

FILE NAME: Scotts (SCTS)

DATE: 1985 July 24

DOC#: SCTS004

DOCUMENT DESCRIPTION: Report - Alternate Carrier Cost Analysis

ALTERNATE CARRIER
COST ANALYSIS

By

Pam Lehr

July 24, 1985

Distribution:

John Cleveland
Mike Connor
Chuck DeMuth
Harvey Goertz

Max Kells
Gary Smith
Mike Thompson
Ron Wietelmann

Introduction

Vermiculite usage in Trionized products exceeded 20,000 tons in 1984 at a cost of \$2.6 million. Annual savings of \$1-2 million are theoretically possible by replacing vermiculite with a less expensive alternate carrier requiring no expansion, sizing or special handling. This report summarizes potential savings for a variety of alternate carriers including fly ash and corn cob flour. The ultimate suitability of any proposed alternate carriers must be determined through extensive laboratory, manufacturing and field studies.

Current Situation

Vermiculite is currently used as an inert carrier in all Trionized products at typical formulation levels of 10-25%. Prior to use, raw vermiculite ore is expanded in one of eight natural gas expanders and then screened to remove sand and other contaminants. The major costs associated with the vermiculite expander operation include maintenance, labor, energy (gas and electric), and sand disposal as well as a 25% vermiculite yield loss.

In addition, vermiculite carries inherent quality, supply and environmental risks. O. M. Scott relies on only two sources in West Virginia and S. Africa for its vermiculite supply. Slight physical differences between W. Virginian and S. African ore require process modifications at the expanders and in production. Serious shortages could result if one of these sources became unavailable for any reason. Although the current vermiculite sources are considered asbestos free, a suggested link between vermiculite (i.e. Turf Builder) and asbestos could create serious public image problems.

All of these factors combined highlight the need to consider alternate carriers to replace vermiculite in Trionized formulations.

Cost Analysis

Bulk delivered prices for 45 inert carriers ranging from rice hulls and pecan shells to clay and perlite were identified by Purchasing and are summarized in Table I. Table II shows an itemized cost comparison between vermiculite and two alternate carriers - fly ash and corn cob flour. (These substances were chosen as examples because fly ash represents one of the lowest cost alternatives and corn cob flour is comparably priced with vermiculite).

The savings reported for alternate carriers in Table III and Figures 1-3 are based on the following assumptions:

1. Yield of alternate carriers is 100% vs. 75% for vermiculite ore.
2. Natural gas & electrical usage in expanders is eliminated.
3. Sand disposal is eliminated.
4. Maintenance to expanders system is eliminated. (Detailed maintenance costs are listed in Table 4).
5. Trionized product yield and quality are equivalent to vermiculite based products.
6. Manpower to operate & monitor expansion system is eliminated.

Results

The estimated annual savings for fly ash and corn cob flour as alternate carriers are \$2.23MM (\$0.072/lb.) and \$1.01MM (\$0.033/lb.), respectively. Corn cobs, currently used as a carrier for control products, are slightly above the break even point for alternate Trionized carriers at \$154/ton.

Figure 2 (Table III A) shows the unit savings for S-1439 Turf Builder (5M bag) at \$0.28 (10.1%) for fly ash and \$0.12 (4.5%) for corn cob flour. Similarly, Figure 3 (Table III B) shows unit savings on S-1092 Turf Builder Plus 2 (5M bag) at \$0.26 (7.7%) and \$0.12 (3.4%) for fly ash and corn cob flour.

Process Requirements

Until recently, mixing technology has been one of the primary obstacles in finding a suitable carrier to replace vermiculite. The paddle mixer used to blend liquid ingredients with vermiculite is inadequate on less absorbent carriers.

A proposed process uses alternate carriers as bulking agents rather than absorbents. In such a process, the carriers are slurried into the resin and form a matrix. The resin is reacted in much the same way MAP and Potash are processed in Polyform.

For this type of processing, an efficient alternative to a paddle mixer is an in-line mixer such as the Arde Dilumelt disperser used in Polyform (Figure 4). Residence times for mixing low PH MAP in Polyform were reduced from 5 minutes to 5-10 seconds after implementing the in-line mixer. As a result, premature reaction problems associated with longer residence times were eliminated. This limit has proven capabilities for producing acceptable slurries with low residence time.

Figure 5 shows a simplified flow diagram of the Trionized Process. Figure 6 shows the proposed flow diagram with the expander removed and the paddle mixer replaced with the in-line mixer. This scheme would also allow Polyform production in the Trionized Plant.

Conclusions

1. If the assumptions listed above are valid, 35 of the proposed carriers could reduce standard costs.
2. Potential savings could exceed \$2MM by replacing vermiculite with a low cost carrier.
3. These savings can represent a 10% reduction in standard costs for S-1439 Turf Builder and may stimulate increased sales due to better competitive pricing.
4. Substantial testing of alternate carriers is needed to determine the feasibility of vermiculite replacement.
5. The system that would allow manufacturing of Trionized products with alternate carriers would also permit manufacturing of Polyform in the Trionized Plant.

