

BEFORE THE
STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

IN RE: INTERNATIONAL PETROLEUM CORPORATION
105 South Alexander Street
Plant City, Florida 33599

RESPONSE TO FDEP
WARNING LETTER #187521
DATED DECEMBER 1, 1997

VOLUME II OF II

Respectfully submitted,

R. L. CALEEN, JR.,
Florida Bar No. 107367

WATKINS, TOMASELLO & CALEEN, P.A.
1725 Mahan Drive, Suite 201
P. O. Box 15828
Tallahassee, Florida 32317-5828
(850) 671-2644

ATTORNEYS FOR INTERNATIONAL
PETROLEUM CORPORATION

RECEIVED
AUG 12 1998
ID E R

Environmental Conservation Laboratories
10207 General Drive
Orlando, Florida 32824
~~407-7828-3318~~
~~Fax 407-7850-0245~~



Laboratories

DHRS Certification No. E83182

CLIENT : Malatino & Associates
ADDRESS: P.O. Box 6630
Lakeland, FL 33807

REPORT # : OR6025
DATE SUBMITTED: December 14, 1996
DATE REPORTED : December 20, 1996

PAGE 1 OF 3

ATTENTION: Tony Malatino

SAMPLE IDENTIFICATION

Sample submitted and
identified by client as:

21154 US19N Mazda Village

12/12/96

#1 - WASTE ANTI-FREEZE 4:00



MALATINO & ASSOCIATES, INC.

"Specialists in Environmental Testing and Services"

TONY MALATINO, C.H.M.S., C.E.I.

President

4415 Florida National Drive, Suites 101 & 102
Mailing Address: P.O. Box 6630 (941) 646-2828
Lakeland, Florida 33807-6630 Tel. & Fax (941) 648-4285

*NON Hazardous
Per A. M. Malatino*



LABORATORY MANAGER

David J. Vesey
David J. Vesey

ENCO LABORATORIES

REPORT # : OR6025

DATE REPORTED: December 20, 1996

PROJECT NAME : 21154 US19N

Mazda Village

PAGE 2 OF 3

RESULTS OF ANALYSIS

EPA METHOD 8010 -

TCLP VOLATILE HALOCARBONS

WASTE ANTI-FREEZE

LAB BLANK

Units

Trichloroethene
Tetrachloroethene

200 U D1
400 U D1

1 U
2 U

µg/L
µg/L

Surrogate:

% RECOV

% RECOV

LIMITS

Bromofluorobenzene
Date Analyzed

82
12/17/96

89
12/17/96

45-141

EPA METHOD 8020 -

TCLP VOLATILE AROMATICS

WASTE ANTI-FREEZE

LAB BLANK

Units

Benzene

200 U D1

1 U

µg/L

Surrogate:

% RECOV

% RECOV

LIMITS

Bromofluorobenzene
Date Analyzed

92
12/17/96

85
12/17/96

67-222

TCLP METALS

METHOD

WASTE ANTI-FREEZE

LAB BLANK

Units

TCLP Lead
Date Analyzed

7420

2.28
12/18/96

0.10 U
12/18/96

mg/L

= Analyte value determined from a 1:200 dilution.

= Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES

REPORT # : OR6025

DATE REPORTED: December 20, 1996

PROJECT NAME : 21154 US19N
Mazda Village

PAGE 3 OF 3

QUALITY CONTROL DATA

<u>Parameter</u>	<u>% RECOVERY</u> <u>MS/MSD/LCS</u>	<u>ACCEPT</u> <u>LIMITS</u>	<u>% RPD</u> <u>MS/MSD</u>	<u>ACCEPT</u> <u>LIMITS</u>
<u>EPA Method 8010</u>				
Methylene chloride	98/ 99/ 84	43-148	1	29
Chloroform	104/102/ 94	61-118	2	15
Carbon Tetrachloride	111/105/ 88	51-126	6	14
Trichloroethene	101/105/ 92	61-121	4	22
Tetrachloroethene	118/106/ 92	69-117	11	18
Chlorobenzene	108/111/ 95	67-119	3	10
<u>EPA Method 8020</u>				
benzene	114/117/102	72-134	2	20
toluene	103/107/100	72-124	4	19
Ethylbenzene	103/107/ 95	67-129	4	21
O-Xylene	105/118/ 93	66-131	12	21
<u>TCLP Metals</u>				
TCLP Lead, 7420	91/ 97/ 99	75-115	6	10

Environmental Conservation Laboratories Comprehensive QA Plan #960038

< = Less Than

MS = Matrix Spike

MSD = Matrix Spike Duplicate

LCS = Laboratory Control Standard

RPD = Relative Percent Difference

(This report shall not be reproduced except in full, without the written approval of the laboratory.

