Ex. 71

SUPPLEMENT A. RECORD

Examination of the Dust and Fine Fractions of Some Asbestos Samples

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J-M Research Laboratories
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Examination of the Dust and Fine Fractions of Some Asbestos Samples

This report gives the results of a preliminary study made to determine the character of the fiber fractions and dusts of several grades of asbestos.

Description of Samples

Six types of fibers were studied as follows:

1. Short fiber Chrysotile
   Danville 7S (J-M #5S6 Screen) was used for the dust tests.
   Danville 7S was used for the abrasion tests.
2. Long fiber Chrysotile
   Danville 3X (3X Grade) obtained from Danville stock.
3. Short fiber African Blue - 3X Grade
   Obtained from Mr. Cannon.
4. High grade Amosite - 3-S
   Regular 3-S 3X fiber obtained from 3X Building.
5. South African Fiber - [illegible]
   Obtained from Mr. Cannon.
6. Rhodesian 5 & 6 Fiber
   (50-1/2% mixture of 5X, 5S and 5A grades)
   Obtained from Mr. Cannon.

Asbestos Dusts

There has been some difference of opinion as to the character of asbestos dusts from different grades of fibers. It was hoped that a microscopic examination of dusts obtained from different fibers would show differences that could be correlated with other known properties of these dusts. Attempts were, therefore, made to collect dusts by several methods. The studies as reported are recognized not to be extensive and the conclusions drawn should be considered suggestive rather than the results of extensive investigations.

1. Method of Collecting Dusts

The method finally adopted was to blow the fibers into a system and collect the fine dust from the system exhaust.

Samples of the fibers were passed through a small #5S60 Sturtevant Blower Company exhaust fan discharging into the system (approximately 3-1/2 feet in diameter by 4 feet in height). The fine dust not collected in the system was withdrawn from the system exhaust at a point about 2 feet above the system. The method of accomplishing this was to insert a brass glass tube (3/8 inch diam.) into the exhaust pipe and slowly withdraw a small volume of air containing suspended dust particles through the tube by means of the suction created by the fan

of the air-way cleaner. The dust particles were intercepted on a sheet of filter paper held in place in the suction line leading to the air-way. In this manner it was found possible to collect a small quantity of the finest dust (about 0.1 gm. after several minutes operation). The rate of feed of fibre to the cyclone blower was approximately thirty pounds in fifteen minutes.

2. Examination of Dusts.

Small quantities of the dusts were removed from the filter papers and placed upon the microscope slides. Examination by transmitted light was not found to be satisfactory because of the extreme fineness of the particles. It was also observed that ordinary mounting media were not suitable for the Chrysotile dusts. Examination of all these latter (Quebec, B.A.-S and S & M) were therefore made with Xylene mounted slides. The dusts were thoroughly stirred into the xylene and the cover glasses pressed into the dusty material. Xylene is not satisfactory for either Amosite or Africanm Blue dusts and glycerine was used as the mounting medium for these.

Photomicrographs (magnification 2000) of each dust sample are included as Plates I to IV. These are:-

I - Thetford VG Dust
II - Thetford XXX Dust
III - African Blue - VGP Dust
IV - Amosite - B-S Dust
V - B.A.-S /A Dust
VI - S & M, /B, /D and /E Dust

The method of taking these photomicrographs was:-

Dust Field Illumination.
3 V 1. 200cm filament lamp.
Leitz 0.60 N.A. dust field condenser.
Leitz 16 mm. apochromatic objective.
Leitz 2MX compensating eyepiece.
Bellows extension 30" giving 2000X magnification.
Wratten H plates - D-1 developer 6.5 minutes - 70°F.
Prints on Ilex /A and /B paper.

The general characteristics of the different dust samples are best appreciated by direct observation and comparison of the plates. However a brief description of each plate is given below.

Plate I Thetford VG Dust
Consists largely of mineral particles of colloidal size and up to about 5 microns diameter.
A few free fibres or very thin bundles of fibres are present and these are evenly curled and twisted.

Plate II Thetford XXX Dust
Consists largely almost of free fibres and thin bundles of fibres showing a curvature and curling than Amosite fibre. Most of the remainder of the sample consists of mineral particles of colloidal size and up to about 1 micron in size.

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Plate III African Blue "B" Dust
Consists principally of long straight free fibres as illustrated in plate. A very small amount of mineral grains of colloidal size and up to 5 microns are also present.

Plate IV Amosite B-8 Dust
Consists principally of mineral grains of colloidal size and up to ten microns in size. A few free fibres are present and these have very little more tendency to emit than Amosite fibre.

