AR226-0710

BIODEGRADATION (BOD/COD)

TEST SUBSTANCE

Identity: A mixture containing perfluorooctanesulfonate, which may also be referred to as PFOS, FC-95, or as a component of FC-203. (1-Octanesulfonic acid) (CAS # 2795-39-3).

Remarks: The 3M production lot numbers were not noted. The test sample is FC-203. Current information indicates it is a mixture of 1.34% PFOS, 35% diethylene glycol butyl ether, 37.85% water, 20% ethylene glycol, 2.66 % Sultone foamer, 3% sodium octyl sulfate, 0.1% sodium lauryl sulfate, and 0.05% tolyltriazole.

The following is an abbreviated summary of multiple biodegradation studies on FC-203. These studies apply to a mixture with incompletely characterized concentrations of impurities. Data does not accurately reflect the degradation potential of the fluorochemical component of the test sample.

METHOD:

Method: Various methods, most not noted.
Type: BOD and Dichromate Reflux COD
GLP: No
Year completed: 1973 - 1980
Contact time: 20 days
Inoculum: Seed from various sources.

RESULTS

Chemical Oxygen Demand (COD) range:	420,000 – 1,070,000 mg/kg
Biochemical Oxygen Demand (BOD) range:	
5-Day:	206,250 – 560,000 mg/kg
10-Day:	450,000 – 646,875 mg/kg
12-Day:	660,000 – 830,000 mg/kg
15-Day:	426,312 – 604,687 mg/kg
18-Day:	660,000 mg/kg
20-Day:	426,562 – 1,100,000 mg/kg

Remarks: Testing was conducted on the mixture as described in the Test Substance Remarks field. The values reported apply to that mixture and not the fluorochemical proportion alone.

CONCLUSIONS

No reliable conclusions can be derived from these studies. The indication is that the majority of the product components are readily biodegradable.

Submitter: 3M Company, Environmental Laboratory, P.O. Box 33331, St. Paul, Minnesota, 55133

DATA QUALITY

Reliability: Klimisch ranking = 3. Study lacks description and records of the method followed. The inoculum is not properly characterized. The testing was conducted on a mixture with chemicals having varying degrees of biodegradability, leading to potential misinterpretation of the results. The sample purity was not properly characterized and the study lacks analytical confirmation of the amount of fluorochemical proportion in the solution.

REFERENCES

The studies were conducted by the 3M Company, Environmental Laboratory, St. Paul, MN, Lab Request numbers 1940 and 5360S in 1973.

OTHER

Last changed: 6/28/00

Form 10620-5-PWO
cc: LAB REQUEST BOOK – 42-5W

3M "Action" 200 P

PRODUCT ECOLOGICAL ASSESSMENT REQUEST FOR LABORATORY WORK

Ref: ENVIR. ASSESS. INQ., # ~~FC-203~~ Commercial Chem DIVISION
PRODUCT: FC-203 (F-5919, LOT-1)

LAB REQUEST NO. 5360 S

REQUESTER

Name: Eric Reiner Phone No. 5074
Request Date: 1-24-80
Project No.: Prob. No.
Code No.:
Sample Date: New Sample to be sent Date Needed: TOC ASAP
Description: Redo BOD/COD Study of FC-203
Purpose of Tests: Previous results are not consistent. Use new sample

LABORATORY

Date Received Sample: 1-29-80
Analyst: WAS, ~~MR~~
Date Completed: ~~2-26-80~~ 2-26-80
Hours Spent: 8 hrs W.A. Schild
Y B P
Please Call Requester If Delays Are Encountered.

		FC-203 Concentrate		FC-203 3% solution	
PHYSICAL & CHEMICAL PROPERTIES					
Heat of Combustion Cal/G (BTU/Lb.)					
Density					
Ash					
Other					
WATER POLLUTION					
~~DH~~ COD – mg/kg duplicate	X	1,120,000		mg/l COD 1,070,000	
COD – mg/kg analyses	X	1,110,000			
BOD_5	X	(SEE BELOW)			
BOD, Ultimate	X				
TOC % (w/w)	X	2.75	X	0.825 calculated from concentrate value. WAS	Send a copy of the TOC Protocol so it can be sent to International contact To show German government officials how we do this test.
~~GC~~ Density – g/ml	X	1.04			
Oxygen Uptake		264,000 mg/l			
Dehydrogenase Activity (TTC)					
Other					

TOC ASAP week possible

NOTES: TOC VALUE BASED ON AN AVERAGE OF FIVE (5) SEPARATE TOC ANALYSES.