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Progress Environmental Laboratories

4420 Pandora Point Road
Tampa, Florida 33619
(813) 247-2805
FAX: (813) 248-1537

- CERTIFICATE OF ANALYSIS - (HRS #E84207 and FDER CompQap #900306G)

To: International Oil Service
105 South Alexander Street
Plant City, FL 33566

Report Date: 3/05/97
Page: 1 of 4

Attn: Michael S. Anderson

PEL Lab # : 9702-00242-1
Client ID : Used Antifreeze
Project ID :
Location : McNamara Pontiac
Matrix : Liquid

Collection Information:
Sample Date: 2/26/97
Sample Time: 0:00
Sampled By : Client
Sample Quality:

Parameter	Method	Results	ND = Less than MDL Units	MDL
GC Volatiles	EPA 8010			
Dichlorodifluoromethane	EPA 8010	ND	ug/l	48
cis-1,2-Dichloroethene	EPA 8010	ND	ug/l	20
Chloromethane	EPA 8010	ND	ug/l	74
Vinyl Chloride	EPA 8010	ND	ug/l	25
Bromomethane	EPA 8010	ND	ug/l	51
Chloroethane	EPA 8010	ND	ug/l	29
Trichlorofluoromethane	EPA 8010	ND	ug/l	36
1,1-Dichloroethene	EPA 8010	ND	ug/l	35
Methylene Chloride	EPA 8010	ND	ug/l	100
Trans-1,2-dichloroethene	EPA 8010	ND	ug/l	42
1,1-Dichloroethane	EPA 8010	ND	ug/l	28
Chloroform	EPA 8010	ND	ug/l	100
1,1,1-Trichloroethane	EPA 8010	ND	ug/l	30
Carbontetrachloride	EPA 8010	ND	ug/l	34
1,2-Dichloroethane	EPA 8010	ND	ug/l	42
Trichloroethene	EPA 8010	ND	ug/l	36
1,2-Dichloropropane	EPA 8010	ND	ug/l	38
Bromodichloromethane	EPA 8010	ND	ug/l	41
2-Chloroethylvinyl ether	EPA 8010	ND	ug/l	130
Cis-1,3-Dichloropropene	EPA 8010	ND	ug/l	38
Trans-1,3-Dichloropropene	EPA 8010	ND	ug/l	42
1,1,2-Trichloroethane	EPA 8010	ND	ug/l	51
Tetrachloroethene	EPA 8010	1410	ug/l	36
Dibromochloromethane	EPA 8010	ND	ug/l	48
Bromoform	EPA 8010	ND	ug/l	80
1,1,2,2-Tetrachloroethane	EPA 8010	ND	ug/l	82
Analysis date	EPA 8010	3-1-97		

- CONTINUED ON NEXT PAGE -

A Florida Progress Company

Progress Environmental Laboratories

- CERTIFICATE OF ANALYSIS -
(HRS #E84207 and FDER CompQap #900306G)

To: International Oil Service
105 South Alexander Street
Plant City, FL 33566

Report Date: 3/05/97
Page: 2 of 4

Attn: Michael S. Anderson

PEL Lab # : 9702-00242-1 (Continued ...)
Client ID : Used Antifreeze

Parameter	Method	Results	ND = Less than MDL Units	MDL
*1,4-Dichlorobutane (10-150%)	EPA 8010	104	%R	
*4-BPB (10-150%)	EPA 8010	91	%R	
GC Volatiles	EPA 8020			
MTBE	EPA 8020	ND	ug/l	63
Benzene	EPA 8020	ND	ug/l	25
Toluene	EPA 8020	180	ug/l	31
Chlorobenzene	EPA 8020	ND	ug/l	43
Ethylbenzene	EPA 8020	65	ug/l	43
m,p-Xylene	EPA 8020	290	ug/l	47
o-Xylene	EPA 8020	170	ug/l	53
1,3-Dichlorobenzene	EPA 8020	ND	ug/l	57
1,4-Dichlorobenzene	EPA 8020	ND	ug/l	41
1,2-Dichlorobenzene	EPA 8020	ND	ug/l	47
Analysis date	EPA 8020	3-1-97		
*Fluorobenzene (81-124%)	EPA 8020	97	%R	
Lead	EPA 6010	2750	ug/l	29.2

- CONTINUED ON NEXT PAGE -

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ENVASIE DOG

INTERNATIONAL OIL SER.

