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# ASBESTOSIS

## PART I

THE Collection and Counting of Dust Encountered in Asbestos Fabricating Plants.

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Monograph (incomplete)

# ASBESTOSIS—Part I: The Collection and Counting of Dust Encountered in Asbestos Fabricating Plants.

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## INTRODUCTION

The Pennsylvania Department of Labor and Industry now is engaged in several surveys on the effect of dusts and their relation to the health of the worker. In view of the limited information now available and the many new uses of asbestos a survey of the conditions presented in asbestos fabricating plants becomes increasingly important.

The 1930 Geneva report of the International Labor Office in "Occupation and Health"[1] cites "The lack of more accurate and detailed data in medical literature regarding this industry in its various branches, including the utilization of by-products is to be deplored in view of the self-evident importance of asbestos dust as a predisposing cause of pulmonary tuberculosis, more especially since the rapidly-increasing development of industries utilizing asbestos adds greatly to the urgency of studying the conditions with a view to their amelioration."

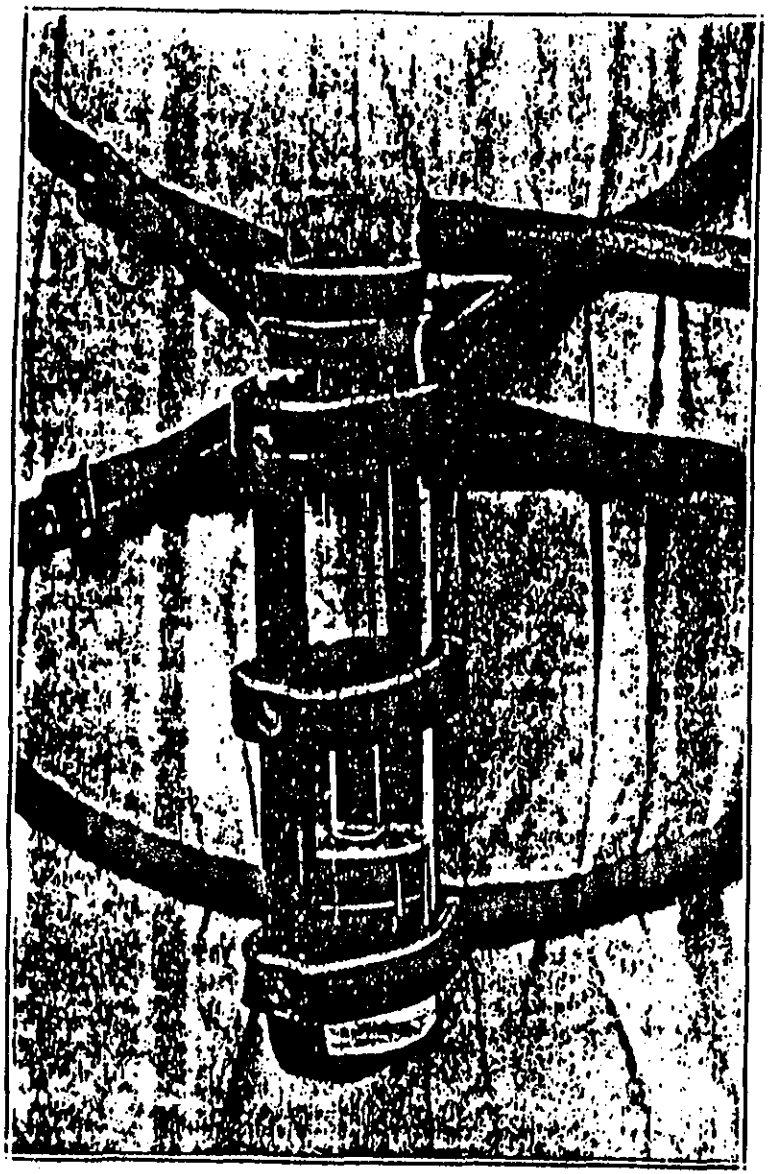
In a survey now being conducted in the asbestos industries approximately one hundred and fifty samples have been collected and the data presented in this paper were obtained from these samples. All the samples were collected in the worker's breathing zone. Dust samples were collected at the site of each operation in the process of manufacture and in some instances two samples at the same time and in the same zone but in different collection mediums.

