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PLAINTIFF'S EXHIBIT

UC-4588

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TECHNICAL SERVICE REPORT

THE EVALUATION OF ASBESTOS T-135 AS A PARTIAL REPLACEMENT FOR TITANIUM DIOXIDE IN A PAPERMAKING FURNISH

for

Weyerhaeuser Corporation
Plainwell, Michigan
August 8, 1969

by

G. L. Dickson

Group Manager - W. L. Carrick

Project No. 452-M33

August 29, 1969

A17251

UNION CARBIDE CORPORATION
Chemicals & Plastics
Research and Development Department
Niagara Falls, New York 14302

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SUBJECT

This report covers the results of the paper machine evaluation of Union Carbide's Asbestos T-135 on Weyerhaeuser's (Plainwell, Michigan) Number 2 machine, August 8, 1969. The purpose of this trial was to illustrate the effectiveness of T-135 as a partial replacement for titanium dioxide in a normal papermaking furnish, and to show the resulting economies from such a substitution.

TRIAL RESULTS

This trial demonstrated the ability of Asbestos T-135 to partially replace titanium dioxide in a high opaque offset paper furnish. During this trial, 20 pounds of T-135 were substituted for 25 pounds of titanium dioxide (per 1350 lb. of furnish), resulting in a savings of approximately $2.70 per beater, or $4.00 per ton of furnish. No operational problems developed during the time Asbestos T-135 was in the system, and product quality equaled that of the pre-trial period. As no attempt was made to determine the optimum replacement level of T-135 for titanium dioxide in this system, it is felt that the potential money savings may be considerably greater than what was reflected by the present work. Guidelines governing the maximum degree of replacement can usually be established after a moderate amount of experience has been gained with T-135.

DISCUSSION

The evaluation of our material was performed during the production run of a 50-lb. white opaque offset paper. Previous to the addition of Asbestos T-135 to the system, their normal furnish was utilized. (Refer to Table I and the Mill Trial Data Sheets for complete furnish and operating information.) Because of a problem involving lower than usual wax pick tests, the trial was delayed until furnish changes were made to overcome this condition. Twenty pounds of opened T-135 (1/2 bag) were added to each beater in place of 25 lb. of titanium dioxide (1/2 bag). Based on a beater capacity of 1350 lb. of furnish, this represents an addition level of 1-1/2% T-135. No other furnish changes were made during the subsequent trial except minor ones which were considered in line with normal production variations. Wet end and reel samples were obtained during both the pre-trial control period and trial proper. These samples were subsequently analyzed at Union Carbide's facilities in Niagara Falls, the results being presented in Tables II-IIC. Calculated retention values, based on these analytical data, are reported in Table III-IIIB. For convenience Table IV contains a summary of Weyerhaeuser's quality control report during these times.

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CONCLUSIONS

This trial showed that Asbestos T-135 can be utilized successfully as a partial replacement for titanium dioxide in this mill's normal furnish. The only precaution observed during this trial was to introduce the T-135 to the furnish after the rosin size had been precipitated by alum. Product quality remained virtually unchanged during the trial period. Opacity was 0.6 points lower (94.8-94.2) but was counterbalanced by a similar increase in sheet brightness (81.9-82.5). This resulted in spite of a substantial drop in ash content, from 18.3% to 15.8%. The lower ash level was the result of less pigment being added to the system in the form of broke as pigment retention was improved slightly during the trial. (Refer Table III) This was especially true of asbestos which was retained better than the other mineral materials present. With additional experience it is felt that even more significant furnish savings should result from the optimum use of Asbestos T-135 on this mill's three paper machines. The present savings of $4.00 per ton of furnish was computed as follows:

(1) Titanium dioxide savings	
25 lb. @ 22¢/lb.	$ 5.50
(2) Asbestos T-135 costs	
20 lb. @ 14¢/lb.	$ 2.80
(3) Net Savings	
Per 1,350-lb. beater	$ 2.70
Per 2,000 lb. of furnish	$ 4.00