TRANSPORTATION AND RECEIVING MANIFEST

DIV. OF INTERNATIONAL PETROLEUM CORP.

STATE CERTIFIED RECYCLER, TRANSPORTER AND COLLECTION FACILITY

EPA I.D. No. FLD 065680613
SO 29-181143

LAD 092096106

MOD 981114051
LA I.D. No. GT-186

☒ PLANT CITY, FL 33566
105 S. ALEXANDER ST.
(813) 754-1504
TAMPA, FL
(813) 229-1739
(800) 282-9585
FAX 1 (813) 754-3789

RECYCLING

- USED OIL
- USED OIL FILTERS
- USED ANTIFREEZE
- PETROLEUM CONTACT WATER

☐ NEW ORLEANS, LA 70129
14890 INTRACOASTAL DR.
(504) 254-9021
(800) 523-9071

☐ WILMINGTON, DE. 19801
505 S. MARKET ST.
(302) 421-9307

Recycling today
for a better tomorrow.

☐ BALTIMORE, MD 21224
6305 E. LOMBARD ST.
(800) 222-2511

IDENTIFICATION

P0384 McNamee Petroleum
1010 N. Central
Orlando, FL 32804
CITY STATE ZIP
Date Shipped 4/28/97
Time
Phone 849-0610

INFORMATION

PROPER SHIPPING NAME	HAZARD CLASS	IDENTIFICATION NUMBER	PACKING GROUP	N.A.E.R.G.
COMBUSTIBLE LIQUID, N.O.S. (CONTAINS PETROLEUM OIL)	COMBUSTIBLE LIQUID	NA 1993	III	128
SOURCE TYPE (USED OIL) CO/A				
4 Used Coolant P.O.# 79663				
SPECIAL HANDLING INSTRUCTIONS END USE CODE MINI/SR		EMERGENCY RESPONSE NUMBER CHEMTREC 1-800-424-9300		

CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

This is to further certify under penalty of law that the above-named materials have not been mixed with hazardous waste according to the rules of the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection.

X [Signature] 4/28/97
GENERATOR'S SIGNATURE DATE

[Signature] 4/28/97
TRANSPORTER No. 2 SIGNATURE & DATE

SIGNATURE DATE

97-PC 6450

MANIFEST DOCUMENT NO.

White - Original

Yellow - Receiving Facility

Pink - Transporter

Green - Generator

prestige printing pp-2004R 7/96

CONTAINERS		QUANTITY	UNIT
1	TT	675	GAL.
No.	TYPE		
DEDUCTIONS		425	
NET GALLONS		250	
PRICE PER GALLON		25	
FREIGHT			
TOTAL		62.50	

☐ CASH
☒ CHARGE (INVOICE TO FOLLOW)

INTERNATIONAL OIL SERVICE

TRANSPORTATION AND RECEIVING MANIFEST

DIV. OF INTERNATIONAL PETROLEUM CORP.
STATE CERTIFIED RECYCLER, TRANSPORTER AND COLLECTION FACILITY

EPA I.D. No. FLD 065680613
SO 29-181143

LAD 092096106

MOD 981114051
LA I.D. No. GT-186

☒ PLANT CITY, FL 33566
105 S. ALEXANDER ST.
(813) 754-1504
TAMPA, FL
(813) 229-1739
(800) 282-9585
FAX 1 (813) 754-3789

RECYCLING

- USED OIL
- USED OIL FILTERS
- USED ANTIFREEZE
- PETROLEUM CONTACT WATER

☐ NEW ORLEANS, LA 70129
14890 INTRACOASTAL DR.
(504) 254-9021
(800) 523-9071

☐ WILMINGTON, DE 19801
505 S. MARKET ST.
(302) 421-9307

Recycling today
for a better tomorrow.

