MERLE BUNDY, M. D.

~~F. A. Blanning~~

~~J. S. Bonte~~

~~D. W. Brown~~ ~~ecl~~

~~R. E. Grenfell~~ 1/5

~~C. V. Penince~~ 1/8

~~J. H. Vail~~

Please return.

MB/rp

1/7/74

HEROES - THE UNIONS & SOME DOCTORS

VILLAINS - INDUSTRY & SOME DOCTORS

MERLE BUNDY, M. D.

Please return to Merle Bundy; M. D.
Room 2575 ~~2519 N.~~

from A J Rinemma
4/14/75

MEMO FROM

Philip X. Masciantonio

Merle Bundy

Thanks for
use of this

Phil

9-29-80

ANNALS OF INDUSTRY

Casualties Of The Workplace

By
Paul Brodeur

Part I

"The New Yorker" - October 29, 1973

ANNALS OF INDUSTRY

CASUALTIES OF THE WORKPLACE

I—SOME NONSERIOUS VIOLATIONS

A YEAR ago last winter, a flurry of unusual activity accompanied the closing of a factory owned by the Pittsburgh Corning Corporation in Tyler, Texas, a city of sixty thousand about a hundred miles east of Dallas. Production stopped on February 3, 1972, and then the factory, which for more than seventeen years had been manufacturing asbestos insulation, was subjected to a cleanup of prodigious scope and intensity. Under the scrutiny of armed Pinkerton guards, who had been hired by the company to keep unauthorized persons away from the plant and its nearby dumps, sixty-two employees spent a week scraping asbestos waste from machinery and other equipment, and removing and burying truckload after truckload of asbestos scrap that had accumulated in the plant. This work force was laid off permanently on February 11th, and a crew of four maintenance men spent the next two weeks washing down ceilings and walls and steam-cleaning every piece of machinery in sight. Meanwhile, thirty-five thousand burlap sacks, in which amosite asbestos had been shipped to the factory from mines in South Africa, and which, once emptied, had been sold for a nickel apiece to some of the rose nurseries for which the Dallas-Tyler area is famous, were repurchased by Pittsburgh Corning at double the price, brought back to the plant in trucks, and buried at one of the factory's dumps. Toward the end of February, the skeleton crew, using acetylene torches, cut up three one-hundred-and-fifty-foot-long chain conveyor belts, three five-hundred-pound cyclone machines, and hundreds of feet of ventilation pipe, all of which were then taken outside and buried in a dump. Other pieces of heavy equipment, including eight twelve-foot-high feeding machines, three one-hundred-foot-long drying ovens, and a dozen dust collectors, were cut up and sold for junk, and still other items, such as saws, an asbestos-scrap grinder, and the draw works and gears for the ovens, were shipped by rail to Pittsburgh Corning's home office, in Pittsburgh. By the end of March, the Pinkertons were no longer needed—there being very little left of the Tyler plant for any trespasser to see—and by the end of April practically nothing remained of the factory except two dilapidated wooden buildings, which had once been warehouses at Camp Fannin, a Second World War training center and P.O.W. camp. One of them—the production building—was virtually empty; the other, the factory's storage area, was half filled with sacks of amosite-asbestos fibre, which the company had not used before shutting the plant.

Although Pittsburgh Corning never gave any official reason for the drastic tidying up that accompanied the closing of its Tyler plant, an explanation of the shutdown itself was made two weeks before by E. W. Holman, the corporation's vice-president in charge of manufacturing and technology. In an interview published in the Tyler *Courier-Times* on January 19th, Holman said that increased costs of buying amosite-asbestos fibre and transporting it from South Africa, plus the fact that his company was finding it more and more difficult to market its finished product because of competition, had brought about a decision to cease operations at the Tyler plant and at a Pittsburgh Corning plant in Port Allegany, Pennsylvania. He remarked that "new clean-air restrictions" had also played a role in "speeding up" the closing of the two factories, since the restrictions would have forced his company to install costly filtering equipment in order to bring the level of asbestos dust in the factories down to lawful limits. According to the *Courier-Times*, Holman acknowledged that asbestos fibres posed a health hazard, but added that he knew of no specific Pittsburgh Corning employee who was suffering from significant illness as a result of working with the product.

Three weeks after Holman's remarks were published, a somewhat different version of the situation at the Tyler plant was given by Anthony Mazzocchi, the director of the Legislative Department of the Oil, Chemical, and Atomic Workers International Union, which had represented employees at the factory since 1962. Speaking at a press conference in Washington, D.C., on February 10th, Mazzocchi disclosed that a government survey had shown major industrial-hygiene deficiencies in the operation of the plant, including a grossly inadequate ventilation system, which had resulted in airborne-asbestos levels constituting a critical occupational health hazard. According to Mazzocchi, the survey had determined that seven of the eighteen workers who had been employed at the factory for ten years or more showed symptoms of asbestosis—scarring of the lungs caused by inhalation of asbestos fibres—which is a significant illness by almost any standard, in that it is irreversible, untreatable, often disabling, and frequently fatal. Pointing out that asbestos has also been proved to be a potent carcinogen, Mazzocchi voiced the fear that many of the men who had worked in the factory would one day be afflicted with lung cancer or other malignant tumors. Moreover, he indicated that a health hazard might extend far beyond the plant, because the company had sold tens of thousands of burlap sacks contaminated with asbestos dust to nurserymen, who used them to wrap evergreens and other stock for shipment to retailers and gardeners throughout the nation.

For its part, Pittsburgh Corning made a public response only to the last of Mazzocchi's disclosures. On February 16th, a spokesman for the company admitted to a reporter for the Tyler *Morning Telegraph* that thirty-five thousand burlap bags had been recalled from

the Dallas-Tyler area, but he denied that there was any reason to consider them a health hazard. The apparent contradiction in this statement was not resolved by the manager of the Tyler plant, who was quoted at the same time as defying anyone to find any of the bags in question. "We've hired bulldozers to put all those bags underground," he said, making an assertion that would soon apply to much of the factory equipment as well. By then, however, word had got out that considerably more of the Tyler plant was buried than burlap bags and cut-up machinery.

IN a sense, the story of the Tyler plant begins with the founding of the Union Asbestos & Rubber Company, in Chicago, in 1918. According to the United States Bureau of Labor Statistics, American and Canadian insurance companies were even then generally declining to insure asbestos workers because of the assumed hazardous conditions of the asbestos industry. Union Asbestos started out as a jobber of railway supplies and an assembler of finished asbestos and rubber products. Business expanded rapidly, thanks to the development of a flexible asbestos tape, which achieved wide use for insulating pipes in steam locomotives, and in 1926 Union Asbestos built a factory in Cicero, Illinois, to manufacture asbestos textiles, insulation materials, packings, brake linings, and gaskets, and a variety of rubber products. Another leap forward took place in the mid-thirties, when the company developed an amosite-asbestos pipe insulation for the Navy. Amosite is a variety of asbestos found in large deposits in the Transvaal region of South Africa, and it had never been used before in the United States, where most asbestos products had been (and continue to be) made of chrysotile, a variety of the mineral that exists in vast deposits in Canada and the Soviet Union, and accounts for ninety-five per cent of the world's production. Because it is as heat-resistant as chrysotile, and can be purchased more cheaply, amosite was chosen for insulating the pipes, turbines, and boilers of modern warships, and by 1940 the Navy's demands for amosite pipe insulation were such that Union Asbestos—or UNARCO, as it had come to be known—started a plant in Paterson, New Jersey. During the war years, the UNARCO plants in Cicero and Paterson churned out amosite pipe covering for the Navy around the clock, winning numerous Army-Navy "E" awards. Such insulation continued to be much in demand in the postwar period, and in 1949 the company set up a third plant to manufacture it, in McGregor, Texas. Then, in November of 1954, as part of a consolidation program, the company shut the McGregor and Paterson factories, and opened the factory at Tyler, Texas.

Little was known about the Tyler plant except that it was set up to operate generally like the factory in Paterson. However, some information that would one day impart tremendous medical significance to this similarity was just then beginning to be developed by Dr. Irving J. Selikoff, a chest physician, who is head of the Division of Environmental Medicine at the Mount Sinai School of Medicine of the City University of New York, director of its Environmental Sciences Laboratory, and a pioneer in the field of asbestos epidemiology. A native of New York City, Dr. Selikoff interned at the Beth Israel Hospital in Newark; did his pathology work at Mount Sinai, where he has been a member of the staff since 1947; and became a chest physician at the Sea View Hospital, on Staten Island, specializing in tuberculosis. In 1951, he participated in the basic research on isoniazid—the antibiotic drug that, by effectively killing tubercle bacilli, has provided a cure for tuberculosis—and in 1953 he founded a medical clinic in Paterson, where, by chance, seventeen of his early patients were men who worked in the nearby UNARCO plant. At the time, fifteen of the men showed some evidence of pulmonary defects resulting from the inhalation of asbestos. When the Paterson factory closed, they went into other work, and at that point Dr. Selikoff decided to continue his observation of them with X-ray examinations and lung-function tests to determine the history and the natural course of asbestosis in men who would not be further exposed, but in whose tissues the previously inhaled fibres would remain. This was the start of a long journey of discovery for Dr. Selikoff, who would eventually help to demonstrate that asbestos is one of the major industrial causes of cancer. At the time, he was interested chiefly in asbestosis, because he was not convinced that the relationship between asbestos and cancer, which had previously been suggested by a number of medical authorities, would prove to be a serious problem. As things turned out, he changed his mind. In 1954, all seventeen men from the Paterson factory were working and apparently able-bodied. Today, only two of them are alive. Of the fifteen who died, seven were victims of lung cancer, two of cancer of the stomach, four of asbestosis, and one of malignant mesothelioma—an invariably fatal tumor of the pleura, the membrane that encases the lung, or of the peritoneum, a similar membrane that lines the abdominal cavity—which rarely occurs without some exposure to asbestos. (One of the fifteen deaths was of heart disease.) As early as 1961, by which time six of the seventeen had died, Dr. Selikoff began to suspect the worst for men who were occupationally exposed to the mineral. At that time, he wrote to Edwin E. Hokin, the president of UNARCO, asking him to make employment records available, so that he could undertake a survey of all the men who had worked in the Paterson factory. Hokin turned the request down, saying the records were not available, but he was surely aware that men who had worked in the Paterson factory might be having medical problems, for during the nineteen-fifties the company had paid out substantial amounts of money to employees of the plant who had become disabled with asbestosis. Dr. Selikoff then wrote to several other large asbestos manufacturers in the United States to ask about the health experience in their plants, and was unable to obtain information from any of them. Meanwhile, he and Dr. Jacob Churg, the chief pathologist at Barnert Memorial Hospital, in Paterson, who had himself been finding asbestosis and lung cancer in a large number of workers from the Paterson factory, took their data to Dr. Roscoe P. Kandle, the Commissioner of the New Jersey State Department of Health. Concerned about the situation, Dr. Kandle applied to the United States Public Health Service for funds to undertake a study of the Paterson plant and to make a statewide survey to determine how many people were being occupationally exposed to asbestos. However, the request was denied, lack of resources being given as the reason.

