Testimony
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Workplace Exposure to Asbestos

Statement of

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Mr. Chairman and members of the Subcommittee, I am Dr. Gregory Wagner, an occupational health expert at the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC). I am pleased to appear before you today to provide this testimony on behalf of NIOSH.

NIOSH is a research institute within CDC, a part of the Department of Health and Human Services. CDC, through NIOSH, is the federal agency responsible for conducting research and making recommendations to identify and prevent work-related illness and injury.

My testimony today will address the current scientific knowledge about health risks to workers from exposure to airborne asbestos. I also will discuss NIOSH's past findings and current research related to asbestos contamination in Libby, Montana.

Background

Asbestos is a term that is generally used to refer to a group of fibrous minerals with exceptional resistance to degradation by heat, acids, bases, or solvents. The minerals are not combustible and have a high melting point and low thermal and electrical conductivity. These and other useful properties had resulted in the development of thousands of commercial uses for asbestos-containing materials by the early 1970s. However, as the use of asbestos dramatically increased, the lethal effects of airborne asbestos became clear. Regulatory action and liability concerns related to the now well-

established connection between inhalation of asbestos fibers and a variety of serious and often fatal diseases have reduced or eliminated the use of asbestos in many commercial products. However, asbestos and asbestos-containing materials are still found in many residential and commercial settings and pose a risk of exposure to workers and others.

Asbestos is defined in Federal regulations as the minerals chrysotile, crocidolite, amosite, tremolite, actinolite, and anthophyllite. The Occupational Safety and Health Administration (OSHA), the Mine Safety and Health Administration (MSHA) and the Environmental Protection Agency (EPA) regulate these six minerals. All of the minerals, except for actinolite, have been used commercially. The results from epidemiologic studies of workers exposed to these minerals provide the scientific evidence of a causal relationship between exposure and adverse health effects in humans.

Asbestos-Related Diseases

Exposure to asbestos significantly increases the risk of contracting several diseases. These include:

1.) **Asbestosis**—a disease characterized by scarring of the air-exchange regions of the lungs;

2.) **Lung cancer**—for which asbestos is one of the leading causes among nonsmokers, and which occurs at dramatically high rates among asbestos-exposed smokers;

3.) **Malignant mesothelioma**—an almost invariably fatal cancer of the tissue lining the chest or abdomen for which asbestos and similar fibers are the only known cause; and

4.) **Nonmalignant pleural disease**—which can appear as a painful accumulation of bloody fluid surrounding the lungs, but which more commonly is seen as thick and sometimes constricting scarring of the tissue surrounding the lungs.

In addition, asbestos exposure is associated with excess mortality due to cancer of the larynx and cancer of the gastrointestinal tract. The malignant diseases—the cancers including mesothelioma—are often fatal within a year or a few years of initial diagnosis. In contrast, asbestosis deaths typically occur only after many years of suffering from impaired breathing.

We do not know exactly how asbestos fibers cause disease. We do know that microscopic fibers can become airborne during various industrial processes or from handling of asbestos-containing materials and can then be inhaled and/or swallowed.

As much as 50 percent or more of inhaled asbestos fibers can remain lodged in the lungs, where it is almost impossible for the body to eliminate them. Asbestos fibers are extremely resistant to destruction in body fluids, and many of these fibers are too long to be engulfed and removed by the cells that normally scavenge and remove particles that happen to deposit in the lungs. Generally, as the burden of retained fibers increases in the body, so does the likelihood of disease. Most asbestos-related diseases, particularly the malignant ones, have long latency periods often extending 10-40 years from initial exposure to onset of illness. While asbestos-related lung cancer and mesothelioma are frequently not curable, they and other asbestos-related diseases are clearly preventable by eliminating or limiting exposures to asbestos. The amount and duration of exposure are factors that can determine the risk of adverse health effects.

The Definition of Asbestos

In 1990 testimony before OSHA, NIOSH broadened its science-based definition of "asbestos" as a result of concerns about the microscopic identification of the six regulated asbestos minerals. The six minerals can also occur in a non-fibrous (so-called “massive”) form. The non-fibrous mineral forms of the six asbestos minerals can be found geologically in the same ore deposits in which the fibrous asbestos minerals occur or in deposits where other commercially exploited minerals are mined (e.g., industrial grade talc). "Cleavage fragments" can be generated from the non-fibrous forms of the asbestos minerals during their handling, crushing, or processing, and these “cleavage fragments” are often microscopically indistinguishable from typical asbestos fibers of the (fibrous) minerals.

The elemental composition of the six asbestos minerals can vary slightly as a result of geological conditions such as pressure, temperature, or proximity of other minerals. Recognizing these variations in elemental composition, NIOSH believes that the six asbestos minerals can be defined by their "solid-solution" mineral series. For example, the mineral series tremolite-ferroactinolite contains the asbestos mineral actinolite. These mineral series are considered solid-solutions in which cations (i.e., sodium, calcium, magnesium, iron, etc.) are replaced by other cations which can affect the elemental composition of the mineral without significantly altering the structure.

