

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-206C and L-5439. (1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptafluoro-, potassium salt, CAS # 2795-39-3)

Remarks: The 3M production lot number was 501. The test sample is referred to as L-5439 and FC-206C. Current information indicates it is a mixture of 0.73% PFOS, 76.09% water, 15% diethylene glycol butyl ether, 4% urea, 1.55% sodium octyl sulfate, 1.47% hydroxy foamer, 1.05% polyoxyethylene mono-octylphenyl ether, 0.06% sodium lauryl sulfate, and 0.05% benzotriazole.

The following is an abbreviated summary of multiple biodegradation studies on FC-206C. These studies apply to the test sample as a mixture with incompletely characterized concentration of impurities. Data does not accurately reflect the biodegradation potential of the fluorochemical component of the test sample..

METHOD:

Methods: Various methods. Most not specified.

Type: BOD (Carbonaceous and Total)

GLP: No

Year completed: 1981-1982

Contact time: 20 days

Inoculum: Stale sewage from 3M's Cottage Grove facility and seed from various sources.

RESULTS

Chemical Oxygen Demand: 360,000 – 450,000 mg/kg

Total Biochemical Oxygen Demand (BOD):

5-Day:	28,000 – 279,300 mg/kg
10-Day:	180,000 – 340,700 mg/kg
12-Day:	300,000 mg/kg
20-Day:	240,000 – 416,500 mg/kg

Carbonaceous-Biochemical Oxygen Demand (C-BOD):

5-Day:	120,000 – 251,800 mg/kg
10-Day:	270,700 – 320,000 mg/kg
12-Day:	330,000 mg/kg
20-Day:	340,000 – 411,000 mg/kg

CONCLUSIONS

No reliable conclusions can be derived from this study. 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

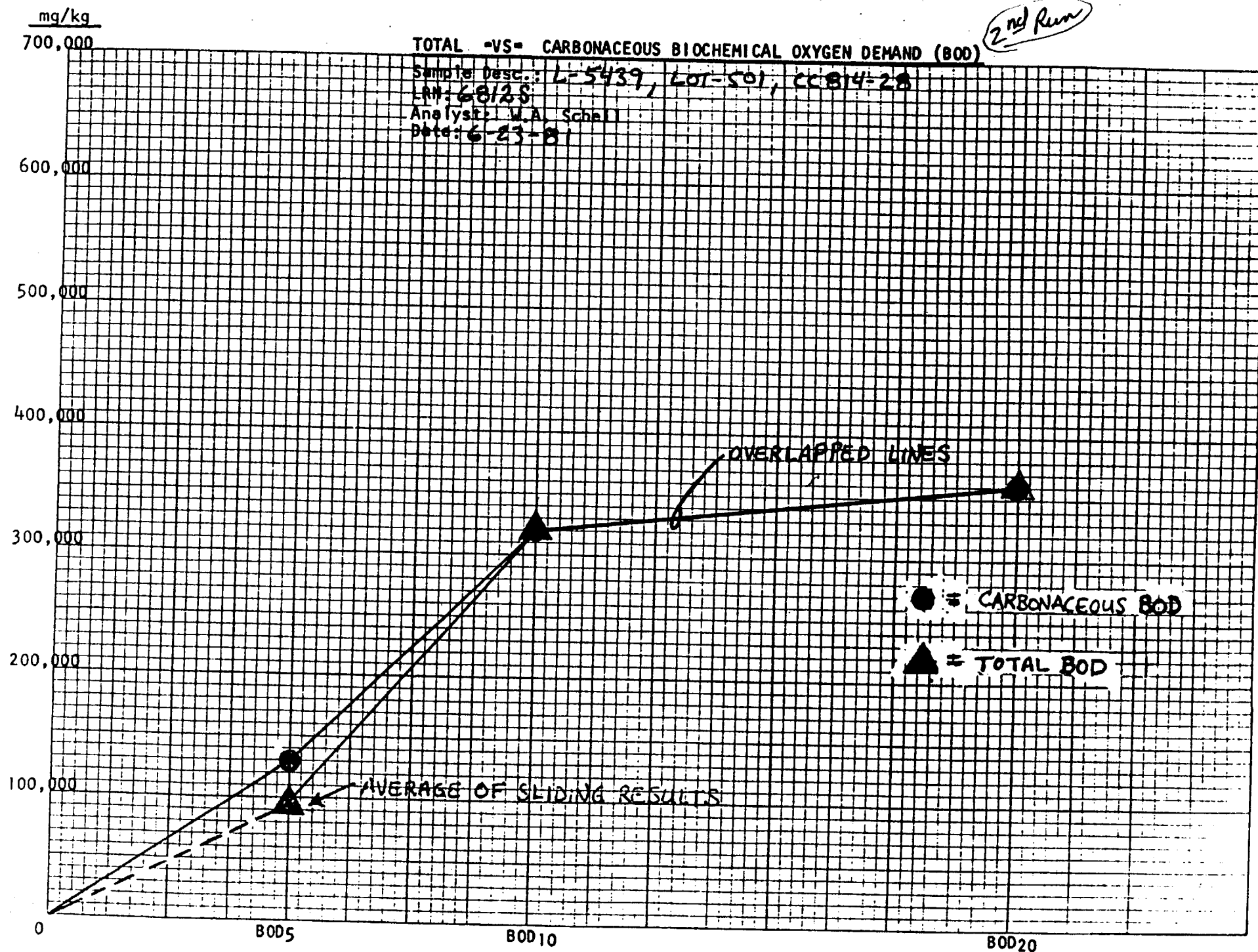
Reliability: Klimisch ranking 3. Study lacks description and records of the method followed. The inoculum is not properly characterized. The testing was conducted on a mixture with chemicals having varying degrees of biodegradability, leading to potential misinterpretation of the results. The studies lack information on the purity of the test substance and lack analytical measurements of the concentration of fluorochemical proportion.