Since Dr. Selikoff already knew that men who had worked in an insulation factory were dying of asbestosis or cancer at an alarming rate, he felt that men who were installing such materials might also risk disease, and early in 1962 he made contact with officials

of New York Local 12 and Newark Local 32 of the International Association of Heat and Frost Insulators and Asbestos Workers. The asbestos insulators had been trying for years without success to interest doctors and various government agencies in their medical problems, so they were only too glad to coöperate, and they urged Dr. Selikoff to study the effects of asbestos exposure among their members. He accepted the responsibility, and, though continuing to monitor those of his original seventeen patients who had survived, temporarily abandoned his project to study the other men who had worked in the Paterson factory. At the time, he did not know of the existence of the UNARCO plant in Tyler, Texas.

THE Tyler plant was then thriving but was about to change hands. UNARCO held a large contract with the Navy to provide pipe covering for atomic submarines, and the factory was also producing insulation for the chemical-processing industry on the nearby Gulf Coast, which was growing rapidly. Over the years, however, the company had acquired half a dozen plants for the manufacture of various products unrelated to asbestos, and this diversification had altered the objectives of its managers, who decided to quit the asbestos business altogether. As a result, the company sold the Tyler plant in 1962 to the Pittsburgh Corning Corporation—a joint venture of the Pittsburgh Plate Glass Company (now called PPG Industries) and the Corning Glass Works—and the production of amosite-asbestos pipe covering continued as before. By the summer of 1963, however, the new owners were apparently entertaining some misgivings about working conditions in the factory, for at that time they asked the Industrial Hygiene Foundation of America to evaluate the asbestos-dust hazard there. The foundation, which is in Pittsburgh, describes itself as "an association of industries for the advancement of healthful working conditions," and it is financed entirely by industry. It sent industrial-hygiene engineers to the Tyler plant in July and August to review the potential health hazards of handling asbestos and to take samples of airborne asbestos-dust concentrations. In its report to Pittsburgh Corning, the foundation made no mention of any health hazard, and assured the company that, except in a few areas, the number of asbestos fibres found in the air of the Tyler plant was well below the threshold limit value of five million particles per cubic foot of air—a safety standard for dust in asbestos factories that had been adopted in 1946 by the American Conference of Governmental Industrial Hygienists, which, despite its imposing title, is not a government agency but a voluntary organization with members from various groups, including industry, and with the self-imposed task of recommending safety standards for hazardous substances in industry. Incredibly, the authors of the foundation's report appear to have based their judgment on the assumption that the threshold limit value of five million particles per cubic foot meant five million asbestos fibres, whereas the proponents of the threshold limit value had intended it to apply to *all* the particulate matter—fibrous and nonfibrous—in a given cubic foot of air. To understand the magnitude of this error, it should be noted that the study upon which the standard was based had been made in the winter of 1935-36 in four asbestos-textile plants where asbestos fibres were found to constitute about ten per cent of the total amount of airborne dust. The asbestos fibres in the airborne dust measured in the Tyler plant by engineers of the Industrial Hygiene Foundation ranged from a low of twenty-nine per cent to a high of fifty-six per cent. The foundation, however, reported the percentages as if they were of little or no consequence, and contented itself with making recommendations for better housekeeping, better ventilation equipment, and improved maintenance of the ventilation system.

These measures were desperately needed, but there is little evidence to suggest that Pittsburgh Corning felt compelled to initiate them, for when the next survey of the plant was made, more than three years later, conditions were even worse. By that time, the company had acquired a new medical consultant—Dr. Lee B. Grant, a retired colonel, who had been Chief of Aerospace Medicine for the United States Air Force Logistics Command, and who had become medical director of one of Pittsburgh Corning's parent corporations, the Pittsburgh Plate Glass Company, in 1965. At Dr. Grant's request, a survey of the Tyler plant was conducted in November of 1966 by J. T. Destefano, safety and industrial-hygiene engineer for the glass division of Pittsburgh Plate Glass, to see if there had been any significant change in the levels of airborne-asbestos dust since the 1963 survey. After analyzing samples of air from sixteen different areas of the plant, Destefano subsequently reported that asbestos-fibre counts exceeded the threshold limit value in seven instances and that in three of the samples the

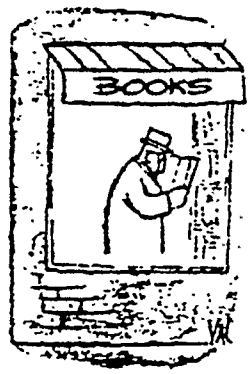
count was twenty million or more fibres per cubic foot of air. Destefano was, apparently, making the same erroneous assumption about the meaning of the threshold limit value which had been made three years before by engineers of the Industrial Hygiene Foundation. As a result, though he also suggested better ventilation equipment and improved maintenance of the ventilation system, his report did not mention that workers at the Tyler plant were breathing concentrations of asbestos fibres ten times greater than those of the recommended safety standard that was supposed to protect them from disease.

DURING the span from 1963 to 1966, a tremendous amount of new information concerning the biological effects of asbestos had been developed and was being circulated through the medical and industrial communities. Perhaps the most important study of the period was the one that Dr. Selikoff conducted of the asbestos insulators. As asbestos workers go, these men had comparatively light and intermittent exposure: they often worked out-of-doors on construction projects; they spent half their time working with materials other than asbestos; and most of the asbestos materials they used had an asbestos content of less than fifteen per cent. (The men at the Tyler plant worked in a confined, far dustier atmosphere, and manufactured a product that had an asbestos content of almost ninety per cent.) In spite of this relatively light exposure, however, Dr. Selikoff found radiological evidence of fibrosis of the lungs—that is, scarring of the lungs—in fully half of eleven hundred and seventeen members of the two locals of the Heat and Frost Insulators and Asbestos Workers. Moreover, among three hundred and ninety-two men with more than twenty years of experience in the trade, he found that three hundred and thirty-nine had developed asbestosis, and that the disease had by then become moderate or extensive in more than fifty per cent of the cases.

Even more alarming were the results of a mortality study of workers in the two locals. During the early part of 1962, Dr. Selikoff and his administrative assistant, Mrs. Janet S. Kaffenburgh, pored over the union records and compiled a list of the names and addresses of all the six hundred and thirty-two men who had been members of the locals on December 31, 1942, and of the eight hundred and ninety men who had joined between then and December 31, 1962. From the union employment records, they obtained detailed work histories of the total membership of fifteen hundred and twenty-two men, including data on the men's leaving work for other employment, war service, illness, or retirement. This enabled them to calculate the onset and duration of exposure to asbestos for each worker. Records of the union health-and-welfare funds provided them with the dates and places of death of two hundred and sixty-two workers who had died between 1942 and 1963, and copies of the death certificates of all but one of them were obtained. In addition, autopsy protocols, histological specimens, and hospital records were reviewed by Dr. Selikoff and Dr. Churg, the Paterson pathologist, in those deaths (approximately half the total) which occurred in hospitals.

In the next phase of the study, Dr. Selikoff and Dr. Churg were joined by Dr. E. Cuyler Hammond, vice-president for epidemiology and statistics of the American Cancer Society, who had participated in an analysis of the medical effects of the atomic explosions that devastated Hiroshima and Nagasaki in 1945, and whose large-scale epidemiological studies of more than a million men and women provided a major basis for the conclusions drawn in the 1964 Surgeon General's report on the effects of cigarette smoking. Since previous studies had suggested that lung cancer associated with asbestosis seldom develops until twenty years after initial exposure to asbestos dust, Dr. Selikoff and Dr. Hammond decided to limit their first analysis to the six hundred and thirty-two men who were on the union rolls as of December 31, 1942. Taking the men's ages into consideration, Dr. Selikoff and Dr. Hammond

then set about comparing the number and causes of death among them with those of the general male population in the United States. The results were depressing. According to the standard mortality tables, two hundred and three deaths could have been expected among the six hundred and thirty-two workers. Instead, there were two hundred and fifty-five, not counting seven men who had died before incurring twenty years of exposure—an excess of twenty-five per cent. The reason for the excess was not hard to find. The fact that twelve of the deaths were attributed to asbestosis was not particularly surprising, but where six or seven deaths from cancer of the lung, pleura, or trachea were to be expected, there were actually forty-five. And where nine or ten gastro-intestinal cancers were to be expected, there were twenty-nine. Since the death rate from lung cancer was known to be more than ten times as high among cigarette smokers as among nonsmokers, Dr. Selikoff and Dr. Hammond realized that they would have to take the smoking habits of the asbestos-insulation workers into account if their findings were to have solid validity. It was, of course, impossible for them to ascertain this information with accuracy in the cases of the two hundred and fifty-five men who had died, so, for purposes of calculation, they assumed that all six hundred and thirty-two men had smoked a pack or more of cigarettes each day, and they demonstrated that even if this had been the case it would have produced a lung-cancer death rate only three and a half times that of the general male population. Cigarette smoking, therefore, could not explain the fact that in this group of asbestos-insulation workers the rate of death from lung cancer was seven times the expected rate.



Because of this study's objectivity, its scope, and its thoroughness, it had a great impact on the medical community. The findings were reported to the annual convention of the American Medical Association in June of 1963—a month before the Industrial Hygiene Foundation began its survey of the Calder plant—and they were published in the spring of 1964 in the *Journal of the American Medical Association*. It was the first study ever made that had taken a large enough group of asbestos workers from a point far enough back in time and followed them long enough to determine unequivocally what their health experience had been. Unlike almost all the previous investigations, which indicated simply that there was a connection between asbestos and various kinds of cancer, it was based upon the incidence of disease within a defined population, and thus answered a fundamental epidemiological question of how many cancers had developed among how many persons exposed. In doing so, it furnished the first incontrovertible evidence that industrial exposure to asbestos was hazardous; it established sound methodology for future studies; and it marked a turning point in the views held by doctors and health officials around the world.

