Asbestos health question perplexes experts

When asked to comment on research directions before an international conference on the biological effects of ingested asbestos in Durham, N.C., last month, Dr. Paul F. Holt of Reading University, England, summed up the feeling of the whole conference in his response. The main question to be investigated, he said, is: Does asbestos matter, or doesn't it?

Coming after more than 40 years of published research on the biological effects of asbestos—research that has been greatly intensified over the past 10 years in the U.S. and abroad—this seems a very preliminary question to still be under investigation. Nevertheless, although asbestos is known to cause severe lung damage and to raise the likelihood of certain cancers developing following heavy exposures, the effect of smaller doses on the general population isn't at all clear.

It seems very farfetched that asbestos could be dangerous, Dr. Holt says, but if it is, then everyone is in very serious trouble. And indeed they would be. It seems likely that asbestos occurs naturally in much of the drinking water in the U.S. Environmental exposure to it is increased by filtration of certain beverages and pharmaceuticals through asbestos filters. Used extensively in construction for its fireproofing qualities, asbestos contaminates the air in most office buildings and stores. An examination of lung sections of people living and working in New York City has shown some fibers in the lungs of every person examined. Similar results probably could be found in any other urban area in the nation.

Clearly, there is a need to determine whether this constant and widespread exposure is hazardous. To help evaluate the danger associated with asbestos exposure as it is now understood and to examine new directions in research to enable a more complete understanding of the effects of asbestos ingestion and exposure, the National Institute of Environmental Health Sciences and the Environmental Protection Agency sponsored last month's conference. Attended by some 130 scientists and public health officials from 12 countries, the conference emphasized the limited amount of information available on the effects of low-level, prolonged exposure. The scientists also pointed out how difficult it is to obtain accurate information on these effects.

There are three serious difficulties in determining the effects of asbestos on human health, the conference speakers agreed:

- The term asbestos itself is misleading, for it encompasses a whole group of minerals that are distinct from each other in chemical composition, particle size, and probably biological effect.
- Many of these particles are so small that detection is extremely difficult and time consuming, placing restraints on the scope of research that can be reasonably undertaken.
- Perhaps the most serious difficulty in asbestos research, however, is the very long period between initial exposure and evidence of biological effects. In the case of mesothelioma, an asbestos-induced cancer of the linings of the abdomen and chest, this time period is usually 25 to 35 years.

Asbestos is any of several silicate minerals existing in fibrous form. The *Federal Register* lists six main types of asbestos mineral, each with its own chemical composition. To add further confusion, each of these chemical forms exists in both a fibrous or "asbestiform" variety and in a nonfibrous type that is sometimes considered an asbestos mineral and sometimes not.

Chrysotile asbestos is the most distinct asbestos form and the one most widely used in industry. A magnesium silicate hydroxide, chrysotile exists in nature as a bundle of very small fibrils, each less than 5 microns in length and about 0.2 micron in diameter. These fibrils are hollow, and their large surface area and relatively high surface charge allow for great adsorption of trace metal ions to these particles.

The other asbestos minerals, collectively referred to as the amphibole minerals, have a significantly larger fiber diameter and are solid fibers. They have sodium, calcium, and iron occurring in their lattice structures, in addition to magnesium and randomly substituted trace metal ions. Although not used as extensively for industrial purposes, the amphibole minerals commonly are found as contaminants of talc, chrysotile, and other widely used minerals.

Chrysotile fibrils are too small to be detected by conventional optical microscopy. To identify these particles positively, Dr. Arthur M. Langer of Mt. Sinai School of Medicine in New York City explains, a combination of transmission electron microscopy, selected area diffraction, and microchemical analysis is needed. Others believe that scanning electron microscopes could be useful in detecting chrysotile in combination with some type of chemical identification, but all agree that the main drawback to any detection technique that requires electron microscopy is the time involved for each analysis—about one man-day per sample. Any investigation of the occurrence of asbestos in the general population or in the environment must consequently be very limited in scope.

Amphibole asbestos fibers are larger. But they also require sublight microscopes for careful examination and cannot be positively identified without additional microchemical or selective area diffraction analysis.

