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MARCH RESEARCH REPORT

1964

Coatings and Resins Group

CONFIDENTIAL

N13111

GLD012831

Subject: One Coat Spred House Paint
(NT23025BJ362)

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Summary: 1. An abstract and a detailed report is given on comparison of Oil-Water and Latex paints. The study has not been completed. (See Abstract)

2. Colors were made for exposure with Arolin, Cargill, Linopol and Linaqua.

3. The viscosity dropped when V855 was substituted for GRV3140 in the RE20169 paint formula.

ABSTRACT

The primary comparisons were made with A.D.M. Arolin X1652, Cargill 1308, Sherwin-Williams Linapol and Spencer Kellogg Linaqua paints and Y3600 EJ and EK.

1. Manufacturing - No appreciable difference.

2. Can storage - Arolin increases in viscosity in white. Others satisfactory.

3. Application - The oil-water systems between latex and solvent thinned, satisfactory. Linapol easiest to apply.

4. Clean up - Satisfactory. Arolin requires soap and water.

5. Drying time - Y3600 EK 15 minutes; Arolin 4-6 hrs; Cargill 4-6 hrs; Linopol 8-24 hrs; Linaqua 8-24 hrs.

6. Early Water Resistance - Y3600 EK best followed by Arolin, Cargill, Linopol and Linaqua.

7. Sheen - Y3600EK, Arolin, Cargill, and Linopol are low sheen paints. Linaqua initially high sheen and dropping on exposure.

8. Color Uniformity - Variable suction surfaces - Y3600 EK good, Arolin Fair, remainder poor.

9. Hiding - All comparable.

10. Whiteness - Initial - Arolin, Cargill, EK, Linaqua, Linopol. After short period, Linapol, EK, Cargill, Arolin and Linaqua. After long period, Cargill, Linaqua and Arolin chalk white. Y3600 remains grayer and yellower. No long term exposure on Linopol.

11. Fading - Green exposures on Cargill and Linaqua look good. Slight chalk masking with Cargill but it was made with talc instead of calcium carbonate.

12. Durability - The oil-water systems fail by chalking and

erosion. The latex systems seem to fail from cracking and flaking.

The blister studies are inconclusive as the primers effect the performance considerably. Most blister studies were made over Y3651 and Y3651A.

On chalky surfaces the oil-water and Y3600EK have equal penetration and adhesion. The latex paints do not penetrate chalk.

The oil-water systems have not been studied on masonry.

Mildew studies are being made in New Orleans.

Report: Oil Water vs Latex Paints

The data submitted in this report covers information obtained by comparing Y3600 EH & EK formulas and oil emulsion and water soluble oils from 1959 to date. One must note the paints have been constantly changed and improved and it must be assumed favorable properties in older formulas have not been lost in newer paints.

Archer Daniels Midland Arolin X1652, Cargill 1308, Sherwin-Williams Linopol, and Spencer Kellogg Linaqua in paints, were compared with one another, with Endurance Y1800 and Spred House Paint Y3600 as the standards.

Manufacturing

Very little difference in manufacturing and no serious problems anticipated. Linopol requires closer control than the others. Arolin and Linaqua 100% solids have advantages in shipping and storage, Cargill 70%, Linopol 60%.

Can Storage

Y-3600 - good can stability.
Arolin 1652, Viscosity increases in white, colors stable.
Cargill 1308, slight viscosity increase, slight settling. With Acrysol present OK.
Linopol - Excellent storage - no change.
Linaqua - some paints excellent viscosity, some have shown viscosity increase.

Application

The oil-water systems do not apply as easily as the straight latex but equal to Y3600EK (1/3 oil). The feel under the brush is that of an easy applying oil paint. Arolin & Cargill apply and level about the same. Linaqua has slightly more drag but has longer wet edge, slightly better lapping properties and better leveling. Linopol has very easy slip and fair leveling.

Clean up

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Clean up seems slightly better than latex system because of the re emulsification properties of the oil systems. Arolin does not clean up with water as well as the others but is satisfactory with soap and water.

Y3600EK requires soap and rubbing to remove the latex. Clean up after continued application on chalk has not been checked.