In October of 1964, in order to review the data that had already been collected and to discuss the problems awaiting solution, the New York Academy of Sciences sponsored an International Conference on the Biological Effects of Asbestos, which was held at the Waldorf-Astoria and was attended by more than four hundred scientists. In addition to the statistics provided by Dr. Selikoff and Dr. Hammond on the incidence of asbestosis and cancer in the insulation workers, there were dozens of reports on the occurrence of disease in people exposed to asbestos. Some of the most alarming information was provided by Dr. J. G. Thomson, of South Africa, who reported finding what appeared to be asbestos bodies—inhaled fibres that have been altered by the reaction of lung tissue, and coated with a colloidal substance rich in iron—in the lungs of one in four people coming to autopsy at random in Capetown. Although asbestos bodies are regularly seen in the lungs of asbestos workers, this discovery indicated that asbestos was becoming a common contaminant in the community at large. There was also a report that mesothelioma was afflicting people who had had only minor exposure to asbestos. This tumor, which takes from twenty to forty years to develop, was previously so rare that it was known to occur in only about one in ten thousand deaths in the general population. By the time of the international conference, however, it was being found increasingly—not only in people who were exposed to asbestos in their work but also in people who lived in the vicinity of asbestos mines [illegible] where asbestos products were manufactured, or who simply lived in the same house with workers who came home with asbestos dust on their clothes. Perhaps the most striking confirmation of this came from London, where Dr. Muriel L. Newhouse, of the Department of Occupational Health at the London School of Hygiene and Tropical Medicine, investigated seventy-six cases of mesothelioma that had been ascertained by autopsy or biopsy in the London Hospital. To no one's surprise, thirty-one of the seventy-six patients had worked with asbestos, but, in addition, eleven of the forty-five who had not worked with asbestos had simply lived within half a mile of an asbestos factory, and nine others—seven women and two men—were relatives of asbestos workers. Most of these women had washed their husbands' work clothes regularly. Both of the men in this group, when they were boys of eight or nine, had had sisters who worked in asbestos-textile factories. One of the sisters had been employed as a spinner from 1925 to 1936, and had died of asbestosis in 1947, at which time it was determined at an inquest that "she used to return from work with dust on her clothes." Her brother, who had apparently had no other sustained exposure to asbestos in his lifetime, died in 1956 of a pleural mesothelioma. Subsequently, in the United States, there were similar findings in a number of places. For example, the proprietor of a junk yard next to the UNARCO factory in Paterson died of mesothelioma, and so did the engineer who first developed the amosite pipe covering manufactured by the company for the Navy, as did his daughter, whose only known exposure to the mineral was that she sometimes played with samples of asbestos products her father brought home for his family to examine. As a result of such incidents, scientists were forced to revise their idea that asbestos was only an industrial hazard, and to give serious consideration to Dr. Thomson's prediction of danger to untold numbers of people in the general community. Such consideration proved to be well founded, for since then the presence of asbestos bodies in the lungs of ordinary urban dwellers has been confirmed by studies made in Miami, London, Belfast, Pittsburgh, and New York City, where, in a recent investigation conducted by Dr. Arthur M. Langer, the chief mineralogist at the Mount Sinai Environmental Sciences Laboratory, electron-microscope examination of repre-

sentative samples of tissue showed chrysotile asbestos to be present in the lungs of a hundred and four out of a hundred and twenty-eight people coming to autopsy at random in three city hospitals.

The attitude of the asbestos industry at this time can perhaps be best illustrated by a cautionary letter that was sent to Mrs. Eunice Thomas Miner, the executive director of the New York Academy of Sciences, on October 26, 1964, just after the Conference on the Biological Effects of Asbestos ended, by lawyers representing the Asbestos Textile Institute—an association of asbestos manufacturers that includes the Johns-Manville Corporation, Raybestos-Manhattan, Inc., and Uniroyal, Inc. The letter began by stating that all member companies of the institute shared a grave concern over recent articles carried in local and national newspapers concerning mesothelioma. It went on to say that "innocent but unwise treatment of research data in public discussions, or leaving it to laymen to appreciate the carefully phrased limitations and qualifications, can cause reactions that are not justified by the state of scientific knowledge," and it urged caution in the discussion of medical research into asbestos disease, "to avoid providing the basis for possibly damaging and misleading news stories." It concluded by warning the New York Academy of Sciences that although the right to discuss these subjects was clear, "the gravity of the subject matter and the consequences implicitly involved impose upon any who exercise those rights a very high degree of responsibility for their actions."

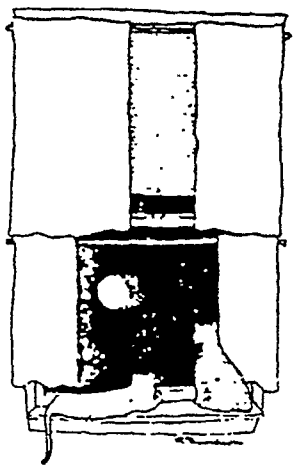
During 1966, the Academy sent out thousands of copies of its report of the conference to doctors, officials of state and federal health agencies, and custodians of medical libraries all over the country, and from 1965 on there were many articles in leading medical journals and dozens of newspaper stories concerning new and alarming data that had been developed about the perils of inhaling asbestos. As a result, it seems highly probable that by late 1967 the industrial-health officer of any responsible company engaged in the manufacture of asbestos products would have been given pause by the kind of report that Dr. Grant received from Destefano in September of that year concerning the levels of asbestos dust in the Tyler factory. In fact, considering Dr. Grant's credentials, any other response would have been astonishing, for in addition to being medical director of the Pittsburgh Corning plant he was also medical consultant to Pittsburgh Corning, he was a member of the American Medical Association, the American Industrial Hygiene Association, and the American Academy of Occupational Medicine, and would one day become president of the American College of Preventive Medicine.

In any case, in December of 1966 Dr. Grant paid a visit to Dr. George A. Hurst, clinical director of the East Texas Chest Hospital—a branch of the Texas State Department of Health that happens to be in Tyler—and asked him to conduct a medical survey of the workers at the Pittsburgh Corning plant to determine if they were encountering health problems as a result of their exposure to asbestos. Dr. Hurst immediately set about designing a study of the workers, which included physical examinations, questionnaires, X-rays, and pulmonary-function tests. On February 3, 1967, having received approval from his superiors at the Texas State Department of Health, in Austin, he wrote Dr. Grant that the study could be conducted at a cost to Pittsburgh Corning of forty-two hundred dollars, and that, upon Dr. Grant's approval, it would be started by the first of May and completed as soon as possible.

On March 7th, however, Dr. Grant wrote a letter informing Dr. Hurst that Pittsburgh Corning had decided to forgo the proposed study in favor of some studies that would be conducted by Dr. Lewis J. Cralley, who was associate program chief for field studies and epidemiology in the Public Health Service's Division of Occupational Health, in Cincinnati. Dr. Grant explained that the Public Health Service had been interested for some time in doing environmental and medical studies of the asbestos-products industry, and had recently agreed to include Pittsburgh Corning's plants in Tyler and Port Allegany in the environmental study. According to Dr. Grant, the Public Health Service did not then have sufficient funds to perform the medical study but hoped to receive additional money for that purpose in July. "For this reason, I would like to hold off until July on making a final decision on your proposed medical study," he wrote Dr. Hurst. "Our management is vitally interested in accomplishing the medical study but would like the U.S.P.H.S. to accomplish it as part of their total study. If U.S.P.H.S. can't do the medical study, they would like to consider your proposal further."

An environmental survey of the

ighty-two samples of air in the factory, vas conducted on March 20, 1967, by ngineers sent there by Dr. Cralley. Jowever, more than a year passed be- e Dr. Cralley's people got around orming Pittsburgh Corning of the esults of the survey. The report was lated March 27, 1968, and it was ent to J. W. McMillan, the works nanager of the Tyler plant, with opies to Dr. Grant and Dr. Cralley. In many respects, McMillan must have ound it a baffling document. On the ne hand, it informed him that when wenty-seven of the air samples col- ected in his factory were analyzed by a tandard method, dust concentrations xceeded the threshold limit value of five nillion particles per cubic foot "in a umber of locations." On the other and, it indicated that when the air amples were analyzed by a new method n use in Great Britain (and soon after- ard adopted in the United States), as- estos-fibre counts were considered high n forty-four of the fifty-five other sam- les. (The fact was that in five of the amples the asbestos-fibre count was wenty to thirty times the range that vas considered high by the British Oc- upational Hygiene Society. Moreover, vith the exception of Pittsburgh Corn- plant in Port Allegany, where as- estos-dust levels were also very high, he over-all asbestos-fibre counts in the Tyler factory were ar greater than those neasured in any of ome thirty other as- estos-products facto- ies that had been sur- eyed by the Division of Occupational Health luring the previous hree years.) In spite of his, the report made no nention that a health azard might exist at he Tyler plant, nor id it advise the works nanager of the factory o improve the ventila- ion system or to insti- ute better housekeeping practices—or, ndeed, to correct any condition that night have led to the excessive fibre ounts it described. Instead, the re- ort concluded by telling him that 'your cooperation in this study is sin- e appreciated and the data gained r your plant are of considerable val- e." It is not known whether the works nanager had the benefit of any medi- al interpretation of the report. Nor is known whether he had any other ay of ascertaining the dimensions of he health hazard that existed in his factory. It is known, however, that two years later he died of mesothelioma.



SINCE the primary responsibility of the Division of Occupational Health was to protect workers from occupational disease, the omission from its report of any concern for the health of the workers at the Tyler plant seems puzzling, to say the least. Part of the trouble undoubtedly stemmed from the roundabout manner in which the Occupational Health people had to go about their business, for at the time they had no legal authority to enter and inspect factories and no enforcement power of their own. To gain access to factories, they had to be expressly invited by state departments of labor, or by the few state departments of health that had rights of access, or, as in the case of Pittsburgh Corning's Tyler plant and the other asbestos plants they were studying, by the companies that owned the factories. Since the Occupational Health people usually had to go hat in hand to industry in order to initiate their asbestos field studies, they appear to have felt a certain constraint about using the information they gathered. For example, in making arrangements to gain access to plants and take air samples, field-studies engineers invariably gave oral assurance to plant management that the identity of individual factories would be kept confidential and would be released only to the appropriate state agencies. In practice, however, the Division of Occupational Health almost never forwarded interpretations of the health consequences of its findings to state agencies, and in most cases it didn't even send them the sampling data—the report on the Tyler plant being no exception—and that, in effect, prevented any possibility of action to remedy any health hazards. The pledge of confidentiality, of course, precluded any possibility that the data collected in the surveys would be made known to the workers whose health was being affected, or to the unions representing them. Moreover, in order not to embarrass management or make workers apprehensive, the government engineers who took air samples during the environmental surveys not only were forbidden to discuss the nature of their activities with any workers they encountered but were also instructed not to wear respirators, which would have afforded them some protection against the hazard of inhaling asbestos dust. As a further extension of this solicitous policy toward industry, the Occupational Health people were careful not to alarm management by reporting in writing the existence of health hazards in any of the asbestos factories they surveyed or by recommending improvements in ventilation equipment and housekeeping procedures to reduce the levels of asbestos dust. In short, they simply took air samples, analyzed them, and reported fibre counts, without drawing any inference as to what the fibre counts might mean in terms of the health and well-being of the men who were exposed to them.

In order to understand more fully what lay behind this practice, it might be helpful to examine the attitude toward asbestos disease held by the people who were in charge of the asbestos field studies at that time. As it happens, I spent several hours one afternoon in March of 1968—a week or so before the report on the Tyler plant was sent out—discussing the asbestos problem with Dr. Cralley and some of his associates in the Division of Occupational Health. At the time, I was looking into the biological effects of asbestos, and I had flown out to Cincinnati to see Dr. Cralley at the suggestion of Dr. Murray C. Brown, who was then chief of the Division of Occupational Health, with offices in Washington, D.C. Dr. Cralley, who received a Ph.D. in industrial hygiene from the State University of Iowa, had joined the Public Health Service in 1941. At the time of our meeting, he had been in charge of epidemiology and field studies for the Division of Occupational Health for nearly four years. He was a fellow of the American Public Health Association, a past chairman of its Occupational Health Section, a past chairman of the American Conference of Governmental Industrial Hygienists, a member of the Committee on Asbestosis and Cancer of the International Union Against Cancer, and an adjunct assistant professor of environmental health at the University of Cincinnati.

