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REPORT ON AN INDUSTRIAL HYGIENE STUDY

OF THE

ZONOLITE COMPANY

Libby, Montana

April 11, 1963

Conducted By:

Benjamin F. Wako
Industrial Hygiene Engineer
Division of Disease Control

Distribution:

This report is confidential
and is not for distribution
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the Zonolite Company.

Participant

Russel Hendricks

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On April 11, 1963 an Industrial Hygiene Study was made of the Zenolite Company of Libby, Montana to determine the degree of compliance of previous recommendations to control the considerable dustiness in the dry mill section of the plant. The study was made in the company of a representative of the Zenolite organization and with the assistance of Doctor Russel Hendricks, of the United States Public Health Service, Salt Lake City, Utah. The methods of collection of samples and analysis of the various components were those recommended by the United States Public Health Service and other official agencies. The additional evaluation of the asbestos content of the dust is currently being done by the United States Public Health Service, Occupational Health Division in Cincinnati, Ohio. The results of this evaluation will not appear in this report but will be reported upon as soon as the data is available.

Description of Operations

The operation of the plant was essentially that as described in previous reports and will not be repeated here except to evaluate the over-all dustiness on each floor and certain comments concerning dust producers at the locations noted. In general, there appeared to be little, if any, improvement at any point in the plant except perhaps at the roll grinder, where a significant reduction in dust contributed to this area has been accomplished. Specifically, the major dust-producing areas were as follows:

Fifth Floor - The screens were very dusty. No apparent improvement had been made although the screen backs on most of the screens in this area were in good condition.

Fourth Floor - Much dustiness continues to be apparent in this area. The screen backs were off some screens. Much dustiness on the fourth floor contributes to the upper floors.

Third Floor - The main dust producers in this area were the number three concentrator bin and the belt transfer point to the concentrator bin. Dust leaks also at number two screw conveyor and the high grade equipment in front of No. 342 screen.

The Halfdeck - This area was extremely dirty, and the backs are off some of the screens.

Second Floor - The dust to the high-grade hammer mill had a hole in it, wasting exhaust capacity. No. 34 screen still leaked badly, and there was no improvement in this area since last study. The tailing chute by the high-grade grizzly and near screen 34 was also a considerable contributor to over-all dustiness. The feed to No. 219 belt was a bad dust producer and should be enclosed and ventilated.

First Floor - Much dust was produced at the high-grade dryer. Leaks from all pipes should be stopped and ventilation applied where dust cannot be controlled by stopping.

First Floor - The feed to belt 108 A was extremely dusty and needs ventilation and enclosure. The high-grade dryer was not operating during the last study and was not accounted for during that study but should be given considerable attention.

No. 618 elevator on the fourth floor leaked badly. There was no excuse for these leaks except for poor operation.

No. 336 elevator on the first floor also leaked dust badly. The cover simply had not been completely replaced.

The size distribution of the dust in the air as determined by the United States Public Health Service indicated an average size of about 3.4 microns. It should be noted that these small diameter particles can be deposited in the deep lung tissue and are more apt to be of physiological significance than those above 10 microns. In any case, over 60 percent of the particles were 5 microns or less, and 75 percent were less than 10 microns, all indicating a serious dust concentration, particularly in view of the quantity of asbestos known to be in the mixture.

TABLE I

Dust-in-Air

Sample No.	Location of Sample	Dust Particles in Sample*	Asbestos Spores in Sample**
1	6th Floor - Dry mill	50.6	12.3
2	5th Floor - Dry mill	65.6	27.2
3	4th Floor - Dry mill	32.4	12.9
4	3rd Floor - Dry mill	31.3	13.1
5	2nd Floor - Dry mill Backstop	71.8	31.2
6	2nd Floor - Dry mill	50.0	20.0
7	1st Floor - Dry mill near high-grade furnace	26.8	10.7
8	1st Floor - Dry mill near main kilns	59.8	23.9
	Maximum Allowable Concentration	20.0	5.0

* Millions of particles per cubic foot of air.

** The asbestos concentrations are calculated on the basis of 40% asbestos in the air-borne dust.

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Conclusions and Recommendations

As noted in all previous reports, considerable effort should be made, immediately, to improve the dust control procedures in the plant to reduce dustiness to an acceptable level. Any work done in the past has apparently been ineffective to the extent that more effort should be given to this feature than has been in the past. It is hoped that in the next 60 days from the date of this report that suitable ventilation will have been applied or dust control measures will have been applied such that the hazardous condition existing at this plant is eliminated.

A review of Table I indicates concentrations of dust in the dry mill as being extremely high and substantially over the maximum allowable concentration for either an asbestos dust, mica dust, or even, in most cases, a nuisance dust. All of the samples were substantially over those noted in the previous studies of 1956 and 1958.

In the past, reports indicated that the vermiculite dust alone could possibly be classed as a nuisance dust; however, on the basis of other information received from the Public Health Service and others, it appears that the classification should be in the order of mica-like minerals and that the maximum allowable concentration for vermiculite dust alone with no asbestos contamination should be in the order of 20 million particles per cubic foot of air rather than 50 million particles per cubic foot for a nuisance dust. According to one author, vermiculite includes a number of mica-like minerals, all hydrated silicates of more or less identical chemical nature. Even though vermiculite substances are generally considered inert and relatively innocuous, there are similarities in physical and chemical properties of vermiculite, talc, leadin and asbestos which suggest strongly that the material should be classed in the same category as talc and that the asbestos content should be closely observed and placed at 5 million particles per cubic foot as the maximum allowable concentration for this portion of air-borne dust. It has been determined that the air-borne dust contains 40% tremolite asbestos.

