PLAINTIFF'S EXHIBIT

UC-3951

THE DISCOVERY COMPANY

California Asbestos

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CALIDRIA "HIGH PURITY" ASBESTOS FOR POROSITY CONTROL, PINHOLE REDUCTION, AND IMPROVEMENT IN TWO-SIDEDNESS

Union Carbide's CALIDRIA "High Purity" Asbestos is a unique mineral fiber which has been fully opened so that it consists essentially of pure individual fibrils. It differs from conventional chrysotile because of the unusual morphology of the massive California deposit from which it is mined, and the exclusive hydraulic process by which it is refined. Because of its unusual purity, high concentration of liberated fibers, and low iron content, it can be used in most papermaking systems. Its cationic charge and fibrous geometry provide unusually high retention in a paper web, higher than that of any other mineral filler or pigment. Also, CALIDRIA chrysotile fibers are more uniformly distributed throughout the sheet.

The above properties can result in more uniform filling of the paper web, reduction in porosity and pinholes, and an improvement of two-sided effects, particularly in lightweight sheets where pinholes and low filler retention are frequently encountered.

Porosity and Pinhole Reduction

The dramatic effect of asbestos on porosity is shown in Figure 1. From the plot it can be seen that relatively small additions (1-2%) to the handsheet furnish caused a sharp reduction in porosity (Gurley Densometer).

In commercial practice, paper mills using CALIDRIA "High Purity" Asbestos have eliminated troublesome pinholes in the sheet with asbestos dosages as low as 1 to 1 1/2% (20-30 pounds per ton of pulp).

Reducing Two-Sidedness

Two-sided differences in sheet properties, such as smoothness and printability, are frequently caused by low and/or uneven filler retention. The result is a relatively low concentration of mineral filler on the wire side of the sheet.

The high retention properties of CALIDRIA "High Purity" Asbestos improve the distribution of fillers in the sheet, since much more filler is retained in the wire side. This effect is illustrated in Figure 2, a plot of filler distribution from Beloit Sheet Splitter analyses of a commercial magazine sheet. The filler ratio from top to bottom of the sheet (felt side to wire side) was improved from about 4/1 to about 2/1 by CALIDRIA "High Purity" Asbestos.

The reduction of two-sided effects by CALIDRIA "High Purity" fiber on 47-pound mimeograph paper is shown by data in Table 1. Smoothness, printability and ink transfer were improved by CALIDRIA Asbestos, particularly on the wire side. Also, opacity was increased 2 to 4 points. These tests were run by the Research Institute of the American Newspaper Publishers Association on commercial paper produced in a carefully monitored mill trial.

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ACL Doc 18586 · Page 1 of 12

asbestosclaims.law/library/18586/1

CALIDRIA ASBESTOS - HIGH PURITY
TYPICAL PHYSICAL CHARACTERISTICS

Specific Gravity	2.45
Moisture Content, % by weight	2
Brightness, % G.E.	74-76
Surface Area, sq. meters per gram	50-70
Particle Shape	Fibrous
Fiber Diameter, microns	0.025
Aspect Ratio, average L/D	200:1
Nature of Surface Charge	Electropositive (cationic)
pH in Water (2% slurry)	9.5
Refractive Index, n_d 25°C	1.54-1.56

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ACL Doc 18586 · Page 2 of 12 asbestosclaims.law/library/18586/2

TABLE I

PRINTING EVALUATION DATA*

MIMEOGRAPH PAPER (Uncoated)

(Paper Conditioned at 72°F and 45% R. H.)

	Control Sample (No Asbestos)	Samples Containing CALIDRIA Asbestos @ 2%	Samples Containing CALIDRIA Asbestos @ 3%	% Improvement
Basis Weight (lb./ream)	47	47	47	-
Opacity (per cent)	87.32	91.2	89.56	Higher, 2-4 points
Smoothness (felt side)	296	257	295	Inconclusive
cc air/min. (wire side)	386	263	322	Smoother
Printing Hardness (per cent)				
(Felt Side)	56.32	56.74	53.46	-
(Wire Side)	53.06	52.86	56.42	-
Ink Transfer (per cent)				
(Felt Side)	33.90	39.60	37.48	9-11
(Wire Side)	26.28	31.28	30.00	14-19
Printability (per cent)				
(Felt Side)	55.50	56.92	57.26	3
(Wire Side)	47.70	53.94	53.94	13