At the beginning of our conversation, Dr. Cralley explained that the asbestos-field-studies program had two components: an environmental team, which had been taking dust counts in asbestos-textile and friction-materials plants since 1964, and a medical-epidemiological team, which would soon begin to give X-ray examinations and

nary-function tests, and blood tests to five thousand men who worked in these factories. He did not tell me that his engineers had already conducted environmental surveys of Pittsburgh Corning's insulation plants in Tyler and Port Allegany, perhaps because the initial focus of the field-studies program was into other areas of the asbestos-products industry, and these two surveys were exceptions. According to Dr. Cralley, the purpose of the field-studies program was to establish criteria for a possible lowering of the threshold limit value for asbestos. It would take many years to develop these criteria, however, for Dr. Cralley's medical studies of the asbestos-factory workers were designed to proceed from the time of first examination, rather than to reconstruct the events of the past, as Dr. Selikoff's and Dr. Hammond's study of the asbestos-insulation workers had done. Dr. Cralley explained that it would take from two to four years to complete the first medical examinations of the five thousand men he proposed to study, and that if funds were available the men would be reëxamined every five years thereafter. "By following these men for the next fifteen or twenty years, we hope to establish a dose-response relationship for asbestosis," he told me. "Then we'll try to determine what level of exposure carries with it no discernible health hazard."

When I asked Dr. Cralley if this twenty-year-from-now evaluation would take into consideration the development of lung cancer and mesothelioma, he replied that it would not—that he was interested only in asbestosis. I then asked him about the medical studies indicating that mesothelioma could occur with minor exposure to asbestos, and he shrugged and replied that in his opinion the association between mesothelioma and asbestos was not proved.

At this point, Dr. William S. Lainhart, assistant chief of field studies in charge of the medical-environmental team, who was sitting in on our talk, explained that since the main purpose of the program was to trace the natural history of asbestos disease, little would be known about the incidence of lung cancer or mesothelioma until the five thousand men under study were reëxamined in future years. "Ideally, we'd like to take a bunch of twenty-year-olds, put them into an asbestos plant where we know the exact dust levels, and observe them for the next fifty years, or until they die," he said. "Of course, we can't do that. We have to devise studies that are practical. For this reason, we estimate that it will take us from fifteen to twenty years to evaluate with any accuracy the medical effects of today's environment in the asbestos industry."

When I asked about the high rate of asbestosis, lung cancer, and mesothelioma that was already afflicting workers in the asbestos industry, Dr. Cralley told me that such diseases were the result of exposures sustained over the past twenty years or so, and that because great improvements had been made in ventilation systems and industrial-hygiene procedures in the meantime, he expected to find much less disease in the future. When I asked him what he would consider a high rate of disease in the men he proposed to examine, he replied that he would not care to estimate. "We'll have to come to that when we come to it," he said. "Remember that practically everyone is susceptible to chest disease to some extent, and that you can get chest disease even from digging in your garden. With the means we now have at hand, we can only *assume* that asbestosis and other diseases are related to asbestos exposure. Our first priority, therefore, is to study our five thousand men over a long period, and use our observations of what happens to them as the criteria for developing a new standard."

At the close of our meeting, I asked Dr. Cralley why, in view of the fact that asbestosis and cancer had afflicted great numbers of asbestos workers since the turn of the century, it had taken so long for the government to begin studying asbestos in earnest. Dr. Cralley said he didn't know. "All I know is that the first real interest came from industry," he told me. "They asked for our help back in 1964, and they have coöperated with us magnificently."

Since it was my understanding that the asbestos industry had never been particularly eager to have its operations scrutinized, I was surprised to hear this, and asked Dr. Cralley what segment of the industry had made the request for help and coöperated so magnificently. "The Asbestos Textile Institute," he replied.

WHATEVER interpretation one wishes to place upon the rather leisurely approach to the problem of asbestos disease by the administrators of the asbestos-field-studies program, the fact remains that during the first seven years of its existence the program placed no emphasis at all upon control of dust levels in asbestos factories, or upon preventive measures for the workers who were exposed to the dust. Indeed, almost all the meaningful data about dust levels in asbestos factories which were acquired by the program between 1964 and 1971 simply accumulated in the files of its Cincinnati offices, as did all the data on the medical examinations of asbestos workers it conducted after 1968. For its part, the asbestos industry seems to have been quite content with this quiet state of affairs. On the one hand, it could state publicly that, with its assistance, the United States Public Health Service was investigating the possible hazards of industrial exposure to asbestos. On the other hand, it could rest assured privately that, because of the long-term nature of these studies, no information would be forthcoming for many years, and that, because of the pledge of confidentiality, none of it would find its way into the hands of anyone who might seek to remedy any hazards that were found in the meantime.

As for the Tyler plant, it seems to have been considered a kind of fluke by almost everyone concerned. By March of 1968, the medical study of the workers in which Pittsburgh Corning was supposed to be vitally interested was either forgotten or held in abeyance. Dr. Grant never did anything further about the study that Dr. Hurst had designed, and Dr. Cralley and his associates in the Division of Occupational Health never got around to conducting their study. Meanwhile, as the health situation at the Tyler plant was going from bad to worse to appalling, a parade of government inspectors continued to troop through the place without any apparent awareness of the hazards that were staring them in the face. On February 13, 1969, still another safety-and-health inspection of the factory was conducted, this time by industrial-hygiene engineers from the Dallas regional office of the United States Department of Labor's Wage and Labor Standards Administration. The Department of Labor inspectors were authorized to enforce the industrial-health regulations of the Walsh-Healey Act of June 30, 1936, which had been amended to apply to companies holding federal contracts in excess of ten thousand dollars. They found a number of unsatisfactory conditions in the plant, including, again, a substandard ventilation system and inconsistent use of respirators by the workers, and they proceeded to take air samples in six areas of the plant to determine the asbestos dust levels. By that time, in spite of the foot-dragging of the Division of Occu-

national Health, the American Conference of Governmental Industrial Hygienists had proposed that the threshold limit value be lowered from five million particles per cubic foot (the standard that had been in effect for [illegible] than twenty years) to two million particles per cubic foot, the first of a series of downward revisions they were to consider—each an admission that previously recommended guidelines had allowed workers to inhale concentrations of dust now deemed harmful. (The two million particles were considered the equivalent of twelve asbestos fibres longer than five microns per cubic centimetre of air—five microns being one-five-thousandth of an inch, and a cubic centimetre of air being an amount equal to what might be contained in a small thimble.) The Department of Labor inspectors, however, not only had no equipment to measure asbestos-fibre counts in terms of the proposed conference standard but analyzed the air samples they took in terms of a standard applicable not to asbestos, a known carcinogen, but, rather, to nontoxic nuisance dusts, such as wood dust and chalk powder. As a result, they failed to realize that even the new standard for asbestos was being exceeded dozens of times over in the [illegible] plant, and contented themselves with recommending that Pittsburgh Corning issue respirators to employees working in dusty areas of the plant. What seems especially ironic about this is that back in the forties, when UNARCO was operating its Paterson factory—the one upon which the Tyler plant was modelled—not only had it paid its employees five cents extra an hour to wear respirators, which they were obliged to do by insurance underwriters anyway, but it had also repeatedly pointed out to the workers that wearing respirators was a precaution that should always be taken in any asbestos factory, and had threatened to fire men who refused to wear them.

As for the inadequate ventilation system, the Department of Labor inspectors recommended in their report, which was sent to James H. Bierer, vice president of Pittsburgh Corning, and Charles E. Van Horne, who had recently become the manager of the Tyler plant, that the company "make a study of the present system with professional advisers and come up to standard, or present qualified proof that the present system is operating within the minimum specified ventilating range." Instead of reinspecting the Tyler plant to make certain that the company had complied with these recommendations, however, the Department of Labor people simply took Pittsburgh Corning's word that approved respirators would be issued to its employees and that the ventilation system would be improved. Indeed, nobody from the Department of Labor visited the factory again until November of 1971.

For its part, Pittsburgh Corning asserts that by May of 1969 the wearing of approved respirators was required for all employees in the Tyler plant—an assertion that is denied by most of the men who worked there—and that the ventilation system had been duly studied with an eye to improving it. During 1969, the company did indeed engage the services of Dr. Morton Corn, professor of occupational health at the Graduate School of Public Health of the University of Pittsburgh, who visited the Tyler and Port Allegany plants and proposed some engineering controls to bring asbestos-dust levels in them down to recommended limits. But if any significant improvements were made in the ventilation system of the Tyler plant, they were clearly not sufficient to bring the dust levels within such limits. In January of 1970, engineers from Dr. Cralley's group at the Division of Occupational Health—which by then had become the Bureau of Occupational Safety and Health—returned to the factory and took seventeen air samples, and these showed the average airborne-asbestos level to be more than double the proposed twelve-fibre standard. In keeping with earlier practice, however, the engineers chose not to point out the existence of any possible health hazard in their report to Pittsburgh Corning, or to make any recommendations for lowering asbestos-dust levels in the Tyler plant. Nor did they forward their findings to the Texas State Department of Health or to any other agency with enforcement powers. Thus did the Bureau of Occupational Safety and Health add to the series of virtually meaningless surveys that had begun back in July of 1963, when Pittsburgh Corning engaged the Industrial Hygiene Foundation of America to evaluate the asbestos-dust hazard in the Tyler plant. During those six and a half years, five separate studies and inspections of the factory had been conducted, and more than a hundred samples of air had been gathered and transported to laboratories in various parts of the country, where they had been counted, weighed, assayed, and painstakingly analyzed by industrial hygienists, who, depending on what standard they were using, had reported their findings in terms of dust particles per cubic foot or dust weight per cubic metre or fibre counts per cubic centimetre but never in terms of what the dust and fibres that the workers were inhaling might be doing to their health.

BY this time, however, some preliminary data concerning the mortality experience of the men who had worked in the UNARCO factory in Paterson were being developed, and what the data revealed might have led one to anticipate a most unhappy fate for many of the workers at the Tyler plant. With the aid of a grant from the National Institute of Environmental Health Sciences, which had become concerned about the potential asbestos hazard to the general public, and wanted accurate data concerning it, Dr. Selikoff had set up an asbestos-control program in Paterson in 1968, and had begun to trace the sixteen hundred and sixty-four men who had been employed at the Paterson plant between 1941, when it opened, and 1954, when Union Asbestos closed it and transferred its operations to Tyler. This was a laborious process, for Dr. Selikoff and Dr. Hammond had only the names of the men to go on, and addresses for them that were from fourteen to twenty-seven years old. By January of 1970 they had managed to trace most of the nine hundred and thirty-three men who had worked at the factory for at least a year between 1941 and 1945, and who, if they were still alive, had passed the twenty-year mark since their initial exposure to asbestos dust. They were also able to collect death certificates for almost all of the four hundred of these men who had died. As in the case of the insulation workers in New York Local 12 and Newark Local 32, the results were alarming, for, even though the study was incomplete, the death certificates showed an extraordinarily high frequency of death resulting from asbestosis, lung cancer, gastro-intestinal cancer, and mesothelioma.