REFERENCES

Test was conducted by multiple vendors at the request of the 3M Company, 3M Environmental Lab, St. Paul, MN, Lab Request Numbers 6812S, 7625, 7736, 7737, 7738, and 7903.

OTHER

Last changed: 6/26/00



2nd Run

Sample Description: L-5439, Lot-501, CC814-28

W.A. Scheff

DATE 6-22-81

SHEET NO.

ULTIMATE BOD RESULTS-
calculated by two methods

Protocol reference:
EAR 2/29/80

CARBONACEOUS DEMAND☆

CARBONACEOUS DEMAND ☆													
Conc. of sample in BOD Dilution bottles:													
3.4	mg/L	79,600	mg/kg	102,000	mg/kg	296,000	mg/kg	319,000	mg/kg	334,000	mg/kg	406,000	mg/kg
6.9	"	23,500	"	94,500	"	301,000	"	312,000	"	312,000	"	348,000	"
10	"	70,200	"	77,400	"	307,000	"	314,000	"	339,000	"	363,000	"
14	"	74,500	"	80,000	"	314,000	"	319,000	"	367,000	"	384,000	"
21	"	125,000	"	128,000	"	328,000	"	331,000	"	-	"	-	"
Average value - (Rounded to 2 sig. figs.)		120,000	"	130,000	"	310,000	"	320,000	"	340,000	"	360,000	"
⊕ = VALUES INCLUDED IN AVERAGE													
Conc. of glucose - glutamic acid reference solution in BOD dilution bottles:													
3.0 ml/300 ml		198	mg/L	205	mg/L	212	mg/L	220	mg/L	226	mg/L	250	mg/L
5.0	"	206	"	210	"	221	"	225	"	238	"	252	"
7.0	"	203	"	206	"	222	"	225	"	236	"	247	"
Average value - (Rounded to 2 sig. figs.)		200	"	210	"	220	"	220	"	230	"	250	"
NOTE: Formula #4 corrects for the DO depletion of the non-seeded dilution water blanks, and uses a seed control dilution to calculate the seed correction value.													
Formula #5 uses the seeded dilution water blanks to calculate the seed correction and to compensate for any DO depletion caused by the dilution water.													
☆ NITRIFICATION INHIBITOR USED													

06/19/2000

ENVIRONMENTAL LABORATORY
ARCHIVED FINAL REPORT

1

LAB REQUEST NO. 7625
REQUESTOR NAME: EAR
DEPARTMENT: 0535
PROJECT NO: 9970012600
DATE RECEIVED: 01/13/1982
DESC: FC-203C & FC-206C