☐ BALTIMORE, MD 21224
6305 E. LOMBARD ST.
(800) 222-2511

IDENTIFICATION	
PO384 MC Namarc Pontre	Date Shipped 7/13/97
1010 W. 6th St	Time
Orlando, FL	Phone 849-0610
CITY	STATE
ZIP	

INFORMATION

PROPER SHIPPING NAME	HAZARD CLASS	IDENTIFICATION NUMBER	PACKING GROUP	N.A.E.R.G.
COMBUSTIBLE LIQUID, N.O.S. (CONTAINS PETROLEUM OIL)	COMBUSTIBLE LIQUID	NA 1993	III	128
SOURCE TYPE (USED OIL) CO/A				
* Used Coolant P.O.# 81736				
SPECIAL HANDLING INSTRUCTIONS END USE CODE MINI/SR		EMERGENCY RESPONSE NUMBER CHEMTREC 1-800-424-9300		

CERTIFICATION	
This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.	
This is to further certify under penalty of law that the above-named materials have not been mixed with hazardous waste according to the rules of the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection.	
GENERATOR'S SIGNATURE	DATE
7/13/97	
TRANSPORTER No. 2 SIGNATURE & DATE	
SIGNATURE	DATE

CONTAINERS		QUANTITY	UNIT
1	TT	500	GAL.
No.	TYPE		

DEDUCTIONS	250
NET GALLONS	250
PRICE PER GALLON	25
FREIGHT	
TOTAL	6250

97-PC 10393
MANIFEST DOCUMENT NO.

White - Original
Yellow - Receiving Facility
Pink - Transporter
Green - Generator

☐ CASH
☒ CHARGE (INVOICE TO FOLLOW)

INTERNATIONAL OIL SERV.

TRANSPORTATION AND RECEIVING MANIFEST

DIV. OF INTERNATIONAL PETROLEUM CORP.
STATE CERTIFIED RECYCLER, TRANSPORTER AND COLLECTION FACILITY

EPA I.D. No. FLD 065680613
SO 29-181143

LAD 092096106

MOD 981114051
LA I.D. No. GT-186

☒ PLANT CITY, FL 33566
105 S. ALEXANDER ST.
(813) 754-1504
TAMPA, FL
(813) 229-1739
(800) 282-9585
FAX 1 (813) 754-3789

RECYCLING

- USED OIL
- USED OIL FILTERS
- USED ANTIFREEZE
- PETROLEUM CONTACT WATER

☐ NEW ORLEANS, LA 70129
14890 INTRACOASTAL DR.
(504) 254-9021
(800) 523-9071

☐ WILMINGTON, DE 19801
505 S. MARKET ST.
(302) 421-9307

Recycling today
for a better tomorrow.

☐ BALTIMORE, MD 21224
6305 E. LOMBARD ST.
(800) 222-2511

IDENTIFICATION

P0384 MS Newbern Pontiac 10/1/97
1010 W. Colonial
Orlando, FL 32804
CITY STATE ZIP
Time
Phone 849-0610

INFORMATION

PROPER SHIPPING NAME	HAZARD CLASS	IDENTIFICATION NUMBER	PACKING GROUP	N.A.E.R.G.
COMBUSTIBLE LIQUID, N.O.S. (CONTAINS PETROLEUM OIL)	COMBUSTIBLE LIQUID	NA 1993	III	128
SOURCE TYPE (USED OIL) 4 Used Coolant P.O.# 84537				
EPA # FLD032617920 Sniffed: OK				
SPECIAL HANDLING INSTRUCTIONS END USE CODE MIN/SR		EMERGENCY RESPONSE NUMBER CHEMTREC 1-800-424-9300		

CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

This is to further certify under penalty of law that the above-named materials have not been mixed with hazardous waste according to the rules of the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection.

XY
GENERATOR'S SIGNATURE DATE 10/1/97

TRANSPORTER No. 2 SIGNATURE & DATE

SIGNATURE DATE

97-PC 15510

MANIFEST DOCUMENT NO.

