PLAINTIFF'S EXHIBIT USG 208

REPORT

UNITED STATES GYPSUM COMPANY

RESEARCH CENTER

Technical Services

TL-201
11012
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Technical Services
E. Chicago - E. W. Lucke
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151 B. W. Nies
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151 J. S. Perry

PAGES: 1
ATTACH: writeup

DUST FROM E. CHICAGO LANDPLASTER:
FREE SILICA CONTENT

Mr. E. W. Lucke obtained a sample of landplaster dust from the dried rock bin area at the E. Chicago Mill, which was received at this laboratory February 5.

It was extracted with a water solution of hydrochloric acid and ammonium chloride. This yielded an insoluble residue (dried at 105C) of 2.27%. When this was tested on the X-ray diffraction apparatus, it was found to contain 25% plus or minus 2% of alpha quartz.

The landplaster dust can be said to contain 25% of 2.27%, or 0.57% free silica.

The attached portion of an article in the Encyclopedia of Chemical Technology, 1st edition, volume 5, pages 317 and 318, indicate--

(a) Gypsum is used as an inert diluent dust in making silicosis experiments on animals.

(b) The permissible concentration of limits of silica dust in air are not applicable to dusts containing less than 5% free silica.

Notebook 2269 - p 7
Notebook 2087 - p. 38

WRITTEN BY J. S. Perry

APPROVED BY K. S. Freeman

SUBJECT Determine free silica in settled E. Chicago landplaster.

PURPOSE Information needed by our insurance department

dc

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1543(2)

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

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of importance in the etiology of silicosis, but acceptance of this hypothesis should depend upon more exhaustive experimental data.

The mixed reaction sometimes produced by dust of the inert group in which silica is mixed with other minerals emphasizes the possible effect of mixed dust on the development of silicosis. The probable importance of concomitant exposures has also been indicated by clinical experience. Gardner investigated these effects experimentally using ferruginous chert and mixtures of quartz and calcined gypsum (16). He found that the percentage of free silica in an airborne dust may not be the same as in the parent substance. This fact may explain the slowness in development of silicosis in workers in certain areas and in certain types of work. When a mixture of calcined gypsum and quartz was present in air, particles of both minerals flocculated and the rate of settling of the mixture was greater than that of either dust in the pure state. Injection experiments with ferruginous chert showed that the iron in the mixture temporarily inhibited the action of silica.

Number of Particles Inhaled in Relation to Production of Fibrosis. From the findings of Gardner, referred to above, and from the flocculation and settling properties of dust, it is apparent that the type of dust may play an important part in determining the number of particles in the workroom atmosphere. Not only may some components of admixtures flocculate and thus change the character of a dust, but silica itself, being a hard material with a tendency to form large particles as compared with those formed by softer minerals, may settle out more quickly than other components of a mixed dust. However, of particular interest is the amount of harmful dust that must be inhaled in order to cause appreciable injury. Determinations of free and total silica in the lungs of patients who have died after fibrosis developed and in those without fibrosis have been made by incinerating the lungs and chemically analyzing the ash for its silica content. Although there have been some variations in published data on the amount of silica in pulmonary tissue necessary to produce silicosis, Sladden (43), McNally (31), Badham and Taylor (1), Fowweather (13), Drinker and Hatch (10) sum up the present knowledge somewhat as follows: As a rough guide, a total silica content as high as 0.2% of dried lung can be considered normal. A content over 1% is definite evidence of dust exposure, and this amount is usually accompanied by fibrosis. Overlapping data and variations in technique make the evidence as to the significance of quantities between 0.2% and 1% of ashed lung inconclusive. This fact is of especial significance, as pointed out by Cummings (7). Since there is usually no evidence of silicotic reaction in lungs containing less than 1.5 2 grams of silica (1% of weight of dried lung), it may be inferred that contraction of silicosis does not necessarily follow the inhalation of silica. Silicosis occurs only after the inhalation of amounts in excess of a minimum.

In any control program we are of course concerned primarily with the amount of dust in the air that will cause fibrosis. It has been suggested that atmospheric concentrations of silica dust should be considered in terms of two thresholds (7): the primary threshold, a level at which a healthy man can be employed for his lifetime without harm, about 5,000,000 particles per cubic foot (light-field count); and the secondary threshold, a level at which a healthy man will inevitably develop silicosis, about 100,000,000 particles per cubic foot (light-field count). The National Silicosis Conference summarizes the situation as follows: "There is evidence that for prolonged exposure a concentration of more than 5 million particles per cubic foot, of a highly siliceous dust, is dangerous. Therefore it is now considered good practice to hold

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concentrations of highly siliceous dust at 5 million particles per cubic foot or less," as based on light-field counting methods.