BIOASSAY

Specify Organism and Method:

BOD RESULTS – mg/kg — mg/l BOD

LEACHATE FROM LEACHING TEST

pH	BOD 5 – 560,000	538,000
COD		
BOD_5	BOD 12 – 830,000	798,000
BOD, Ultimate		
TOC	BOD 20 – 1,100,000	1060,000
GC		
Bioassay	(see attached worksheets)	
Other		

OTHER

Bioaccumulation
Persistence
Degradation Products

000431

White - Return to Requester Canary - Environmental Engrg. Office File Pink - Environmental Engrg. Lab Goldenrod - Return to Requester

Environmental Laboratory
BOD Work Sheet - Samples

3M

Lab Req. No. ◗ 53605		BOD Run No. ◗ 80-5	
Analyst	Date Started 1-30-80	5 · Day BOD Readings	
W. A. Schmidt		Analyst M. Roberts	Date 2/4/80

Sample Description FC-203 (F-5919, LOT-1)

Initial Dilution	0.250 g of Sample diluted to 250 ml with DI water	
Initial Dilution Factor	1000 (Dilution factor = 1 if undiluted)	

Bottle No.	Conc. of Sample[1] (mg/l)	Sample Size[2] ml	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Sample	5 BOD · Day mg/kg	Average 5 BOD · Day
99	1.67	0.50	8.95	7.80	1.15	0.81	489,000	mg/kg
98	3.33	1.0	8.95	6.95	2.00	1.66	498,000	
16	6.67	2.0	8.95	4.55	4.40	4.06	609,000	560,000
23	13.3	4.0	8.90	1.70	7.20	6.87	515,000	
56	26.7	8.0	8.95	<0.5	—	—		

Note: 1. Conc. = Concentration of sample (ml/l or mg/l) in BOD bottles.

2. Sample Size = ml or g of sample or diluted sample added to BOD Bottle.

Comments

Environmental Laboratory
BOD Work Sheet - Samples

3M

Lab Req. No. ▶ 53605		BOD Run No. ▶ 80-5	
Analyst	Date Started 1-30-80	12 - Day BOD Readings	
W. A. Schiel		Analyst W. A. Schiel	Date 2-11-80

Sample Description FC-203 (F-5919, LOT-1)

Initial Dilution	0.250 g	of Sample diluted to 250 ml with DI water
Initial Dilution Factor	1000	(Dilution factor = 1 if undiluted)

Bottle No.	Conc. of Sample[1] (mg/L)	Sample Size[2] (ml)	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Sample	12 BOD - Day mg/kg	Average 12 BOD - Day mg/kg
99	1.67	0.50	8.95	7.10	1.85	1.37	822,000	830,000
98	3.33	1.0	8.95	5.80	3.15	2.67	801,000	
16	6.67	2.0	8.95	2.80	6.15	5.67	851,000	
23	13.3	4.0	8.90	<0.5	—	—		
56	26.7	8.0	8.95	—	—	—		

Note: 1. Conc. = Concentration of sample ~~(ml/l or~~ (mg/l) in BOD bottles.

2. Sample Size = ml or g of sample or diluted sample added to BOD Bottle.

Comments

Form 19758 PWO

Environmental Laboratory
BOD Work Sheet - Samples

3M

b Req. No. ▶ 53605		BOD Run No. ▶ 80-5	
Analyst	Date Started 1-30-80	20 - Day BOD Readings	
W. A. Schiel		Analyst Wade A. Schiel	Date 2-19-80

Sample Description FC-203 (F-5919, LOT-1)

Initial Dilution	0.250 g	of Sample diluted to 250 ml with DI water
Initial Dilution Factor	1000	(Dilution factor = 1 if undiluted)

Bottle No.	Conc. of Sample[1] mg/l	Sample Size[2]	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Sample	20 - Day BOD mg/kg	Average 20 - Day BOD
99	1.67	0.50	8.95	5.30	3.65	2.88	1,730,000*	* mg/kg
98	~~1633~~ 1633	1.0	8.95	4.50	4.45	3.68	1,100,000	1,100,000
16	~~3.33~~ 3.33	2.0	8.95	1.25	7.70	6.94	1,040,000	
23	13.3	4.0	8.90	—	—	—		
56	26.7	8.0	8.95	—	—	—		

Note: 1. Conc. = Concentration of sample (ml/l or mg/l) in BOD bottles.

