PLAINTIFF'S EXHIBIT
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Tremolite Asbestos Exposure

at the

W. R. Grace Vermiculite Mine,

Libby, Montana

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General

The W. R. Grace Co., Zonolite Division mine and mill northeast of Libby, Montana produce cleaned and classified vermiculite. This material, when heated to exfoliation temperature, expands to several times its volume, due to the conversion to steam of water between its mica like plates. The resultant expanded vermiculite is used for insulation, as an aggregate in plasters, for packing and also as a nutrient carrier in animal feeds.

The vermiculite deposit at Libby is mined by open pit methods from the mountain above the mill. After blasting the ore is loaded by power shovel into trucks and hauled to the grizzly. The ore is only part vermiculite and among the other materials present is some tremolite asbestos and a small amount of silica.

From the grizzly the ore is conveyed by belt and stored in hoppers above the mill. At the start of the milling the ore is first wet by water sprays and then cleaned by jigs, spirals and screens. When wet mill processing is complete, the vermiculite is dried in rotary kilns and lifted in bucket elevators to the top end of the dry mill. The five grades of vermiculite are produced by screens and grinders while the remaining dirt is removed. The finished product is lowered to the bottom of the mountain by skips and the tailings are dumped over the side of the mountain. From the lower storage area the product is trucked to the loading dock on the Kootenai River where it is blown into hopper cars. A small amount of a special high purity grade vermiculite is taken to the exfoliating plant in Libby, where it is expanded for use as a nutrient carrier for animal feed called Verxite. The reminder of the product is shipped to over fifty expanding plants in the U.S. and some is exported. At the time of the survey over 150 workers were employed at the mine, mill, loading dock, plant and office. This level of employment had been fairly constant since the operation increased in size about ten years ago.

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Dust Exposure

The samples listed in Table 1 were collected during a survey on June 25-26, 1968. Weather conditions were clear and calm until the afternoon of the 26th when a strong wind began while samples were being collected in the Verxite plant in Libby. Both impinger and membrane filter samples were collected. Breathing zone impinger samples all had simultaneous membrane filter samples collected at the same time and location. Membrane filter samples using type AA (0.8 μ) filters in open face field monitors were collected by Cassella personal sampler pumps set at 1.7 lpm. Personal samples were collected by attaching the pumps to the workers belt and connecting it to a filter holder fastened to his lapel. Some general air samples were collected using the same personal sampler pumps with the filter face pointing downward at about breathing level.

All impingers were counted at the mill office using the American Conference of Governmental Industrial Hygienists method. The fiber counts on membrane filters were made by the method used in the Public Health Service study of asbestos product plants.(1)

Threshold Limit Value

If the dust were vermiculite or other inert material it would be considered a nuisance dust and a Threshold Limit Value (TLV) of 50 million particles per cubic foot (mppcf) or 15 mg/m^3, whichever is the smaller, would apply. If a significant amount of quartz were present, the formula 250/(% SiO_2 + 5) would be used to calculate the TLV in mppcf. However, since a significant amount of tremolite asbestos is present, the asbestos is the major health hazard and the asbestos TLV will be governing. The present accepted TLV for asbestos containing dust is 5 mppcf.(2) In applying this TLV all the dust is counted, not just the fibers, and no correction is made for the asbestos content of the dust. A new tentative asbestos TLV of 2 mppcf or 12 fibers longer than 5 μ/cc has been proposed to replace the 5 mppcf TLV, based on the conclusion that 5 mppcf may not be low enough to protect the health of the workers. The 12 fiber/cc alternate for the first time permits evaluation of the asbestos hazard in mixed dust environments. In Great Britain, the British Occupational Hygiene Society has established a standard using the fiber count method in which concentrations above 2 fibers longer than 5 μ/cc are considered unsafe. All of the experience upon which these TLV's are based is from exposure to chrysotile. However, in the absence of other data, it must be assumed that tremolite asbestos is equally toxic and the same limits should apply.

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Discussion of Results

Conditions at the mine would appear satisfactory by the 5 mppcf TLV but must be considered doubtful by the tentative 12 fiber/cc TLV since several concentrations approached or exceeded this value. The wet mill exhibited fiber concentrations of about half the tentative TLV, undoubtedly due to carry over from the dry mill. By both impinger and membrane filter measurements, the dry mill is in excess of the TLV, with a maximum exposures of over 8 times the tentative fiber TLV. Other areas at the mill have low concentrations although even some of these would be considered unsafe by British criteria. The loading dock measurements are not representative since no cars were being loaded. The one high concentration occurred during the operation of a front-end loader by the foreman. Verxite plant concentrations were less than half the tentative TLV, although the high wind blowing through the open building may have reduced these below the normal level. In general the dry mill poses a serious hazard to the health of the workers and some other areas are of doubtful safety.

Controls

No control was exercised at the mine and the wheels of the dump trucks churned up a cloud of dust from the road dirt which contained some tremolite. Although the seriousness of the exposure is doubtful, the use of a binder on the road surface would be beneficial. The wet mill concentrations will reduce in proportion to improvements in the dry mill. Local exhaust ventilation was used extensively in the dry mill but it is evident from the dust concentrations that it was not sufficiently effective. A detailed listing of the improvements necessary is not possible because of the number and variety of the machines. In general, however, a tightening up of all hoods is required. A combination of smaller hood openings and increased air flow should be obtained such that control velocities of at least 200 fpm result at all openings.(3) This is a matter of detailed hood redesign, increased system capacity and continuous maintenance. The respirator program in the mill was not effective since the respirators were not of an approved type and were not being worn by all employees.

Other areas of the mill and verxite plant appeared satisfactory although peak exposures to individuals will undoubtedly occur on some operations. When it is necessary for a worker to create or enter a hazardous dust cloud for a short period, Bureau of Mines approved dust respirators are appropriate means of control.

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In all areas a monitoring program should be established to evaluate the effectiveness of new control measures, reveal peak exposures and determine exposure levels during adverse weather conditions. The present impinger method is satisfactory but the membrane filter fiber count method is preferred since only the fibers would be counted and other, less hazardous particulates would not affect the count.

Recommendations

The road surface at the mine should be treated to reduce the dust. The local exhaust system at the dry mill should be improved by reducing hood openings and increasing system capacity so as to provide at least 200 fpm at all hood openings.

Bureau of Mines approved respirators should be provided for all intermittent hazardous operations where local exhaust is not practical. They should be regularly maintained and their proper use should be enforced.(4)

A continuous monitoring program using the membrane filter fiber count method should be established to ensure that worker exposures do not exceed safe limits.

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References

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2. Threshold Limit Values for 1968. American Conference of Governmental Industrial Hygienists. (in press)

3. Industrial Ventilation, American Conference of Governmental Industrial Hygienists. 9th ed. (1968)

4. Respiratory Protective Devices Manual. American Industrial Hygiene Association and American Conference of Governmental Industrial Hygienists. 1963

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