Drying Time

Straight latex and Y3600EK (1/3 oil) dries definitely faster than the oil systems, becoming tack free almost immediately. Arolin 4-6 hrs, Cargill 4-6 hrs, Linopol 2-4 hrs, Linaqua 24 hrs. Y3600EK becomes hard rather quickly, the oil systems remain soft like Y1800. Initial dirt collection not compared.

The early water sensitivity was checked by applying paints over Y3651A and drying 16, 8, 6, 4, 2, 1, ½ and ¼ hrs in room conditions. The paints were sprayed with water 15 minutes and then left overnight in the rain.

Dry	Order of Removal While Spraying				
Hrs.	Linopol	10# Acrysol Cargill	3600 EK	Arolin	Linaqua
¼	3	2	5	1	4
½	6	8	-	13	9
1	7	10	-	16	14
2	11	12	-	30% off	15
4	17	5% off	-	-	19
6	18	5% off	-	-	20
8	22	1% off	-	-	21
16	-	-	-	-	-

Linaqua failed by erosion, the others by loss of adhesion and peeling. The blank spaces indicate the area still intact after an additional 16 hrs in the rain. Cargill - 8 hrs dry - severe blistering, 16 hrs dry fine blisters, Linopol - 16 hr dry - fine blisters. 3600EK - fine blisters on all except 16 hrs dry. Arolin - fine blisters 2 hr dry, remainder OK. Linaqua - 16 hr dry - large severe blisters. The blisters disappeared on drying on all except Linaqua.

Sheen

Y3600EK, Arolin, Cargill and Linopol are low sheen paints. Linaqua paints have higher sheen initially but flatten on aging like oil paints. EK has good sheen over variable suction surfaces, Linaqua considerable change, Linopol and Cargill slight change, Arolin quite uniform. This may present a problem on large areas until chalking starts.

Color

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Color development has been a problem with the oil system. Arolin is best giving the deepest colors, the most stable color on continued agitation and most uniform over variable suction surfaces. Cargill and

Linaqua flocculate color on agitation and Linopol paint becomes unstable. The latter three have poor color holdout. Linopol has inert flotation leaving a white haze on the dry paint. Considerable work required.

Hiding

The hiding of the oil systems on drawdown are essentially the same. On brush application the oil systems seem to be slightly better than the straight latex and about the same as Y3600EK (1/3oil). A full scale mileage test has not been run.

Whiteness

Initially the whiteness order was Arolin, Cargill, EK, Linaqua and Linopol. After a short aging period Linopol becomes whitest, EK, Cargill, Arolin and Linaqua. Linaqua is only slightly whiter than Y1800.

Dirt collection also enters into the whiteness problem. Dirt collection on exposures between January and March 1964 - straight PVA systems least, Y3600EJ, Y3600EK (1/3 oil), Linopol, Cargill #615 formula, Arolin, Cargill 1290W-1 (contains Acrysol, Cargill 640 formula, Y1800C and Linaqua. None were so severe that one would rule out the paint on this property only.

Durability

Cargill P-103-103A (Green) and P 103-104 (White) Dec. 1959, are the oldest oil water exposures we have. Both are in excellent condition, White - Chalk 3, cracking 10, erosion 7, very clean and rich looking. It is comparable to Y1800 exposed about the same time. The green is very rich appearing, no fading and very slight chalk masking.

Spencer Kellogg XP1282 (presently Linaqua), over Y1851 and self primed look good. The color is slightly grayer than the control (1850); chalk 3, Erosion 4 (control 5), whiteness 8 (control 10-).

Cargill paint was compared with Y3600 and Y1800 exposed in May 1961.

Cargill/1851 Chalk 4,Erosion 7, whiteness 10,cracking 10

Y3600/1851 Chalk 4, Erosion 10, whiteness 7 plus, cracking 7

Cargill and 1800 are equal in appearance although Cargill has slightly greater erosion. 3600 has slightly more dirt as it does not self clean as readily.

Cargill and Y3600 were compared self primed. Cargill is in excellent condition but Y3600 has cracked, is 50% flaked off and very discolored.