2. Sample Size = ml or g of sample or diluted sample added to BOD Bottle.

Comments *0.50-ml dilution omitted from average BOD value. W. A. Schiel 2-26-80

Form 19756 PWO

Environmental Laboratory
BOD Work Sheet - Blanks, Controls, and Standards

file original

3M

Lab Request No. ▶ 53604/53605		BOD Run No. ▶ 80-5	
Analyst W.A. Schuil	Date Started 1-30-80	5 · Day BOD Readings	
Seed Type & Source Domestic sewage	Seed Concentration 6ml/l	Analyst W.R. Roberts	Date 2/4/80

Nonseeded Dilution - Water Blank SAVE

Bottle No.	Initial D.O. (A_1)	Present D.O. (A_2)	D.O. Depletion ($A_1 - A_2$)	Average D.O. Depletion ($\bar{A}_1 - \bar{A}_2$)
75	8.95	8.70	0.25	
16	8.90	8.70	0.20	0.2
128	8.90	8.25	0.15	

Seeded Dilution - Water Blank (optional) SAVE

Bottle No.	Initial D.O. (C_1)	Present D.O. (C_2)	D.O. Depletion ($C_1 - C_2$)	Average D.O. Depletion ($\bar{C}_1 - \bar{C}_2$)
13	8.95	8.60	0.35	
22	8.95	8.70	0.25	0.30
1	8.90	8.60	0.30	

Seed Controls SAVE

Bottle No.	Sample Size	Initial D.O. (B_1)	Present D.O. (B_2)	D.O. Depletion ($B_1 - B_2$)
118	20	8.60	6.95	1.65
55	40	8.40	5.10	3.30
68	80	7.75	0.70	7.05

Glucose - Glutamic Acid Standard SAVE (207 ± 20 mg/l)

Bottle No.	Sample Size	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Standard	5 / BOD · Day	Average 5 / BOD · Day
115	3.0	8.95	6.70	2.25	2.10	210 191	
3	5.0	8.90	5.30	3.60	3.45	207 196	210 200
90	7.0	8.95	4.00	4.95	4.80	206 198	

correction for nonseeded blanks

Potassium Hydrogen Phthalate Standard (optional)

Bottle No.	Sample Size	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Standard	____ / BOD · Day	Average ____ / BOD · Day

Environmental Laboratory
BOD Work Sheet - Blanks, Controls, and Standards

3M

Lab Request No. ▶ 53605		BOD Run No. ▶ 80-5	
Analyst: M. Roberts, W.A. Schell	Date Started: 1-30-80	12 · Day BOD Readings	
Seed Type & Source: Chocolate sewage	Seed Concentration: 6 ml/l	Analyst: Wade A. Schell	Date: 2-11-80

Nonseeded Dilution - Water Blank SAVE

Bottle No.	Initial D.O. (A_1)	Present D.O. (A_2)	D.O. Depletion ($A_1 - A_2$)	Average D.O. Depletion ($\bar{A}_1 - \bar{A}_2$)
75	8.95	8.65	0.30	
16	8.90	8.70	0.20	0.23
128	8.90	8.70	0.20	

Seeded Dilution - Water Blank (optional) SAVE

Bottle No.	Initial D.O. (C_1)	Present D.O. (C_2)	D.O. Depletion ($C_1 - C_2$)	Average D.O. Depletion ($\bar{C}_1 - \bar{C}_2$)
13	8.95	8.45	0.50	
22	8.95	8.55	0.40	0.45
1	8.90	8.45	0.45	

Seed Controls SAVE

Bottle No.	Sample Size	Initial D.O. (B_1)	Present D.O. (B_2)	D.O. Depletion ($B_1 - B_2$)
118	20	8.60	6.05	2.55
55	40	8.40	2.65	5.75
68	80	7.75	<0.05	—