Since standards of safe atmospheric dust concentration based on medical findings have been suggested tentatively for only a few industrial dusts, and since considerable study is necessary to form a basis for such standards for other industrial dusts, a tentative arbitrary measure of what is good practice may be used. This should be within the limits of good engineering practice and yet low enough to control the silicosis hazard for most industrial exposures. The following formula is frequently used to express the maximum permissible concentration of silica in the air:

Multiply the percentage of free silica by the total dust-particle count per cubic foot (light-field technique). If the result is over 5,000,000, the concentration may be considered too high. For example: a dust containing 10% free silica with an average total concentration of 30,000,000 particles per cubic foot would give 0.10 times 30,000,000, which equals 3,000,000 (good practice). A dust containing 30% with an average total concentration of 50,000,000 particles per cubic foot would equal 0.3 times 50,000,000 or 15,000,000 (unsatisfactory). This formula is not applicable to any dust containing less than 5% free silica.

The Division of Industrial Hygiene, National Institute of Health, has suggested that an attempt should be made to have highly siliceous dusts kept at a concentration below 4,000,000 particles per cubic foot since considerable silicosis occurred in the pottery industry even with low dust concentrations (12).

Dust may also be simply a nuisance. It is considered good practice to control even relatively harmless dust sufficiently to prevent concentrations in excess of 50,000,000 particles per cubic foot (by light-field count) in the workroom air.

Particle Size in Relation to Development of Fibrosis. The influence of particle size on the production of fibrosis is closely allied to the influence exerted upon pulmonary retention of the dust. In addition, particle size may be an important determinant in the [illegible] grave of dustiness or type of dust in the air. However, perhaps the greatest effect of particle size is upon the chemical activity of the substance in question. Whenever a solid or liquid is ground or broken into particles as small as dust, the surface area is greatly increased. Thus if a cube of mineral 1 cm. in each of its dimensions is ground into small cubes 1 cu. μ in size, there will be 10^{12} particles with a total surface area of 6 sq.m. as compared with 6 sq. cm. for the original cube. McCrae (30) found 70% of the particles in silicotic lungs were less than 1 μ in diameter and that the largest were not greater than 10.5 μ. An upper limit of 10 μ as the maximum size that will produce silicosis has been suggested because larger particles are probably collected by the mucus in the upper respiratory tract and moved out of the lungs by ciliary action. The importance of small particles in the production of fibrosis has been well demonstrated by Tebrock, Nehuls, and Drinker (46). These investigators produced liver fibrosis in experimental animals by intravenous injections of suspended silica and found that particles less than 0.6 μ in diameter caused much more fibrosis than larger particles. Briefly, silicosis is caused by the inhalation of silica particles less than 10 μ in diameter. Recent work suggests that particles of less than 0.6 μ may be of great importance in this respect.

Individual Predisposition. Detailed discussion of the role of individual predisposition in the etiology of silicosis is hardly necessary. Race and sex seem to play little part, although race may be a factor in the development of tuberculosis just as financial status may be a factor. Certainly it is known that of two persons working in the same dusty exposure, one may contract silicosis in a few years while the other may

Dust sample

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THE SARANAC LABORATORY
FOR THE STUDY OF TUBERCULOSIS
OF THE EDWARD L. TRUDEAU FOUNDATION
SARANAC LAKE, N.Y.

February 5, 1943

Daniels

Mr. William Daniels
U. S. Gypsum Company
Oakfield, New York

Dear Bill:

Mr. Durkan expects to be at Oakfield on Monday morning to start the dust survey.

I have gotten in touch with Dr. Brumfiel and he will be available for testimony if needed next week. You may count on me also but I hope it will not be necessary for me to stay more than one day as my schedule is very full at the present time.

I will look forward to seeing you then.

Sincerely yours,

Leroy U. Gardner

Leroy U. Gardner, M. D.
Director

LUG:PBH

P. S. On consulting the X-ray Department I find that we did not keep the films taken when we made the survey. They were sent back to the doctor who took them in Batavia, Pierce I believe his name was.

L.U.G.

On 1933 reading on this case ves - negative

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