CONTRACT LAB(S):
EXP COMP DATE: 03/10/1982
DATE COMPLETED: 03/16/1982
PROJECT LEAD:
PHONE NO:
3M FAX NO: 651-778-6176

THESE ARE PROPOSED MIL-SPEC AFFF MATERIALS. PLEASE LET ME REVIEW COPIES OF
WORK SHEETS

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
1		FC206C	L-6518		
	BOD-05	BOD-05		28000 MG/KG	
	BOD-10	BOD-10		180000 MG/KG	
	BOD-20	BOD-20		290000 MG/KG	
	COD-RFX	COD (DICHROMATE REFLUX)		380000 MG/KG	
	FOAM-POT	FOAMING POTENTIAL		SEE ATTACHED REPORT	
2		FC203C	L-6519		
	BOD-05	BOD-05		56000 MG/KG	
	BOD-10	BOD-10		450000 MG/KG	
	BOD-20	BOD-20		580000 MG/KG	
	COD-RFX	COD (DICHROMATE REFLUX)		730000 MG/KG	
	FOAM-POT	FOAMING POTENTIAL		SEE ATTACHED REPORT	
3			DUP 1		
	C-BOD-05	BOD-05 (CARBONACEOUS)		25000 MG/KG	
	C-BOD-10	BOD-10 (CARBONACEOUS)		120000 MG/KG	
	C-BOD-20	BOD-20 (CARBONACEOUS)		290000 MG/KG	
	COD-RFX	COD (DICHROMATE REFLUX)		360000 MG/KG	
4			DUP 2		
	C-BOD-05	BOD-05 (CARBONACEOUS)		49000 MG/KG	
	C-BOD-10	BOD-10 (CARBONACEOUS)		300000 MG/KG	
	C-BOD-20	BOD-20 (CARBONACEOUS)		600000 MG/KG	
	COD-RFX	COD (DICHROMATE REFLUX)		740000 MG/KG	

5-04-82

ENVIRONMENTAL LABORATORY FINAL REPORT

LAB REQUEST NO. 7903

EQUESTER NAME: EAR

EPT: 0535

PROJECT NO: 9970012600

DATE RECEIVED: 3-31-82

ESC: FC 206C FC-203C MIL SPEC TESTING

CONTRACT LAB: GAL

CONTRACT LAB COST: 368

3M E-L HOURS: 0

EST CMPLT DATE: 4-26-82

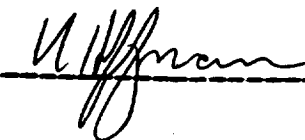
DATE COMPLETED: 5-03-82

THE PURPOSE OF THIS REQUEST IS TO TEST OUR EXPECTATION THAT THE CAUSE OF
ALBRAITH LAB'S HIGH BOD 20/COD RESULTS IS NITRIFICATION CAUSED BY THEIR BOD
SEED

SAMPLE	DATE	CODE	DESCRIPTION	TEST	RESULT
1	1-08-82	LT 501	FC-203C	*BOD 05	519000MG/KG
				*BOD 10	520700MG/KG
				*BOD 20	615750MG/KG
				*C-BOD 05	253700MG/KG
				*C-BOD 10	557300MG/KG
				*C-BOD 20	671000MG/KG
				*COD-RFX	776450MG/KG
2	1-08-82	LT 502	FC-206C	*BOD 05	279300MG/KG
				*BOD 10	340700MG/KG
				*BOD 20	416500MG/KG
				*C-BOD 05	123700MG/KG
				*C-BOD 10	270700MG/KG
				*C-BOD 20	411000MG/KG
				*COD-RFX	407250MG/KG
3		#1	FC-203C KNOX SEED	*BOD 05	512800MG/KG
				*BOD 10	578300MG/KG
				*BOD 20	670000MG/KG
				*C-BOD 05	357600MG/KG
				*C-BOD 10	523700MG/KG
				*C-BOD 20	641000MG/KG
4		#2	FC-206C KNOX SEED	*BOD 05	247700MG/KG
				*BOD 20	395500MG/KG
				*C-BOD 05	251800MG/KG
				*C-BOD 10	310500MG/KG
				*C-BOD 20	374000MG/KG
				*BOD 10	322500MG/KG