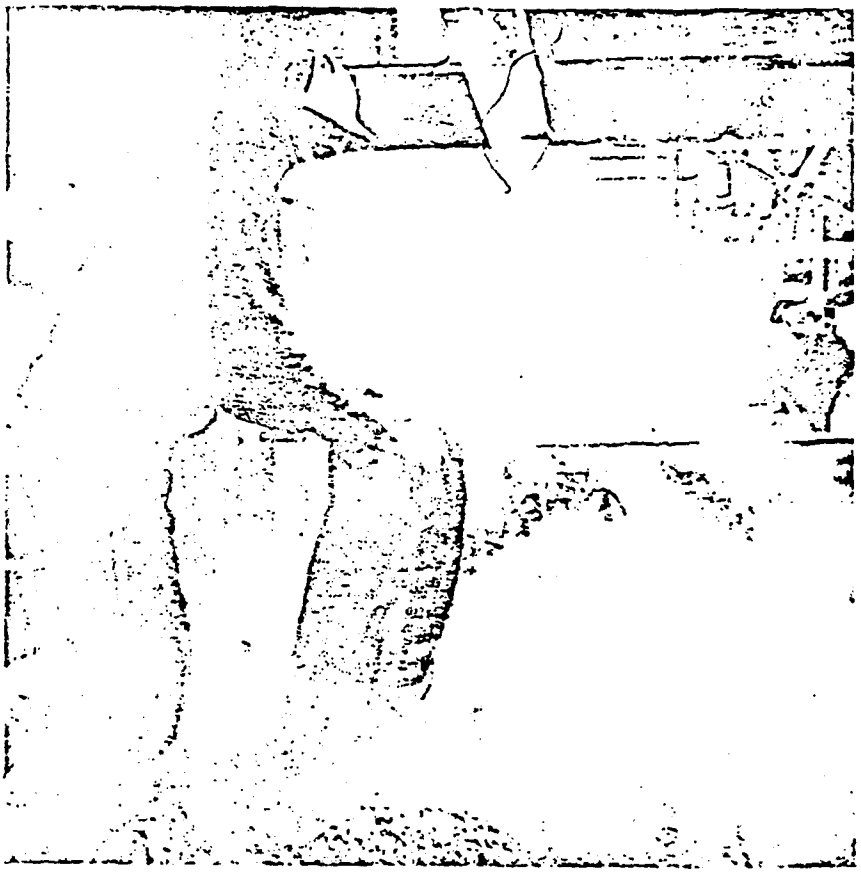
Chrysotile fibers in lung tissue

The research workers at the conference expressed great hope that advances in automated analysis would make more extensive sampling possible by cutting down on the time required for analyzing each sample. Dr. Eugene P. White of Pennsylvania State University, for example, described a computerized system for examining small particles using a scanning electron microscope that is currently used in his laboratory for analysis of coal mine dust.

The most serious deterrent to understanding the biological effect of ingested and inhaled asbestos, however, is the long incubation period of certain asbestos-induced effects. Asbestos workers in the shipbuilding industry in the U.K. in the 1930's began to develop statistically high incidences of the previously rare cancer form mesothelioma in the late 1950's, more than 20 years after their asbestos exposure. Since that time, many other cases of the disease have been reported in patients who worked with asbestos 25 to 35 years earlier.

Dr. Irving J. Selikoff, director of the Environmental Health Sciences Center at Mt. Sinai School of Medicine, presented data to the conference from several mortality studies of occupationally exposed asbestos workers in New York and New Jersey. His studies show increases in interthoracic cancer and mesothelioma more than 20 years after heavy asbestos exposure.

In addition, he found that although lung cancer deaths did not appear to be more frequent among nonsmoking asbestos workers than among the general nonsmoking population, they were very much more frequent among smoking asbestos workers than among other smokers. In one study of 17,800 asbestos insulation workers, of whom 9590



Asbestos cement worker wears mask to screen out chrysotile fibers

were smokers, there were five to six times the predicted number of deaths from lung cancer among the smokers. A smaller study of insulation workers in New York showed 10 times the expected number of deaths caused by lung cancer among the workers who smoked cigarettes.