TABLE I
ALTERNATE CARRIER PRICES

Description	Bulk Price (\$/T)	Description	Bulk Price (\$/T)
Slag, screened	11-13	Clay, Bentonite (Calcium)	110-125
Calcium Carbonate (Carey #60)	17.76(TK)/22.25(Rail)	Zeolite, Natural	110-125
Calcium Carbonate (Carey #80)	17.76(TK)/22.25(Rail)	Clay, Bentonite (Volclay SPV-200)	120-170
Bottom Ash	19-25	Clay, Bentonite (Volclay #325)	120-170
Fly Ash (Powder)	20-25	Clay, Attapulgite (16/30)	125
Sawdust (Hardwood)	34	Powdered Glass (-200 mesh)	130
Slag	37-43	Powdered Glass (-400 mesh)	130
Gypsum Waste	40-50	Clay, Montmorillonite (16/30)	130-135
Calcium Carbonate (Med. 20-60)	48.17	Diatomaceous Earth (Grade M-77)	130-145
Calcium Carbonate (Fine Q100)	54.67	Diatomaceous Earth (Grade M-78)	130-145
Ball Clay, 325 Mesh, Red (101)	55-60	Diatomaceous Earth (Grade M-79)	130-145
Ball Clay, 325 Mesh, Lt. Gray (401)	55-60	Classified Pith/Chaff	135.20
Pecan Shells (pith meal)	55-60	Graded Oak Sawdust (Screened)	145-150
Ball Clay, 325 Mesh C & C	62	Rice Hulls	145-150
Ball Clay (Coppin Light)	65	Corn Cobs	154
Clay Attapulgite Diluex	86	Pumice (Med.)	155-180
Clay Attapulgite (100 Mesh)	89	Pumice (Powder)	160-175
Clay Attapulgite (200 Mesh)	91.50	Pumice (Coarse)	170-175
Corn Corb Flour	96-101	Pumice (Grade 7)	170-175
Vermiculite, #4 Ore	104	Pecan Flour (-200 Mesh)	235
Furafil M	105	Perlite, expanded	260
Furafil O	105		
Powdered Glass (30x50)	110		
Powdered Glass (30x80)	110		

*Prices provided by Max Kells in letter dated June 12, 1984.

Some prices are negotiable.

TABLE II
ALTERNATE CARRIER
COST COMPARISON (ANNUAL BASIS)

	Standard Vermiculite (1984 Cost)	Alternate Carriers		<i>no carrier</i>
		Corn Cob Flour (Est)	Fly Ash (Est)	
Raw Materials	\$2,139,280	\$1,522,180	\$ 310,650	0
Maintenance	132,210	43,300	43,300	0
Energy (Gas)	180,720	-0-	-0-	0
Energy (Electric)	36,300	16,000	16,000	0
Sand Disposal	17,600	-0-	-0-	0
Labor	90,000	-0-	-0-	0
Total Cost	\$2,596,110	\$1,581,480	\$369,950	0
Annual Savings	-0-	\$1,014,630	\$2,226,160	
Savings/lb. Carrier	-0-	\$0.033	\$0.072	

TABLE III A
TURF BUILDER STANDARD COSTS
(S-1439)

	<u>5M</u>	<i>no carrier</i>	<u>10M</u>	<u>15M</u>
Stock No.	23309		23317	23325
Unit Wt. (lb.)	<u>16.88</u>	12.6875	<u>33.74</u>	<u>50.26</u>
Carrier Wt. (%)	22.9	0	22.9	22.9
Cost				
Raw Material	<i>for 7 1/2% 1.2938</i> \$1.52	1.2626	\$3.02	\$4.52
Conversion	0.88	1.8305	1.49	2.10
Packaging	<u>0.33</u>	0.3005	<u>0.50</u>	<u>0.68</u>
Total	\$2.73	0.37	\$5.01	\$7.30
Savings				
Corn Cob Flour (\$/%)	0.12/4.5		0.24/4.9	0.36/5.0
Fly Ash (\$/%)	0.28/10.1		0.55/11.1	0.84/11.3

TABLE III B
TURF BUILDER PLUS 2 STANDARD COSTS
(S-1092)

	<u>5M</u>	<u>10M</u>	<u>15M</u>
Stock No.	23697	23721	23739
Unit Wt. (lb)	16.88	33.74	50.26
Carrier Wt. (%)	21.5	21.5	21.5
Cost			
Raw Material	\$2.15	\$4.28	\$6.40
Conversion	0.90	1.51	2.14
Packaging	<u>0.33</u>	<u>0.50</u>	<u>0.67</u>
Total	\$3.38	\$6.29	9.21
Savings			
Corn Cob Flour (\$/%)	0.12/3.4	0.23/3.6	0.34/3.7
Fly Ash (\$/%)	0.26/7.7	0.52/8.3	0.78/8.5

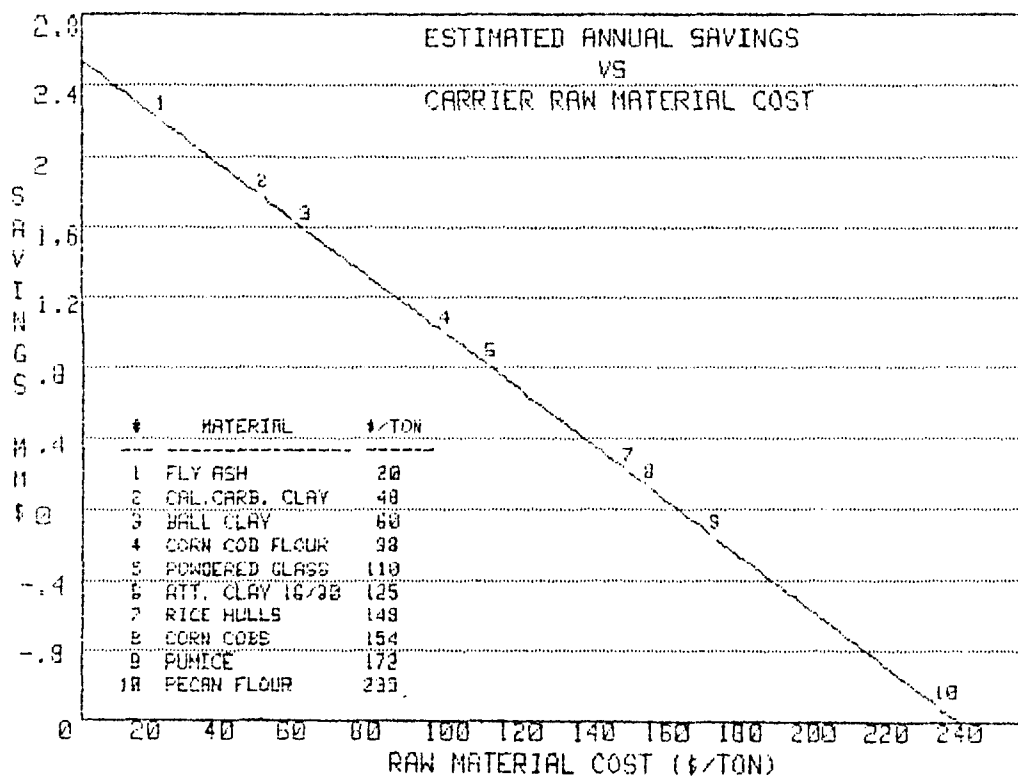


FIGURE I:

