dangerous to workers' health. His resarch led to needed modifications in the work environment for the asbestos industry. However, later in the 1970s, when studies came out showing that the effects of asbestos fibers varied depending on the type of asbestos used, Dr. Selikoff and the people who were working with him called this "revisionism." "All you have to do is see one or two mesothelioma patients to know it doesn't take much asbestos to produce it," said Selikoff. "I'm only interested that human beings not be further exposed to asbestos. And those who say they should be further exposed really have to explain why."[2]

Many studies of the health effects of asbestos on miners and industrial workers have been done. Since the late 1970s, Dr. Malcolm Ross (see accompanying interview), a minerologist from the U.S. Geological Survey and a world authority on asbestos, has been helping the medical profession to understand the different properties of the various minerals categorized as asbestos. There are six main varieties of asbestos, only three of which have been commercially used. They are classified together, because they all contain long chains of silicon and oxygen, which give them their fibrous characteristics.

Of the three commercially used, two: crocidolite, or "blue asbestos," and amosite, or "brown asbestos," are of the amphibole variety. The third type is chrysotile, or "white asbestos"; its fibers are much curlier and are thus known as the serpentine variety.

Dr. Ross published numerous papers, including an extensive survey published in 1984,[3] of the studies done on the adverse health effects of asbestos to asbestos mining and industry workers, in order to help to predict the health risks of non-occupational exposure. The studies showed that 1) mesothelioma is principally caused by blue asbestos and to a lesser extent brown asbestos, but not by chrysotile or white asbestos; 2) asbestosis and lung cancer can be caused by all three types of commercially used asbestos, although the risk of lung cancer is greatly increased in those who smoke; and 3) the risk posed by working with asbestos is clearly dependent on the amount of asbestos fibers that are airborne.

OSHA has determined that 0.1 fibers/cubic centimeter is the highest density of airborne asbestos that can be allowed in a safe workplace. A few of the studies done of workers show that this is a very safe limit. Chrysotile asbestos miners of Quebec, who worked for more than 20 years under conditions where there was an average of 20 fibers/cubic centimeter in the air that they breathed, were found to live perfectly normal lives, with no increase in mortality. A study done in Cardiff, Wales, of asbestos cement workers, showed no increased incidence of lung cancer or other asbestos-related diseases, even though the 1,970 workers surveyed had been exposed to average levels of 1-2 fibers/cubic centimeter of mostly chrysotile or white asbestos per milliliter of air for a period of six months or longer between the years of 1936 and 1977.

The level of 1-2 fibers per cubic centimeter is much lower than the level that workers experienced either in asbestos textile manufacturing, or installing or removing asbestos insulation in heating and electrical conduits, or in any workplaces without ventilation. Studies of the workers under such conditions showed a marked increase in death due to cancer and asbestosis (although mesothelioma was still restricted to those exposed to the amphibole type of asbestos and not chrysotile).

If this had been the end of the story, it would have been a very successful case of industrial hygiene at work. It is very clearly established that those who work with asbestos and install it in buildings must take great precautions.

The political witch-hunt

Unfortunately, the EPA and private environmental organizations extrapolated the work that Dr. Selikoff and others had done, transforming the message into one of great public danger to *anyone* exposed to *any* amount of asbestos. Their motto, used to scare parents, homeowners, and schoolchildren alike, was "one fiber can kill." Although 90-95% of the asbes-

Asbestos is not guilty!

Co-author Dr. Paul Lysenko is a research chemist, originally from Ukraine. He graduated from the University of Kharkov in 1932, and soon after developed a very efficient technique for the conversion of low-quality coals into standard quality coking coals. Lysenko's technique met with political opposition from supporters of existing technolgies, but it was so successful that it was implemented throughout the Donbass region in the late 1930s. Scientific journals in Germany and the United States published translations and abstracts of many of Lysenko's papers.

Although his brother, Trofim D. Lysenko, was an Academician whose name became synonymous with Stalinist science, Paul Lysenko was driven into exile in 1942, by the same Soviet political regimentation of scientific research that had glorified his brother. Paul and his wife Natalie moved to the United States in 1949, under the sponsorship of the International Rescue Committee.

This article is composed of excerpts from five different appeals concerning asbestos that Drs. Paul and Natalie Lysenko presented to the U.S. Congress, the President, and the EPA during second half of the 1980s.