2-132 exposure 10-27-62 is the first comparison with Arolin. The results are as follows:

	Whiteness	Dirt	Chalk
Y3600EH	7+	8+	9
Arolin X1652 8113-3-200	10-	10	4
Cargill 1308 Batch 381	10-	10-	5
P&L 6-T-1 (Linaqua)	10-	10-	3
Pacific Varnish Oil 41-261	8 +	10-	5
S-W A-100 (Latex)	7	8	9

The oil systems are cleaner and whiter because of higher chalk rate.

Exposure 3-51 -- 5-29-63

Boards were primed with Y3651, Linaqua Primer 894-P-20, Arolin Primer 8113-3-50 and FE3-123-1 (an acrylic latex primer). Topcoats were Y3625 (EJ formula) Linopol TB, Arolin X-1652 TB and Cargill 1308 TB all tinted with pthalo green.

In each case the dirt collection was greatest over the paint primed with Arolin, second over 3651 and least over Linopol. It appeared there was a tackiness caused by an exudate from the primer. There was slight chalk in reverse of the dirt collection also indicating higher binder content in the topcoat. The chalk was too low to be self cleaning. The Linaqua paint was most uniform over the four primers, Cargill a close second, Linapol not too satisfactory and Y3625 was poor over the acrylic primer. The results with these primers and with the topcoats may indicate the relative protection they might give wood. No specific tests have been run to determine wood protection.

White paints on the same primers showed Linaqua best followed by Cargill. Y3600EJ was yellower and dirtier. The chalk rates were 5, 5 and 10 respectively. Linapol and Arolin paints had thickened and were not tested on this exposure.

Blister tests run on the Hut cannot be conclusive as the blisters obtained are more closely related to the wood and the primer. Blisters follow the grain lines of the wood. However, comparison was made of the swelling properties of the paints on glass after one month dry. Y3600 EK least swelling followed by Arolin, Linopol, Cargill and Linaqua.

The oil-water paints definitely adhere through chalk better than the straight latex but about equal to Y3600 EK. The tests were run by applying paints to old chalky panels and determining the penetration by microscopic examination. The tape test is unsatisfactory because of the variations in adhesion of the tape to the paint.

The oil-water systems have not been studied on masonry surfaces. GLD012836

The mildew studies are in New Orleans and will be returned in the near future.

The viscosity stability of the oil-water vehicles was compared in a standardized formula (essentially 3600EK) to determine if the instability was caused by the vehicle or the suppliers paint formula. Table 4 and 5 lists the formulas. The results were essentially the same as in the suppliers formulas. Arolin caused the viscosity to rise in the white but was stable in colors, Cargill increased in viscosity for several days and then dropped back to initial, the others were satisfactory. See Table 4 & 5.

Oil-Water Paint - Colors

Bayberry, Evergreen, Sunbeam Yellow, Cape Cod Red, Antique Brown and Bark were made with Arolin Cargill, Linapol and Linaqua for exposure tests. Color uniformity of Arolin of sealed and unsealed Morest Charts was best, Cargill and Linopol was fair and better than Linaqua. See table 1, 2 and 3.

Substituting V-855 for GRV-3140 with RE20169

The stability of RE20169 with modifiers has been good up to date. However, when NH_4OH was added to determine the optimum Ph level of a white paint (ME4-85-1) with RE20169 and V-855, a viscosity drop was noted.

To investigate this phenomena (ME4-87-1) white paint was made with RE20169 and V-855, and it behaved similarly.

Then Y-3600EK was used as control for it showed only a slight viscosity drop with the addition of NH_4OH, this slight change lead to believe that the presence of VM-885 might contribute to better stability, a white formulation (ME4-90-1) was made with VM-885, RE20169 and V-855, an identical test with NH_4OH showed only a one KU drop. Further evaluations will be made. See table 6.