G.L. Dickson/bsn

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TABLE I

FURNISH SCHEDULE

ime	Clay (Inches)	TiO_2 (Pounds)	Asbestos T-135 (Pounds)	Short Fiber (Pounds)	Broke (Pounds)	Remarks
ugust 7	3	100	-	288	1056	Production of Montgomery opaque, smooth finish.
ugust 8						
10:10 a.m.	0	80	20	288	1056	One beater containing T-135 furnished in error.
10:30 "	0	100	-	288	1056	Clay eliminated from furnish in order to lower ash content.
3:35 p.m.	0	75	-	432	912	Short fiber fraction increased in order to improve wax pick.
5:20 "	0	150	-	432	912	Additional titanium dioxide added in order to improve sheet opacity.
6:15 "	0	100	-	432	912	Sheet quality acceptable.
6:35 "	0	50	40	432	912	Trial initiated.
6:55 "	0	75	20	432	912	Standard trial furnish on machine. 20 lb. T-135 substituted for 25 lb. titanium dioxide.

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TABLE II

Stuff Box Analyses
August 8, 1969

Reel No.	Reel Time	% Ash	% TiO_2	% Asbestos T-135
		Pre-trial Control Period		
144	11:30 AM	23.60	11.59	0
145	12:20 PM	24.45	11.55	0
146	1:00 PM	24.75	11.52	0
147	1:40 PM	24.20	10.86	0
148	2:50 PM	24.17	11.05	0
149	3:30 PM	24.90	10.82	0
150	4:10 PM	22.18	8.67	0
151	4:45 PM	20.24	7.90	0
152	5:40 PM	20.63	8.39	0
153	6:20 PM	21.69	8.91	0
Average		23.08	10.13	0
		Transitional Period		
154	6:50 PM	20.61	8.81	0.68
155	7:35 PM	20.44	8.11	1.11
Average		20.52	8.46	0.90
		Asbestos T-135 Trial		
156	8:30 PM	19.18	7.19	1.42
157	9:15 PM	18.98	7.07	1.54
158	9:50 PM	18.82	7.18	1.54
159	10:30 PM	18.86	7.02	1.54
160	11:05 PM	19.09	7.69	1.54
Average		18.99	7.23	1.52

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TABLE IIA

Headbox Analyses
August 8, 1969

Reel No.	Reel Time	% Consistency	% Ash	% TiO_2	% Asbestos T-135
		Pre-trial Control Period			
144	11:30 AM	0.959	32.68	15.91	0
145	12:20 PM	1.185	34.43	16.74	0
146	1:00 PM	0.996	34.18	16.83	0
147	1:40 PM	0.976	33.07	15.46	0
148	2:50 PM	0.963	33.58	15.76	0
149	3:30 PM	0.958	34.77	15.91	0
150	4:10 PM	0.937	31.85	12.45	0
151	4:45 PM	0.872	28.37	10.85	0
152	5:40 PM	0.920	28.33	11.65	0
153	6:20 PM	0.952	30.16	12.50	0
Average		0.972	32.14	14.41	0
		Transitional Period			
154	6:50 PM	0.912	28.17	11.61	0.74
155	7:35 PM	0.866	27.57	10.34	1.35
Average		0.889	27.87	10.98	1.04
		Asbestos T-135 Trial			
156	8:30 PM	0.806	26.09	9.64	1.60
157	9:15 PM	0.832	25.60	9.47	1.79
158	9:50 PM	0.816	24.86	9.79	1.66
159	10:30 PM	0.840	24.92	8.35	1.79
160	11:05 PM	0.821	25.35	9.60	1.85
Average		0.823	25.36	9.37	1.74

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TABLE IIB

Tray Water Analyses
August 8, 1969

Reel No.	Reel Time	% Consistency	% Ash	% TiO_2	% Asbestos T-135
		Pre-trial Control Period			
144	11:30 AM	0.314	55.62	26.63	0
145	12:20 PM	0.363	56.16	28.19	0
146	1:00 PM	0.346	57.21	27.50	0
147	1:40 PM	0.332	56.99	28.31	0
148	2:50 PM	0.304	56.86	27.90	0
149	3:30 PM	0.373	56.17	25.20	0
150	4:10 PM	0.370	53.39	21.36	0
151	4:45 PM	0.276	52.51	20.91	0
152	5:40 PM	0.229	54.22	23.07	0
153	6:20 PM	0.313	51.98	22.41	0
Average		0.322	55.11	25.15	0
		Transitional Period			
154	6:50 PM	0.262	51.88	21.95	1.11
155	7:35 PM	0.252	51.03	19.72	2.40
Average		0.257	51.46	20.84	1.76
		Asbestos T-135 Trial			
156	8:30 PM	0.215	50.30	19.00	3.14
157	9:15 PM	0.217	49.92	19.64	3.33
158	9:50 PM	0.224	46.30	15.41	3.02
159	10:30 PM	0.277	46.78	17.15	3.20
160	11:05 PM	0.264	47.13	16.74	3.26
Average		0.239	48.08	17.59	3.19