Plate V Rhod-B #1 Dust
Consists mainly of thin bundles of fibres partially pulled open. Some loose free fibres and much less colloidal and small mineral grains than in 6 & 8.

Plate VI 6 & 8, #2, #3 and #4 Dust
Consists mainly of free fibres and thin bundles of fibres partially pulled open. Only a small amount of colloidal and small sized mineral grains are present.

5. Discussion of Dust Examinations
The most outstanding generalization permitted by these limited observations is that the dust of short fibre and low grade asbestos is principally non-asbestic mineral materials, anisotropic in shape, whereas the dust from the longer fibred asbestos is distinctly fibrous in character, containing only a relatively small amount of non-fibrous particles. Both low grade Quebec Chrysotile (Plate I) and the low grade Amosite (Plate IV) consist principally of colloidal and mineral particles. The particles of the Rhodesia #2 dust are considerably smaller than those of the Amosite fibre. The dusts from the long fibre Quebec Chrysotile (Plate II), that from the long fibre African Blue (Plate III) and the long fibre Chrysotile from Rhodesia and South African (Plates VI and V) all contain large numbers of individual fibres and even bundles of fibre. African Blue - B, Rhod-B, and 6 & 8 dusts are principally fibrous. It is noted that the Chrysotile fibres are more or less curled or twisted. The African Blue fibres are notably straight.

No attempt is made here to express an opinion as to the relative harmfulness of the various dusts. It would appear reasonable, however, that the exceedingly long African Blue fibres and the large size Amosite particles would be more harmful than the smaller Chrysotile fibres and particles. It is to be remembered that all of the dusts were collected in the same apparatus and with the same volumes of air flowing off the particles. The procedure in collecting the particles was the same in all cases. It is concluded, therefore, that the very fine dust particles and fibres were approximately the same expedites for remaining suspended in air or being unprevented thereby. In this connection it was noted that air containing dust approximately 1 chrysotile contains very long fibres (up to several hundred microns in length). Observations on dusts collected from windows and ledges of the higher elevations of the buildings show a surprisingly large amount of long fibres. Fibres of medium of small as to settle even though of great length seem to be capable of fairly stable suspension in air. Examination of the dust from a respirator used by an operator in the asbestos industry showed the presence of many long fibres. In very fine dust. It was significant that the fibres noted together on the surface of the respirator and formed an effective filtering layer and that the finer mineral particles were entirely

The -65, +150 fractions of all samples are distinctly fibrous. The Amosite and particularly the African Blue samples appear more gritty and abrasive than the Chrysotile samples. Some of the -150 mesh samples appear appreciably fibrous to the eye although all of the long fibre grades contain appreciable quantities of microscopic fibres. The African Blue and Amosite fibre -325 mesh samples are harsh and abrasive. Tests were conducted to determine the comparative abrasiveness of the several samples as described below.

2. Method of Making Abrasion Tests

Attempts were made first to make the abrasion tests with conventional equipment and with power driven devices commonly used for this purpose. The results obtained were not satisfactory and the following hand test method was finally adopted. This simple method proved to be accurate and showed startling differences in the relative abrasive properties of the samples.

Test Method

0.5 gm. of the sample to be placed on a flat, highly polished plate of aluminum, size about 3" x 3". A piece of clean medium flannel about 2" square is placed upon the powder. The operator then rubs the powder over the surface of the metal plate with the flannel affording a circular rubbing motion with the hand, care being taken to apply an all pressure and with all samples the same even pressure. Fifty complete circular strokes requiring about one minute operating time is sufficient for the test. All of the tests were made by the same operator. With some practice it is possible to develop considerable skill in carrying out this test.

3. Results of Abrasion Tests

The African Blue samples were shown to be considerably more abrasive than any of the others. The Amosite samples are the next most abrasive. All of the Chrysotile samples are less abrasive than Amosite. The 6 & 6 samples were the most abrasive of the Chrysotiles. The 3MR-6 and the long fibre Quebec Chrysotile scarcely scratched the aluminum surface under the conditions of the test. The short fibre Quebec samples were less abrasive than the 6 & 6 but slightly more so than long fibre Quebec and 3MR-6. In some cases, it was found that the -325 mesh fractions contained aluminum almost as much as the coarser fractions. The tabulation below notes the relative abrasiveness of the asbestos samples of the same mesh size. The numbers indicate the order of abrasiveness, i.e. number 1 represents the greatest abrasiveness, etc. This tabulation does not indicate the relative abrasiveness of the different fractions of the same fibre grade.