NIOSH bases this expanded "asbestos" definition—encompassing the entire solid-solution mineral series for each of the six currently regulated asbestos minerals and including cleavage fragments from the non-fibrous forms of these minerals—on scientific evidence from cellular and animal studies suggesting that dimension, specifically length and diameter, as well as durability, may be more critical factors in causing disease than chemical or elemental composition.

NIOSH Studies of Vermiculite Workers in Libby, Montana

In June 1980, OSHA asked NIOSH to provide technical assistance to investigate lung problems in workers at a plant using vermiculite that had been mined in Libby. Shortly thereafter, MSHA also requested technical assistance from NIOSH to investigate the

magnitude of health hazards in vermiculite mines. MSHA was particularly concerned about two reported cases of "dust-related lung disease" in workers at the Libby mine.

In response to these requests, NIOSH initiated epidemiological studies in Libby, Montana. The epidemiological studies carried out by NIOSH between 1980 and 1985 showed that occupational exposure to mineral fibers that contaminate Libby vermiculite caused high rates of asbestos-related diseases among exposed workers at the Libby mine complex. The fibers these workers were exposed to included tremolite, one of the minerals within the definition of asbestos as currently regulated. Some recent evidence indicates that only 10 to 20% of the fibrous mineral content of the Libby vermiculite was tremolite. A much higher proportion—80 to 90%—of the fiber contaminant in this vermiculite has been characterized as several other similar fibers that are not currently regulated as asbestos, such as richterite and winchite. Richterite and winchite are fibrous minerals that are not classified as asbestos by mineralogists.

NIOSH played a pivotal role in documenting the health hazard associated with occupational exposure to asbestos-contaminated vermiculite at the mine in Libby, Montana. NIOSH made its findings available beginning in 1985 through meetings in Libby with workers and their representatives, employer representatives, and members of the community. NIOSH also published its findings in several scientific papers to alert the occupational health community about the identified problem. It is clear in hindsight that further work remained to be done, in particular, with respect to further studies of

downstream users of Libby vermiculite products. NIOSH is applying what we learned from our Libby investigations to our current and future activities both in Libby and throughout our program.

Current NIOSH Studies

At present, NIOSH is following up on potential exposures of workers who use or process vermiculite from other sources. Since closure of the Libby mine in 1990, most of the vermiculite now being produced for domestic use is obtained from one of four mines, three of them domestic and one located in South Africa. The degree to which the vermiculite from these other sources is contaminated with asbestos is not clear. At OSHA's request, NIOSH is conducting environmental sampling at expansion plants and horticultural operations where vermiculite is used. NIOSH will complete asbestos exposure assessments at two expansion plants for each vermiculite ore supplier, along with a number of horticultural sites. We expect the field data collection to be completed by the end of 2002. At present, field sampling has been completed at four expansion plants and three horticultural operations. From these studies we expect to learn the degree to which an asbestos exposure hazard exists in vermiculite from sources other than Libby, Montana. Once these studies are completed, we plan to produce and disseminate a technical report that describes the extent to which newly mined or imported vermiculite presents an asbestos risk to current vermiculite worker. Based on the findings, we may issue further guidance for protective measures to be taken.

Future Research Activities

Additional research possibilities that NIOSH is considering include efforts to better determine physical and/or chemical characteristics affecting toxicity of fibers including those occurring naturally and those manufactured. Direct evidence by which to attribute particular health effects to each possible fiber type is not currently available. Epidemiological studies of people exposed to naturally occurring or manufactured fibers would provide important new information, and studies conducted with animals could provide mechanistic and other toxicologic data.

Asbestos fibers have many different lengths and diameters. Additional work to improve and standardize the methods for asbestos fiber measurement is being considered because it would help advance prevention and control efforts to protect exposed workers. Human assessment of risk and occupational exposure limits is based on airborne fiber concentrations determined by the use of phase contrast microscopy (PCM). This analytical method leaves an undetermined number of asbestos fibers collected on each sample uncounted because many fibers are too small in diameter to be detected and because the standard procedure for counting fibers using PCM takes into account only fibers longer than 5 micrometers in length. Current asbestos exposure risk assessment is based only on a subset of fibers that can be detected using PCM techniques. More sensitive analytical methods are currently available, but these methods could benefit from better standardization.

Conclusion

In summary, we know much about the adverse health effects caused by the inhalation of asbestos fibers. Increased understanding of the health effects of fibrous minerals that fall outside the existing definitions of asbestos will help us find ways to provide appropriate protection for workers exposed to those materials. Further identification of workplace sources of vermiculite exposure and the tracking of persons potentially exposed to fiber-contaminated vermiculite and other contaminated materials will help us develop appropriate public health strategies for preventing exposure to these materials. While information continues to be gathered, public health prudence requires that vermiculite from the Libby mine or products containing vermiculite originating in Libby be considered potentially dangerous and that proper precautions be taken to minimize the generation and inhalation of any dust during the handling of these materials until analysis of the particular vermiculite or vermiculite-containing product shows that it does not produce an asbestos hazard.