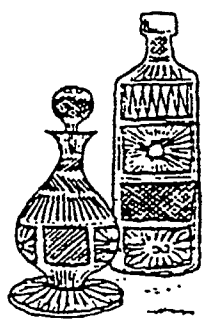
Meanwhile, Dr. Selikoff had continued to maintain a close watch on the insulation workers' health, paying particular attention to those men with more than twenty years' experience, whom he examined once or twice a year. He was thus able to detect symptoms of illness in many [illegible] men

much earlier than they might have been detected otherwise, and to observe with great accuracy the mortality experience of the three hundred and seventy men whom he had found in 1963 to be survivors of the original six hundred and thirty-two members of the union in 1942. The death rate continued to be disastrous. Between January of 1963 and March of 1968, sixty deaths would normally have been expected to occur among these men. Instead, there were a hundred and thirteen. Fifteen were caused by asbestosis, and, as with the earlier study, the rest of the excess turned out to have been caused by cancer of various kinds. Two or three bronchogenic cancers would have been normal, but twenty-eight occurred, and, where the actuarial tables predicted only two gastro-intestinal cancers, there were eight. In addition, a sharp rise in the number of mesotheliomas was observed. In the earlier study, in which none had been expected, there had been four in two hundred and fifty-five deaths; between 1963 and 1968, thirteen of these rare tumors were found in a hundred and thirteen deaths.

In the spring of 1969, Dr. Selikoff presented these findings to the International Conference on Pneumoconiosis, Johannesburg, South Africa, which was attended by dozens of scientists from all over the world—among them Dr. Brown, the chief of the Bureau of Occupational Safety and Health, who had been designated a vice-president of the conference, and Dr. Cralley, who had become director of the Bureau's Division of Epidemiology and Special Services. By this time, Dr. Selikoff and other scientists had developed reliable data to show that the insulation workers whose disastrous mortality experience he had documented had developed asbestosis or cancer by working in areas of asbestos dust whose levels were considerably below the twelve-fibre standard proposed by the American Conference of Governmental Industrial Hygienists. Armed with this data, Dr. Selikoff recommended to the Bureau of Occupational Safety and Health in October of 1969 that an interim level for asbestos be set at two fibres per cubic centimetre—a standard that had also been recommended by the British Occupational Hygiene Society, and had been adopted by Her Majesty's Inspectorate of Factories. Dr. Selikoff pointed out that such a standard was intended only for the prevention of asbestosis, and not of cancer, which might well be associated with exposure levels below those resulting in asbestosis. By way of emphasizing this possibility, he pointed out that among the insulation workers there were as many excess deaths resulting from mesothelioma as from asbestosis, and twice as many excess deaths resulting from lung cancer. In spite of the alarming data supporting Dr. Selikoff's recommendation for a lower level, the bureau's asbestos experts appear to have been unconvinced that such action was necessary. A year later, when the bureau finally got around to proposing a standard for asbestos, it settled upon the twelve-fibre standard. As usual, the Bureau of Occupational Safety and Health was lagging far behind, for by this time—the autumn of 1970—the Conference of Hygienists had proposed lowering the level for asbestos to five fibres.

To more fully comprehend the absurdity of such proposals and recommendations, one should know that there are always many fibres smaller than five microns in length in any amount of air containing asbestos dust. In fact, most experts in the field readily acknowledge that there may be hundreds, if not thousands, of these smaller fibres, or fibrils—tinier particles into which asbestos fibres readily fragment—simultaneously present for each one longer than five microns. (Indeed, if it were not for the electron microscope, the extent to which asbestos is fibrous would be difficult to believe, for approximately a million individual fibrils can lie side by side in a linear inch of chrysotile asbestos, whereas about four thousand glass fibres—such as those found in various insulation materials—or six hundred human hairs can be aligned along the same distance.) Little is known about the disease potential of fibres smaller than five microns in length; nor does anyone know how many asbestos fibres of any length must be inhaled in order to induce scarring of the lungs, cancer, and mesothelioma. Why, then, count only fibres longer than five microns—which, in effect, constitute only a tiny portion of the total? The reason is simply that the average industrial-hygiene laboratory is equipped with an ordinary phase-contrast optical microscope, capable of resolving only relatively large particles, whereas most particles smaller than five microns can often be seen only by electron microscopy, which is expensive and not readily available. Hence, even though recommended standards of two, five, or twelve fibres greater than five microns in length per cubic centimetre, or thimbleful, of air might actually reflect a hundred, or even a thousand, asbestos fibres per thimbleful, such

tandards have continually been justi-ed on the basis of economic feasibility, heer convenience, and wishful think-ng—in other words, in the hope that ounting only the larger particles would t t serve as an index for measuring e contamination of the air being udied. As for how these patently and dmittedly inaccurate counts of fibres er thimbleful can be translated in rms of the lungs of asbestos workers, should be pointed out that in a nor-al eight-hour working day a normal orker will breathe in and out about ight cubic metres of air. Since each ubic metre contains a million cubic entimetres, or a million thimblefuls, e worker is breathing in and out ight million thimblefuls of air each ay. Thus, an asbestos worker toiling an environment that is supposed to ontain, say, only two fibres greater an five microns in length per thim-eful of air can in fact be inhaling ywhere from eight hundred million eight billion asbestos fibres and fibrils all sizes each day. No one knows r sure how many of these inhaled rticles may subsequently be exhaled, t recent studies of the aerodynamics asbestos fibres suggest that as many fifty per cent of the fibres may well -ained in the lungs. Not that any-eds aerodynamic studies to prove at the lungs will retain vast numbers asbestos fibres. That has been proved eyond a doubt by Dr. Langer, of the Mount Sinai Environmental Sciences aboratory, who, using elec-on microscopy to analyze ng-tissue specimens in au-opsies of asbestos workers, as been able to calculate that many as a hundred thou-nd billion to a million bil-on asbestos fibres and fibrils ad accumulated over the ears in the lungs of some of em. However, even as late the autumn of 1970, no e in the Bureau of Occu-tional Safety and Health or, for that atter, in the independent medical com-unity (let alone in the boardrooms of e asbestos industry) was talking about e hazard in terms of human lungfuls literally billions upon billions of sbestos fibres. Everyone was talking out it, as almost everyone still is, the euphemistic terms of thimblefuls containing two, five, or, at the ry most, a dozen fibres. In this way d a few needles become the metaphor r indeed, the medically and scien-fically accepted definition of —a whole wstack.



At the end of 1970, however, an event occurred that showed some promise of overcoming the ignorance, laxity, and confusion that had so long enveloped the asbestos problem and other occupational-health problems. On December 29th, after two years of prodding from industrial unions, led by the United Steelworkers of America and the Industrial Union Department of the A.F.L.-C.I.O., Congress passed Public Law 91-596—the first comprehensive occupational-health legislation it had enacted since the Walsh-Healey Act of 1936. Known as the Occupational Safety and Health Act of 1970, Public Law 91-596 sought to "assure safe and healthful working conditions for working men and women," and under its terms the federal government was authorized to develop and set mandatory occupational-safety-and-health standards applicable to any business that engaged in interstate commerce. The Secretary of Labor was given the authority to promulgate improved standards, and to enforce them by conducting inspections of factories and other workplaces and by issuing citations and imposing penalties if the standards were violated. The Department of Health, Education, and Welfare was made responsible for developing criteria for the establishment of the safety and health standards, including regulations for dealing with toxic materials and harmful physical agents and for instituting education and training programs to produce an adequate supply of manpower to carry out the provisions of the Act. So that the department could perform these functions, the Act provided for a National Institute for Occupational Safety and Health, called NIOSH, which replaced the Bureau of Occupational Safety and Health, and which was also given authority to enter factories for inspections and investigations, but, since the Act did not go into effect until April 28, 1971, and since NIOSH did not begin its operations until June 30th of that year, little or nothing was done during the next few months to resolve the problem of industrial exposure to asbestos. This delay was disheartening to many trade-union people and to independent medical researchers, who had hoped for quick action on a new asbestos standard. However, the business-as-usual attitude that had characterized governmental policy toward the operations of the asbestos industry for so long was about to be shattered by a series of disclosures that, fittingly, would have their apotheosis in the revelation of the atrocious working conditions that had prevailed through the years at the Tyler plant.

THE new turn of events got started on May 20, 1971, when industrial hygienists from the Meadville office of the Pennsylvania Department of Environmental Resources sent Pittsburgh Corning a report on some recent inspections they had made at the company's insulation plant at Port Allegany, a small town in the northwestern part of the state. The Commonwealth of Pennsylvania had not yet adopted the standard of twelve fibres per cubic centimetre, so the hygienists who inspected the Port Allegany plant were using the long-outmoded standard of five million particles per cubic foot, which is roughly the equivalent of thirty fibres per cubic centimetre. Even though Pittsburgh Corning had installed some new ventilating equipment in the factory during the previous two years, the inspectors found that dust levels exceeded the old standard in five of twenty-five air samples. In one of the samples, the count was more than twenty-six million particles, which meant that there may have been approximately a hundred and fifty fibres per cubic centimetre of air in that location—five times the outdated standard. Such dust levels—and even higher ones—had, of course, been found and ignored in the Tyler plant for years, and the management of Pittsburgh Corning may well have come to expect this process to be repeated elsewhere. The Pennsylvania inspectors, however, gave the company sixty days to improve the ventilation system and institute better housekeeping practices to reduce dust levels at the factory.

While Pittsburgh Corning's managers were mulling over this unexpected situation, some personnel changes were taking place at NIOSH that would soon cause them additional problems. Having reached retirement age, Dr. Cralley was about to leave the Division of Epidemiology and Special Services, which was being reorganized into the Division of Field Studies and Clinical Investigations. A number of positions in the new division had opened up, among them that of chief medical officer, and it was filled on July 1st, with the appointment of a thirty-year-old doctor named William M. Johnson. A native of Olean, New York, Dr. Johnson was brought up in Saranac Lake, graduated from the Stanford University School of Medicine in 1968, interned at the [illegible]

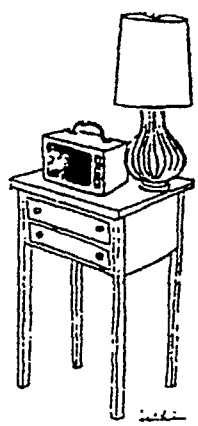
York at Buffalo, and had just completed a two-year training program in occupational health at the Harvard School of Public Health. He had decided to fulfill his military obligation by putting in a two-year stint with the United States Public Health Service, and, as things turned out, it did not take him long to become immersed in his job there. Within a few days of Dr. Johnson's arrival at the NIOSH offices in Cincinnati, one of the engineers who had been conducting field studies under Dr. Cralley told him about the environmental surveys of asbestos factories that had been in the files for several years. "That engineer was particularly concerned about the situation at the Tyler plant," Dr. Johnson has recalled. "And when I started digging through the files myself, I realized he had good reason to be, for it was plain as day that there was an incredibly serious health problem down there. At that point, I went to Dr. Cralley and asked him whom I should see about the situation. He suggested that I get in touch with Dr. Grant, Pittsburgh Corning's medical consultant. However, when I called Dr. Grant, on July 13th, he told me there really wasn't much of a health problem at the Tyler plant, because the place was so dusty that people didn't stay around there long enough to get sick. He also told me that there were no plans to improve the factory's ventilation system, and that the company planned to convert from asbestos to mineral wool in the near future."