The question of most concern to public health officials, and the area of most intensive research at present, is the effect of asbestos exposure at intermediate levels and the effect of low-level exposure to asbestos in combination with low levels of other carcinogens that are often present in the environment.

Research on these questions takes two directions. The most reliable information on the health hazard of asbestos to man will come from one of the research directions, studies of the effect of the mineral on man himself. Thus, the studies that Dr. Selikoff and his associates have begun on asbestos workers in New York and New Jersey are being continued and expanded. Dr. Selikoff points out that there are some cases of mesothelioma in New Jersey that cannot be traced to any asbestos exposure. These are being further investigated to see if a cause for them can be found. Multiple effect correlations, such as that between cigarette smoking and asbestos fiber inhalation, are being looked for also.

Dr. Ian Webster of the National Research Institute for Occupational Diseases in Johannesburg, Republic of South Africa, told the conference of a massive effort by the South African government to establish the danger of asbestos exposure. South Africa mines both amphibole and chrysotile types of asbestos. The government hopes to conduct mortality studies on all of the workers in these mines since 1953.

Most of the workers come from nomadic groups living in the desert regions of South Africa. They work in the mines for brief periods then return to their homes, making them very difficult to keep track of. Nevertheless, the government hopes to be able to follow a substantial number of these workers and determine, at the very least, which asbestos forms are the most dangerous ones.

The other direction of current asbestos research uses laboratory animals to study details of the effect of the fibers on tissues. The drawbacks of making inferences from animal models were repeatedly pointed out by speakers at the conference. Especially in cancer research, different animal species often respond substantially differently to the same agent. Consequently, many different animal models must be used and compared if animal response is to be reliably extrapolated to humans.

Animal studies seem to show that although inhaled asbestos can be found in the diaphragm, liver, and the epidermal layer close to the gastrointestinal tract, ingested asbestos is very poorly absorbed, if at all, through the lining of the stomach and colon. Dr. John M. G. Davis of the Institute of Occupational Medicine, Edinburgh, Scotland, could detect no asbestos passing through the stomach or intestinal walls of rabbits fed asbestos fibers in his laboratory. However, Dr. R. D. Pontefract of the Canadian Food Research Laboratories injected an asbestos sample directly into the stomachs of laboratory animals and was able to detect about 0.1% of his sample in the epiderm. In studies with baboons, Dr. Webster found that very little ingested asbestos penetrates the walls of the stomach and colon and that almost all that does is of the smaller chrysotile type. Studies with inhaled asbestos also show that the fiber that is absorbed is predominantly the chrysotile type.

Conclusive evidence on the effect of environmental levels of asbestos on man, or even reliable estimates of what that level is, will not be available for some time. In the meantime, current asbestos exposure may be causing cancers that will not be detectable until the next century. Thus, representatives of regulatory agencies present at the conference agree with asbestos research workers that asbestos presents too much of a threat to human health to be used indiscriminately until conclusive evidence is available. There is not yet complete agreement, however, on what sort of regulation should be implemented.

Dr. William Eisenberg of the Food and Drug Administration explains that it is not possible for FDA to run electron microscopy analyses of all the potential sources of asbestos contamination under its jurisdiction. At present, analysis by polarized light microscopy is used to determine purity of foods and drugs, even though this method probably misses many of the smaller and more easily absorbed asbestos fibers that may be present in these materials. FDA's main concern, according to Dr. Eisenberg, is with parenteral drugs rather than with substances that enter the body through the gastrointestinal tract, since relatively small amounts of ingested asbestos appear to penetrate the body. Last September FDA began taking steps to eliminate the use of asbestos filters in the production of parenteral drugs.

EPA's Gordon Everett calls for standardization of reporting data so that the necessarily limited amount of data collected in each study can be usefully compared with results from other studies. He points out that information on the biological effects of asbestos is very limited and that the effects of many asbestos substitutes have not been investigated at all. Before asbestos use is banned, it should be certain that a safer alternative is available, he cautions.