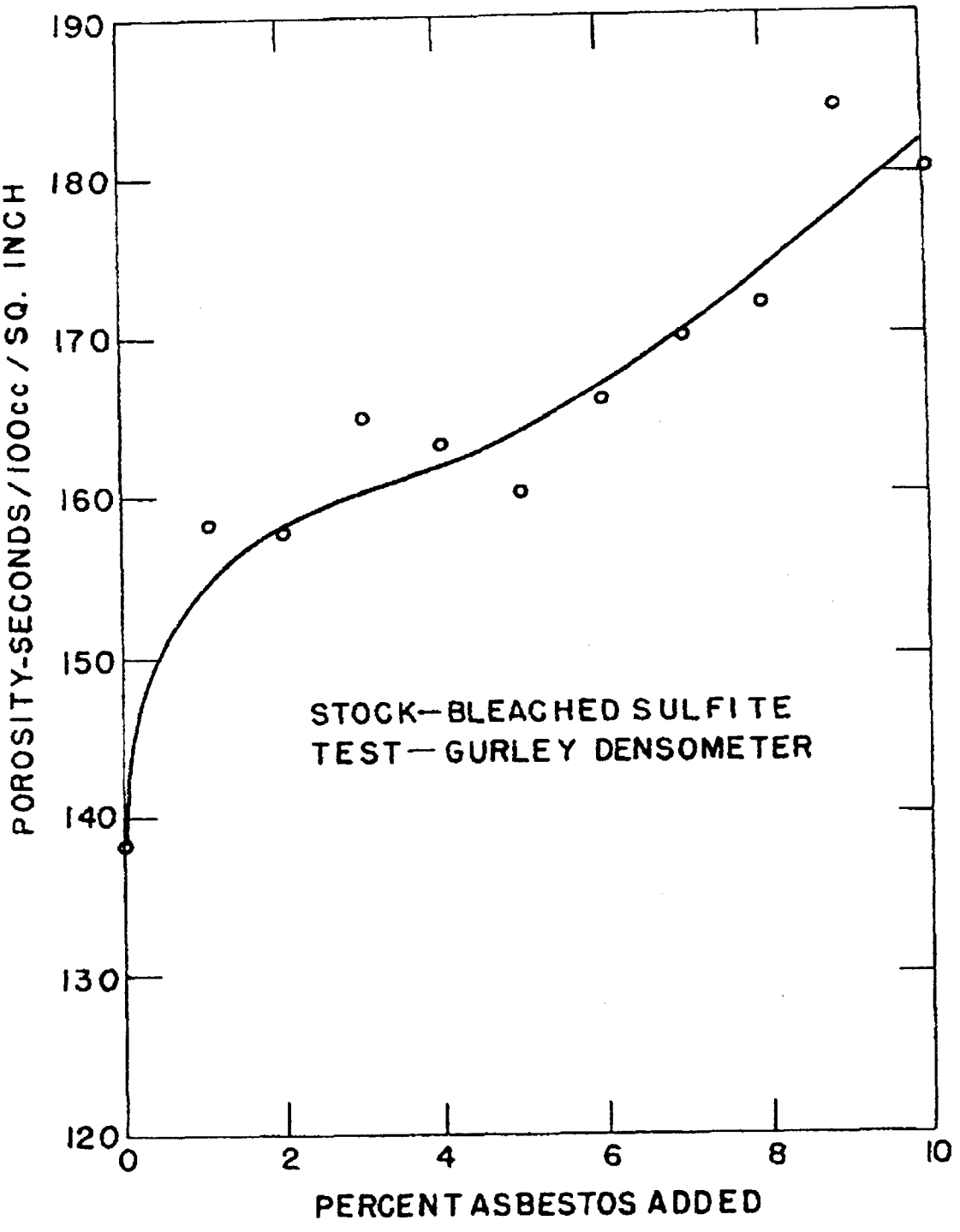
*The average value shown for each characteristic evaluated represents 25 tests on a minimum of ten sheets for trial or control condition. Tests were run by the Research Institute of the American Newspaper Publishers association.

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FIGURE 1

EFFECT OF ASBESTOS CONTENT ON HANDSHEET POROSITY.