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TABLE IIC

Reel Samples Analyses
August 8, 1969

Reel No.	Reel Time	% Ash	% TiO_2	% Asbestos T-135
		Pre-trial Control Period		
144	11:30 AM	19.36	8.05	0
145	12:20 PM	19.11	8.62	0
146	1:00 PM	19.86	8.67	0
147	1:40 PM	19.89	8.51	0
148	2:50 PM	18.90	7.44	0
149	3:30 PM	19.79	7.62	0
150	4:10 PM	17.77	6.43	0
151	4:45 PM	16.88	5.96	0
152	5:40 PM	16.34	5.98	0
153	6:20 PM	17.34	6.87	0
Average		18.52	7.42	0
		Transitional Period		
154	6:50 PM	17.13	6.36	0.43
155	7:35 PM	16.52	6.18	0.92
Average		16.82	6.27	0.68
		Asbestos T-135 Trial		
156	8:35 PM	No Sample		
157	9:15 PM	15.72	5.45	1.29
158	9:50 PM	15.82	5.41	1.36
159	10:30 PM	15.67	5.29	1.42
160	11:05 PM	No Sample		
Average		15.74	5.38	1.36

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TABLE III

Over-all Filler Retention
(Reel/Stuff Box x 100)

Reel No.	Reel Time	% Ash	% TiO_2	% Asbestos T-135
		Pre-trial Control		
144	11:30 a.m.	82.0	69.5	-
145	12:20 p.m.	78.2	74.6	-
146	1:00 p.m.	80.2	75.3	-
147	1:40 p.m.	82.2	78.4	-
148	2:50 p.m.	78.2	67.3	-
149	3:30 p.m.	79.5	70.4	-
150	4:10 p.m.	80.1	74.2	-
151	4:45 p.m.	83.4	75.4	-
152	5:40 p.m.	79.2	71.3	-
153	6:20 p.m.	79.9	77.1	-
Average		80.2	73.2	
		Transitional Period		
154	6:50 p.m.	83.1	72.2	63.2
155	7:35 p.m.	80.8	76.2	82.9
Average		82.0	74.1	75.6
		Asbestos T-135 Trial		
156	8:30 p.m.	No Reel Sample		
157	9:15 p.m.	82.8	77.1	90.8
158	9:50 p.m.	84.1	75.3	88.3
159	10:30 p.m.	83.1	75.4	92.2
160	11:05 p.m.	No Reel Sample		
Average		82.9	74.4	89.5

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TABLE III-A

One-Pass Filler Retention
(Reel/Headbox) x 100

Reel No.	Reel Time	% Ash	% TiO_2	% Asbestos T-135
	Pre-trial Control Period			
144	11:30 a.m.	59.2	50.6	-
145	12:20 p.m.	55.5	51.5	-
146	1:00 p.m.	58.1	51.5	-
147	1:40 p.m.	60.1	55.0	-
148	2:50 p.m.	56.3	47.2	-
149	3:30 p.m.	56.9	47.9	-
150	4:10 p.m.	55.8	51.6	-
151	4:45 p.m.	59.5	54.9	-
152	5:40 p.m.	57.7	51.3	-
153	6:20 p.m.	57.5	55.0	-
Average		57.6	51.5	
	Transitional Period			
154	6:50 p.m.	60.8	54.8	58.1
155	7:35 p.m.	59.9	59.8	68.1
Average		60.4	57.1	65.4
	Asbestos T-135 Trial			
156	8:30 p.m.	No Reel Sample		
157	9:15 p.m.	61.4	57.6	72.1
158	9:50 p.m.	63.6	55.3	81.9
159	10:30 p.m.	62.9	63.4	79.3
160	11:05 p.m.	No Reel Sample		
Average		62.1	57.4	78.2