Since Dr. Johnson had received considerable instruction at Harvard in the effects of asbestos exposure, he was less than reassured by his conversation with Dr. Grant. During the next two weeks, he gathered as much information as he could about conditions at Tyler and Port Allegany; then he discussed the situation thoroughly with Dr. Joseph K. Wagoner, who had arrived at NIOSH on August 1st to replace Dr. Cralley as director of the new Division of Field Studies and Clinical Investigations. Dr. Wagoner had received his Doctor of Science degree in epidemiology and biostatistics from the Harvard School of Public Health in 1970, and had spent ten years as an epidemiologist with the Public Health Service's National Cancer Institute, where he was instrumental in the long struggle to develop and institute standards for the protection of uranium miners, who were occupationally exposed to radioactive dust. He was as seriously disturbed about the potential health hazard at Tyler as Dr. Johnson was, and together the two men decided to make it and other asbestos-products factories their first order of business.

In the meantime, pressed by the deadline given by the Pennsylvania state inspectors for cleaning up the Port Allegany plant, and aware of Dr. Johnson's concern about conditions at the Tyler factory, Pittsburgh Corning made a move to head off some of the pressures that were building up against its asbestos operations. On August 3rd, the company filed an application for a variance from occupational-safety-and-health standards with the Assistant Secretary for Occupational Safety and Health of the Department of Labor, in Washington. Under the terms of the Occupational Safety and Health Act of 1970, the Secretary of Labor could grant a variance to an employer if he determined that the employer "has demonstrated by a preponderance of the evidence that the conditions, practices, means, methods, operations, or processes used or proposed to be used by an employer will provide employment and places of employment to his employees which are as safe and healthful as those which would prevail if he complied with the standard." Pittsburgh Corning's application for a variance was signed and submitted by E. W. Holman, the vice-president in charge of manufacturing and technology—who told the Tyler *Courier-Times* that he knew of no specific Pittsburgh Corning employee suffering from significant illness as a result of working with asbestos. In the application, Holman stated that the threshold limit value for asbestos was exceeded in some areas of the company's Tyler and Port Allegany plants, that the company had been unable to comply with the required standard because of the unavailability of effective ventilation equipment, and that the ineffectiveness of the available equipment had become particularly significant since the reduction of the standard for asbestos from twelve fibres per cubic centimetre to five. The fact that such a reduction in the official standard had not taken place but had only been published as a proposed change by the Conference of Hygienists suggests that Pittsburgh Corning's managers either were afflicted with a bad case of nerves or were trying to obscure the fact that neither factory was in compliance even with the obsolete standard of five million particles per cubic foot, let alone the twelve-fibre standard itself.

The application for a variance went on to say that as of June, 1971, the company had spent nearly two hundred thousand dollars for [illegible] and

development of a mineral-wool substitute for asbestos, that it would begin to use mineral wool in some of its operations in August, and that it hoped to make a complete conversion to mineral wool at the Port Allegany and Tyler plants by the middle of 1972. As for the steps the company had taken to provide working conditions as safe and healthful as those which would prevail if the government standard for asbestos had been complied with, Holman stated that Pittsburgh Corning had supplied approved respirators and had required workers to use them; that it had also purchased and was experimenting with new respirators; that it had provided dust-collection and ventilation apparatus; that it had expanded its program of periodic medical examinations; that it had improved housekeeping procedures by the more frequent use of vacuum cleaners; and that it had "provided and will continue to provide health education programs that fully explain to its employees the health hazards associated with asbestos exposure and how they can protect themselves." In a sworn affidavit attached to the application for a variance, Dr. Grant stated that he had knowledge of the matters set forth in the application "so far as said application states that the applicant has provided for its employees health education programs that explain to said employees the health hazards associated with asbestos exposure and how they can protect themselves."



Back at the Division of Field Studies and Clinical Investigations, in Cincinnati, several weeks were to pass before Dr. Johnson and Dr. Wagoner would learn of Pittsburgh Corning's application for a variance. Meanwhile, on August 9th, Dr. Johnson called Horace Adrian, chief of the industrial-hygiene program of the Texas State Department of Health, in Austin, and told him of the extraordinarily high dust levels that had been found in the Tyler plant. Adrian told Dr. Johnson that he had never seen copies of any inspection of the Tyler plant—indeed, he gave Dr. Johnson the impression that he did not know the factory existed—and he would look into the situation as quickly as possible. A week later, Adrian informed Dr. Johnson that he was going to Tyler the next day, August 17th, to conduct a walk-through survey of the factory and to meet Dr. Grant, who also planned to be there. (As it turned out, the purpose of Dr. Grant's visit to Tyler on August 17th was to give the workers there an educational talk on the health hazards of asbestos exposure, which Pittsburgh Corning had already claimed to have done in its application for a variance, filed two weeks before.) On August 24th, Dr. Johnson telephoned Dr. Grant, in Pittsburgh, to tell him that the Division of Field Studies and Clinical Investigations wanted to examine the workers at the Tyler plant. Dr. Grant replied that Dr. Hurst, of the East Texas Chest Hospital, had just finished giving the Tyler workers medical examinations, including X-rays and pulmonary-function tests, and he suggested that NIOSH might wish to defer its study of the men until the results of Dr. Hurst's tests could be made available.

In the light of this development, Dr. Johnson and Dr. Wagoner decided to hold off for the time being on their examination of the Tyler workers, and to conduct a medical survey of the men in the Port Allegany plant. (At that point, they had no idea that almost five years before Dr. Hurst had outlined a proposed—and rejected—medical study of the Tyler workers for Pittsburgh Corning.) On September 7th, in order to make arrangements for the survey of the Port Allegany workers, Dr. Johnson went to the plant, where he met Dr. Grant for the first time, and heard him give a talk to the workers on the health hazards associated with asbestos. According to Dr. Johnson, Dr. Grant indicated in his talk that the levels of asbestos dust at Port Allegany were not high enough to be considered dangerous to health. Dr. Grant also claimed that the dust levels were considerably lower than the ones that the insulation workers studied by Dr. Selikoff had been exposed to. (Actually, Dr. Selikoff had demonstrated that the insulation workers were exposed to levels of asbestos dust far below the twelve-fibre standard.) In addition, Dr. Grant implied that cigarette smoking was an important factor in the development of asbestosis, although such few data as are available indicate a very limited effect of cigarette smoking on lung scarring. (Dr. Grant may have misinterpreted some studies conducted by Dr. Selikoff and Dr. Hammond, which showed that asbestos workers who smoke cigarettes run eight times the risk of dying of lung cancer as cigarette smokers in general, and ninety-two times the risk of men who neither work with asbestos nor smoke.) But what Dr. Johnson found most disturbing of all was Dr. Grant's assertion that, in addition to smoking cigarettes, a man would have to undergo from twenty to thirty years of exposure to asbestos before experiencing any adverse effects. Later that day, Dr. Johnson made a point of telling Dr. Grant, in the presence of union officials, that radiological evidence of pulmonary fibrosis had been found in men with less than ten years' exposure, and that there was strong medical evidence to support the belief that lung cancer and mesothelioma could occur at exposure levels far below those that could cause asbestosis. This encounter with Dr. Grant seems to have marked a turning point in Dr. Johnson's dealings with Pittsburgh Corning, for, he has explained, "I came away from it feeling that Dr. Grant had grossly minimized the hazard of working with asbestos, and I assumed that he had probably done the same thing at Tyler on August 17th." Dr. Johnson's mistrust of the company's intentions was heightened a few days after this, when he discovered that Pittsburgh Corning had filed the application for a variance with the Occupational Safety and Health Administration; he believed the application to be not only self-serving but downright false in its claim that the company had undertaken to inform its employees adequately about the hazards of working with asbestos.

In addition, Dr. Johnson and Dr. Wagoner had other reasons to fear that no immediate action would be taken to reduce the health hazard at Tyler and Port Allegany. In the middle of August, they had prepared a memorandum expressing their concern about conditions at the two plants (it also included data from Dr. Cralley's files about excess mortality among workers in several large asbestos-textile factories) and sent it to Dr. Marcus M. Key, the director of NIOSH, which had set up its headquarters in Rockville, Maryland. During August and September, as it happened, there were huge internal problems at NIOSH headquarters about how the institute should carry out its role under the Occupational Safety and Health Act and how it should coördinate its activities with those of the Department of Labor's Occupational Safety and Health Administration, which had been given responsibility for enforcing health standards under the Act. An administrative crisis ensued, with the result

uld give Dr. Johnson or Dr. Wagner any assurance that something ould be done to alleviate the conditions at the Tyler and Port Allegany

Feeling increasingly frustrated, . Johnson and Dr. Wagoner decided after the encounter with Dr. Grant at the situation was serious enough warrant their taking matters into eir own hands. The following week, Dr. Johnson telephoned Steven Wodka, the legislative aide for the Oil, Chemical, and Atomic Workers International Union, and told him about e environmental studies of dust levels the factory which he had found ried in the files. (The two men had et previously to discuss the problem workers exposed to beryllium at e Kawecki Berylco Industries plant, Hazleton, Pennsylvania, where, as in e case of Tyler, the Bureau of Occutional Safety and Health had gathed data about health hazards associed with a substance that the workers ere exposed to but had for a number years neglected to inform the workrs of the dangers involved.) Upon arning of the situation at Tyler, Vodka immediately sent Dr. Johnson letter requesting that he make the vironmental data available, and, on ber 24th, Dr. Johnson sent em off to the union's Legislative Dertment, in Washington, D.C.