Total Annual Savings For Various Alternate Carriers. (Based on 20,570 Ton Vermiculite Usage in 1984).

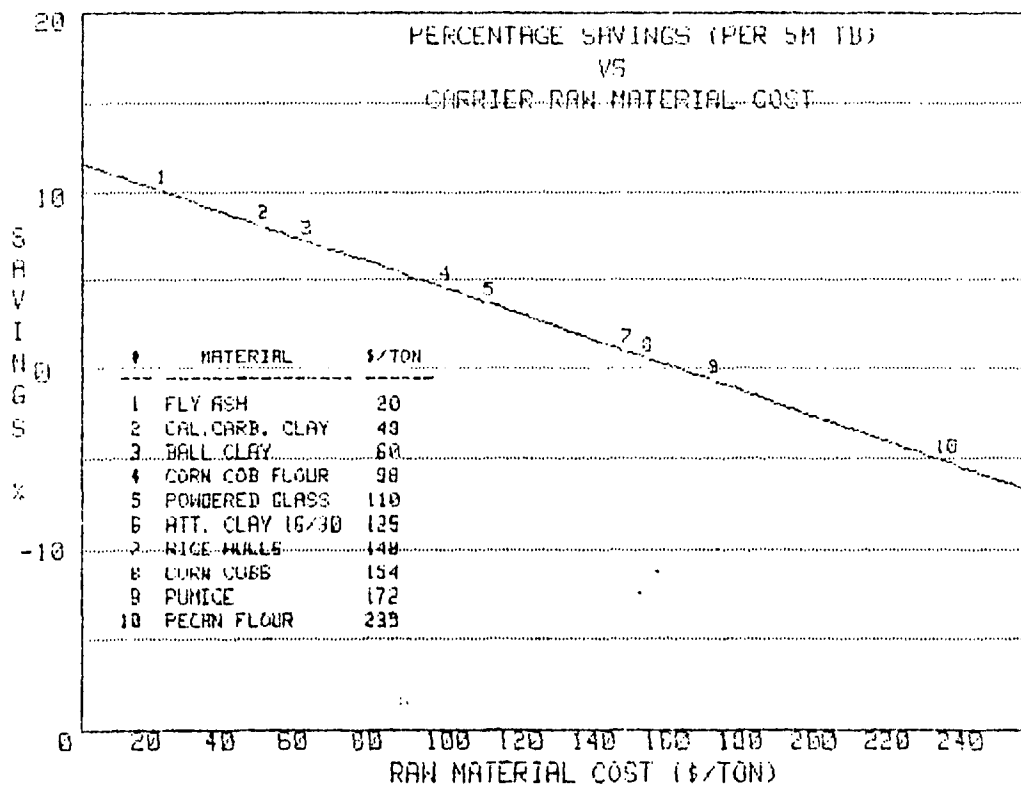
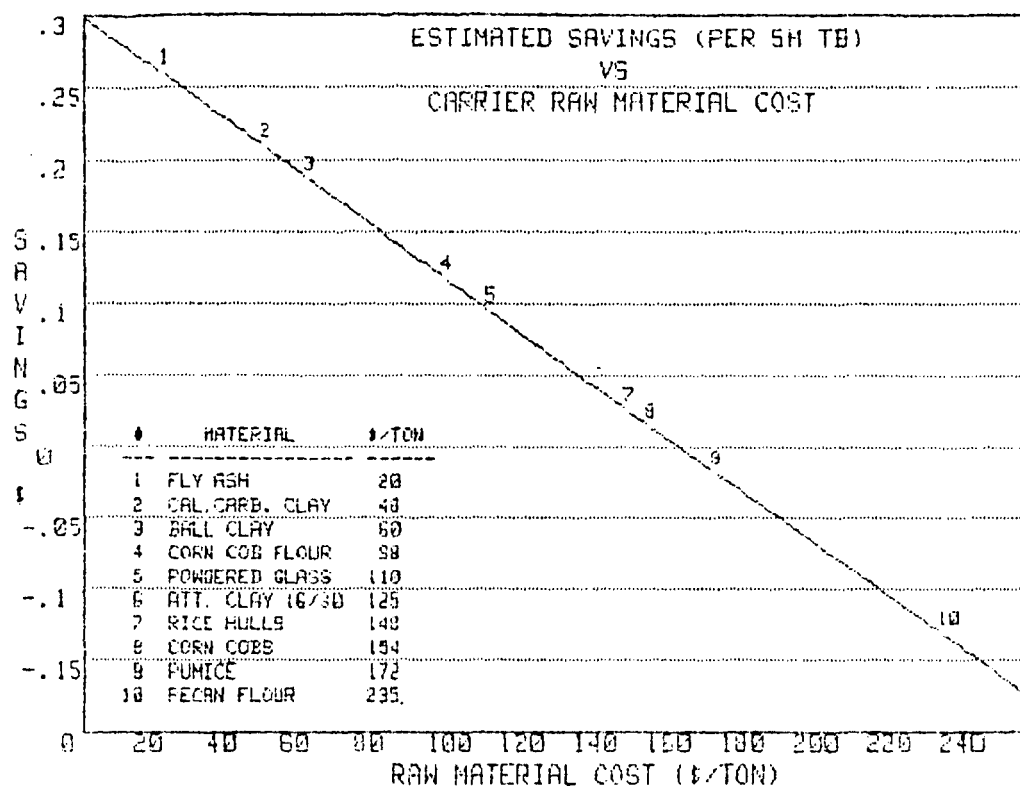