The purpose of this report is to discuss our modification of the technique already in use in its application for this type of work.

## METHOD

The modified form of the Greenburg-Smith impinger[2] was used for the collection of dust particles. A cylindrical flask 210 millimeters in height and 50 millimeters in diameter is graduated to 325 cubic centimeters. A line is marked 5 millimeters from the base of the flask for use in gauging the impinging distance. The impinger tube, made according to specified measurements, is inserted through a No. 10 rubber stopper which fits the flask. In the modified form of the impinger apparatus, the bottom of the flask is used as the impinging surface. When sampling dust in the field a calibrated flowmeter was used so as to insure collection at the rate of one cubic foot per minute. All samples were taken as close to the face of the worker as possible. For this purpose a specially designed holster (Fig. 1) to support the impinging flask was strapped to the chest of the worker. The holster was made entirely of leather straps one-half inch in width. It was

FIGURE 1



LEATHER HOLSTER WITH IMPINGER IN PLACE



constructed so that the fluid in the flask could be seen at all times without removing the flask from the holster.

In making the dust counts, the method suggested in the United States Public Health Report[3] was followed where it was found to be applicable for this type of dust. After the sample was properly diluted it was shaken for one minute, and a cubic centimeter was transferred to a Sedgwick-Rafter Counting Cell. The sample was not previously filtered through a 325 mesh screen (so that particles smaller than 40 microns in diameter are permitted to pass through.) Other investigators[4] have found asbestos bodies in the lungs from 20 to 100 microns in length. A Zeiss monobjective binocular microscope (DSC[1]) was used. It was fitted with an achromatic objective 8 n a and a 15X eyepiece. A Whipple ocular micrometer disk was used for counting. All dust counts were made within 24 hours after sampling.

## RESULTS

Reports of other investigators[5] have shown the efficiency of distilled water as a collection medium for silica dust. Distilled water was first used but considerable difficulty was experienced in counting the dust particles. It was noted that the particles of dust become agglomerated. Even when the time interval between the collection and counting was but an hour, this agglomeration was observed. A second medium 95 per cent U. S. P. ethyl alcohol was substituted for distilled water. The use of ethyl alcohol completely eliminated the difficulties caused by the clumping of the dust particles. The distribution of the dust in this medium was excellent. The outline of the particles was distinct, and the counting much simplified. O. W. Smith[6] reports the optical efficiency of alcohol 93.0 per cent as compared to 92.5 per cent for distilled water, so from this standpoint there can be no objection to the use of alcohol.

It was decided to sample the same dust zone and collect the dust particles in two different mediums. With this in mind two complete impinger outfits were employed. The only difference in these was that the flask of one contained alcohol, while the other contained distilled water. The impinger openings of the two outfits were separated by a fixed distance of one and three-fourth inches. The samples were collected at the same time, and the results are shown clearly in the photomicrographs.

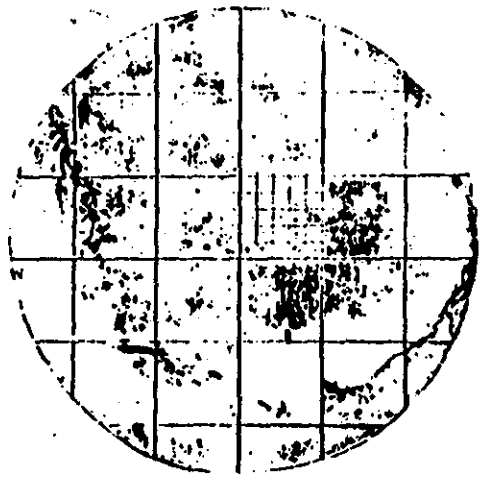
Figure 2 shows the appearance of the dust particles when collected in distilled water, with clear indication of the clumping of the dust particles.

