

compared to the untreated asbestos fibers. Drs. Lemen and Groth of NIOSH (Tr. 6/21, pp. 189-191) testified at the public hearings that, to date, *in vitro* studies do not show with any degree of certainty that modification of asbestos fibers can prevent adverse health effects. They contend that the *in vitro* studies did not measure the fiber sizes of the modified asbestos fibers to determine whether the treatment shortened the fiber. Dr. Groth cited a study by Monchaux (Ex. 84-438) that showed that acid leaching of chrysotile decreased its mesothelioma toxicity in rats; however, the treatment also shortened the fiber. He was not certain, therefore, whether the reduced toxicity derived from the treatment or the shortening of the fiber. In addition, no evidence was presented in the record to indicate that modified fibers are incapable of causing adverse effects after administration into laboratory animals. Mr. Warren, of the SNA, in his testimony agreed with this position. When asked whether OSHA should deregulate modified chrysotile, Mr. Warren responded:

SNA's position is not that it wants [modified fibers] to be exempted from regulation. Indeed, it expects to be covered. And that is certainly true because the *in vivo* testing is not completed. There is no present basis available for making any biological distinction [between modified and unmodified fibers]. (Tr. 7/5, p. 49)

Based on these considerations, OSHA has decided that it is prudent from a public health viewpoint to continue to include chemically treated asbestos in the Agency's definition of asbestos (See Section IX. Summary and Explanation for General Industry).

G. Tremolite and Anthophyllite

In the November, 1984 notice, OSHA reviewed a number of epidemiological studies that suggested that the talc miners and millers are at excess risk of mortality from lung cancer, mesothelioma, and non-malignant respiratory disease (Exs. 84-025, 84-141, 84-181, 84-211), and have a high prevalence of pleural thickening and calcification, decreased pulmonary function, and lung fibrosis (Ex. 84-181). It is known that many, but not all, commercial talc deposits contain serpentine and amphibole asbestos and the minerals tremolite and anthophyllite, which may be found in amorphous, fibrous, or asbestiform habits (Ex. 84-039). At the time, based largely on epidemiological studies conducted by NIOSH (Ex. 84-029, 84-181), OSHA concluded that

"Talc containing asbestos minerals . . . appear to pose a significant health risk to exposed workers, and talc workers exposed to asbestos should receive the protection afforded by the asbestos standard" (48 FR 51120).

Specifically, Brown et al. (Ex. 84-029) of NIOSH conducted a historical prospective study of talc miners and millers employed at a New York State talc facility operated by the R.T. Vanderbilt Company. Although the company reported that the talc at this facility contained no asbestos, NIOSH (Exs. 84-39, 84-181) reported finding asbestiform tremolite and anthophyllite following analysis of personal and bulk samples by electron microscopy and x-ray diffraction techniques. As measured by optical microscopy, average air concentrations of fibers greater than 5 μ m in length ranged from 1.7 f/cc to 9.8 f/cc as an 8-hour TWA in the mine. In the mill, average 8-hour TWA exposures for these fibers ranged from 1.5 f/cc to 8.4 f/cc.

The cohort studied by Brown et al. (Ex. 84-029) consisted of 398 workers employed between 1947 and 1959. Cause-specific mortality rates were compared to those of U.S. white males, adjusted for age and calendar period. Brown et al. reported significantly elevated increases in cancer mortality (9 observed vs. 3.3 expected) and non-malignant respiratory disease mortality (8 observed vs. 2.9 expected). One death from mesothelioma was reported, but the death could not be specifically attributed to exposure to tremolite or anthophyllite. Of the 10 individuals who died of cancer, 3 worked previously for other New York State talc companies.

Gamble et al. (Ex. 84-181) of NIOSH also conducted a cross-sectional morbidity study of the same facility. Of 158 male miners, 121 participated in a survey consisting of a respiratory questionnaire, chest X-ray, and spirometric testing. The morbidity experience of this cohort was compared to that of coal miners, potash miners, chrysotile asbestos workers, and synthetic wool textile workers. Coal and potash miners were used as comparison groups because they were likely to be similar to talc miners in many non-occupational respects that affect respiratory morbidity. Gamble et al. (Ex. 84-181) found that, compared to coal and potash miners, talc miners with no previous work history at other talc mines had a significantly elevated prevalence of pleural thickening and calcification. When all talc workers were combined, with or without prior talc exposure, the researchers found increased prevalences of cough, phlegm production, dyspnea, and x-ray

abnormalities. Talc workers also had significantly decreased pulmonary function, which was associated with duration and intensity of exposure.

OSHA also reviewed a third study that presented conflicting findings in workers at the same facility (48 FR 51118). Stille and Tabershaw (Ex. 84-198) studied all male workers employed sometime between 1948 and 1977 at this facility. Vital status and information on control variables were determined for 655 men. Cause-specific mortality rates were compared to U.S. white males, adjusted for age and calendar period. Non-significant excesses of mortality from lung cancer and non-malignant respiratory disease were observed in the cohort; these excesses were attributed to a "smoking effect," rather than to an effect from occupational exposure (Ex. 84-198).

As a further analysis, Stille and Tabershaw (Ex. 84-196) separately analyzed the mortality experience of cohort members with a history of any prior work experience and cohort members with no prior work experience. Among the subcohort of 540 males with prior work experience, significant elevations were found for mortality from all cancers, liver cancer, lung cancer, lymphopietic cancer, and non-malignant respiratory diseases. No elevated causes of death were found for the subcohort of 115 males with no prior work experience. Stille and Tabershaw concluded that "Since the cancers and lung diseases typically have long latencies, the possibility exists that exposures prior to work at the . . . study mine and mill were responsible for at least some of . . . [the increased incidences of diseases observed]" (Ex. 84-196, p. 482). They also concluded that "workers with 'exclusive' . . . [study mine and mill] employment seem to be at no considerable risk of . . . lung cancer. . . ." (Ex. 84-196, p. 483).

OSHA also presented comments by Brown et al. on the Stille and Tabershaw study (48 FR 51119). To summarize, Brown et al. (Ex. 84-218, pp. 178-179) commented that Stille and Tabershaw failed to analyze mortality by length of followup period. The analysis of subcohort with or without prior work history was "not likely to be very informative," because of the small size and young age of the cohort that had no prior work history. Because of these and other concerns about the Stille and Tabershaw study, Brown et al. concluded as follows:

"[The Stille and Tabershaw] report fails to address adequately the question of whether or not there is an increased risk from lung cancer specifically associated with working