* = CONTRACT LAB

APPROVED AND SUBMITTED BY



DATED

5-5-82



P. O. BOX 4187, 2323 SYCAMORE DR., KNOXVILLE, TENNESSEE 37921 / 615 546-1335

CERTIFICATE OF ANALYSIS

Mr. David Seely
3M Environmental Eng. & Pollution Control
Post Office Box 33331
St. Paul, Minnesota 55101

April 26, 1982

Received: April 1st

Dear Mr. Seely:

Analysis of your compounds gave the following results:

Your# ,

Our# ,

Analysis,

WC-5045

COD

776,450 mg/kg

Seed A (derived from S & W Laboratories)

5 Day BOD		519,000 mg/kg
10 Day BOD		520,700 mg/kg
20 Day BOD	$BOD_5/COD = .79$	615,750 mg/kg
Carbonaceous BOD 5		253,700 mg/kg
Carbonaceous BOD 10		557,300 mg/kg
Carbonaceous BOD 20	$BOD_20/COD = .86$	671,000 mg/kg

Seed B (from Knoxville Treatment Plant)

5 Day BOD		512,800 mg/kg
10 Day BOD		578,300 mg/kg
20 Day BOD	$BOD_5/COD = .86$	670,000 mg/kg
Carbonaceous BOD 5		357,600 mg/kg
Carbonaceous BOD 10		523,700 mg/kg
Carbonaceous BOD 20	$BOD_20/COD = .82$	641,000 mg/kg
		407,250 mg/kg

Seed A (derived from S & W Laboratories)

5 Day BOD		279,300 mg/kg
10 Day BOD		340,700 mg/kg
20 Day BOD	$BOD_5/COD = 1.02$	416,500 mg/kg
Carbonaceous BOD 5		123,700 mg/kg
Carbonaceous BOD 10		270,700 mg/kg
Carbonaceous BOD 20	$BOD_20/COD = 1.01$	411,000 mg/kg

LR
7903-1

Copies of raw data
shub sent to GAR
4-30-82
JES

2

WC-5046

COD



P. O. BOX 4187, 2323 SYCAMORE DR., KNOXVILLE, TENNESSEE 37901 / 615 548-1884

CERTIFICATE OF ANALYSIS

Mr. David Seely
Page 2
April 26, 1982

Your# ,

2

Our# ,

WC-5046

Analysis,

Seed B (from Knoxville Treatment Plant)

5 Day BOD		247,700 mg/kg
10 Day BOD		322,500 mg/kg
20 Day BOD	BOD/COD .97	395,500 mg/kg
Carbonaceous BOD 5		251,800 mg/kg
Carbonaceous BOD 10		310,500 mg/kg
Carbonaceous BOD 20		374,000 mg/kg

$BOD_{20}/COD = .92$

Sincerely yours,

GALBRAITH LABORATORIES, INC.