When Wodka discussed the Tyler uation with his boss, Anthony Mazcchi, the director of the Legislative epartment, Mazzocchi remembered r. Selikoff's telling him about a study at he, Dr. Hammond, and Dr. hurg were conducting of the morlity experience of the men who had en employed at the Paterson plant. lazzocchi quickly got in touch with r. Selikoff, who, as it turned out, had mpleted the first part of the study a ek or two before, and was about to esent his data at the Fourth Internanal Pneumoconiosis Conference of e International Labor Office, in charest, on September 29th. When lazzocchi told him about the environental data on the Tyler plant that r. Johnson was making available to e union, Dr. Selikoff sent Mazzocchi e results of his study of the Paterrn workers. They were as alarming the mortality data on the asbestos rs. Of three hundred and thirve men who had been employed the Paterson factory for a year or re between 1941 and 1945, eighty-ght had died by December 31, 1959, d fifteen could not be traced. Howr, Dr. Selikoff, Dr. Hammond, and r associates had managed to trace every one of the remaining two hundred and thirty men who were alive on January 1, 1960, and had studied their experience up to June 30, 1971. Using the standard mortality tables, Dr. Hammond calculated that no more than forty-seven deaths would normally have been expected to occur among these men during that eleven-and-one-half-year period. Instead, there were a hundred and five. Fourteen of the deaths were caused by asbestosis, and, as with the insulation workers, a large majority of the excess deaths were caused by cancer. Two or three lung cancers would have been normal, but twenty-five occurred, and deaths from cancer of the stomach, the colon, and the rectum were three times what the standard mortality tables predicted. In addition, although none would normally have been expected, there were five deaths from mesothelioma.

Mazzocchi and Wodka were profoundly disturbed at the results of the Paterson study, for they could only conclude that the similarity of operations in the two factories meant that much the same thing would happen to the men at Tyler. Meanwhile, as they were trying to decide what to do, Pittsburgh Corning was informed by the Department of Labor that no action would be taken on its application for a variance from occupational-safety-and-health standards until after a public hearing, and that no hearing could be held until the spring of 1972. Since this meant that the company would be forced to comply with existing health standards until then, and since the company had failed to prove that mineral wool could be successfully substituted for asbestos in high-temperature pipe covering, the Pittsburgh Corning people found themselves in a bind. In the early part of October, therefore, they told representatives of Local 4-202, in Tyler, with whom they were negotiating a new contract, that they might have to shut the plant, but said that they wished to consider the local union's proposals on wages, health, and safety before making a final decision. When Mazzocchi and Wodka learned of the company's action, they suspected that Pittsburgh Corning was using the threat of a shutdown to force the local union to minimize its demands for improved working conditions at the Tyler plant. After consulting with representatives of Local 4-202, the two men determined that a strict-compliance program should become part of the union's contract proposal on safety and health. They then submitted a formal request to Dr. Johnson at NIOSH on October 7, 1971, for a comprehensive industrial-hygiene study of the Tyler factory and a medical survey of the men who were working there. Upon receiving this request, Dr. Johnson made the necessary arrangements with Pittsburgh Corning and with the Texas State Department of Health, which had previously offered to cooperate, and a survey of the plant was scheduled for the last week of the month.

AS things turned out, the NIOSH inspection of the Tyler plant coincided with a crescendo of protest that had been building up for many months over the plight of tens of thousands of workers throughout the country who were being exposed to excessive concentrations of asbestos dust. On August 3rd—the day Pittsburgh Corning filed its application for a variance—Dr. Selikoff wrote to James D. Hodgson, the Secretary of Labor, making carbon copies for leading officials of six labor unions whose members worked with asbestos, and for Dr. Key, at NIOSH. His letter said:

DEAR MR. HODGSON:

Your department has published initial standards in the Federal Register, in accordance with the Occupational Safety and Health Act of 1970. I understand that these are "initial" and that modifications may be expected as a result of research criteria being developed by the National Institute for Occupational Safety and Health.

One "standard" in the published list is so wrong, and represents such serious hazard to workmen, that I advise its urgent revision.

I refer to the standard for asbestos, which would allow workmen to be exposed to environments containing as many as twelve fibres per cubic centimeter of air. Our research in one asbestos trade—insulation work—demonstrates that work in the past in areas with levels of two to three fibres per cubic centimeter of air has resulted in a very great increase of death due to cancer and to asbestosis. Just how serious this has been may be appreciated from current statistics: at present, one in every five deaths among insulation workers is due to lung cancer, one in ten to cancer of the pleura or peritoneum, one in ten to scarred lungs or asbestosis.

The proposed level is much higher than actually *now* exists. It is so high as to make totally ineffective current efforts by both industry and labor to control this unhappy occupational health hazard.

In Great Britain, the approved level is *less than* one-fifth the standard here proposed and levels of twelve fibres per cubic centimeter for more than even ten minutes would be sufficient to require that the workman wear protective clothing and use an efficient respirator.

Mr. Albert E. Hutchinson, President of the International Association of Heat and Frost Insulators and Asbestos Workers, AFL-CIO, has calculated that there are

approximately one hundred thousand men employed doing asbestos insulation work in the United States, in various unions and in various industries. Utilizing statistical calculations by Dr. E. Cuyler Hammond, director of the Department of Statistics of the American Cancer Society, it may be predicted that, if the situation remains the same and does not improve, there will be more than seventeen thousand excess deaths of lung cancer among these men, as well as almost ten thousand unnecessary deaths of cancer of the pleura or peritoneum, ten thousand wholly preventable deaths of asbestosis, and many thousand other cancer deaths, in this one trade alone. Thousands of deaths will occur in other industries, to add to the unhappy toll of this serious error.

I urge you, then, to recall this standard, and substitute one that will help protect workingmen forced to work with this dangerous material.

Although Dr. Selikoff's letter did not engender any immediate response from Secretary Hodgson, it did evoke profound concern among the union officials to whom he sent carbon copies. When Dr. Selikoff returned to New York from Bucharest, Sheldon W. Samuels, the Director of Occupational Health, Safety, and Environmental Affairs for the A.F.L.-C.I.O.'s Industrial Union Department, invited him to attend a meeting of the I.U.D.'s ad-hoc Committee on the Asbestos Hazard, in Washington, on October 18th, so that he might present additional information, which the union people hoped would enable them to get some effective action from the Department of Labor on the problem of occupational exposure to asbestos. Meanwhile, having discovered additional reports in the old Bureau of Occupational Safety and Health files which showed excessive dust counts in a dozen more asbestos factories (there was also an incomplete study of mortality among employees of those factories, which showed an extraordinary number of deaths resulting from asbestosis among men in their forties and fifties), Dr. Johnson and Dr. Wagoner continued to express concern about the asbestos problem to their superiors at NIOSH, who they hoped would take a firm stand in advising the Secretary of Labor to promulgate a tough emergency standard for asbestos. On October 4th, feeling that the situation was getting out of hand, Dr. Johnson and Dr. Wagoner visited Dr. Selikoff in New York to exchange information about the asbestos problem in general and, in particular, about Johns-Manville's asbestos-textile factory in Manville, New Jersey, where that corporation has owned and operated the largest complex of asbestos-products factories in the world for more than fifty years. Dr. Cralley's files had yielded up several environmental studies showing that excessive dust levels had existed in the Manville asbestos-textile factory at least since 1965, when the first study was made; a 1969 medical survey showing findings consistent with asbestosis in thirty-one of a hundred and seventy-nine chest X-rays of the factory employees; and an incomplete mortality study showing, on preliminary analysis, four deaths from mesothelioma and at least ten other asbestos-related deaths among a hundred and eighty asbestos-textile workers. Indeed, the situation at Manville appeared to be similar to the one at Tyler, and on a larger scale. In 1967, engineers from Dr. Cralley's office—now the Department of Field Studies and Epidemiology—had taken air samples that were not analyzed for asbestos fibres until September of 1971, when Dr. Johnson discovered the data in the files. That September, too, Dr. Johnson had fibre counts completed on over a hundred air samples that engineers from Dr. Cralley's division had taken at the Manville asbestos-textile plant during the spring of 1971. The fibre counts showed that even then there were as many as twenty fibres per cubic centimetre of air in some operations of the plant.

Dr. Johnson and Dr. Wagoner believed these data to demonstrate a serious and persistent health hazard at the Johns-Manville factory, and they were anxious to know if Dr. Selikoff could give them any additional information, particularly with regard to other cases of mesothelioma that might have occurred in Manville. As it happened, Local 800 of the United Papermakers and Paperworkers Union, which represented the company's production workers, had provided Dr. Selikoff with a roster of its membership several months before, and he, Dr. Hammond, and one of their associates at Mount Sinai, Dr. William J. Nicholson, had just begun a mortality study of the Johns-Manville employees, so Dr. Selikoff was able to give his visitors details on about a dozen deaths among the workers which had been caused by mesothelioma.

On October 5th, Dr. Johnson and Dr. Wagoner went to Trenton, where they met with the commissioner of the New Jersey Department of Labor and Industry and the deputy commissioner of the state's Department of Health, and told them of the health hazard that they believed to exist at the Johns-Manville plant. When they asked these officials to investigate the situation,

however, they learned that the state considered it to be a federal problem and, in any case, did not possess modern fibre-counting equipment for such a task. The following day, the two men took the data they had compiled at the John-Manville textile factory to the New York Regional Office of the Occupational Safety and Health Administration, in New York City, only to discover that the people there did not possess adequate fibre-counting equipment, or even know how to use such equipment properly. With that, they flew back to Cincinnati and got in touch with officials of the United Papermakers and Paperworkers Union. A few weeks later, they learned something from the union people that the commissioner of the New Jersey Department of Labor and Industry had known for more than a year—that in 1969 alone the Johns-Manville Corporation had paid out $887,341 in workmen's compensation to two hundred and eighty-five employees of the Manville plant who had become disabled with asbestosis.

At his meeting with union leaders in Washington on October 18th, Dr. Selikoff documented his contention that the Department of Labor should establish a standard for occupational exposure to asbestos to replace the current twelve-fibre standard. At the same time, he stressed the fact that any standard for asbestos exposure could be concerned only with the prevention of pulmonary fibrosis, and that little was known as to how low a standard might have to be in order to prevent asbestos-related cancer, which had accounted for fully three-quarters of the excess deaths among the insulation workers.

On November 4, 1971, the Industrial Union Department transmitted through George Taylor, the executive secretary of the A.F.L.-C.I.O.'s standing committee on safety and occupational health, a letter urgently requesting Secretary Hodgson to use the powers granted him by the Occupational Safety and Health Act of 1970 to declare an emergency standard governing the industrial use of asbestos. The letter declared that the existing twelve-fibre standard constituted "a license to jeopardize without effective restraint the lives of millions of workers," and urged the Secretary to declare an emergency standard of two fibres per cubic centimetre and to issue a bulletin prescribing that an appropriate label be affixed to each container of asbestos and asbestos products warning workers of danger. In addition, the letter asked the Secretary to get in touch with the administrator of the Environmental Protection Agency "to enable him to investigate the necessity for invoking the imminent-danger provisions of the Clean Air Act, as amended in 1970, to protect our families and communities from the effects of ambient asbestos that escapes from the workplace."