FIGURE II:

Unit Savings In Dollars (Top) And Percentage
Of Total Standard Cost (Bottom) For 5M Turf Builder
(S-1439)

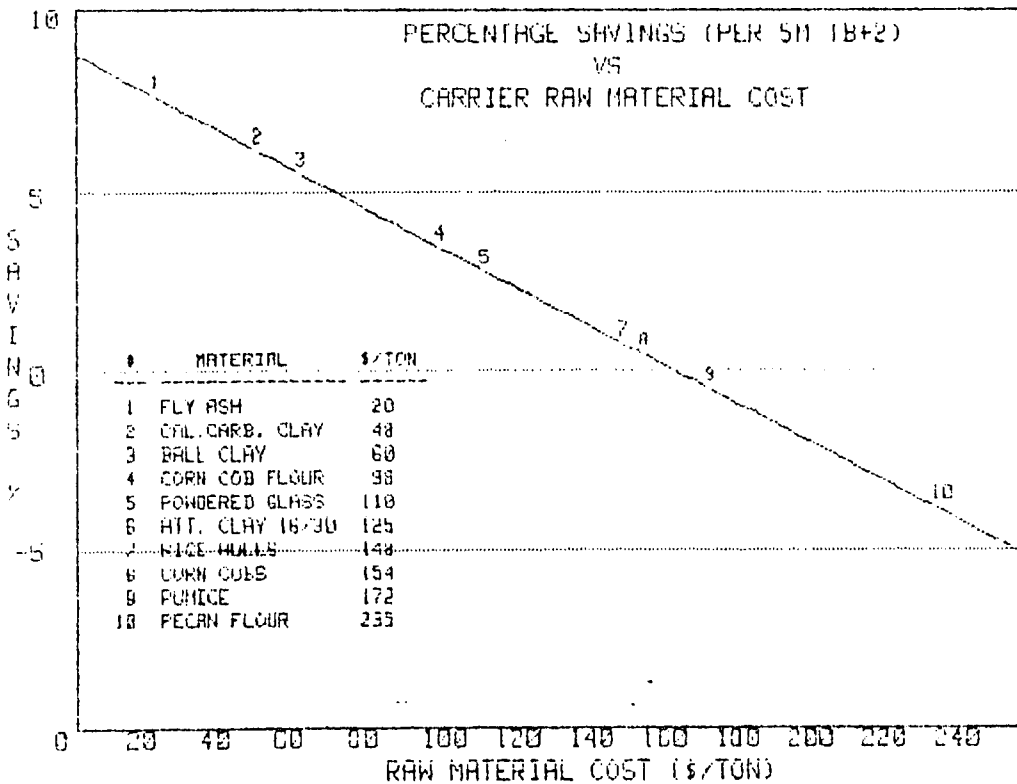
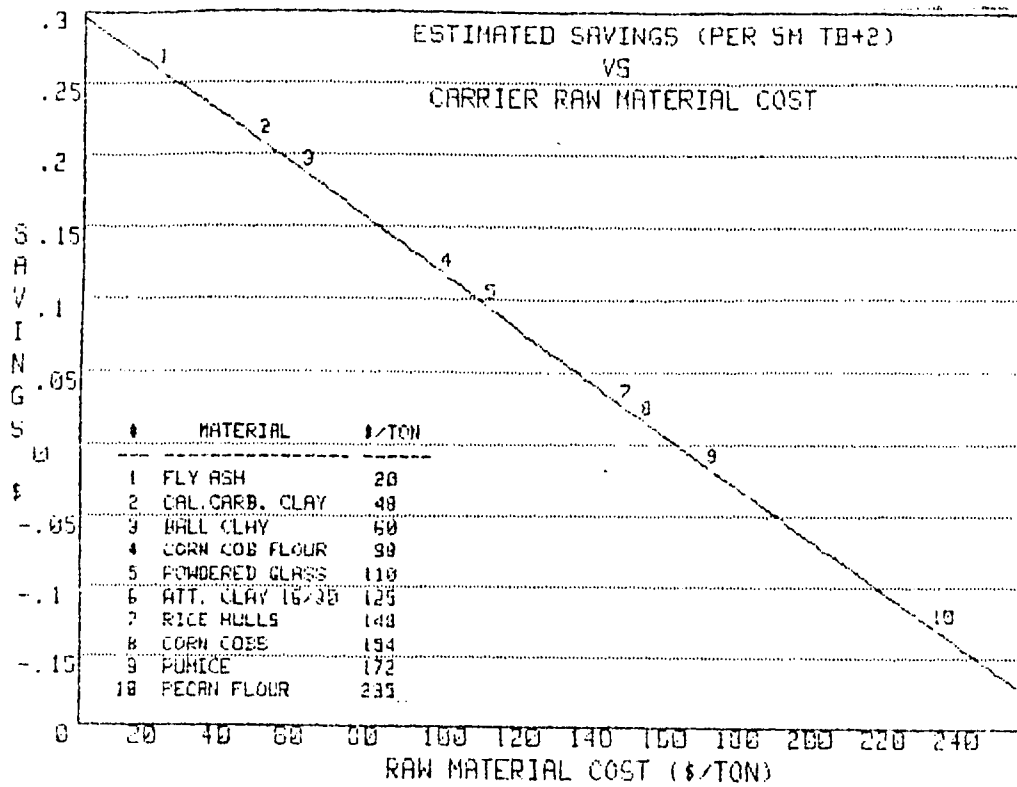


FIGURE III:

Unit Savings In Dollars (Top)
And Percentage Of Total Standard Cost
(Bottom) For 5M Turf Builder Plus 2 (S-1092)

FIGURE IV:

Illustration Of In-Line Mixer
Currently Used In Polyform.