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TABLE III-B

Wire Retention

$$1 - (C_{\text{Tray water}}/C_{\text{Headbox}}) \times 100$$

Reel No.	Reel Time	Total Solids	% Ash	% TiO_2	% Asbestos T-135
		Pre-trial Control Period			
144	11:30 a.m.	67.2	44.3	45.2	-
145	12:20 p.m.	69.4	50.0	48.4	-
146	1:00 p.m.	65.3	41.9	43.2	-
147	1:40 p.m.	66.0	41.4	37.7	-
148	2:50 p.m.	68.4	46.6	44.1	-
149	3:30 p.m.	61.1	37.1	38.3	-
150	4:10 p.m.	60.5	33.8	32.3	-
151	4:45 p.m.	68.4	41.4	39.0	-
152	5:40 p.m.	75.1	52.4	50.7	-
153	6:20 p.m.	67.1	43.3	41.1	-
Average		64.9	43.2	42.2	
		Transitional Period			
154	6:50 p.m.	71.3	47.1	45.7	56.9
155	7:35 p.m.	70.9	46.1	44.5	48.3
Average		71.1	46.6	45.1	51.1
		Asbestos T-135 Trial			
156	8:30 p.m.	73.3	48.6	47.4	47.7
157	9:15 p.m.	73.9	49.2	45.9	51.5
158	9:50 p.m.	72.6	48.9	56.8	50.1
159	10:30 p.m.	67.0	38.1	32.3	41.1
160	11:05 p.m.	67.8	40.2	43.9	43.3
Average		71.0	45.0	45.5	46.8

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TABLE IV

QUALITY CONTROL DATA
August 8, 1969

Reel No.	Reel Time	Basis Weight	Caliper	Opacity	Wax Pick	% Ash	Brightness	Ink Pen.
Spec.		50	41 ± 2	95 ± 1	13	16-18	81 ± 1	1-2'
50 Lb. Montgomery Opaque Vellum Finish								
Pre-Trial Period								
144/	10:50 am	50.2	42.3	95.5	11	23.0	81.0	35"
144	11:30 "	50.3	42.7	95.5	11	18.5	82.0	40"
145	12:20 pm	51.2	42.3	95.5	12	18.0	82.0	1'25"
146	1:00 "	49.0	40.0	95.0	11	19.0	-	
147	1:40 "	50.8	42.0	95.5	11	19.0	82.0	30"
148	2:50 "	50.0	42.7	95.0	12	17.5	-	
149	3:30 "	48.5	41.3	94.5	13	19.0	82.0	30"
150	4:10 "	48.8	41.0	94.0	13	18.0	-	
151	4:45 "	47.7	40.7	93.5	13	16.0	82.0	45"
152	5:40 "	50.7	42.7	94.0	13	16.0	-	
153	6:20 "	50.0	42.7	94.5	13	17.0	82.0	30"
Average		49.7	41.9	94.8	12	18.3	81.9	40"
Transition Period								
154	6:50 pm	51.2	44.3	94.5	13	16.0	-	
155	7:35 "	48.3	42.7	94.0	13	16.0	82.0	2'50"
Average		49.8	43.5	94.2	13	16.0	82.0	2'50"
Asbestos T-135 Trial								
156	8:30 pm	47.7	40.7	94.0	13	16.0	-	
157	9:15 "	48.8	42.3	94.0	14	15.0	82.0	2'30"
158	9:50 "	50.8	42.0	94.0	13	15.0	-	
159	10:30 "	51.5	43.0	94.5	13	16.0	82.0	1'40"
160	11:05 "	49.8	43.0	93.5	-	-	-	
161	11:45 "	48.8	43.0	94.0	13	15.5	82.5	1'30"
162	12:30 am	50.7	42.3	96.0	11	-	83.0	
163	1:10 "	50.5	42.3	95.0	11	17.0	83.0	1'

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TABLE IV (CONTD.)