2. Richard Stone, "News and Comment: No Meeting of the Minds on Asbestos," *Science,* Vol. 254, November 1991, p. 929.

3. M. Ross, "A Survey of Asbestos-Related Disease in Trades and Mining Occupations and in Factory and Mining Communities as a Means of Predicting Health Risks of Nonoccupational Exposure to Fibrous Minerals," *Definitions for Asbestos and Other Health Related Silicates, ASTM STP 834,* Benjamin Levadie, ed. (Philadelphia: American Society for Testing and Materials, 1984), pp. 51-104.

tos used in the United States is of the safer chrysotile type, the EPA ran a campaign which, at its height, tried to have all asbestos removed from buildings, and its use completely banned by 1996.

Fortunately, the Asbestos Information Association succeeded in overturning the ban on all asbestos products in 1991, by taking the EPA to court.

It cannot be an accident that this issue was picked up by the EPA in the 1970s. Think back to the change in attitude of public institutions between 1969 (the height of the Apollo Moon landing program) and 1979 (the EPA's first banning of asbestos). Environmentalism and "small is beautiful" philosophies began to dominate. In 1972, the Club of Rome published a Malthusian-premised computer projection called *Limits to Growth,* purporting to prove that the biggest danger that mankind faces in the coming decades is its own belief in growth and progress.[4]

Asbestos was the second major substance to be banned by the first EPA Administrator, William Ruckelshaus. The first chemical to be banned had been the pesticide DDT, which had all but eradicated malaria in many developing countries, and which Ruckelshaus admitted that he banned, not for scientific reasons, but for political ones.[5] Alongside this was the witch-hunt against nuclear energy, a technology that promised to bring abundant, cheap, clean, and safe energy to many nations of the world, with the Atoms for Peace program.

But for anyone who went to school in the 1970s or later, asbestos was known as a "poison" and nothing else. According to the Asbestos Information Association, the use of asbestos dropped from nearly 800,000 tons/year in the mid 1970s to about 41,000 tons in 1990. The real damage that has been done by creating such an atmosphere of terror, is to abort the excitement in new technologies and discoveries of an entire generation.

That is not to say that asbestos use has disappeared altogether. There was a very effective fight put up against the environmental ban by both the scientific and the industrial community. As Dr. Ross mentions, he started working on educating the medical community and the public on the minerology of asbestos as early as 1978. Right up until 1984, he thought that he was making progress.

However, the anti-asbestos campaign was also building. In 1979, the EPA came out with its first "Guidance Document" for schools on asbestos abatement. In this document, they discouraged air sampling as an "inappropriate" method for determining the asbestos danger. The report argued that

4. Dennis Meadows, Donella Meadows, Jorgen Randers, and William W. Behrens, *The Limits To Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Signet Classics, 1972).

5. Marjorie Mazel Hecht, "Scientists Score DDT Ban," *21st Century Science & Technology,* Summer 1992, p. 48.

We are both chemists and have been familiar with asbestos for many years, dating back to our university days. We would like to show you why continuing the use of asbestos is not only safe, but very important to the economy of the United States.

Asbestos products, especially those that are already in place, like asbestos roofing felts, flooring felts, vinyl asbestos tile, asbestos cement pipes, and asbestos clothing, which the Environmental Protection Agency (EPA) proposes to eliminate, are not dangerous, because they do not lose their fibers into the air wherever they are—on the ceiling, on the roof, or on the floor, even during a fire. In order to release asbestos fibers into the air, the asbestos has to be mechanically chipped, sanded or ground.

Asbestos is and can be dangerous for workers who are working in the asbestos industry, where asbestos is being ground by industrial machines. For such industries, there are special health safeguards to protect the workers by having them wear masks, etc.

During a fire, asbestos insulation on pipes stays practically unchanged. But, during a fire, a modern substitute for asbestos for pipe insulation does pollute the air with soot and gases which are very toxic. The modern plastic handles of many tools—for example, screwdriver handles—can burn up in a few minutes. The fumes from one small plastic handle of only a few ounces can kill everyone in the room where the fire took place.

But the handles that are made of a mixture of plastic and asbestos either don't burn at all, or only smolder very slowly. Everyone caught in a fire in the same room could either leave or put out the smoldering item.

We would also like to note, that the injection of asbestos fibers into animals, causing sickness in the animals, does not indicate that breathing these fibers will cause lung cancer. For instance, a cow which is eating hay and is breathing near hay for years will still give healthy milk and does not get lung cancer. However, an injection of hay fibers can kill this cow, or make her sick, depending on the quantity of the injection.

Already a lot of damage has been done to the asbestos industry. In 1973, in the United States, 875,000 tons/year of asbestos products were being used. By 1984, because of the persecution campaign against asbestos, only 240,000 tons were used.

Asbestos products are safe, not toxic. U.S. school buildings need asbestos products.

—Paul and Natalie Lysenko