As might be supposed, the Industrial Union Department's letter placed considerable pressure upon Secretary Hodgson to take some kind of action. When he did so, however, on December 7th, he declared an emergency standard for asbestos of five fibres longer than five microns per cubic centimetre of air. This, of course, was an emergency standard only in the eyes of the Department of Labor, since it was two and a half times as great as the standard requested by the Industrial Union Department, and since the Conference of Hygienists had already published it as a proposed change. It is not known what, if any, medical data prompted the Secretary of Labor to select the five-fibre standard, or why he chose to disregard the data indicating that asbestos disease could occur at this level of exposure. Perhaps he was seeking a middle ground that he hoped would be satisfactory both to industry and to the union people. If so, he was neglecting the responsibility placed upon him by the Occupational Safety and Health Act for promulgating standards that, even if they entailed conflict, would assure "the greatest protection of the safety or health of the affected employees." In any case, it is a pity that he was not aware of the NIOSH report on Pittsburgh Corning's Tyler plant, which was then slowly making its way through the bureaucratic labyrinth, for the story of the plant constituted incontrovertible evidence of the sorry tangle of ignorance, laxity, and lack of communication that had from the very beginning characterized government policy toward occupational exposure to asbestos. The story of Tyler also made a mockery of one of the basic assumptions behind this policy: that the government could and would force industry to abide by a numerical fibre standard, and, by so doing, could insure healthful working conditions in asbestos factories.

THE NIOSH inspection, which was conducted between October 26th and October 29th, included an industrial-hygiene survey, carried out by engineers from NIOSH's Division of Technical Services, and a medical survey, performed by a three-man team from the Division of Field Studies and Clinical Investigations. The medical team was headed by Dr. Johnson, who has a vivid memory of his first look at the Tyler plant. "Two carloads of us drove in from Dallas late on the afternoon of the twenty-sixth," he recalls. "The factory was situated in an industrial district on the outskirts of town, and it consisted of a pair of wood-shell buildings, each of which was about a thousand feet long, fifty feet wide, and thirty feet high. When we arrived, we were met in the front office by Mr. Charles E. Van Horne, the plant manager, and since it was late in the day, there was just time for a quick preliminary walk-through. The place was an unholy mess. Why, compared with it, the Port Allegany plant looked like a hospital operating room! A thick layer of dust coated everything—from floors, ceilings, and rafters to drinking fountains. As we walked through the interior, we saw men forking asbestos fibre into a feeding machine as if it were hay. They obviously had no idea of the hazard involved. Farther down the line, we came upon some fellows with respirators hanging around their necks, who were sitting in an open doorway eating watermelon. I hate to think of the fibre counts on those slices of watermelon. I remember turning to Dr. Richard Spiegel, one of my assistants, 'This is intolerable,' I told him. He was as shocked as I was."

It did not take Dr. Johnson and his associates from NIOSH long to realize that at virtually every stage of the manufacturing process enormous quantities of asbestos dust were being spewed out into the factory. In addition to poor housekeeping procedures, the chief cause was a grossly inadequate ventilation system. Other aspects of the plant's operation were found to be equally hazardous. The scrap-grinding machine, where refuse from various operations was made reusable, was extremely dusty and lacked sufficient ventilation equipment, and a fan near the feed hoppers simply contributed turbulence that redispersed dust into the working envi-

ironment. Moreover, both the scrap grinder and the feeding machines relied on a dust-collection system that consisted of canvas bags inside the plant, beneath the roof. These bags were periodically emptied by mechanical shaker, and when this happened huge amounts of asbestos dust were released into the air; then, after it had settled, instead of being vacuumed the dust was swept into piles with push brooms. The ventilation equipment on the saws in the finishing department was also found to be inadequate; excessive amounts of asbestos dust were escaping into the air there as well.

Because of Pittsburgh Corning's application for a variance, the NIOSH inspectors learned, the wearing of respirators had been mandatory in all areas of the plant since August. However, instead of being used for emergency or backup protection, as industrial-hygiene standards prescribed, the respirators were obviously being employed in the Tyler plant as substitutes for an adequate dust-control system and for proper housekeeping. Nor did the company have any adequate program for selecting, fitting, cleaning, and maintaining the respirators worn by its employees, and many of the men were wearing them improperly. In addition to noting these hazards, the inspectors saw that the factory's lunchroom was within fifty feet of one of the dustiest operations in the plant, and that workers were allowed to enter it wearing clothes that were contaminated with asbestos. The NIOSH men also discovered that compressed-air outlets throughout the plant were being used to blow excess dust off the employees—a practice that simply reintroduced asbestos fibres into the working environment.

As a result of these multiple deficiencies in the ventilation system and in the operating procedures of the Tyler plant, Dr. Johnson and his associates were not surprised to find that, of a hundred and thirty-eight air samples taken at different locations in the factory, a hundred and seventeen exceeded the recommended five-fibre standard. (Of course, even if the Tyler plant *had* observed that standard, workers not wearing respirators would still have been inhaling at least forty million asbestos fibres in an eight-hour working day.) What astonished them, however, was how *much* the levels exceeded the recommended standard, at almost every step in the manufacturing process. In the mixing department, where the feed hoppers and the scrap grinder were situated, the maximum concentration was a hundred and eighty-nine fibres per cubic centimetre of air, and the average was seventy-five. In the forming department, where the material was rolled on mandrels, the maximum concentration was a hundred and thirty-four fibres per cubic centimetre, and the average was thirty-nine. In the finishing department, where pipe covering was trimmed and sawed, the maximum concentration was two hundred and eight fibres per cubic centimetre—an approximation, for the air sample was actually too dusty to permit an exact count under a microscope—and the average was forty-one. Even in the inspection and packing department, where the finished product was weighed, boxed, and shipped, the maximum concentration was ninety-two fibres per cubic centimetre, and the average was twenty-three—nearly double the interim standard of the Department of Labor, nearly five times the standard recommended by the hygienists, and ten times the level of exposure that Dr. Selikoff and other epidemiologists had found to be responsible for the extraordinary number of excess deaths among the insulation workers. But the true intensity of the exposure of the Tyler workers can only be appreciated when one recognizes that such concentrations of long asbestos fibres per thimbleful of air really meant that, before they were required to wear respirators in August, some of these men were inhaling up to a billion of the longer fibres each working day, and many more of the shorter ones, which were not being counted by the engineers.

Since asbestos-induced cancers generally take at least twenty years to develop, and the Tyler plant had been in operation for only seventeen years, Dr. Johnson and his associates did not yet expect to find neoplasms among the sixty-three men working there. However, in order to complement the X-rays and pulmonary-function tests that had been performed in August by Dr. Hurst, they examined the employees for rales—crackling sounds in the chest which can occur with asbestosis—and for finger clubbing, a thickening of tissue at the fingertips which often occurs with asbestosis. After comparing notes with Dr. Hurst, they determined—even without the benefit of the X-rays, which they were not allowed to see—that seven of the eighteen workers with more than ten years of employment at the factory met at least three of four criteria for asbestosis. These criteria included, besides rales and finger clubbing, dyspnea, which is shortness of breath, and marked reduction in forced vital capacity, which is an inability to take sufficient air into the lungs because of pulmonary fibrosis. Reduced pulmonary function was also observed in some workers who had been employed at the plant for less than five years. Because of these findings, Dr. Johnson and his associates concluded that the health of the sixty-three employees at the Tyler plant had been gravely jeopardized, but they wished to have the X-rays reviewed by an expert panel of radiologists before making a definitive diagnosis of asbestosis on an individual basis. As things turned out, however, they were seeing only the tip of the iceberg, for when they got around to examining the company's employment records they discovered that a total of eight hundred and ninety-five men had worked in the plant at one time or another. Considering the disastrous mortality figures of the men who had worked at the Paterson factory between 1941 and 1945, this was disturbing news, to say the least. It also provided a chilling corollary to Dr. Johnson's first conversation with Dr. Grant, back in July, when Dr. Grant had suggested that there wasn't much of a health problem at the Tyler plant, because people didn't work there long enough to get sick.

The preliminary report of the NIOSH survey, declaring that an extremely serious occupational-health situation existed at the Tyler plant, was sent, on November 16th, to Dr. James E. Peavy, the commissioner of the Texas State Department of Health, and copies went to a number of other officials, including Dr. Key, Dr. Grant, Van Horne, and John K. Barto, the regional administrator for the Occupational Safety and Health Administration, in Dallas. Barto received the report on November 18th, and acted quickly on it, for he was aware that industrial hygienists from the Department of Labor's Dallas office had inspected the Tyler plant nearly three years before, and, even though they had found an inadequate ventilation system and faulty respiratory protection, had not taken any effective action to remedy the situation, or even reinspected the factory to see whether Pittsburgh Corning had corrected the defects. On November 23rd, Barto sent his assistant, Clarence E. Holder, and John P. Beck, an industrial hygienist, to conduct still another inspection of the Tyler plant. As might be expected, their findings simply substantiated those of the survey conducted by NIOSH. On December 1st, Holder and Beck informed Van Horne of violations of occupational-safety-and-health regulations found in the

plant included not only improper wearing of respirators but failure to examine workers to determine whether they had the physical capacity for wearing respirators, inadequate housekeeping, and insufficient dust control. They also told the plant manager that citations would be issued and penalties imposed, and that the violations would require immediate corrective action—except extensive improvements in ventilation and dust equipment, for which a later date would be set. Holder and Boyle then returned to Dallas, where in the next two weeks, as they awaited analysis of air samples they had taken, they wrote up a lengthy report of their inspection, which was sent to Holman, the corporation's vice-president in charge of manufacturing and technology, at Pittsburgh Corning's home office, on December 16th. In the meantime, Secretary Hodgson had declared the emergency five-fibre standard for asbestos, but since the inspectors for the Occupational Safety and Health Administration had surveyed the factory under the twelve-fibre standard published in the *Federal Register* of May 29th, they decided it would be unjust to apply the new regulation *ex post facto* to the situation at Tyler. As things turned out, their sense of fair play made little difference, for the obsolete twelve-fibre standard was exceeded—in some instances, ten times over—in forty-two of the forty-four air samples they had taken at the plant. Even so, the Occupational Safety and Health people failed to cite Pittsburgh Corning for violating any fibre standard, or even to list, in the citation for insufficient dust control, the specific dust levels they had found. Moreover, although their *Compliance Operations Manual* clearly compelled them to follow Section 17 (k) of the Occupational Safety and Health Act, which states that "a serious violation shall be deemed to exist in a place of employment if there is a substantial probability that death or serious physical harm could result from a condition which exists . . . unless the employer did not, and could not with the exercise of reasonable diligence, know of the presence of the violation," the inspectors listed the conditions they had discovered at the Tyler plant not under the heading of "Serious Violations" but under the heading of "Nonserious (Other) Violations," which, according to their manual, applied to situations "where an incident or occupational illness resulting from violation of a standard would probably not cause death or serious physical harm." If the violations had been considered serious, the Administration could have assessed Pittsburgh Corning as much as a thousand dollars for each one. For nonserious violations, the Occupational Safety and Health Administration could have assessed a penalty of anywhere from a thousand dollars each to no penalty at all, depending upon the inspector's judgment of "the severity of the injury or disease most likely to result." Given this latitude, the Administration people undertook to grant Pittsburgh Corning the benefit of every doubt. For three violations—improper wearing of respirators, failure to examine the workers to see if they could wear respirators, and inadequate housekeeping—they proposed a fine of twenty-five dollars each. For insufficient dust control, they proposed a fine of a hundred and thirty-five dollars. The total came to two hundred and ten dollars. —PAUL BRODEUR

(This is the first of a series of articles.)