Model D-6000

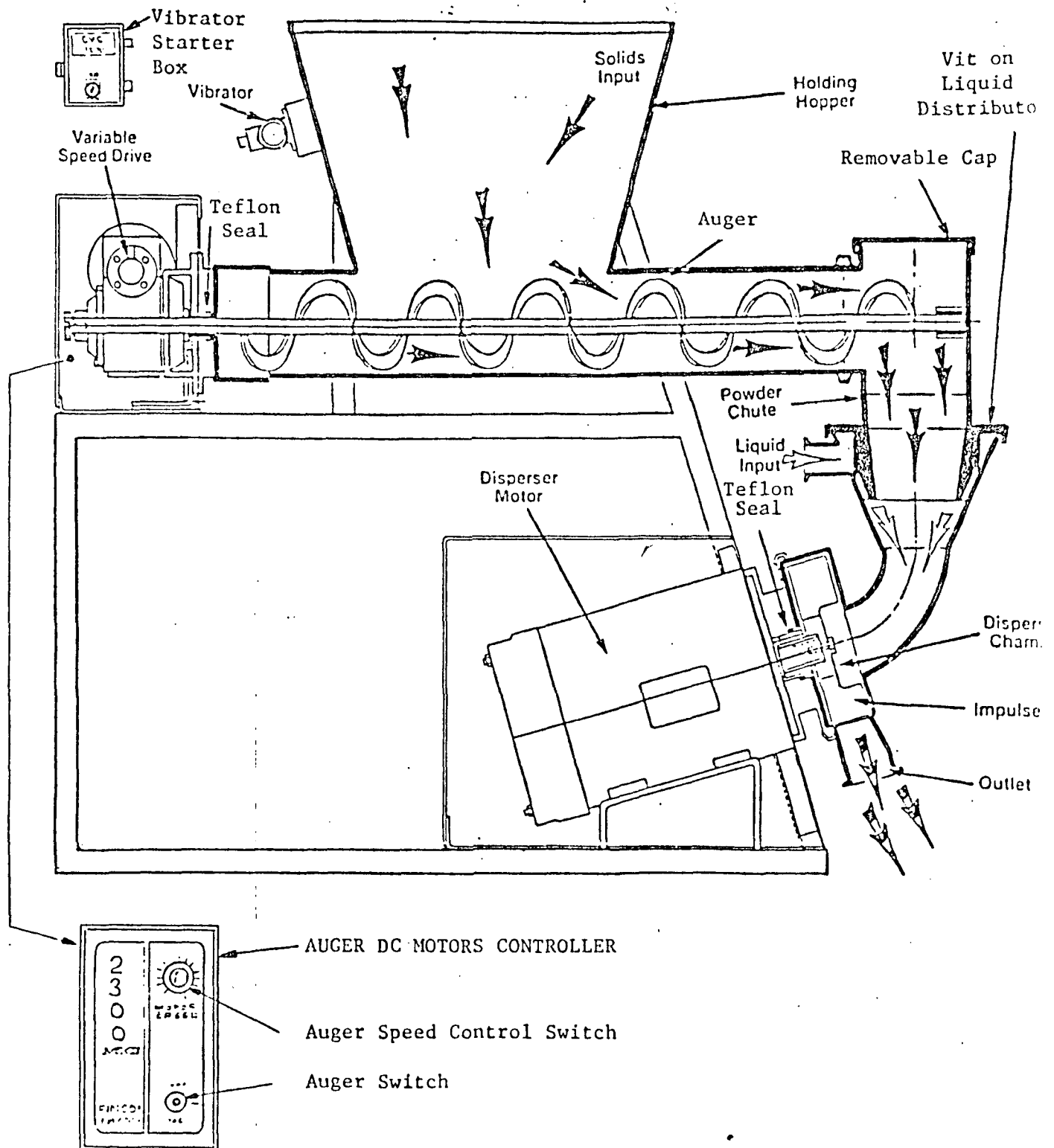


FIGURE V

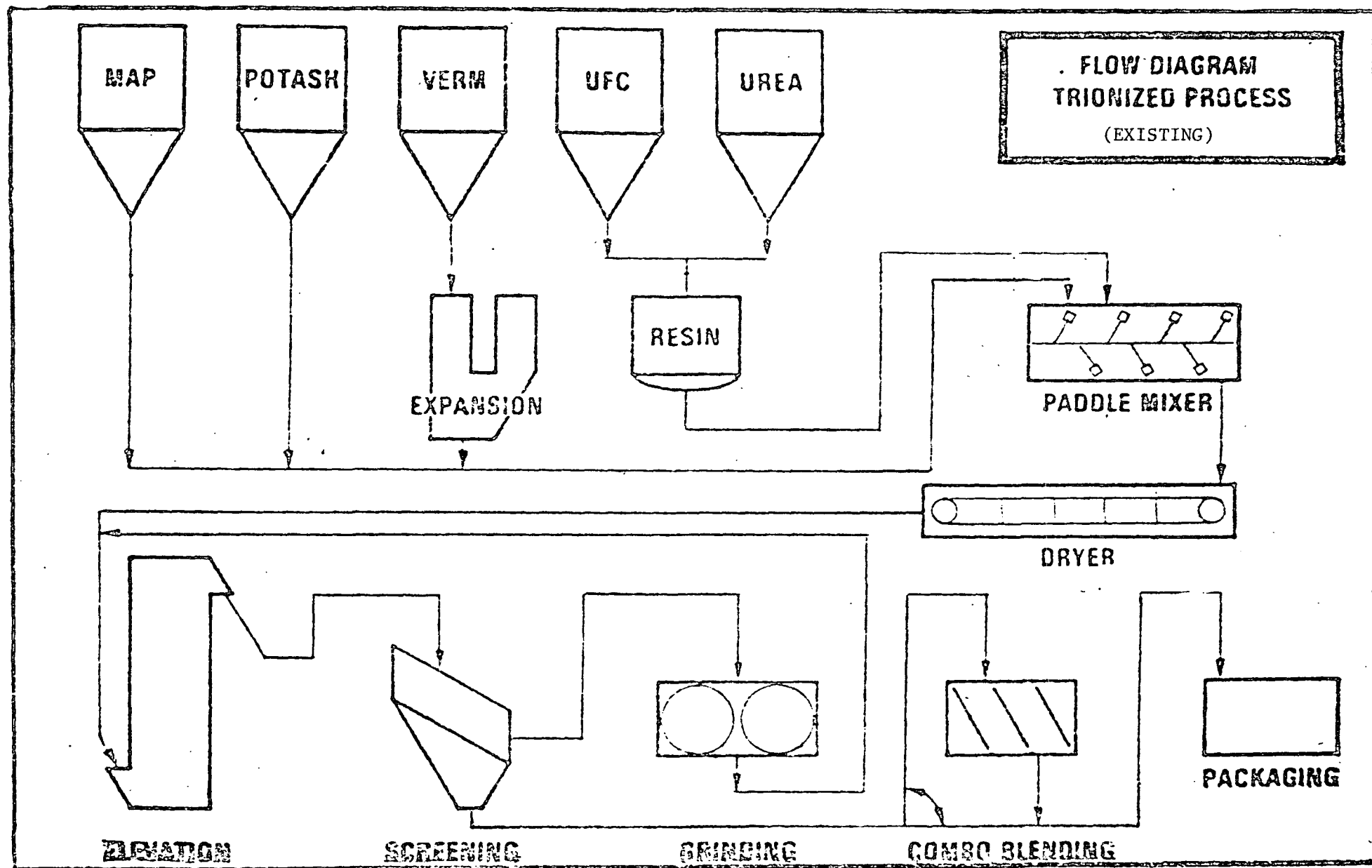