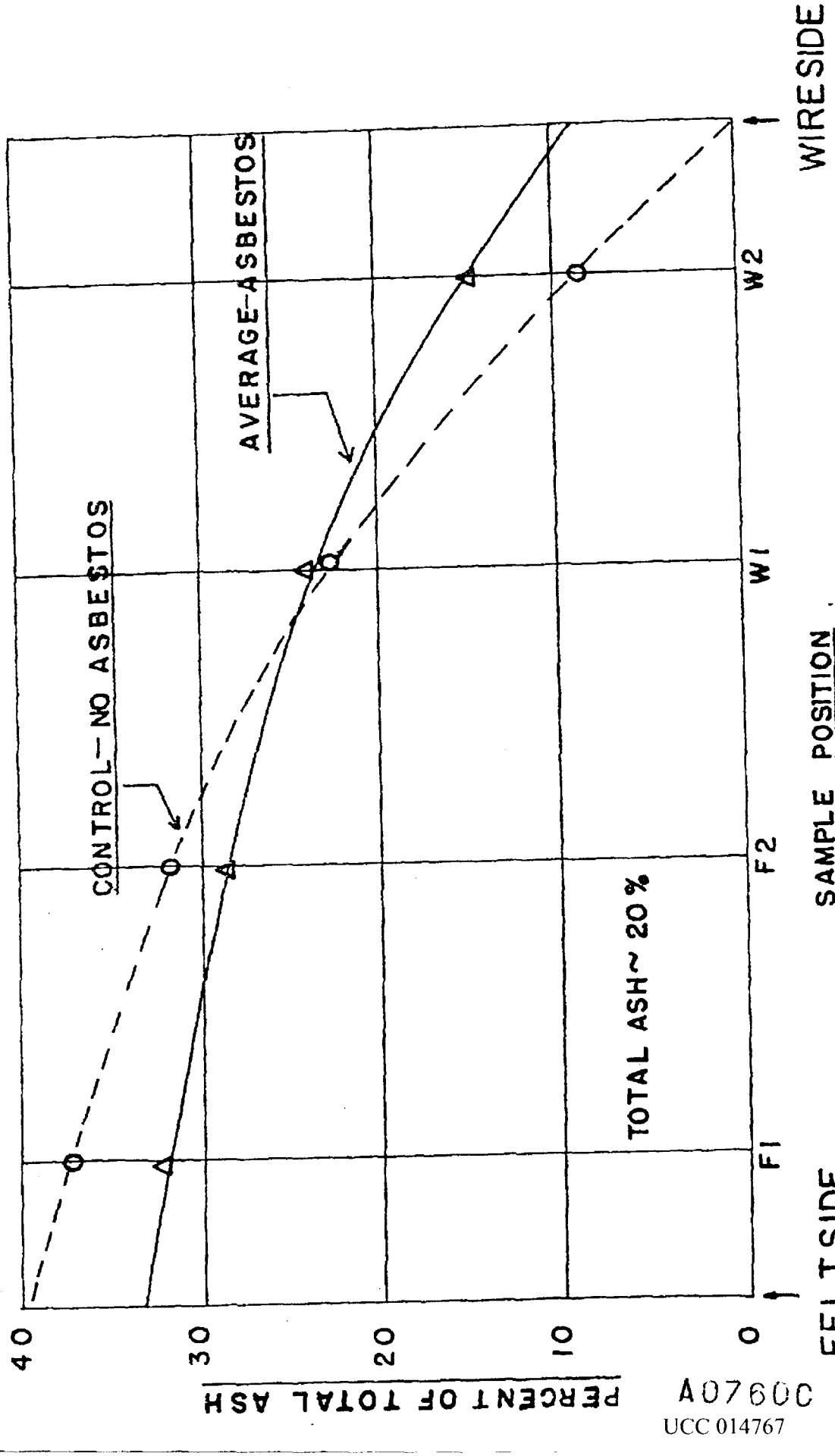


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FIGURE II

SPLIT SHEET ANALYSES
GRADE—MAGAZINE PAPER



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Calidria ASBESTOS

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CALIDRIA ASBESTOS FOR PAPER COATINGS

Introduction

Calidria High Purity Asbestos is a highly refined form of chrysotile asbestos with extremely fine, short fibers. Because of its fibrous nature and water holding properties, Calidria Asbestos is an effective pigment for increasing the bulk of paper coatings and improving the flow characteristics of coating colors. Lower density coatings exhibit better porosity with Calidria High Purity Asbestos. In small amounts, Calidria High Purity increases the thixotropy of starch coating formulations for improved rheological characteristics on roll coaters.