ADM - AROLIN 1652 TABLE I (SHP March 1964)

		ME4-62-1	ME4-63-1	ME4-63-2	ME4-71-1	ME4-72-1
S-14	Water	335.0	315.0	321.0	381.0	368.6
CH-473	TKPP	3.0	3.0	3.0	4.0	4.0
	Tergitol NPX	10.0	10.0	10.0	--	--
CH-181	Ethylene Glycol	18.6	18.6	18.6	18.6	18.6
	Colloid 581-B	2.0	2.0	2.0	2.0	4.0
CH-450	Daxad 30	--	--	--	7.0	7.0
CH-474	Igepal CTA-639	--	--	--	8.0	8.0
	W-208 Zopaque R88	102.0	13.0	250.0	--	--
W-121	Snowflake	143.0	150.0	85.0	45.4	45.4
W-188	Nytal 300	144.0	155.0	92.0	145.0	145.0
G-73	Chrome oxide	25.0	--	--	--	--
YW-89	Yellow oxide	--	55.0	6.5	59.4	59.4
W-33	Zinc oxide	--	--	75.0	30.0	30.0
B-131	Witco Black F-1	--	--	--	4.2	4.2
R-269	Red oxide Mapico #344	--	--	--	24.3	24.3
W-158	Mineralite 3X	--	--	--	21.0	21.0
M-239	Celite 281	--	--	--	37.0	37.0
CH-380	Phenyl Mercuric Borate	1.5	1.5	1.5	--	--
VM-659	Super Ad It	--	--	--	6.0	6.0
195T-27	Cellosize QP-4400 (3% soln.)	33.0	50.0	68.3	50.0	62.5
	Acrysol G-110	10.0	10.0	10.0	15.0	15.0
	Arolin 1652	275.0	250.0	250.0	215.0	215.0
	24% Lead Drier "Witco"	6.0	5.0	5.0	5.0	5.0
	6% Cobalt Drier "Witco"	2.5	2.0	2.0	2.0	2.0
	6% Manganese Drier "Witco"	2.5	2.0	2.0	2.0	2.0
305A-90	Thalo Blue	--	15.9	--	--	--
305G-78	Thalo Green	--	24.7	--	--	--
Solids Volume		50%	47.5%	47.7%	41.4%	41.4%
PVC		32.0%	34.7%	35.0%	35.7%	35.7%
Yield in Gals.		100.0gal.	100.0gal.	100.0gal.	100.0gal.	100.2gal.

SWP LINOPOL

TABLE II (SHP March 1964)

		ME4-64-1	ME4-64-2	ME4-65-3	ME4-66-1	ME4-69-1	ME4-70-1	ME4-73-1
S-14	Water	211.0	218.3	218.3	218.3	232.5	228.3	235.0
	Balab 748	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Zinosperse A	14.0	14.0	14.0	14.0	14.0	14.0	14.0
	Natrosol 250 HR (2.5% soln.)	75.0	90.0	90.0	90.0	75.0	75.0	60.0
W-35	Leaded Zinc Oxide 10-12%	75.0	75.0	75.0	75.0	30.0	140.0	75.0
	Tamol 850	7.0	7.0	7.0	7.0	7.0	7.0	7.0
CH-468	KTPP	2.0	2.0	2.0	2.0	4.0	2.0	4.0
W-208	Zopaque R88	10.0	63.0	--	250.0	--	190.0	--
W-121	Snowflake	112.0	117.0	115.1	58.5	45.4	--	81.3
W-188	Nytal 300	115.0	119.0	120.0	61.0	145.0	--	81.3
YW-89	Yellow Oxide	47.0	--	7.3	5.7	59.4	--	63.3
G-73	Chrome Oxide X-1134	--	22.3	--	--	--	--	--
BN-56	752 Brown	--	--	24.1	--	--	--	--
R-269	Red Oxide Mapico #344	--	--	59.0	--	24.3	--	21.4
B-131	Witco Black F-1	--	--	--	--	4.2	--	--
W-158	Mineralite 3X	--	--	--	--	21.0	--	--
M-239	Celite 281	--	--	--	--	3710	50.0	--
W-189	Asbestine 3X	--	--	--	--	--	90.0	--
W-10	Barytes	--	--	--	--	--	--	50.0
BN-62	Brown Oxide #575	--	--	--	--	--	--	47.6
	Linopol	360.0	360.0	360.0	360.0	360.0	360.0	360.0
	Acrysol G-110	5.0	5.0	5.0	5.0	5.0	5.0	15.0
VM-659	Super Ad It	1.0	1.0	1.0	1.0	2.0	1.0	2.0
	Aquadis 24% Lead Drier	8.6	8.6	8.6	8.6	8.6	8.6	8.6
	Aquadis 6% Cobalt Drier	4.3	4.3	4.3	4.3	4.3	4.3	4.3
305-A-90	Thalo Blue	13.4	--	--	--	--	--	--
305-G-78	Thalo Green	21.3	--	--	--	--	--	--
305-B-130	Black Dispersion	--	--	--	--	--	--	6.5
	Solids Volume	40.6%	40.6%	40.6%	40.6%	40.6%	41.2%	40.5%
	PVC	35%	35%	35%	35%	35%	35.9%	35%