FIGURE VI

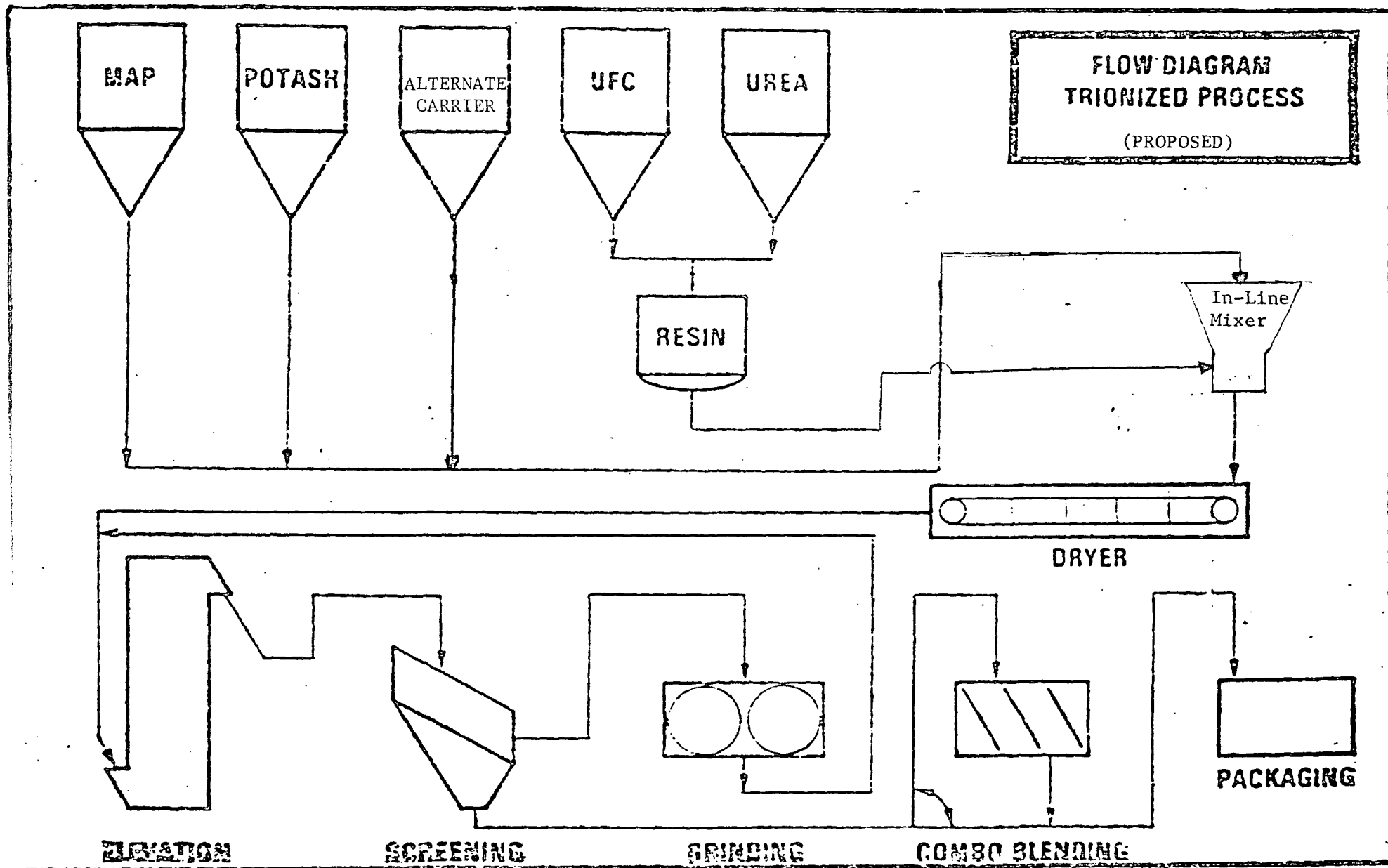


TABLE 4
VERMICULITE HANDLING SYSTEM
MAINTENANCE COSTS (1984)

