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DEPARTMENT OF MINES AND TECHNICAL SURVEYS

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Corrected

INVESTIGATION OF SELECTED SAMPLES OF COALINGA-TYPE ASBESTOS SUBMITTED BY ATLAS MINERALS

by

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A.A. Winer*

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SUMMARY OF RESULTS

Asbestos fibre from the Coalinga area, California, was subjected to dry sieving (Alpine Jet and Ro-Tap) and to specific surface measurements (Dyckerhoff). Results for some dry sieving, Bauer-McNett and oil absorption tests were supplied by Atlas Minerals.

Combined Alpine Jet and Ro-Tap sieve results failed to show any significant variations. This is probably due to the physical properties of asbestos, which allow the fibres to open and entangle.

Although a correlating trend was shown between surface area and oil absorption, there was no statistical significance. Many more results are necessary to evaluate whether a relationship actually does exist.

When the minus 200 and minus 70 mesh from the Alpine Jet and Ro-Tap are combined and compared to the corresponding minus 200 mesh from the Bauer-McNett, a relationship is exhibited. A potential therefore exists for a rapid test.

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INTRODUCTION

Mr. Bryant Bullen of Atlas Minerals, having obtained permission by phone for a test program at the Mines Branch, personally delivered 30 samples of Coalinga asbestos fibre. Atlas Minerals is a subdivision of Atlas Corporation with offices in Salt Lake City, Utah. The asbestos samples were from a company-owned deposit in the Coalinga area of California.

A representative cross-section, consisting of 18 samples, was selected by Mr. Bullen for testing by:

(a) Air Jet sieving
(b) Ro-Tap screening
(c) Specific Surface - Dyckerhoff air permeability tester.

This investigation was designated MP-NMM-2-64.

Mr. Bullen agreed to forward the results for oil absorption and Bauer-McNett wet classification on duplicate samples. These values may be related to the present results.

Typical characteristics for a Coalinga asbestos fibre were compared with a typical Canadian fibre of similar grade by Atlas Minerals. The results are shown in Table 1.

TABLE 1

Typical Physical and Chemical Characteristics*

1. Dry Screen Analysis (100 g 20 min Ro-Tap)

	% Retained	
	Atlas AZ-20	Canadian 7 Fibre
+ 10 mesh	0.0	4.0
+ 20 mesh	4.0	16.8
+ 28 mesh	14.5	20.1
+ 35 mesh	22.0	27.8
+ 65 mesh	38.5	4.0
+ 100 mesh	6.5	1.8
+ 200 mesh	5.5	6.9
- 200 mesh	9.0	18.6
	100.0	100.0

2. Oil Absorption - Raw Linseed Oil (ml/100 g asbestos)	98.2	47.0
3. Surface Area (cm^2/g) (Dyckerhoff system)	28,000	12,000
4. Colour Index (G)	75	56
5. Dry Bulk Density (lb/cu ft) loose	6.0	16.0
6. Dry Bulk Density (lb/cu ft) compressed at 4 lb/sq in.	22.2	42.0
7. Magnetic Index (Mapes Magnetic Analyser)	0.2	3.5
8. Per cent Rock	0.4	2.2

9. Chemical Analysis:

% SiO_2	40.2	37.0 - 43.0
% Al_2O_3	1.5	0.2 - 1.5
% FeO	1.4	0 - 6.0
% Fe_2O_3	1.6	1.0 - 5.0
% CaO	0.1	0 - 0.3
% MgO	41.5	39.5 - 43.9
% Loss on ignition	13.6	12.0 - 15.0

*These characteristics are considered typical and are not to be regarded as specifications.

TESTS PERFORMED

Preliminary Testing

The optimum sieving time was determined in a series of preliminary tests. Ten grams of asbestos fibre was sieved on the Alpine Jet using a 200 mesh screen. Sieving periods of 1 to 9 minutes were used. The plus 200 mesh fraction was then screened on the Ro-Tap using 20, 35 and 65 mesh screens. Table 2 shows that the break comes at 5 minutes with the Alpine Jet.