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TABLE III (SHP March 1964)

		EE4-65-1	EE4-65-2	EE4-65-3	EE4-70-1	EE4-70-2	ME4-62-2
W-208	Glidden R-88	282.0	20.7	11.7	--	95.0	102.0
W-121	Calcium Carbonate	51.0	133.0	135.0	85.0	133.0	143.0
W-188	Nytal 300 Talc	55.6	137.0	141.0	85.0	134.0	144.0
W-33	Zinc Oxide Lead Free	63.0	do	do	do	do	--
W-10	Barytes	--	--	--	114.0	--	--
YW-89	Iron Oxide Yellow	5.0	7.7	49.6	66.0	--	--
BN-56	Brown	--	25.0	--	--	--	--
R-269	Iron Oxide Red	--	61.7	--	22.7	--	--
BN-62	Brown Oxide	--	--	--	60.0	--	--
G-73	Chromium Oxide	--	--	--	--	24.0	25.0
M-484	Surfynol TG	2.0	do	do	do	do	do
KTPP		7.2	do	do	do	do	6.0
CH-322	Tamol 731	13.6	do	do	do	do	12.0
CH-181	Ethylene Glycol	12.0	do	do	do	do	do
VM-659	Super Ad It	2.0	do	do	do	do	--
Foamicide 581-B		4.0	do	do	do	--	4.0
CH-280	25% Triton X-100	18.0	do	do	do	do	do
Acrysol G-110		15.0	do	do	do	do	do
Natrosol 250 H.R. 2.5%		30.0	39.9	30.0	do	39.9	40.0
Cargill 1308		367.0	336.0	do	do	do	395.0
Advacar 6% Co		2.0	do	do	do	do	2.4
Advacar 6% Mn		2.2	do	do	do	do	2.4
Advacar 24% Pb		9.0	do	do	do	do	do
S-14	Water	235.0	do	221.8	240.5	235.0	182.0
305-A-90		--	--	13.8	--	--	--
305-G-78		--	--	22.0	--	--	--
305-B-130		--	--	--	6.8	--	--
CH-444		--	--	--	--	4.0	--
CH-380		--	--	--	--	--	1.5

ME4-77-1

TABLE IV (SHP March 1964)

		ME-79-1	ME4-79-2	ME4-79-3	ME4-79-4
S-14	Water	160.0	do	do	do
CH-473	TKPP	4.0	do	do	do
CH-450	Daxad 30	7.0	do	do	do
CH-474	Igepal CTA-639	8.0	do	do	do
CH-181	Ethylene Glycol	18.6	do	do	do
CH-447	Defoamer #357	2.5	do	do	do
195-T-27	Cellosize QP-4400 (3% soln)	62.5	do	do	do
B-131	Witco Black F-1	4.2	do	do	do
YW-89	Yellow Oxide	59.4	do	do	do
R-269	Red Oxide Mapico #344	24.3	do	do	do
W-33	Zinc Oxide	30.0	do	do	do
W-188	Nytal 300	145.0	do	do	do
W-158	Mineralite 3X	21.0	do	do	do
W-121	Snowflake	45.4	do	do	do
M-239	Celite 281	37.0	do	do	do
CH-380	Phenyl Mercuric Borate	1.5	do	do	do
Acrysol	G-110	10.0	10.0	10.0	--
CH-444	Balab #746	2.0	2.0	2.0	2.0
	Arolin 1652	215.0	--	--	--
	Linopol	--	360.0	--	--
	Cargil 1308	--	--	310.0	--
	24% Lead Driers	5.0	8.6	7.0	5.0
	6% Cobalt Driers	2.0	4.3	1.8	--
	6% Manganese Driers	2.0	--	1.8	1.5
GRV-3140	Urethane Oil	--	--	--	65.9
RE20169	Acrylic Latex	--	--	--	385.0
	Celloxize QP-4400 (dry)	--	--	--	1.2
	Water	191.3	68.2	121.6	--
CH-181	Ethylene Glycol	--	--	--	6.0
S-148	Refined Kerosene	--	--	--	12.0
195-T-27	Cellosize QP-4400 (3% soln.)	25.0	--	--	--
	Solids Volume	41.4%	41.4%	41.4%	41.4%
	PVC	35.8T	35.8%	35.8%	35.8%
	Yield in Gals.	100.0	100.0	100.0	100.0