<u>Equip.No.</u>	<u>Description</u>	<u>Labor</u>	<u>Materials</u>	<u>Total</u>
*0005	Vermiculite Feed Conveyor	\$1,760.00	\$58.16	\$1,818.16
*0009	#1 Raw Ore Screw	1,144.00	230.04	1,374.04
*0010	#2 Raw Ore Screw	330.00	13.41	343.41
*0011	#3 Raw Ore Screw	561.00	16.09	577.09
*0015	#4 Raw Ore Screw	66.00	0.00	66.00
*0017	#5/#6 Raw Ore Screw	33.00	0.00	33.00
*0018	#1 Vermiculite Transfer Screw	264.00	73.12	337.12
*0019	#2 Vermiculite Transfer Screw	418.00	21.11	439.11
*0022	#7 Raw Ore Screw	11.00	0.00	11.00
*0023	#8 Raw Ore Screw	0.00	0.00	0.00
1008	#1 Stoner	1,309.00	90.82	1,399.82
1009	#2 Stoner	1,155.00	373.93	1,528.93
1010	#3 Stoner	1,749.00	689.63	2,438.63
1011	#1 Stoner Fan	0.00	0.00	0.00
1012	#2 Stoner Fan	0.00	0.00	0.00
1013	#3 Stoner Fan	0.00	0.00	0.00
1014	#1 Turbo Blower	0.00	0.00	0.00
1015	#2 Turbo Blower	0.00	0.00	0.00
1016	#3 Turbo Blower	0.00	0.00	0.00
1017	#4 Turbo Blower	0.00	0.00	0.00
1039	#4 Stoner Fan	0.00	0.00	0.00
1040	#5 Stoner Fan	0.00	0.00	0.00
1041	#6 Stoner Fan	0.00	0.00	0.00
1042	#7 Stoner Fan	132.00	0.00	132.00
1182	#8 Stoner	352.00	52.96	404.96
1227	#4 Stoner	1,067.00	347.79	1,414.79
1228	#5 Stoner	869.00	60.69	929.69
1230	#7 Stoner	1,133.00	83.25	1,216.25
1286	#8 Stoner Fan	0.00	0.00	0.00
1287	#1 Control Panel	451.00	429.29	880.29
1288	#2 Control Panel	693.00	501.94	1,194.94
1289	#3 Control Panel	0.00	0.00	0.00
1290	#4 Control Panel	440.00	457.86	897.86
1291	#5 Control Panel	495.00	0.00	495.00
1292	#6 Control Panel	253.00	226.09	479.09
1293	#7 Control Panel	187.00	429.29	616.29
1294	#8 Control Panel	0.00	0.00	0.00
1295	#1 Flame Control System	55.00	47.71	102.71
1296	#2 Flame Control System	0.00	0.00	0.00
1297	#3 Flame Control System	121.00	325.00	446.00
1298	#4 Flame Control System	0.00	0.00	0.00
1299	#5 Flame Control System	44.00	0.00	44.00
1301	#6 Flame Control System	22.00	94.71	116.71
1302	#7 Flame Control System	22.00	325.00	347.00
1303	#8 Flame Control System	0.00	0.00	0.00
1304	#1 Recorder	11.00	0.00	11.00
1305	#2 Recorder	0.00	0.00	0.00
1306	#3 Recorder	0.00	0.00	0.00

*Equipment Retained with Alternate Carrier Handling System

<u>Equip.No.</u>	<u>Description</u>	<u>Labor</u>	<u>Materials</u>	<u>Total</u>
1307	#4 Recorder	0.00	0.00	0.00
1308	#5 Recorder	110.00	0.22	110.22
1309	#6 Recorder	44.00	325.00	369.00
1310	#7 Recorder	44.00	91.34	135.34
1311	#8 Recorder	77.00	0.00	77.00
2014	#8 Turbo Blower	198.00	309.96	507.96
2025	#1 Port Valve	0.00	0.00	0.00
2026	#2 Port Valve	0.00	0.00	0.00
2027	#3 Port Valve	0.00	0.00	0.00
2056	#4 Port Valve	0.00	0.00	0.00
2063	#8 Port Valve	0.00	0.00	0.00
2065	#5 Port Valve	0.00	0.00	0.00
2101	#5 Turbo Blower	0.00	0.00	0.00
2102	#6 Turbo Blower	0.00	0.00	0.00
2103	#7 Turbo Blower	0.00	0.00	0.00
2106	#6 Port Valve	0.00	0.00	0.00
2107	#7 Port Valve	0.00	0.00	0.00
3005	#5 Expander	3,190.00	2,224.92	5,414.92
*3008	Dust Coll. Rotary Valve	902.00	793.15	1,695.15
3009	#1 Expander	2,728.00	176.99	2,904.99
3010	#2 Expander	6,787.00	1,704.82	8,491.82
3011	#3 Expander	6,226.00	1,345.03	7,571.03
3021	#4 Expander	1,419.00	61.40	1,480.40
3052	#6 Expander	7,460.00	921.47	8,381.47
3053	#7 Expander	539.00	13.23	552.23
3081	#8 Expander	3,102.00	1,111.17	4,213.17
*3082	#1 Silo	88.00	7.71	95.71
*3083	#2 Silo	209.00	0.00	209.00
*3083A	Positioner	0.00	0.00	0.00
*3084	#3 Silo	429.00	45.19	474.19
*3085	#4 Silo	825.00	132.23	957.23
*3086	#5 Silo	220.00	6.56	226.56
*3086A	Positioner	0.00	0.00	0.00
*3087	#6 Silo	253.00	0.00	253.00
*3087A	Positioner	0.00	0.00	0.00
*3088	#7 Silo	473.00	70.00	543.00
*3088A	Positioner	0.00	0.00	0.00
*3089	#8 Silo	44.00	0.00	44.00
*3089A	Positioner	0.00	0.00	0.00
*3094	Dust Coll. Rotary Valve	968.00	0.00	968.00
*3095	#1 Dust Coll. Screw	539.00	45.78	584.78
*4008	#3 Silo	0.00	0.00	0.00
*4053	Dust Coll. Cyclone	121.00	2.00	123.00
4055A	#1 Secondary Blower	33.00	0.00	33.00
4055B	#2 Secondary Blower	0.00	0.00	0.00
4055C	#3 Secondary Blower	0.00	0.00	0.00
4055D	#4 Secondary Blower	0.00	0.00	0.00
4055E	#5 Secondary Blower	0.00	0.00	0.00
4055F	#6 Secondary Blower	165.00	109.28	274.28
4055G	#7 Secondary Blower	132.00	0.00	132.00
4055H	#8 Secondary Blower	0.00	0.00	0.00
4059	#1 Drum Feeder	165.00	0.00	165.00
4060	#4 Drum Feeder	176.00	29.72	205.72
4061	#3 Drum Feeder	33.00	0.00	33.00
4062	#4 Drum Feeder	44.00	4.56	48.56

