdraft cutting table for use during hand sawing. A portable vacuum cleaner provides the required air ventilation. Scrap material is disposed of in a plastic bag.



A high velocity dust collector for use on power hand saws.



Mixing of asbestos cement in plastic bags.

The bagging of waste material prior to disposal.



15191480



Single Use Respirators. These are suitable for use in asbestos concentrations up to 50 fibers/milliliter and should be used for the dustier jobs during installation of asbestos insulation materials. They should be worn during all blocking or hand cutting operations as excess dust is often generated.



Disposable Filter Respirators. These are suitable for the same conditions as single use respirators. They should not be used unless a respirator maintenance program is available on the work site.

RESPIRATORS

NOTE: On July 1, 1976 the applicable level for which respirators A and B are suitable drops to 20 fibers/milliliter and that of C to 200 fibers/milliliter. At that time respiratory protection should be provided at all concentrations above 2 fibers/milliliter.

Air Supplied Respirators. These must be used in asbestos dust concentrations above 500 fibers/milliliters. However, they would be required only in the most extreme conditions such as removal of old insulation in small shipboard compartments.

Powered Air Purifying Respirators. These are for use in asbestos concentrations up to 500 fibers/milliliter, and are suitable for the removal of old insulation material or the spraying of asbestos fiber.



15191481