Gail R. Hutchens

Gail R. Hutchens
Exec. Vice President

GRH:yd

4-05-82

ENVIRONMENTAL LABORATORY FINAL REPORT

LAB REQUEST NO. 7737

EQUESTER NAME: EAR

EPT: 0535

PROJECT NO: 9960012600

ATE RECEIVED: 2-16-82

ESC: FC-206-C AND FC-203C MIL SPEC TESTING

EE ALSO LRS 7625 7736 7738

CONTRACT LAB: SERCO

CONTRACT LAB COST: 860

3M E-L HOURS: 0

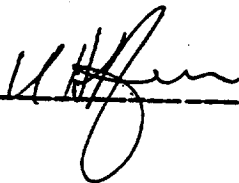
EST CMPLT DATE: 4-06-82

DATE COMPLETED: 4-01-82

SAMPLE	DATE	CODE	DESCRIPTION	TEST	RESULT
1		FC203C	LOT501 L6519	*BOD 05 *BOD 10 *BOD 20 *COD-RFX	130000MG/L 370000MG/L 440000MG/L 737000MG/L
2		FC206C	LOT502 L6518	*BOD 05 *BOD 10 *BOD 20 *COD-RFX	71000MG/L 190000MG/L 240000MG/L 370000MG/L
3		FC-780	LOT 501	*BOD 05 *BOD 10 *BOD 20 *COD-RFX	48000MG/L 160000 MG/L 210000MG/L 287000MG/L
4		FC203C	#1 INHIBITED	*BOD 05 *BOD 10 *BOD 20	58000MG/L 140000MG/L 440000MG/L
5		FC206C	#2 INHIBITED	*BOD 05 *BOD 10 *BOD 20	28000MG/L 65000MG/L 260000MG/L
6		FC-780	#3 INHIBITED	*BOD 05 *BOD 10 *BOD 20	21000MG/L 51000MG/L 220000 MG/L

* = CONTRACT LAB

APPROVED AND SUBMITTED BY



DATED

4-6-82



1931 West County Road C2
Roseville, Minnesota 55113 (612) 636-7173

LABORATORY ANALYSIS REPORT NO: 263
03/18/82

PAGE 1

JM Company
Bldg. 2-3E-09 P.O. Box 33331
St. Paul MN 55133
Mr. Keith Hoffmann
Lab Coordinator

DATE COLLECTED:
DATE RECEIVED: 02/16/82
COLLECTED BY: CLIENT
PICKED UP BY: CLIENT
SAMPLE TYPE: PRODUCT SAMPLE

SERCO SAMPLE NO: 749 750 751
SAMPLE DESCRIPTION:

ANALYSIS:	FL 203C 7737-1	200C 7737-2	780B 7737-3
BOD, 5-day, mg/L	130000	71000	48000
BOD, 10-day, mg/L	370000	190000	160000
BOD, 20-day, mg/L	440000	240000	210000
BOD, carbonaceous, mg/L	58000	28000	21000
BOD, 10-day carbonaceous, mg/L	140000	65000	51000
BOD, 20-day carbonaceous, mg/L	440000	260000	220000
COD, Chemical Oxygen Demand, mg/L	737000	370000	287000

All analyses were performed using EPA or other recognized methodologies.

Report submitted by

Richard R. Dahl
Project Manager

< means "not detected at this level"

SANITARY ENGINEERING LABORATORIES, INC.



4-26-82

ENVIRONMENTAL LABORATORY FINAL REPORT

LAB REQUEST NO. 7738

QUESTER NAME: EAR

PT: 0535

OBJECT NO: 9960012600

TE RECEIVED: 2-23-82

SC: FC-206C AND FC 203C MIL SPEC TESTING

CONTRACT LAB: CAPS

CONTRACT LAB COST: 450

3M E-L HOURS: 0

EST CMPLT DATE: 4-16-82

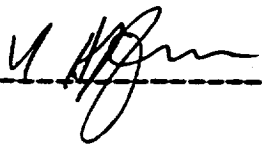
DATE COMPLETED: 4-23-82

E ALSO LRS 7625 7736 7737

SAMPLE	DATE	CODE	DESCRIPTION	TEST	RESULT
1		FC203C	LOT501 L6519	*BOD 05 *BOD 10 *BOD 20 *COD-RFX	140000MG/KG 540000MG/KG 570000MG/KG 950000MG/KG
2		FC206C	LOT502 L6518	*BOD 05 *BOD 10 *BOD 20 *COD-RFX	36000MG/KG 260000MG/KG 260000MG/KG 410000MG/KG
3		FC-780	LOT501	*BOD 05 *BOD 10 *BOD 20 *COD-RFX	24000MG/KG 220000MG/KG 240000MG/KG 360000MG/KG
4		FC203C	#1 INHIBITED	*BOD 05 *BOD 10 *BOD 20	63000MG/KG 480000MG/KG 620000MG/KG
5		FC206C	#2 INHIBITED	*BOD 05 *BOD 10 *BOD 20	32000MG/KG 260000MG/KG 320000MG/KG
6		FC-780	#3 INHIBITED	*BOD 05 *BOD 10 *BOD 20	20000MG/KG 210000MG/KG 230000MG/KG

* = CONTRACT LAB

APPROVED AND SUBMITTED BY



DATED

4-26-82



CAPSULE LABORATORIES

ADVANCED TECHNOLOGY DIVISION

A Division of Economics Laboratory, Inc.
605 West County Road E, St. Paul, MN 55112, (612) 482-8855

FILE WITH LR 773

April 29, 1982

Mr. Dave Seely
3M Environmental Lab
935 Bush Ave.
Bldg. 2-3E
St. Paul, MN 55144

Dear Dave,

Enclosed please find the results for COD on your sample # 7738-1. The test was rerun per your request. This time the test was performed using a larger amount of sample. The previous test may have been biased due to the large dilution factor.