TABLE 2

Optimum Sieving Time

Alpine Jet		Ro-Tap				
Sieving Period (min)	% Retained on 200 mesh	Sieving Period (min)	%			
			+20	-20+35	-35+65	-65
9	61	10	4.0	23	22	12
7	61	10	4.0	23	22	12
5	61	10	3.0	25	22	10
3	65	10	6.0	25	23	12
2	67	10	6.0	25	23	12
2	67	10	6.0	26	23	12
1	71	10	7.0	28	24	12

Alpine Jet Sieve

Ten grams of each sample was processed for 5 minutes on the Alpine Jet Sieve using a 400 mesh screen. The fibre remaining was weighed. This procedure was repeated using the 200 mesh screen.

Ro-Tap Sieving

The plus 200 mesh fibre from the Alpine Jet sieve was placed on a series of screens (20, 35, 65) and mechanically sieved for 10 minutes on the Ro-Tap.

Specific Surface

Fifty grams of each sample was loaded into the Dyckerhoff according to the QAMA (1) method and the time recorded for each test. Because of the very fine asbestos, the air passage time was long. Therefore, it was decided to take only two readings provided the results were within the allowable $\pm$ 3 per cent deviation.

Bauer-McNett and Oil Absorption

The results of these tests were supplied by Atlas Minerals for correlation with our Dyckerhoff results.

RESULTS AND DISCUSSION

The results obtained in the above tests are summarized in Table 3.

The results shown in columns 4 and 5 were contributed by Atlas Minerals. Column 4, "Ro-Tap, Mill Screening" refers to the milled product which was screened immediately after processing; whereas column 5 represents the results after conditioning the product prior to screening. The difference due to conditioning is very noticeable when columns 4 and 5 are compared.

Column 7, "Ro-Tap, +200 Mesh", approaches the results in column 5 for the 20 and 40 screen sizes and shows less deviation.

An interesting observation was noted when the results in column 6, "Jet Sieve, -200 Mesh", were added to the "-70 Mesh", column 7, and then compared to the "Bauer-McNett, -200 Mesh" in column 8. This comparison of the calculated percentage with the corresponding Bauer-McNett result is shown in Table 4.

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(1) Manual of Testing Procedures for Chrysotile Asbestos Fibres.

TABLE 3

Summary of Test Results

1	2	3	4				5				6			7				8					9	10
Sample No.	Composites in Sample	Date of Product	Ro-Tap Mill Screening 100 g - 30 min % retained				Ro-Tap 1-64 Screening 100 g - 30 min % retained				Jet Sieve 10 g - 5 min % retained			Ro-Tap ÷ 200 Mesh (6) 10 min % retained				Bauer-McNett % retained					Blaine Dyckerhoff	Oil Absorption
			20	40	70	-70	20	40	70	-70	400	200	-200	20	40	70	-70	20	40	70	200	-200	(sec)	cc/100 g
0	5	3-63	2	31	50	17	3	33	42	22	69	57	43	3	19	23	12	1.6	8.7	16.1	18.1	55.5	952	78
3	16 to 20	4-63	3	35	43	19	4	29	45	22	74	64	36	3	23	23	13	3.5	10.9	18.3	18.9	48.4	912	92
6	31 to 35	5-63	3	32	47	18	4	21	47	28	73	61	39	3	22	23	13	4.5	12.2	16.0	16.4	50.9	727	70
9	48,49,50	6-63	4	30	45	20	4	23	45	28		62	38	3	24	23	12	3.1	11.4	18.0	18.1	49.4	733	68
12	61 to 65	7-63	4	34	45	17	3	24	47	26		62	38	3	25	23	11	4.5	12.6	16.3	16.0	50.6	749	71
14	71 to 75	8-63	4	39	43	14	4	29	46	21		63	37					5.9	14.3	18.4	16.6	44.8	836	74
15	76 to 80	8-63	4	34	44	18	3	29	48	20		64	36	4	26	23	11							68
18	91 to 95	8-63	4	33	45	18	4	28	47	21		61	39	4	26	22	11	4.7	12.8	16.5	15.3	50.7	831	76
21	106 to 110	9-63	4	26	49	21	3	24	48	25		59	41	3	23	23	12	3.8	10.4	16.2	17.0	52.6	677	62
24	121 to 125	9-63	3	28	48	21	3	23	48	26	74	57	43	1	22	21	13	3.3	10.6	14.9	14.8	46.4	671	65
27	136,139,140	10-63	3	32	47	17	3	26	46	25	73	63	37	3	24	24	12	2.9	10.4	15.2	15.2	56.3	802	60
30	151 to 155	10-63	3	32	46	19	3	26	47	24	72	58	42	4	21	22	11	2.8	9.2	15.9	11.7	60.4	772	65
B-365		8-63	6	26	47	21	5	23	45	26	69	60	40	4	25	22	10	6.9	12.8	0.4	26.3	53.6	743	65
B-400		8-63	5	58	28	9	2	40	44	14	70	61	39	3	25	22	10	3.0	11.4	16.4	15.4	53.8	969	72
B-541		8-63	6	40	39	15	6	36	42	16	77	67	43	7	29	21	9	7.9	13.6	0.3	27.6	50.6	1010	58
B-548		8-63	3	20	49	28	3	20	44	33	70	57	43	3	21	22	12	4.1	10.4	6.1	20.7	58.9	568	55
B-555		8-63	3	35	46	15	3	30	48	19	70	57	43	2	23	21	9	3.6	9.7	14.1	15.1	63.5	855	68
A-1		3-63					5	29	41	25	75	64	36	5	23	22	13	4.9	12.4	16.9	16.4	59.4	931	68
High			6	58	50	28	6	40	48	33	77	67	43	7	29	23	13	6.9	14.3	18.4	26.3	63.5	1010	92
Low			2	20	28	9	3	20	41	14	69	57	33	1	19	21	9	1.6	8.7	0.3	11.7	46.4	568	55
Average			3	33	45	18	3.6	27	46	23	72	61	39	3.4	24	22	11	4.2	11.4	13.9	17.6	53.1	809	68
Range			4	38	22	19	3	20	7	19	8	10	10	6	10	2	4	5.3	5.6	18.1	14.6	17.1	442	37