Mesh Size	Chrysotile I	Chrysotile II	African Blue "F"	Amosite Ref	3MR-6 #1	6 & 6 #2, #3 and #4
-65, +150	4	6	1	2	5	3
-150, +325	4	5-6	1	2	5-6	3
-325	5	6	1	2	4	3

Dr. of Dust and Fine Fractions of Some Ash. Samples.

Examination of the elutriated test pieces easily shows the differences in the various samples. The original test pieces are therefore submitted as follows:-

Sample Number	Kind of Fibre	Fraction
[illegible]	Danville YB	-65, +150 -150, +200 -200
[illegible]	Danville YB	-65, +150 -150, +200 -200
[illegible]	African Blue YBF	-65, +150 -150, +200 -200
[illegible]	Amosite - B-6	-65, +150 -150, +200 -200
[illegible]	B.A.L.6 FA	-65, +150 -150, +200 -200
[illegible]	C.A.C. FA, FB and FC	-65, +150 -150, +200 -200

Summary

1. Samples of dusts from Quebec Chrysotile, Rhodesian Chrysotile, Amosite and African Blue asbestos have been collected and examined microscopically.
2. Examinations have been made of fine screen fractions of each of the fibre samples.
3. The dusts from the 1-ogar fibre grades consist principally of microscopic fibres.
4. Dusts from low grade and short fibre asbestos consist principally of microscopic non-asbestic mineral particles.
5. Fine fractions of African Blue fibre and Amosite fibre are much more abrasive than evaporable Chrysotile fractions.
6. C.A.C. Chrysotile fibre fractions are more abrasive than the Quebec Chrysotile sample examined.

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7. Short fibre Quebec Chrysotile (as represented by 7E Grade) is more abundant than long fibre from the same source (1E Grade).

8. Individual fibres of several inches in length float readily in air.

9. It is considered doubtful if fibres as found in asbestos dusts can readily find their way into the lungs. This conclusion is reached as the result of observations on the collection of dusts on filtering surfaces, respirators, etc.. Microscopically fine asbestos fibres apparently mat or felt together readily and form a layer capable of holding back non-fibrous dust particles.

10. Photomicrographs (XXXX) of the asbestos dusts are presented.

11. Samples of the fine screen fractions of the samples have been retained.

12. Aluminum tank plate showing the relative abrasiveness of the fine fractions of all samples are submitted.

Photomicrographs by Dr. D.G. Miller
Preparation of samples by Messrs. S.D. Williams and G.A. Gaffney
Abrasion tests by Dr. J.L. Blakely

Report by:_____
A.I. Cummins

TABLE 2

Examination and Properties of the Fine Fractions of Asbestos Fibres

Fibre Designation	Exhibit Number	Screen Size		Description
Rhodesia 7B	2A	-66	+150	Rather high content of hard mineral aggregates about 40μ in size. Large bundles of fibres (200 to 400μ). Many free ends fibres (most of these 200 to 400, few below 10μ). Large amount of colloidal particles.
	2B	-150	+325	Very high content of large hard mineral aggregates (75 to 150μ in size). Many bundles of fibres (100 - 150μ). Low content of free ends fibres (most of these 50μ, few below 10μ). Low content colloidal particles.
	2C	-325		Rather high content of hard mineral aggregates (10 to 75μ). Few small bundles (200μ). Practically no free fibres of any size.
Rhodesia 3B	3A	-66	+150	Large bundles of fibres (200 - 400). Few hard mineral aggregates (40μ). Many free ends fibres ranging mainly from 200 - 400μ in size with a few below 10μ. Large amount of colloidal particles.
	3B	-150	+325	High content of large hard mineral aggregates ranging from 75 - 150μ in size. Many bundles of fibres (200 - 300μ). Low content of free ends fibres mainly 50μ in size but with a very few below 10μ. Low content of colloidal particles.
	3C	-325		Rather broken hard mineral aggregates mainly 10 - 75μ in size. Few small bundles (200μ). Practically no free fibres or no colloidal particles.
African Blue ore	11A	-66	+150	Large bundles of fibres (200 - 400μ in size). Few large hard mineral aggregates (about 200μ). Many free fibres ends ore ends but both are crumpled (mainly 50 to 400μ in size with a few 5μ and less). Large amount of colloidal particles.
	11B	-150	+325	Same as the average grade of this fibre except Larger content of mineral aggregates and bundles. Aggregates vary from 75 to 150μ in size. Bundles from 200 to 400μ in size. Most of the free fibres appear from 50 to 100μ with a few 5μ and less.
	11C	-325		High content of rather hard mineral aggregates ranging from 10 to 75μ in size. Bundles range from 50 to 100μ. Low content of very short free fibres and colloidal particles.

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