Glucose - Glutamic Acid Standard SAVE

Bottle No.	Sample Size	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Standard	12 / BOD · Day (mg/l)	Average 12 / BOD · Day (mg/l)
115	3	8.95	6.50	2.45	1.97	197	
3	5	8.90	4.85	4.05	3.58	215	210
90	7	8.95	3.40	5.550	5.08	218	

Potassium Hydrogen Phthalate Standard (optional)

Bottle No.	Sample Size	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Standard	____ / BOD · Day	Average ____ / BOD · D

Form 19755 PWO

Environmental Laboratory
BOD Work Sheet - Blanks,
Controls, and Standards

3M

Lab Request No. ▶ 53605		BOD Run No. ▶ 80-5	
Analyst: M. Roberts, W.A. Schil	Date Started: 1-30-80	20 · Day BOD Readings	
Seed Type & Source: Chemolite sewage	Seed Concentration: 6 ml/l	Analyst: W.A. Schil	Date: 2-19-80

Nonseeded Dilution - Water Blank SAVE

Bottle No.	Initial D.O. (A_1)	Present D.O. (A_2)	D.O. Depletion ($A_1 - A_2$)	Average D.O. Depletion ($\bar{A}_1 - \bar{A}_2$)
75	8.95	8.60	0.35	
16	8.90	8.55	0.35	0.35
128	8.90	8.55	0.35	

Seeded Dilution - Water Blank (optional) SAVE

Bottle No.	Initial D.O. (C_1)	Present D.O. (C_2)	D.O. Depletion ($C_1 - C_2$)	Average D.O. Depletion ($\bar{C}_1 - \bar{C}_2$)
13	8.95	7.85	1.10	
22	8.95	8.05	0.90	0.983
1	8.90	7.95	0.95	

Seed Controls SAVE

Bottle No.	Sample Size	Initial D.O. (B_1)	Present D.O. (B_2)	D.O. Depletion ($B_1 - B_2$)
118	20	8.60	3.60	5.00
55	40	8.40	< 0.5	
68	80	7.75	—	

Glucose - Glutamic Acid Standard SAVE

Bottle No.	Sample Size	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Standard	$\frac{20}{BOD}$ · Day	Average $\frac{20}{BOD}$ · Day
115	3	8.95	4.55	4.40	3.64	364	
3	5	8.90	2.55	6.35	5.59	336	340
90	7	8.95	0.95	8.00	7.25	311	

Potassium Hydrogen Phthalate Standard (optional)

Bottle No.	Sample Size	Initial D.O. (D_1)	Present D.O. (D_2)	Total D.O. Depletion ($D_1 - D_2$)	Depletion Due To Standard	$\frac{\quad}{BOD}$ · Day	Average $\frac{\quad}{BOD}$ · Day

Form 19755 PWO

See Meeting

6-1-92

Description	Strong COD. ppm	BOD - ppm					Bioassay Static 96hr.
FC-200 2515	800,000	5-Days 45,000	14-Days 495,000	20-Days 540,000	24 Days 540,000		0.005
FC-200-2036, 2037, 2516	800,000	5-Days 45,000	14-Days 495,000	20-Days 540,000	24-Days 540,000		0.012
FC-200 2517	800,000	5-Days 45,000	14-Days 495,000	20-Days 540,000	24-Days 540,000		0.010
FC-200 Comp 33111:47	800,000	5-Days 45,000	14-Days 495,000	20-Days 540,000	24-Days 540,000		0.00
FC 200 Premix 6% 30849-19A	48,000	5-Days 18,000	12-Days 33,000	18-Days 33,000		Before Cure	0.06
FC-200-6% 30849-19B	60,000	5-Days 24,000	12-Days 37,500	18-Days 36,000		After Cure	0.025
FC-201 Lot1	960,000	5-Days 240,000	12-Days 600,000	18-Days 600,000			0.040
FC-203 Lot4 3%	1,000,000	5-Days 240,000	12-Days 660,000	18-Days 660,000			0.043
AF-3 Lot-11129	480,000	5-Days 180,000	12-Days 300,000	18-Days 300,000			0.028
AF-5 Lot 10663	340,000	5-Days 150,000	12-Days 225,000	18-Days 225,000			0.018
Siperols Lot A403B2	560,000	5-Days 420,000	12-Days 450,000	18-Days 450,000			0.012
FC 203 (6%)	779,000	5-Days 0	10 Days 293,000				
FC 200 (Trout)							