Reel No.	Reel Time	Basis Weight	Caliper	Opacity	Wax Pick	% Ash	Brightness	Ink Pen.
164	1:50 a.m.	50.2	43.0	94.0	12	-	83.0	
165	2:50 "	49.3	42.0	94.0	11	16.0	82.5	40"
166	3:30 "	49.8	43.0	93.5	11	-	-	
167	4:20 "	49.0	42.0	94.0	12	16.0	82.0	1'25"
168	5:05 "	51.2	43.7	94.0	12			
	Average	49.8	42.5	94.2	12	15.8	82.5	90"

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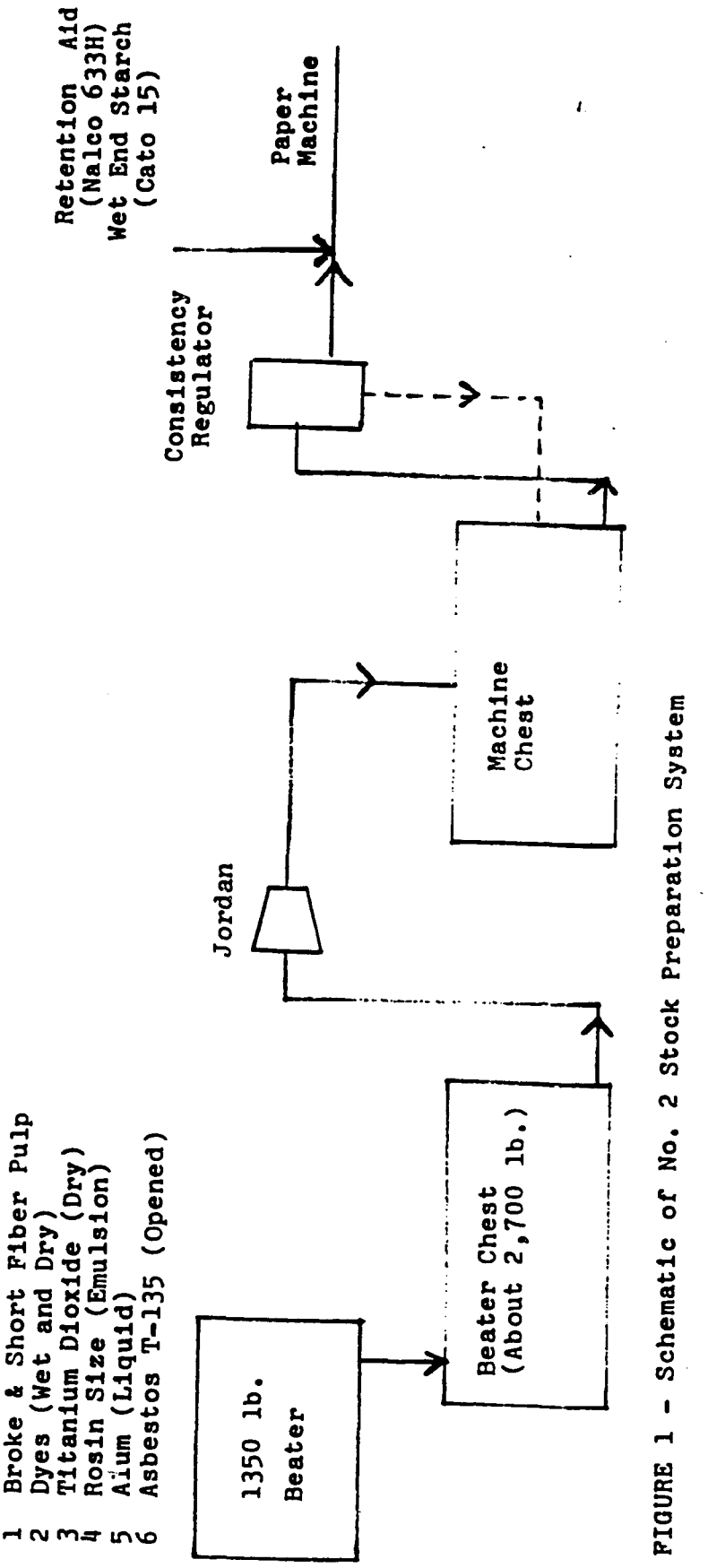


FIGURE 1 - Schematic of No. 2 Stock Preparation System

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UNION CARBIDE CORPORATION

MINING & METALS DIVISION

MILL TRIAL DATA SHEET

August 8, 1969

I. COMPANY LOCATION AND DATE OF TRIAL Weyerhaeuser Co., Plainwell, Mich.

II. COMPANY REPRESENTATIVES AND TITLES Glen Ketchum, Project Engineer, Lou Burd, Stock Preparation Superintendent, Emil Warnez, Paper Mill Superintendent

III. UCC REPRESENTATIVES R. T. Scott and G. L. Dickson

IV. TRIAL OBJECTIVES (In order of importance) Evaluation of Asbestos T-135 as a partial replacement for titanium dioxide

V. PRODUCT IDENTIFICATION

Type of Product White offset Coated ~~Yes~~/No

Grade Name Montgomery opaque blue white

Basis Weight 50 and 60 lb.