TABLE 4

Calculated Percentage Compared to Corresponding Bauer-McNett Results

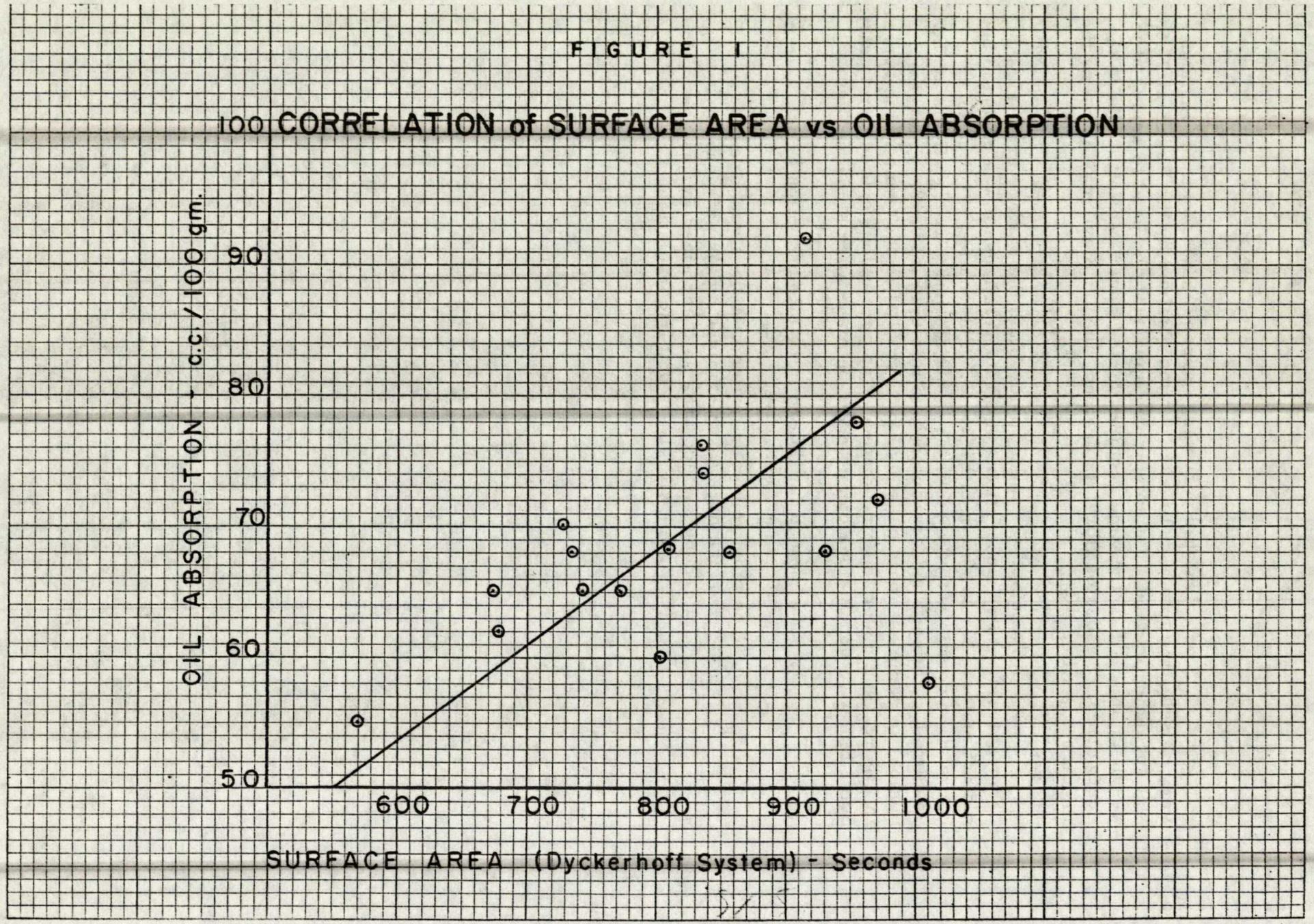
1	2	3	4
Jet Sieve -200 mesh from Column 6, Table 3	Ro-Tap -70 mesh from Column 7, Table 3	Addition of Columns 1 and 2 (Calculated Per cent)	Bauer-McNett -200 mesh from Column 8, Table 3
% by Weight	% by Weight	% by Weight	% by Weight
43	12	55	56
36	13	49	48
39	13	52	51
38	12	50	49
38	11	49	51
39	11	50	51
41	12	53	53
43	13	56	46
37	12	49	56
42	11	53	60
40	10	50	54
39	10	49	54
43	9	52	51
43	12	55	59
43	9	52	64
36	13	49	59