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ME4-83-1

TABLE V (SHP March 1964)

		ME4-84-1	ME4-84-2	ME4-84-3	ME4-84-4
S-14	Water	160.0	do	do	do
CH-473	TKPP	4.0	do	do	do
CH-450	Daxad 30	7.0	do	do	do
CH-474	Igepal CTA-639	8.0	do	do	do
CH-181	Ethylend Glycol	18.6	do	do	do
CH-447	Defoamer #357	2.5	do	do	do
195-T-27	Cellosize QP-4400 (3% soln.)	62.5	do	do	do
W-208	Zopaque R88	250.0	do	do	do
W-91	Zopaque SD	50.0	do	do	do
W-33	Zinc Oxide	50.0	do	do	do
W-188	Nytal 300	116.0	do	do	do
CH-380	Phenyl Mercuric Borate	1.5	do	do	do
	Acrysol G-110	10.0	do	do	do
CH-444	Balab #746	2.0	do	do	do
	Arolin 1652	215.0	--	--	--
	Linopol	--	360.0	--	--
	Cargill 1308	--	--	310.0	--
	24% Lead Driers	5.0	8.6	7.0	5.0
	6% Cobalt Driers	2.0	4.3	1.8	--
	6% Manganese Driers	2.0	--	1.8	1.5
GRV-3140	Urethane Oil	--	--	--	65.9
S-148	Refined Kerosene	--	--	--	12.0
RE20169	Acrylic Latex	--	--	--	385.0
195-T-27	Celloxize QP-4400 (3% soln.)	25.0	--	--	--
	Cellosize QP-4400 Dry	--	--	--	.75
CH-181	Ethylene Glycol	--	--	--	6.00
S-14	Water	191.3	68.2	121.6	2.4
	Solids Volume	41.4%	41.4%	41.4%	41.4%
	PVC	35.8%	35.8%	35.8%	35.8%
	Yield in Gals.	100.0	100.0	100.0	100.5

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RE-20169 Acrylic Latex TABLE VI (SHP March 1964)

		ME4-85-1	ME4-87-1	ME4-90-1
W-208	Zopaque R-88	225.0	230.0	220.0
W-91	Zopaque SD	--	20.0	30.0
W-121	Snowflake	73.0	--	--
W-188	Nytal 300	74.5	48.7	--
W-140	Multiflex MM	--	50.0	--
W-223	Alsilate "W"	--	30.0	30.0
W-241	Ruby Talc #400	--	--	99.3
CH-380	Phenyl Mercuric Borate	1.5	1.5	1.5
CH-473	TKPP	3.0	3.0	3.0
CH-474	Igepal CTA-639	4.0	4.0	4.0
CH-450	Daxad 30	7.0	7.0	7.0
CH-447	Defoamer #357	2.5	2.5	2.5
195-T-27	Cellosize QP-4400 (3% soln.)	60.0	60.0	60.0
V-855	Linseed Alkyd	66.4	66.4	66.4
VM-885	Water Solution Acrylic	--	--	75.0
S-148	Refined Kerosene	12.0	12.0	12.0
S-14	Water	162.5	187.5	127.7
RE-20169	Acrylic Latex	330.0	330.0	290.0
VM-432	24% Lead Drier	5.0	5.0	5.0
VM-433	6% Manganese Drier	1.5	1.5	1.5
195-%-27	Cellosize QP-4400 (3% soln.)	85.0	60.0	85.0
CH-444	Balab #746	4.0	4.0	4.0
	Solids Volume	37.0%	37.0%	37.0%
	PVC	35.0%	35.0%	35.0%