Daily Production 75,000 lb. Lb./hour 3,000

Total Daily Production of Mill -

(Tissue and Board) No. of Plys -

VI. MACHINE DESCRIPTION

Type of Machine Fourdrinier, open headbox, dandy roll

Machine No. 2 (Cylinder) No. of Cylinders -

Machine Speed 525 (Tissue) Reel Speed -

(Tissue) % Crepe - Wire Mesh Plastic

Wire Width 94" Machine Trim 90-1/2 inches

Size Press Horizontal 8-10% Starch Calenders Double stack:
Vellum Finish - 1 & 0
Smooth Finish - 5 & 6

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VII. AUXILIARY EQUIPMENT

Refiners	Type	Location	Loading (amp.)
	1 Jordan	After beater chest	80

Saveall (Type) Disc Flow Rate -

VIII. STOCK PREPARATION - Continuous or Batch

Type Beater and Capacity Hollander at about 1350 lb.

No. of Beater Chests and Capacity 1 Beater chest at about 2700 lb.

Machine Chest Capacity -

Stock Freeness (Mach. Chest and Stuff Box) -

Headbox Consistency 0.8-1.2%

Makeup pH Machine pH 4.5-4.8

IX. FURNISH MAKEUP* Basis (lb./ton, etc.)

Furnish Constituent	%	Pounds
Fiber Components:		
Short fiber	20-30%	
Broke	70-80%	
Retention Aid		Approx. 0.5 lb./ton
Wet end starch		Not recorded
Defoamer		Not recorded
Dyes		As required
Rosin size		
Alum		
Opacifiers		See attached schedule

* For board systems include furnish for each medium - topliner, underliner, filler, and backliner.

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X. ASBESTOS ADDITION - Pellet Repulper (Type) None required

Asbestos Grade T-135 Open Lot No. -

Point of Addition Hollander beater

Pounds of Asbestos Added 30 per ton BDF 20 per beater

_____ per hour

Per cent asbestos addition on BDF 1-1/2%

XI. SUPPLEMENTARY INFORMATION

Quality Control Data Record

Stock Prep. Log

Sampling (in order of importance)

Pitch & Retention Trials	Board Trials	Tissue and Towel
Reel	Tray Water	Stuff box
Stuff box	Vat	Reel
Headbox 250-ml. sample	Stuff box	Headbox
Tray 500-ml. sample	Reel	
Saveall effluent	Saveall effluent	
Saveall influent	Saveall influent	

Identify samples by name, date, time

Wet samples should approximate 500 ml.

Weight of BD filter pad is required for all vat, tray, and saveall samples.

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XII. TRIAL LOG (Comments including changes in furnish and operating conditions)

Time	Comments
8/7/69	Number 2 machine on 40- and 50-lb. Montgomery opaque, smooth finish.
8/8/69	
10:50 a.m.	Change to 50 lb. Montgomery opaque, vellum finish. One beater furnished with Asbestos T-135 by mistake. Trial delayed because of low wax pick test results.
1:00 p.m.	Slight problem with foam.
3:30 p.m.	Short fiber component of furnish increased from 20% to 30% in order to improve wax pick.
5:00 p.m.	Smoothing press raised because of minor buildup on roll.
6:30 p.m.	Asbestos T-135 trial initiated. First beater dumped with twice the required amount of T-135 in order to shorten transition period.
7:30 p.m.	Smoothing press lowered. No problem with stock buildup.
5:15 a.m.	Change to 60-lb. Montgomery opaque, vellum finish.

Recorded by Gordon L Dickson Date Aug 4, 1969

Witnessed and Understood by _____ Date _____

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DISTRIBUTION LIST

Messrs.	M. P. Ballmer	New York
	B. K. Barton	Chicago
	W. L. Carrick	Bound Brook
	F. D. Dexter	New York
	G. L. Dickson	Niagara Falls
	B. D. Dobbs	Cincinnati
	T. E. Dougherty	New York
	C. F. Gray	New York
	W. V. Gutzmer	Chicago
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	W. S. Young	New York
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