Calidria High Purity is effective at low levels of addition, and 5% in a clay pigment is sufficient to display the advantages without excessive viscosity effects.

Calidria Asbestos is recommended for the following paper coating uses:

1) To increase the opacity and porosity of web offset publication grades.
2) To upgrade the brightness and opacity of low brightness rawstocks such as unbleached kraft papers, linerboard, and cylinderboard.
3) As an extender for TiO_2 in coating formulations.
4) As a thickener for control of rheology in starch roll coater formulations.
5) Reduced ink mottle and better smoothness are often achieved with Calidria High Purity Asbestos.

Calidria Asbestos is available in two forms for paper coating applications. High Purity Pellets (HPP) were used in the formulations contained herein and are recommended for several reasons: essentially dust-free, more amenable to automatic handling and metering, less expensive to store and use. High Purity Open (HPO) is the open fiber form of Calidria High Purity Asbestos. It is easier to disperse than the pelletized form. Following are typical physical properties for HPP and HPO:

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This paper contains "Calidria" asbestos T-135, an efficient, low-cost opacifier. It is 60-lb. Fairmount offset produced by Tileston & Hollingsworth Co., a subsidiary of Diamond International Corporation.

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Specific Gravity	2.45
Moisture Content, % by wt.	2
Brightness, G. E., %	74-76
Magnetite Content, %	less than 0.7
pH 5% Aqueous Slurry	9.0-9.5
Particle Shape	fibrous
Particle Size Diameter	0.025 microns
Aspect Ratio (average L/D)	200:1
Nature of Surface Charge	Electropositive (cationic)

Compatibility

When properly dispersed, Calidria Asbestos is compatible with all of the commonly used components in coating colors.

Dispersion Preparation

For optimum performance, special attention should be given to the preparation of Calidria Asbestos dispersions. The water absorbing characteristics of asbestos require that it be dispersed at low total solids. Asbestos also requires more dispersant than clay pigments, and is best dispersed with high speed, high shear equipment such as a Cowles Dissolver or Kady Mill. An effective technique for preparing high solids dispersions of Calidria Asbestos and clay consists of first dispersing the asbestos and then dispersing the dry clay in the dispersion of asbestos. Fluid dispersions of 95/5 clay-asbestos can be prepared with this technique at 62% total solids. An organic anionic dispersant such as Tamol 731(1) is recommended for preparing the asbestos dispersions.

Procedure

Charge the ingredients to a Cowles Dissolver or Kady Mill in the following order:

	Lbs.
Water	600
(1) Tamol 731 (as is)	4
Calidria Asbestos (Dry)	50
Predispersed Clay (Dry)	950
Per Cent Total Solids=	62%
Brookfield Viscosity, cps at 10 RPM=	1460

First disperse the Calidria Asbestos in the water and Tamol 731 for 15 minutes. This results in a fluid dispersion of Calidria Asbestos at 8% total solids. Add the predispersed clay and continue agitation for another 15 minutes.

Pigment slips of similar viscosities are obtained containing 3% asbestos at 67% total solids and 7.5% asbestos at 50% total solids. For most purposes 3 to 5% asbestos is adequate.

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(1) Rohm and Haas (supplied as a 25% aqueous solution).

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ACL Doc 18586 · Page 7 of 12 asbestosclaims.law/library/18586/7

After the pigment slip is prepared it may be formulated with binders and other additives in the normal manner.

Obtaining a proper dispersion is critical. When properly dispersed, the clay-asbestos dispersions and coating colors will pass 60 to 100 mesh screens. Routine screening is recommended to assure that the asbestos is completely dispersed. Poorly dispersed coating colors will plug filter screens and will not give satisfactory coating properties.

The effect of Tamol 731 concentration on the viscosity of 95/5 clay/asbestos dispersions is shown in Figure 1. Table 1 is a summary of the effect of various dispersants used to reduce the viscosity of 95/5 clay/asbestos mixtures.

