PLAINTIFF'S EXHIBIT

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PARADOXICAL POLLUTANT

Currently in the wind in a number of cities are plans to ban or restrict the use of sprayed asbestos insulation because of the growing concern that the airborne fibers may endanger the health of the general public as well as those who are occupationally exposed to the dust. Philadelphia recently prohibited asbestos spray in building construction and last spring New York imposed strict regulations regarding its use.

Paradoxically, asbestos is indispensable for much safety, quiet and comfort in man's environment, but continued occupational exposure to its dust causes asbestosis, pulmonary fibrosis and is associated with a very high incidence of lung cancer and mesothelioma. Mesothelioma has been demonstrated in people living within a half mile of an asbestos factory and fibers have been found in dust of homes that were occupied 15 years before by men who worked with the mineral.

The ubiquitous fibers have been detected in all air samples examined in New York and consecutive autopsies in many urban areas revealed asbestos bodies in the lungs of more than a fourth of the general population.* While the present amount of asbestos in ambient air may not be hazardous to health the level is constantly increased by new construction and the demolition of old buildings. The very fine fibers (350 Å in diameter), once released tend to remain airborne for very long periods, perhaps indefinitely, and may be inhaled years later. Another problem is asbestos' slow rate of decay: the fibers are said to have a half-life of infinity.

Asbestos, meaning "inextinguish-

*Some of the percentages were 20% in Cape Town, 24% in Miami, 31% in Pittsburgh, 42% in San Francisco, 48% in Montreal and 49% in New York.



Worker spraying insulation containing asbestos on steel g

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able" in Greek, was known to the ancients who used the fine, silky mineral fibers to weave the funeral robes of kings and the wicks for the vestal virgins' eternal lamps. Marco Polo learned of a fossil substance, not unlike wool, that was made into cloth and bleached with fire.

The modern industry was initiated in 1879 with the opening of the world's first mine in Quebec. In less than a century asbestos production rose from 300 tons to the current 4 million tons that are mined chiefly in Canada, the Soviet Union and South Africa.

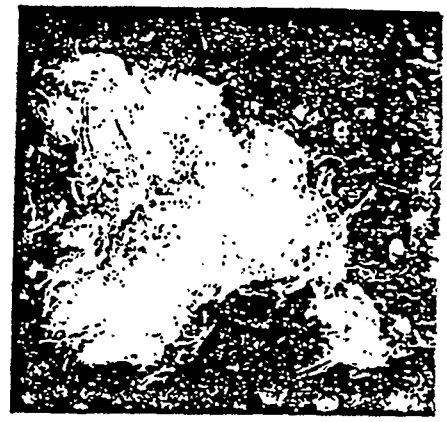
Proliferation. The United States, the world's largest consumer, imports about 950,000 tons of white chrysotile asbestos, and some 50,000 tons of blue crocidolite and brown amosite. The fire-resistant, flexible fibers that are finer than spider silk but stronger than steel wires have almost 3000 different applications. They protect buildings, vehicles, cables and conduits from the elements, shield electric installations, and by providing acoustic tiles they help to prevent noise pollution. Asbestos is used in paints, sealants, spark plugs, brake linings, safes, ovens, safety clothing, fireproof rugs, brewery filters and 95 percent is combined with cement, asphalt and various plastics.

Pathology. Almost 2000 years ago Pliny the Elder and Strabo, the Greek geographer, noted that slaves weaving asbestos suffered from a lung ailment. The first reference to the effects of the mineral in modern literature was an observation in 1900 by Dr. H. Montague Murray of London's Charing Cross Hospital. In an autopsy of a man who had worked in an asbestos textile mill for 14 years, Dr. Murray found severe pulmonary fibrosis along with asbetos fibers and, hence presumed that the disease was occupational. A French labor inspector reported a number of deaths among asbestos spinners and weavers several years later and in 1919 Philadelphia radiologists Pancoast and Landis discovered abnormalities in chest x-rays of American workers.

The disease was named asbestosis in 1927 by British physician Dr. William E. Cooke who found extensive pulmonary fibrosis and yellowish-brown particles in the lungs of a woman who had worked in an asbestos factory for 20 of her 33 years. Dr. Cooke called the particles "curious bodies" and wrote that there seemed no doubt that they were "the heavy, brittle, iron-containing fragments of asbestos." Within a few years a British factory inspector examined 363 textile workers, found a fourth suffering from pulmonary fibrosis and observed that the incidence of disease was directly proportional to the length of exposure; 81 percent of the men who had worked in the industry for 20 years or more had fibrosis. These findings prompted Parliament to enact a law in 1931 requiring more effective control of the dust in factories, periodic medical examinations for workers and compensation for those who developed the disease.

After South Carolina pathologist Dr. Kenneth M. Lynch in 1935 reported the death of a weaver from lung cancer associated with asbestosis, autopsies of British asbestos workers revealed the two diseases in a striking number of cases. In 1955 a statistical study by Dr. Richard S. Doll showed that asbestos textile workers with more than 20 years exposure had an 11 times higher risk of lung cancer than men in the general population. Dr. Doll concluded that "lung cancer was a specific industrial hazard of certain asbestos workers."

A more ominous conclusion was drawn by Johannesburg pathologist Dr. J. Christopher Wagner from his studies of cases of mesothelioma in individuals who had lived near asbestos mills and dumps. Only 12 of 89 patients with this rare tumor had a history of industrial exposure but Dr. Wagner and his colleagues found that others had much less exposure such as playing near an asbestos dump in childhood. One of several studies that substantiated an association between mesothelioma and non-occupational, environmental exposure to asbestos was an investigation of 76 cases which had been confirmed by autopsy or biopsy at the London Hospital. Dr. Muriel Newhouse found that while 31 of these individuals had worked with asbestos, 11 had merely lived within half a mile of a factory and nine had been exposed only be-



cause they lived in households of asbestos workers.