White - Original

Yellow - Receiving Facility

prestige printing pp-2004R 7/96

CONTAINERS		QUANTITY	UNIT
1	TT	525	GAL
No.	TYPE		
DEDUCTIONS		325	
NET GALLONS		200	
PRICE PER GALLON		25	
FREIGHT			
TOTAL		50.00	

☐

CASH

☒

CHARGE
(INVOICE
TO FOLLOW)

Pink - Transporter

Green - Generator



PHOSLAB

Tel 941-682-5897

806 W. Beacon Road • Lakeland, Florida 33803

Fax 941-683-3279

Client: International Petroleum Corporation
105 South Alexander Street
Plant City, Florida 33566

Attn: Mr. Rick Davis
P. O. #:
Project: McNamara Pontiac
Reference: Used Antifreeze

Sampled By: A.M. Malatino
Sample Date: 09-30-97
Date Received: 09-30-97
Analysis Date: 10-01-97
Analyzed By: GJF/JMC

CERTIFICATE OF ANALYSIS

TOXICITY CHARACTERISTIC LEACHING PROCEDURE
EPA METHOD 1311

Sample ID: Used Antifreeze

	<u>Conc., mg/L</u>	<u>Regulatory Limit</u>
Tetrachloroethene	<0.01	0.70
Trichloroethene	<0.01	0.50
Benzene	<0.01	0.50
Lead	<0.01	5.00



QA OFFICER



CHEMIST



4420 Pendola Point Road
Tampa, Florida 33619
(813) 247-2805
FAX: (813) 248-1537

Progress Environmental Laboratories

- CERTIFICATE OF ANALYSIS - (HRS #E84207 and FDER CompQap #900306G)

To: International Oil Service
105 South Alexander Street
Plant City, FL 33566

Report Date: 4/25/97
Page: 1 of 2

Attn: Bob Brown

PEL Lab # : 9704-00266-1
Client ID : Used Antifreeze
Project ID :
Location : Moody Truck Center
Matrix : Antifreeze

Collection Information:
Sample Date: 4/17/97
Sample Time: 14:30
Sampled By : Client
Sample Quality:

Parameter	Method	Results	ND = Less than MDL Units	MDL
GC Volatiles	EPA 8010			
Chlorodifluoromethane	EPA 8010	ND	ug/l	4.8
1,1,2-Dichloroethane	EPA 8010	ND	ug/l	2.0
Chloromethane	EPA 8010	ND	ug/l	7.4
Vinyl Chloride	EPA 8010	ND	ug/l	2.5
Bromomethane	EPA 8010	ND	ug/l	5.1
Chloroethane	EPA 8010	ND	ug/l	2.9
Trichlorofluoromethane	EPA 8010	ND	ug/l	3.6
1,1-Dichloroethene	EPA 8010	ND	ug/l	3.6
Methylene Chloride	EPA 8010	ND	ug/l	10.0
Trans-1,2-dichloroethene	EPA 8010	ND	ug/l	4.2
1,1-Dichloroethane	EPA 8010	ND	ug/l	3.5
Chloroform	EPA 8010	ND	ug/l	10.0
1,1,1-Trichloroethane	EPA 8010	ND	ug/l	3.0
Carbontetrachloride	EPA 8010	ND	ug/l	3.4
1,2-Dichloroethane	EPA 8010	ND	ug/l	4.2
Trichloroethene	EPA 8010	ND	ug/l	3.6
1,2-Dichloropropane	EPA 8010	ND	ug/l	3.8
Bromodichloromethane	EPA 8010	ND	ug/l	4.1
2-Chloroethylvinyl ether	EPA 8010	ND	ug/l	13.0
Cis-1,3-Dichloropropene	EPA 8010	ND	ug/l	3.8
Trans-1,3-Dichloropropene	EPA 8010	ND	ug/l	4.2
1,1,2-Trichloroethane	EPA 8010	ND	ug/l	5.1
Tetrachloroethene	EPA 8010	ND	ug/l	18.0
Bromochloromethane	EPA 8010	1240	ug/l	4.8
Bromoform	EPA 8010	ND	ug/l	8.0
1,1,2,2-Tetrachloroethane	EPA 8010	ND	ug/l	8.2
Analysis date	EPA 8010	04-24-97		

- CONTINUED ON NEXT PAGE -

Progress Environmental Laboratories

- CERTIFICATE OF ANALYSIS -
(HRS #E84207 and FDER CompQap #900306G)To: International Oil Service
205 South Alexander Street
Plant City, FL 33566Report Date: 4/25/97
Page: 2 of 2