<u>Equip.No.</u>	<u>Description</u>	<u>Labor</u>	<u>Materials</u>	<u>Total</u>
4063	#5 Drum Feeder	88.00	17.64	105.64
4064	#6 Drum Feeder	165.00	0.00	165.00
4065	#7 Drum Feeder	0.00	0.00	0.00
4066	#8 Drum Feeder	308.00	12.07	320.07
*4067	Distribution Screw	517.00	252.22	769.22
*4068	Dust Coll.Double Dump Valve	143.00	101.82	244.82
*4070	Vermiculite D.C. Discharge Screw	462.00	41.29	503.29
*4071	Dust Collector Main Fan	220.00	0.00	220.00
*4072	Dust Collector Housing	957.00	372.20	1,329.20
4074	Elevator Screen	330.00	0.00	330.00
5008	#1 Cyclone Valve	0.00	0.00	0.00
5009	#1 Hydro Fan	616.00	37.54	653.54
5010	#2 Hydro Fan	363.00	0.00	363.00
5011	#3 Hydro Fan	286.00	34.43	320.43
5022	#2 Cyclone Valve	33.00	26.70	59.70
5023	#3 Cyclone Valve	2,090.00	101.71	2,191.71
5024	#4 Cyclone Valve	33.00	0.00	33.00
5028	#5 Cyclone Valve	33.00	0.00	33.00
*5042	#1 Ore Elevator	748.00	110.21	858.21
*5043	#2 Ore Elevator	275.00	0.00	275.00
*5044	#3 Ore Elevator	803.00	60.65	863.65
*5045	#4 Ore Elevator	363.00	140.43	503.43
*5046	#5/#6 Ore Elevator	6,251.00	139.51	6,390.51
*5047	#7 Ore Elevator	5,973.00	7,309.68	13,282.68
*5048	#8 Ore Elevator	748.00	9.36	757.36
5051	#6 Cyclone Valve	198.00	116.18	314.18
5052	#7 Cyclone Valve	0.00	0.00	0.00
5053	#8 Cyclone Valve	22.00	0.00	22.00
*5056	Ore Unload Elevator	374.00	17.45	391.45
*5057	Dust Collector	407.00	651.55	1,058.55
6004	#1 Hydro Filter	2,168.00	823.90	3,441.90
6005	#2 Hydro Filter	649.00	9.36	658.36
6006	#3 Hydro Filter	121.00	0.00	121.00
6012	#4 Hydro Filter	22.00	0.00	22.00
6019	#5 Hydro Filter	253.00	5.74	258.74
*6021	"C" Conveyor	374.00	843.93	1,217.93
6024	#6 Hydro Filter	275.00	643.31	918.31
6025	#7 Hydro Filter	352.00	0.00	352.00
6028	#8 Hydro Filter Fan	869.00	282.33	1,151.33
6029	#8 Hydro Filter	341.00	0.00	341.00
6031	#5 Hydro Filter Fan	517.00	377.90	894.90
6032	#6 Hydro Filter Fan	275.00	0.00	275.00
6033	#7 Hydro Filter Fan	242.00	0.00	242.00
6034	#4 Hydro Filter Fan	66.00	0.00	66.00
*7020	"A" Conveyor	847.00	657.71	1,504.71
*7021	"B" Conveyor	1,265.00	1,471.48	2,736.48
*7025	Dust Collector Fan	176.00	52.95	228.95
8031	Roof Screw	1,650.00	0.00	1,650.00
8032	#1 Vermiculite Expander Elev.	1,485.00	255.05	1,740.05
8033	#2 Vermiculite Expander Elev.	297.00	0.00	297.00
8035	#3 Vermiculite Expander Elev.	88.00	0.00	88.00
8036	#4 Vermiculite Expander Elev.	506.00	153.29	659.29
8037	#5 Vermiculite Expander Elev.	22.00	0.00	22.00
8038	#6 Vermiculite Expander Elev.	1,122.00	288.89	1,410.89
F1005	Sand System	9,372.00	2,811.09	12,183.09

Sub Total (Retained)

\$43,295.99

Total

\$132,209.19

SC-0555785

Scotts_Springer_021233