High Bulking Properties

The high bulking properties of the clay-asbestos pigment combinations may be demonstrated by settling tests on the diluted dispersions. The presence of 5% Calidria Asbestos in the pigment will increase the volume of the pigment sediment 20 to 30% over that of a similar dispersion containing no asbestos. An increase in volume of the pigment would be expected to decrease the bulk density of the coating and thus increase the coverage obtained from a given weight of pigment. It is believed that most of the benefits derived from the asbestos result from the lower coating density.

Examples

The following data demonstrate the effect of Calidria Asbestos on coating color viscosities and coating properties using several different rawstocks. In all examples, comparisons are made between a No. 2 predispersed clay and a 95/5 mixture of No. 2 predispersed clay and Calidria Asbestos. The clay-asbestos dispersions were prepared using the techniques described above. Clay dispersions without Calidria High Purity were prepared at 70% total solids using 0.1% TSPP.

I. Publication Grade Coating

Rawstock: 35 lbs./ream (3300 ft2) paper, 76 brightness
Binder: 10% starch, 6% vinyl acetate latex
Total Solids: 54%
pH: 7.5
Coat Weight: 5.0 lbs./ream (3300 ft2)

	100% Clay	95% Clay-5% Calidria Asbestos
Brookfield Viscosity, cps.		
10 RPM	13,500	17,500
100 RPM	2300	3070
Brightness	81	83
Opacity	90.5	93.5
K and N Ink, Brightness	59.0	54.5
IGT Pick, No. 3 Ink, fpm	250	270
Sheffield Porosity	4.2	9.0

Calidria Asbestos improved the brightness, opacity, ink receptivity, and porosity of the coating.

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ACL Doc 18586 · Page 8 of 12 asbestosclaims.law/library/18586/8

II. Unbleached Kraft Coating
Rawstock: Unbleached Kraft, 25 brightness
Binder: 16% UCAR Latex 40[1]
Total Solids: 58%
pH: 7.5
Coat Weight: 12 lbs./ream (3300 ft²)

	100% Clay	95% Clay-5% Calidria Asbestos
Brookfield Viscosity, cps		
10 RPM	225	3030
100 RPM	90	730
Brightness	66	72
K and N Ink, Brightness	32.5	29.0

The increase in brightness with Calidria Asbestos on this low brightness rawstock demonstrates the very significant increase in covering and hiding power obtainable on rough, low brightness substrates. The ink receptivity is also improved by Calidria Asbestos.

III. Cylinder Board Coating
Rawstock: Cylinder Board, 54 brightness
Binder: 6% protein, 14% styrene-butadiene latex
Total Solids: 50%
pH: 8.5
Coat Weight: 4 lbs./1000 ft²

	100% Clay	95% Clay-5% Calidria Asbestos
Brookfield Viscosity, cps.		
10 RPM	8560	12,600
100 RPM	1315	1800
Brightness	72	73.5
K and N Ink, Brightness	43.5	40.5
IGT Pick, No. 4 Ink, fpm	490	515

In this example, Calidria Asbestos improved the brightness and ink receptivity of this cylinder board coating.