FORM 10620-PWO

CC FC-203
206

cc: LAB REQUEST BOOK – 42-5W

File: Compounds FC-203

Water and Wastewater

REQUEST FOR LABORATORY WORK Lab Request No. 1940

TO: ENVIRONMENTAL ENGINEERING LABORATORY – BUILDING 53-6N

Requestor	Lab Personnel
Name: BACON Request Date 12/5	Date Rec'd. Sample: 11-30-73
Project No. 7F7028 Prob. No. 07 Code # 3400	Analyst: Joe Ruiz
Description: 5 Samples	Y 73 B 14 P 166
Sample Date: _____ Date Needed: _____	Date Completed: 12/2/73
Hold Sample For _____ Days Est. Time: _____ Hrs.	Hrs. Spent: _____

Sample Description	FC 203	FC 203 6/6	Butyl Carbitol	Ethylene Glycol
Total Hardness, mg/l as $CaCO_3$		Lot 4		
Calcium Hardness, mg/l as $CaCO_3$		Chuck		
"P" Alkalinity, mg/l as $CaCO_3$		Gary		
"M" Alkalinity, mg/l as $CaCO_3$		Dale		
pH				
Sulfate, mg/l as SO_4				
Nitrate, mg/l as NO_3				
Chloride, mg/l as Cl				
Silica, mg/l as SiO_2				
Fluoride, mg/l as F				
Ortho Phosphate, mg/l as P				
Total Phosphate, mg/l as P				
Total Chromium, mg/l as Cr				
Hex. Chromium, mg/l as Cr				
Total Cyanide, mg/l as CN				
Ferrocyanide, mg/l as CN				
Iron, mg/l as Fe				
Manganese, mg/l as Mn 20-DAY	537,813	336,562	1,575,000	1,078,125
Surfactant, mg/l as LAS 15-DAY	604,687	436,312	1,417,600	1,143,750
Phenol, mg/l 10-DAY	646,875	459,000	1,453,125	1,190,625
BOD, mg/l 5-DAY	300,000	206,250	686,000	515,625
COD, mg/l (Short, Long, Dilute)	878,000	420,000	1,826,666	1,280,000
Total Suspended Solids, mg/l				
Volatile Suspended Solids, mg/l				
Turbidity, mg/l Silica				
Total Solids, mg/l				
Total Volatile Solids, mg/l				
Conductivity, mhos				
Total Bacteria, No./100 ml				
Total Coliform, No./100 ml				
Fecal Coliform, No./100 ml				
Fecal Streptococcus, No./100 ml				
Ammonia Nitrogen, mg/l as N				
Kjeldahl Nitrogen, mg/l as N				
Oil and Grease, mg/l				
TOX				

Comments: BOD_5, BOD_{10}, BOD_{ult}

000439

White – Environmental Engrg. Lab Canary – Environmental Engrg. Lab Pink – Environmental Engrg. Lab Goldenrod – Requesters Copy

FORM 10E60-2-PWO

5 DAY 12/12

ENVIRONMENTAL ENGINEERING LAB

BOD WORK SHEET

Date: 12/7/13

Dilution Water: 1

Seed: 90 ml

Blanks: 7 7.6, 8 8.4, 9 8.0, 10 8.5 Bk Ave. 8.1

Bottle No.	Sample Size	Description	D.O.	Depletion	5 Day BOD
142	.4 - 1.0013	BROWN	8.3	~~1~~	~~75,000~~
143	.8	FC 203	7.5	.9	337,500
144	1.6	872,000	6.8	1.6	~~300,000~~ 4
145	3.2	5/1000	~~7.2~~	~~7.0~~	~~675,000~~
138	.4	FC 203 6%	8.7	—	
137	.8	L-3243	8.5	—	
139	1.6	420,000	7.9	.5	93,750
140	3.2	5/1000	6.2	2.2	206,250
136	.2	Butyl Carbitol	8.7	—	
157	.4	1,826,666	7.9	.5	375,000
158	.8	5/1000	7.0	1.4	735,000
159	1.6		5.0	3.4	637,500
119	.4	Ethylene	8.0	.4	300,000
141	.8	Glycol	7.0	1.4	525,000
165	1.6	1,280,000	5.7	2.7	506,250 4
166	3.2	5/1000	3.8	4.6	431,250