If you have any other questions or problems, please call.

Sincerely,

CAPSULE LABORATORIES

Betsy A. Hannum

Betsy A. Hannum
Senior Chemist *PaL*

BAH:jjd



TECHNICAL DATA

April 29, 1982

Samples submitted for testing by SM Environmental Lab on April 26, 1982

<u>Sample Description</u>	<u>Capsule Log #</u>	<u>COD</u>
7738-1 (Old Capsule Log # 12193)	13322	720,000 mg/kg



TECHNICAL DATA

April 16, 1982

Samples Submitted by: Minnesota Mining & Manufacturing Company

Samples Received on: February 24, 1982

	Capsule Log #	12193	12194	12195
		203C	206C	780B
	Sample Description:	7738-1	7738-2	7738-3
		luc set 740,000 + 730,000 Series set 737,000 us Navy set 714,000	3m set 260,000 Pace set 450,000 Series set 370,000 Navy set 347,000	ck
COD		950,000 mg/kg	410,000 mg/kg	360,000 mg/kg
5 Day BOD Uninhibited		140,000 mg/kg	36,000 mg/kg	24,000 mg/kg
5 Day BOD Inhibited		63,000 mg/kg	32,000 mg/kg	20,000 mg/kg
10 Day BOD Uninhibited		540,000 mg/kg	260,000 mg/kg	220,000 mg/kg
10 Day BOD Inhibited		480,000 mg/kg	260,000 mg/kg	210,000 mg/kg
	Navy 517,000 Series 440,000 3m 580,000	570,000 mg/kg	260,000 mg/kg	240,000 mg/kg
20 Day BOD Uninhibited		620,000 mg/kg	320,000 mg/kg	230,000 mg/kg
20 Day BOD Inhibited		290,000	260,000	220,000
	Pace 440,000 Series 440,000 Pace 440,000	290,000	260,000	220,000
		370,000	250,000	

06/19/2000

ENVIRONMENTAL LABORATORY
ARCHIVED FINAL REPORT

1

LAB REQUEST NO. 7736
REQUESTOR NAME: EAR
DEPARTMENT: 0535
PROJECT NO: 9960012600
DATE RECEIVED: 02/16/1982
DESC: FC-206 CCONTRACT LAB(S): PACE
EXP COMP DATE: 03/16/1982
DATE COMPLETED: 03/12/1982
PROJECT LEAD:
PHONE NO:
3M FAX NO: 651-778-6176

SEE ALSO LRS 7625 7737 7738

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
1		FC203C	LOT501 L6519		
PACE	BOD-05	*BOD-05		500000	MG/KG WET
PACE	BOD-10	*BOD-10		620000	MG/KG WET
PACE	BOD-20	*BOD-20		800000	MG/KG WET
PACE	COD-RFX	*COD (DICHROMATE REFLUX)		810000	MG/KG WET
2		FC206C	LOT502 L6518		
PACE	BOD-05	*BOD-05		250000	MG/KG WET
PACE	BOD-10	*BOD-10		300000	MG/KG WET
PACE	BOD-20	*BOD-20		350000	MG/KG WET
PACE	COD-RFX	*COD (DICHROMATE REFLUX)		450000	MG/KG WET
3		FC-780	LOT 501		
PACE	BOD-05	*BOD-05		190000	MG/KG WET
PACE	BOD-10	*BOD-10		210000	MG/KG WET
PACE	BOD-20	*BOD-20		250000	MG/KG WET
PACE	COD-RFX	*COD (DICHROMATE REFLUX)		350000	MG/KG WET
4		FC203C	#1 INHIBITED		
PACE	BOD-05	*BOD-05		470000	MG/KG WET
PACE	BOD-10	*BOD-10		580000	MG/KG WET
PACE	BOD-20	*BOD-20		730000	MG/KG WET
5		FC206C	#2 INHIBITED		
PACE	BOD-05	*BOD-05		240000	MG/KG WET
PACE	BOD-10	*BOD-10		300000	MG/KG WET
PACE	BOD-20	*BOD-20		370000	MG/KG WET
6		FC-780	#3 INHIBITED		
PACE	BOD-05	*BOD-05		170000	MG/KG WET
PACE	BOD-10	*BOD-10		210000	MG/KG WET
PACE	BOD-20	*BOD-20		250000	MG/KG WET