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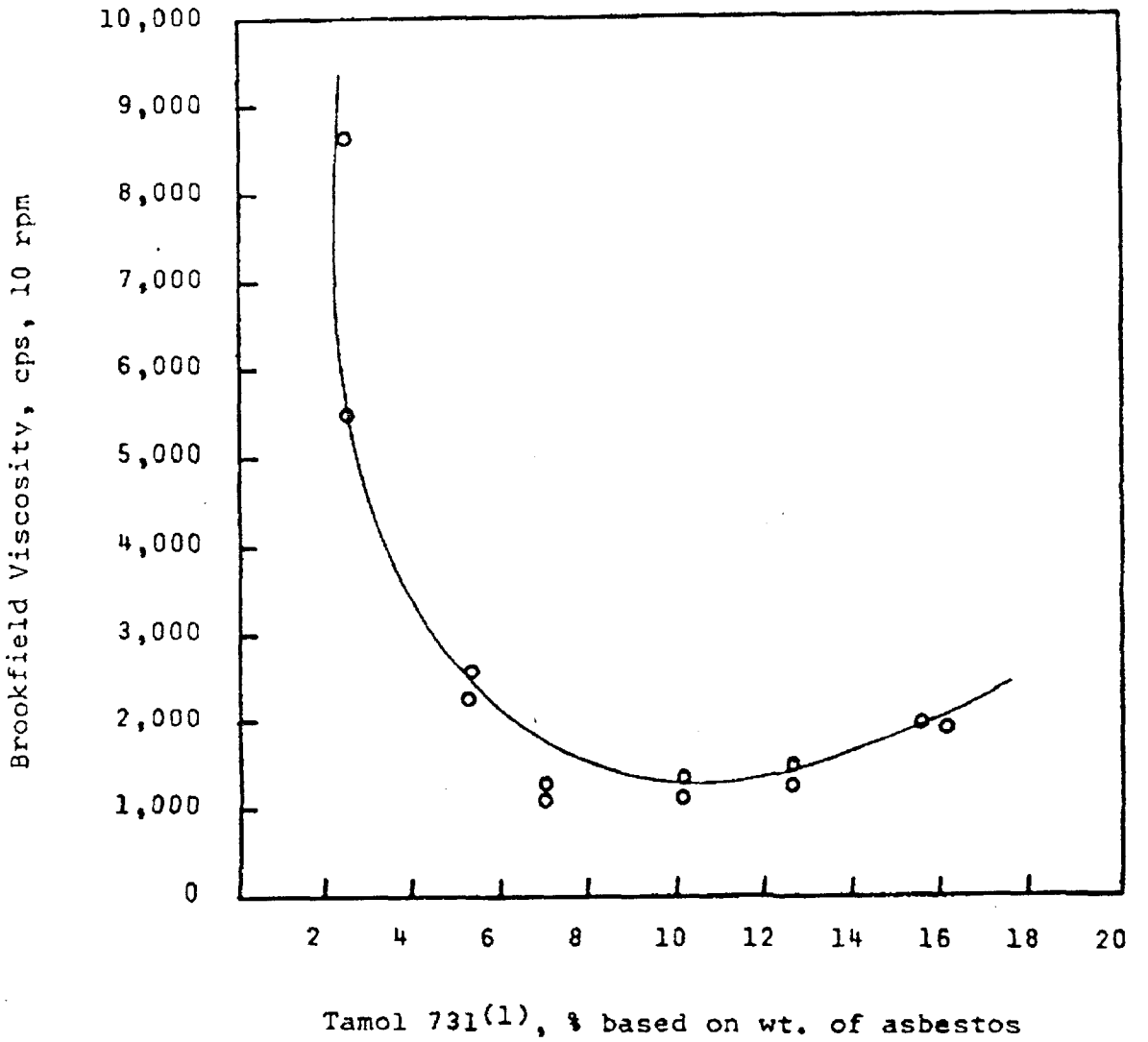
(1) Union Carbide Corporation's acrylic latex.

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ACL Doc 18586 · Page 9 of 12
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FIGURE 1

EFFECT OF TAMOL 731 CONCENTRATION ON VISCOSITY OF 95/5 CLAY/ASBESTOS DISPERSIONS AT 67% SOLIDS



(1) 25% Solution, as is.

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ACL Doc 18586 · Page 10 of 12
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TABLE I

EFFECT OF DISPERSANTS ON VISCOSITY OF

95/5 CLAY/ASBESTOS DISPERSIONS AT 67% TOTAL SOLIDS

Dispersant	Dosage(1)	Viscosity Brookfield, cps 10 RPM	100 RPM
Tetrasodium Pyrophosphate	5.06	9,600	2,770
Potassium Tripolyphosphate	5.06	16,400	4,900
Calgon T(2)	6.96	10,900	3,040
Tamol 731, 25%(3) Solution	7.60	1,220	498
Tamol 850, 30%(3) Solution	33.5	7,700	1,910
GANTREZ AN 135, 6%(4) Solution	29.8	18,500	5,200
Starch, Stayco M,(5) 25% Solution	8.0	8,160	2.060

(1) Dosage for minimum viscosity, % by wt. based on wt. of asbestos.

(2) Calgon Corp., Pittsburgh, Pa.

(3) Rohm and Haas, Philadelphia, Pa.

(4) GAF Corporation, New York City

(5) A. E. Staley Mfg. Co., Decatur, Ill.

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ACL Doc 18586 · Page 11 of 12
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asbestosclaims.law/library/18586/12