FORM 10560-2-PWO

10-Day

ENVIRONMENTAL ENGINEERING LAB

BOD WORK SHEET

Date: 12/12/73

Dilution Water: 15A

Seed: 80ml

Blanks: 1 6.0, 8 7.3, 9 6.5, 10 7.2 Bk Ave. 7.2

Bottle No.	Sample Size	Description	D.O.	Depletion	5 Day BOD	Av
142	.4	BACON	5.5	1.7	1,275,000	
143	.8	FC 103	4.5	2.7	1,012,500	
144	1.6	872,000	3.8	3.4	637,500	144
145	3.2	f/1000	(.2)	7.0	656,250	
138	.4	FC 103 6%	6.3	(.9)	675,000	
137	.8	L-3243	5.2	2.0	750,000	
139	1.6	420,000	4.8	2.4	450,000	
140	3.2	f/1000	2.4	4.8	450,000	
156	.2	Butyl Carbitol	5.9	1.3	1,950,000	
157	.4	1,896,666	4.8	2.4	1,800,000	
158	.8	f/1000	3.0	4.2	1,575,000	1,7
159	1.6		(.1)	7.1	1,331,250	
119	.4	ETHYLENE GLYCOL	5.5	1.7	1,275,000	
141	.8	1,280,000	3.8	3.4	1,275,000	1,9
165	1.6	f/1000	1.3	5.9	1,106,250	1,1
166	3.2		(.1)	7.1	665,625	

FORM 10560-2-PWO

15-DAY

ENVIRONMENTAL ENGINEERING LAB

BOD WORK SHEET

Date: 12/22/7

Dilution Water: 15

Seed: 90ml

Blanks: 7 5.3, 8 6.8, 9 6.0, 10 6.7 Bk Ave. 6.7

Bottle No.	Sample Size	Description	D.O.	Depletion	5 Day BOD
142	.4	BACON	5.7	(1.5)	1125000
143	.8	FC 303	4.2	2.5	937500
144	1.6	872,000	3.5	3.2	600,000
145	3.2	£1000	(.7)	6.0	609,375
138	.4	FC 303 6%	5.9	.8	600,000
139	.8	L-3243	5.0	1.7	637,000
140	1.6	420,000	4.5	2.2	412,000
	3.2	£1000	2.0	4.7	440,625
156	.2	Butyl Carbitol	5.5	1.2	1800000
157	.4	1,826,666	4.5	2.2	1650,000
158	.8	£1000	2.5	4.2	1575000
159	1.6		(.7)	6.6	1,237,500
119	.4	ETHYLENE	5.2	1.5	1125,000
141	.8	Glycol	3.5	3.2	1,200,000
165	1.6	1,280,000	(.9)	5.8	1087,500
166	3.2	£1000	(.7)	6.6	618,750

FORM 10560-2-PWO

20-DAY

Pg. 166
Pg 14

ENVIRONMENTAL ENGINEERING LAB

Date: 12/27/73

BOD WORK SHEET

Dilution Water: 15

Seed: 90 ml

Blanks: 7 4.5, 8 6.1, 9 5.2, 10 6.2 Bk Ave. 6.1

Bottle No.	Sample Size	Description	D.O.	Depletion	5 Day BOD
142	.4	BACON	4.7	1.4	1,050,000
143	.8	FC 203	3.8	2.3	862,500
144	1.6	870,000	3.1	3.0	562,500
145	3.2	÷1000	.2	5.9	553/25
138	.4	FC 2036%	5.7	7	625,000
137	.8	2-3243	4.7	1.4	525,000
139	1.6	420,000	4.0	2.1	393,750
140	3.2	÷1000	1.2	4.9	459,375
156	.2	Butyl Carbitol	5.0	1.1	1650000
157	.4	1,856666	4.0	2.1	1575000
158	.8	÷1000	1.9	4.2	1575000
159	1.6		.2	5.9	1,106,250
119	.4	Ethylene	4.8	1.3	975000
141	.8	Glycol	3.2	2.9	1087500
165	1.6	1,280,000	.4	5.7	1068750
166	3.2	÷1000	.4	5.9	553/25