Figure 3 is a photomicrograph of dust from the same zone, taken at the same time, but collected in an ethyl alcohol medium. In this case both the large and the small particles maintained a dispersed position on the cell surface. There is no tendency towards agglomeration of the particles.

Figures 4 and 5 likewise illustrate another dust zone separate from the one described above. The former reports the water medium and

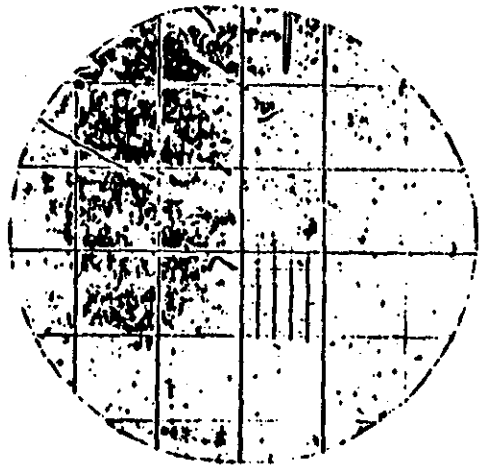
the latter the ethyl alcohol medium. In the photomicrograph, each side of the square formed by small cross lines of the Whipple disc measures 20 microns.

FIGURE 2



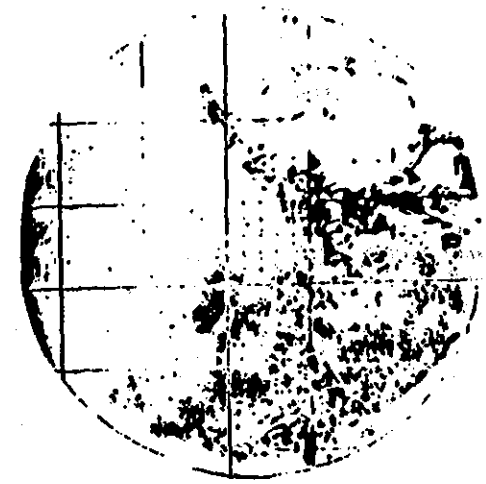
PHOTOMICROGRAPH WATER MEDIUM

FIGURE 3



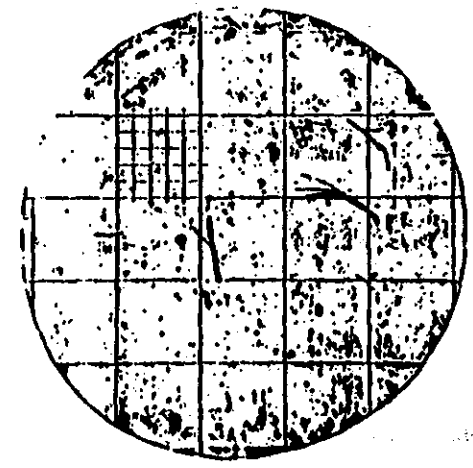
PHOTOMICROGRAPH ALCOHOL MEDIUM

FIGURE 4



PHOTOMICROGRAPH WATER MEDIUM

FIGURE 5



PHOTOMICROGRAPH ALCOHOL MEDIUM

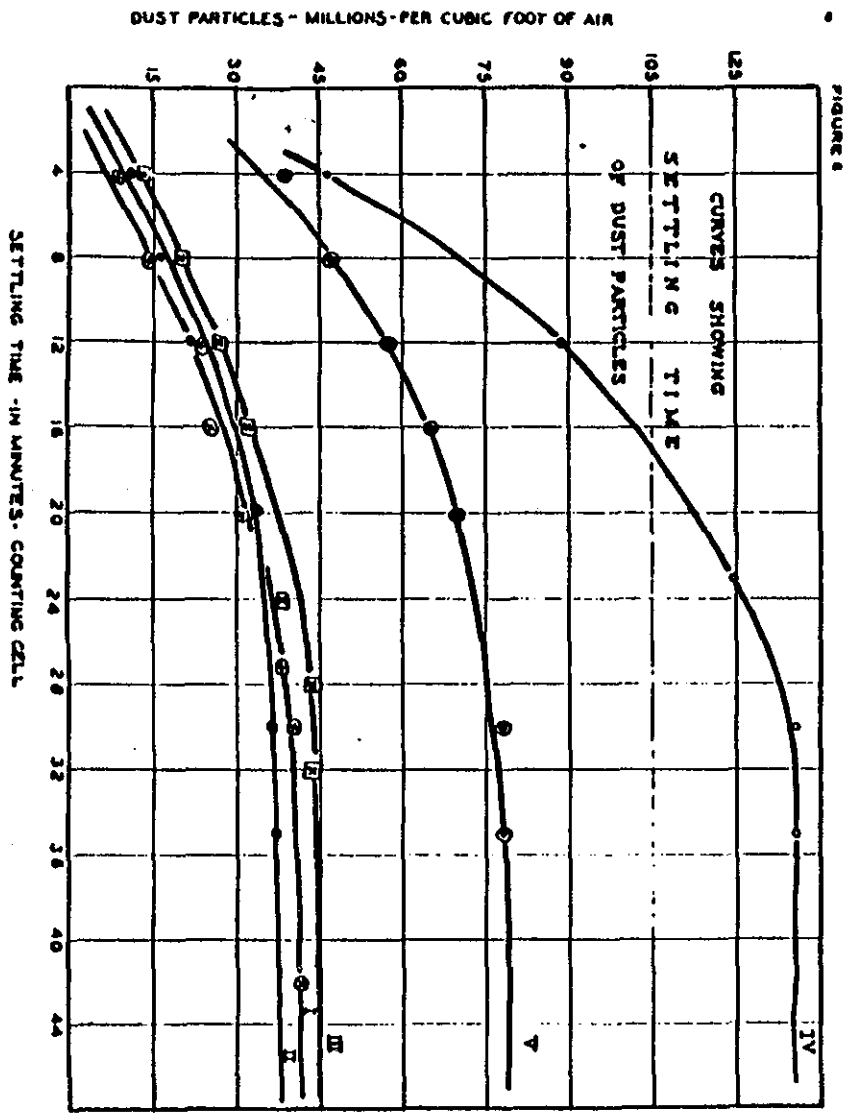



FIGURE 6

CURVES SHOWING SETTLING TIME OF DUST PARTICLES



## SETTLING OF PARTICLES

The United States Public Health Service[1] found that the Sedgwick- Rafter cells should stand from 10 to 20 minutes before counting to allow the dust particles to settle. However, for dust collected in plants making asbestos products, our findings indicate that a longer time is necessary. This dust was allowed to settle in the cell for 30 minutes before any counting was done. We found that this additional 10 minutes is required to permit a complete settling out of the particles. Experiments were conducted to determine the time factor for settling of this particular kind of dust in the cell. Figure 6 is a series of curves showing the settling time of the dust particles. It will be noted that it was necessary to allow the cell to stand 30 minutes before counting.

## SUMMARY

Samples of dust, taken in plants for fabricating asbestos products, were collected by a modified form of the standard method, using a 95.0 per cent U.S.P. ethyl alcohol as a medium. In this medium the particles were well distributed and readily counted. When distilled water was utilized as the collecting medium, agglomeration occurred immediately and made counting impossible. Dispersion of the dust in alcohol is good. A settling time of at least 30 minutes was required before counting. The particle count in any given field remained constant after this period. A modified holster is described. It is constructed of leather straps, in such a way that the fluid in the impinger flask is visible at all times.

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