TABLE II

Benzene Soluble Material (Air or Oil Mist)

Sample No.	Location and Description	Concentration in Airborne
1	Over shaking table, wet mill, 3/6/62 3:25 pm	100.0
2	Over shaking table, wet mill, 3/7/62 11:30 am	110.0
MAXIMUM ALLOWABLE CONCENTRATION:		None Established

* per cubic meter of air

Table II indicates the presence in the air of the wet mill concentrations of air-borne material which manifests itself as a "tarry" compound when extracted in benzene. Since there is no established threshold limit for this type of material, no recommendations are made based on the magnitude of the concentrations found, except that in all probability, the concentrations should be kept as low as is technically and economically feasible. By way of comparison, the values noted exceed the concentrations found in the air in Libby during the most severe smoggy or foggy days.

Attached to the report are pieces of the filters used to determine the benzene soluble portion of the air-borne particulate. A piece of clean filter is also attached for comparison.

At the time of this study, there was no attempt made to determine each of the locations which were contributing to dustiness in the building as was done in the past study of 1958 since, on the observation, it was clear that all of the locations enumerated during the 1958 study were still in existence and, perhaps, even others were added to this group. Therefore, it is assumed that all of the dust producers noted on Pages 3, 4, 5, 6 and 7 of the 1958 study were still in evidence and should be corrected immediately in order to reduce dustiness to an acceptable level.

Toxicity

Toxicity of the elements found in the dust from processing of vermiculite has been discussed in the past; however, since vermiculite is essentially a hydrous magnesium mica and is usually an alteration product of phlogopite or biotite mica, it has been determined that the maximum allowable concentration of 20 million particles per cubic foot should apply to pure vermiculite rather than classing it as a nuisance dust. A type of pneumoconiosis has been found to occur among workers whose only exposure was to mica dust. Drossen and others¹ "in examination of 57 men exposed to dust generated by grinding mica which was practically free of free-silica found 10 cases of pneumoconiosis. X-ray examination of 456 men with more than half of their industrial exposure in the mica field had an additional group of 79 workers so employed reveal definite pathology of 9.4% and 11.4%, respectively, double that in a comparable group with no mica exposure." In the final analysis; however, the asbestos content of the dust is the controlling factor making the maximum allowable concentration 5 million particles per cubic foot for this component of the dust.

Conclusions and Recommendations

As indicated in the findings of this study, it appeared that no progress had been made in reducing dust concentrations in the dry mill to an acceptable level and that, indeed, the dust concentrations had been increased, substantially, over those in the past. In view of the findings of this study and those included in the past two studies of 1956 and 1958, it is recommended:

1. That immediate attention be given to reducing dust concentrations in the dry mill to the acceptable levels of 12 million particles per cubic foot of air. It is likely that if the dust concentrations, in general, are reduced to 12 million particles per cubic foot of air (upper) that the fraction of the dust concentration which is asbestos will also be reduced to about the 5 million particle concentration recommended for asbestos.

2. That consideration be given to the possibility of substantial concentrations of petroleum mists or droplets being ejected into the atmosphere if the floatation process is successful and a large number of floatation machines are put into use. As the bubbles break, small quantities of floatation agents are distributed into the air, although the concentrations of this material may not be significant.

3. That, since there was a substantial odor of vaporized diesel oils and other petroleum products in the wet mill, consideration be given to reducing evaporation of petroleum products to a minimum by covering those parts that do not need to be open to the atmosphere, by reducing spillage, and other methods of evaporation reduction.

¹ Drossen, W., et al. Pneumoconiosis Among Mica and Vermiculite Workers, Public Health Bulletin No. 250, USPHS, 1950.

DEFINITIONS

Maximum Allowable Concentration

Values are given in the following calculations for the maximum allowable atmospheric concentrations of contaminants to which workers may be exposed for an eight-hour working day without injury to health.

These values are based on the best available information from industrial experience, from experimental studies, and, when possible, from a consideration of the toxic effects on man. These values are not fixed values but are based on a study by the Committee on Air Pollution, American Conference of Governmental Industrial Hygienists for changes, revisions, or additions as further data and experience are available. Maximum Allowable Concentrations should be used as guides in the control of health hazards and should not be regarded as the line between safe and dangerous concentrations. They represent conditions only within which it is felt that workers may be repeatedly exposed, day after day, without their health being adversely affected. The figures listed refer to average concentrations of an eight-hour working shift rather than a maximum which is not to be exceeded even momentarily. The amount to which these figures may be exceeded for short periods during the work day depends upon a number of factors such as the nature of the contaminant, whether very high concentrations even for short periods produce acute poisoning, whether the results are cumulative, the frequency with which high values occur and for what periods of time. All data is taken into consideration in arriving at a decision as to what level of exposure is deemed to exist.

These values are not intended for use, or the modification for use, in the evaluation or control of community air pollution or air pollution abatement.

Weighted Average Concentration

In the evaluation of a worker's exposure to any harmful material, cognizance of the amount of time spent by a worker in a contaminated atmosphere should be taken. For this reason, an attempt was made to determine the amount of time a worker spent on all his jobs where they were not continuous although in many cases this was impossible. Weighted average exposures more nearly represent a worker's actual exposure over an eight-hour day than does a single sample result representing an exposure for one or two hours per day. Whenever mention is made of weighted average exposures in the body of this report, calculations were made according to the following formula:

$$\text{WEIGHTED AVERAGE} = \frac{\text{Concentration of material} \times \text{hours exposed}}{\text{Hours worked}}$$