Another hazard of environmental contamination was demonstrated by Finnish radiologist Dr. Raimo Kiviluoto, in an x-ray survey of 6312 residents of a county with an asbestos mine. Dr. Kiviluoto discovered pleural calcification of the type usually found after asbestos exposure in 499 people who had never worked in the mine. A similar study of the 7101 inhabitants of a neighboring county without an asbestos mine revealed no case of pleural calcification.

Physiology. Breathlessness is the chief symptom of asbestosis and it may not appear until after long exposure. The physiologic defect, which is similar to the "alveolar capillary block syndrome," is marked by reduced vital capacity, hyperventilation at rest as well as during exercise, a decrease in the lung's diffusing capacity and impaired blood oxygenation.

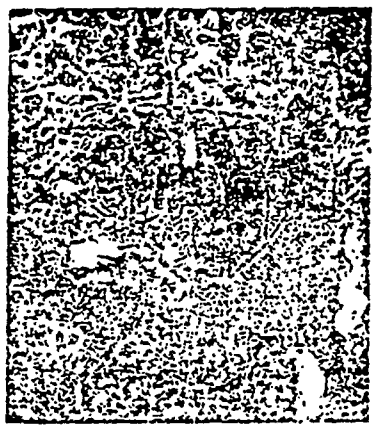
One of the problems in identifying asbestos in the lungs is its tendency to split into submicroscopic fibers but researchers have followed the formation of asbestos bodies in the hamster lung by means of light, phase and electron microscopy. In this process which takes place chiefly in alveolar macrophages, and to a lesser extent in septal and alveolar epithelial cells, minute fragments of asbestos become coated with iron micelles from hemosiderin granules.

Experiments with guinea pigs showed that inhalation of asbestos dust caused bronchiolitis with extension of the inflammatory reaction to adjacent alveoli. This is followed at a later stage by progressive, widespread fibrosis of the lungs.

Pioneer. Dr. Irving J. Selikoff, director of the Environmental Sciences Laboratory at the Mt. Sinai

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Opposite, asbestos fibers: above, x-ray showing asbestosis and microphotograph of asbestos bodies and fibers in lung. Below, from right, J. B. Jobe, Johns-Manville vice-president, research assistant Jo Anne Schwartz, Dr. I. J. Selikoff and A. E. Hutchinson of insulation workers' union.



school of medicine, pioneered research and prevention of asbestos-related diseases in insulation workers. A specialist in pulmonary diseases,* he became interested in the asbestos problem when 17 workers in an insulation factory were referred to his clinic in 1953. The following year the factory closed, the men left the trade for other jobs but Dr. Selikoff continued to examine them periodically to observe the course of asbestosis in men who were no longer exposed. Within seven years six of the men died.

Dr. Selikoff then launched a survey with Drs. Jacob Churg and E. Cuyler Hammond of 632 insulation workers who had 20 years or more of exposure. The researchers examined union records, work histories, hospital charts, death certificates, autopsy protocols, histologic specimens and found that of the 255 fatalities, 45 men died of cancer of the lung or pleura, about seven times the expected rate. There was also a striking increase in expected mortality in 29 deaths from cancer of the stomach, colon, or rectum. One peritoneal and three pleural tumors were mesotheliomas, an incidence that the investigators noted was exceedingly high for such a rare tumor. As a result of another report associating mesothelioma and asbestos exposure, Dr. Selikoff received a call from a physician who had just learned that his wife and her sister had worked as volunteers for six weeks during World War II installing insulation in a shipyard. The sister had died in 1966 of mesothelioma.

In another survey of insulation workers, Drs. Selikoff, Hammond and Churg found that of 283 men with a history of regular cigarette smoking, 24 died of bronchogenic carcinoma while none of 87 non-cigarette smokers died of the disease. It was calculated that a combination of asbestos exposure and cigarettes increased the risk of death from lung cancer by almost 92 times. Dr. Selikoff recently pointed out that increased asbestos levels in the atmosphere might compound the already high risk of lung cancer for smokers in the general population.

"Partnership for Prevention." In 1968 Johns-Manville, the largest asbestos producer, joined the insulation workers' international union, the Public Health Service's Bureau of Occupational Safety and Health, and Mt. Sinai's Environmental Sciences Laboratory in supporting a preventive hygiene research program. Through this unique cooperative effort of industry, labor, medical science and government new techniques for controlling asbestos dust, disposable masks and respirators for workers have been developed. The program led to the adoption of the New York regulations regarding the use of sprayed insulation. These rules, the first of their kind in the country, require that spray areas be completely enclosed by tarpaulins and cleaned of waste before enclosures are dismantled to prevent "snowfalls" of insulation.

Most experts believe that effective control of asbestos dust is possible and more desirable than prohibiting certain uses of the indispensable mineral. The Public Health Service and the industry have developed methods for monitoring optically visible dust in the atmosphere but it is much more difficult to detect the submicroscopic particles. At present the recommended level of asbestos in occupational exposure is five fibers per cc. and while the highest level measured in Manhattan air was 100 nanograms per cubic meter this could represent ten million chrysotile fibrils.

At a recent press conference a spokesman for the industry stated: "There is presently no evidence of hazard to the general public from exposure to the minute amounts of asbestos that may be present in community air." Others fear that unless increased levels are prevented asbestos in future decades could rival cigarettes as a cause of lung cancer.

* He shared the Lasker Clinical Award in 1955 for the original studies of isoniazid therapy for tuberculosis.

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