* = CONTRACT LAB DATA

Internal Correspondence

cc: D. R. Ricker - 53-4N
D. L. Bacon/R. L. Bohon - 21-2W-05

To: J. A. PIGNATO - COMMERCIAL CHEMICALS LAB - 236-2A-01
From: E. A. REINER - ENVIRONMENTAL LABORATORY/EE & PC - 21-2W-5
Subject: MIL-SPEC AFFF BOD AND COD TESTING
Date: MAY 25, 1982

3M

Attached is a summary of the BOD, carbonaceous BOD, and COD test results on FC-203C, FC-206C, and FC-780B. This testing was conducted at the 3M Environmental Laboratory and four outside laboratories. The results were more variable than I had anticipated.

The Galbraith results on FC-206C were typical of their result from past testing, i.e., they had a very high BOD₂₀/COD ratio. This occurred despite the fact that some of this testing was done with a nitrification inhibitor (the C-BOD results) and some of the tests were done using a seed unlikely to contain a large population of nitrifying organisms (seed from the Knoxville waste treatment system). While I had previously thought that their results were due to nitrification, I must now say that I do not know why Galbraith gets such atypically high BOD results.

I plan to use the average data from all of these tests in preparing our Product Environmental Data Sheets and input for our Material Safety Data Sheets. If you have any questions concerning these data, please feel free to contact me on 778-5079.



EAR/mk

Attachment

BOD, CARBONACEOUS BOD, AND COD DATA ON MIL-SPEC AFFF PRODUCT

<u>Lab</u>	<u>BOD₂₀</u> <u>(mg/kg)</u>	<u>C-BOD</u> <u>(mg/kg)</u>	<u>COD</u> <u>(mg/kg)</u>	<u>BOD₂₀</u> <u>COD</u>	<u>C-BOD₂₀</u> <u>COD</u>
<u>FC-203C Lot 501</u>					
3M	580,000	600,000	730,000 740,000	.79	.81
Pace	800,000*	730,000*	810,000 730,000		
Serco	440,000	440,000	737,000	.60	.60
Capsule	570,000	620,000	950,000	.6	.65
Galbraith	616,000	671,000	776,450	.79	.86
S & W Seed					
Galbraith	670,000	641,000	776,450	.86	.82
Knoxville					
Average	575,000	594,000	782,000	.73	.75
S. D.	85,000	90,000	80,000	.12	.12

* Calculated BOD's from different dilutions were very inconsistent. Pace agreed to repeat this work but inadvertently lost their repeated test results as well. We did not request a third testing nor did we include these values in the averages.

<u>FC-206C Lot 502</u>					
3M	290,000	290,000	380,000 360,000	0.78	0.78
Pace	350,000	370,000	450,000	0.78	0.82
Serco	240,000	260,000	370,000	0.65	0.70
Capsule	260,000	320,000	410,000	0.63	0.78
Galbraith	416,500	411,000	407,250	1.02	1.01
S & W Seed					
Galbraith	395,500	374,000	407,250	.97	.92
Knoxville					
Average	325,000	338,000	396,000	.81	.83
S. D.	73,000	57,000	33,000	.16	.11

<u>FC-780B Lot 501</u>					
3M	240,000	230,000	320,000 330,000	.74	.71
Pace	250,000	250,000	350,000	.71	.71
Serco	210,000	220,000	287,000	.73	.77
Capsule	240,000	230,000	360,000	.67	.64
Average	235,000	232,000	329,000	.71	.71
S. D.	17,000	13,000	28,000	.03	.05