The calculated percentage approximates, in many instances very closely, the minus 200 mesh fraction obtained by the Bauer-McNett wet screening method. Jet sieving can apparently be used to arrive at the result in almost half the time required by the Bauer-McNett. Where the dust content of asbestos fibres is desired, the Jet Sieve may serve as the means for a rapid test.

An attempt was made to correlate the surface area (air permeability) with oil absorption. A direct relationship was expected but did not materialize as shown in Figure 1. The scatter resulted in a correlation coefficient of 0.44 which is not statistically significant at the 95% level. A significant coefficient is a minimum of 0.48. A larger number of samples would possibly have established the trend which appears in Figure 1 but under the circumstances no conclusions can be firmly stated. Some tentative conclusions can however be made after studying Figure 1.

1. The method for determining oil absorption is not sufficiently sensitive.
2. The most important parameter does not appear to be surface area as determined by air permeability. Perhaps surface area as determined by gas absorption (B.E.T.) will give a better correlation.

FIGURE I


CORRELATION of SURFACE AREA vs OIL ABSORPTION
OIL ABSORPTION - c.c./100 gm.
100
90
80
70
60
50
600
700
800
900
1000
SURFACE AREA (Dyckerhoff System) - Seconds

CONCLUSIONS

1. There is no significant variation in the results for the combined Jet Sieve - Ro-Tap method (columns 6 and 7, Table 3) despite the fact that the surface areas of the head samples differ as shown in column 9. This lack of variation may be due to opening of the fibres by the air and tapping. Under these conditions sieving is not sufficiently sensitive to reveal any differences.

2. When the minus 200 mesh from the Jet Sieve (column 1, Table 4) is added to the corresponding minus 70 mesh from the Ro-Tap (column 2) the results approximate the minus 200 mesh from the Bauer-McNett method (column 4). This may form the basis for a rapid test for dust content in asbestos.

3. A correlation between surface area and oil absorption was not found to be statistically significant although a trend is evident.

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