Attn: Bob Brown

Lab # : 9704-00266-1 (Continued ...)
Ident ID : Used Antifreeze

Parameter	Method	Results	ND = Less than MDL Units	MDL
1,4Dichlorobutane (10-150)	EPA 8010	125	NR	
4-BFB (10-150)	EPA 8010	84.0	NR	
GC Volatiles	EPA 8020			
MTBE	EPA 8020	ND	ug/l	6.3
Benzene	EPA 8020	7.9	ug/l	2.5
Toluene	EPA 8020	8.6	ug/l	3.1
Chlorobenzene	EPA 8020	25.5	ug/l	4.3
m-Xylene	EPA 8020	ND	ug/l	4.3
p-Xylene	EPA 8020	ND	ug/l	4.7
o-Xylene	EPA 8020	ND	ug/l	5.3
1,3-Dichlorobenzene	EPA 8020	ND	ug/l	5.7
1,4-Dichlorobenzene	EPA 8020	ND	ug/l	5.9
1,2-Dichlorobenzene	EPA 8020	ND	ug/l	7.0
Analysis date	EPA 8020	04-24-97		
Fluorobenzene (81-124)	EPA 8020	97.3	NR	
Lead	EPA 6010	69.8	ug/l	2.92

Respectfully submitted,
Charles R. Ingram, Quality Assurance Officer.

INTERNATIONAL PETROLEUM CORPORATION
GENERATOR'S WASTE MATERIAL
PROFILE SHEET

A. GENERAL INFORMATION

GENERATOR NAME: Moody Truck Center
FACILITY ADDRESS: 4600 Phillips Hwy
Jacksonville 32207

TRANSPORTER:

TRANSPORTER PHONE:

GENERATOR US EPA ID#:

GENERATOR STATUS: SQC

PHONE: 904 739-2296 FAX: 904 730 3461

TECHNICAL CONTACT: Bob Brown

TITLE: Service Mgr

NAME OF WASTE: Antifreeze

PROCESS GENERATING WASTE: Desel Repair

QUANTITY:

B. PHYSICAL CHARACTERISTICS OF WASTE

Color

ODOR ☐ NONE ☒ MILD ☐ STRONG

PHYSICAL STATE @ 70°F LAYERS

FREE LIQUIDS

DESCRIBE

☐ SOLID

☐ SEMI-SOLID

☐ MULTILAYERED

☒ YES

☒ LIQUID

☐ POWDER

☐ BI-LAYERED

☐ NO

☐ SINGLE PHASED

VOLUME 100%

pH: ☐ < 2

☒ 7.1-10

SPECIFIC GRAVITY

FLASH POINT

☐ 2-4

☐ 10.1-12.5

☐ < .8

☐ 1.3-1.4

☐ < 70°F

☐ > 200°F

☐ CLOSED CUP

☐ 4.1-6.9

☐ > 12.5

☐ 0.8-1.0

☐ 1.6-1.7

☐ 70°F -100°F

☒ NO FLASH

☐ OPEN CUP

☐ 7

☐ N/A

☒ 1.1-1.2

☐ > 1.7

☐ 101°F-139°F

☐ EXACT

☐ EXACT

☐ EXACT

☐ 140°F- 200°F

C. CHEMICAL COMPOSITION (TOTALS MUST ADD TO 100%)
(mg/L)

D. METALS

☐ TOTAL (ppm) ☐ EPA EXTRACTION PROCEDURE

Cryol
water

85 %
95 %

ARSENIC (as)

SELENIUM (se)

BARIIUM (ba)

SILVER (ag)

CADMIUM(cd)

COPPER(cu)

CHROMIUM(cr)

NICKEL(ni)

MERCURY(hg)

ZINC(zn)

LEAD(pb)

HALLIUM(li)

CHROMIUM-HEX (cr + 6):

CHECK ONE BOX

☐ SOLIDS OR SLUDGES THAT ARE NOT PETROLEUM RELATED: EXPLAIN:

☐ SOLIDS OR SLUDGES CONTAMINATED WITH USED OIL:

☐ SOLIDS OR SLUDGES CONTAMINATED WITH VIRGIN PETROLEUM OIL

☐ WASTE WATER THAT IS NOT PETROLEUM RELATED: EXPLAIN:

☐ WASTE WATER CONTAMINATED WITH USED OIL

☐ WASTE WATER CONTAMINATED WITH VIRGIN OIL

☐ WASTE WATER CONTAMINATED WITH FUEL

☐ USED OIL

☐ VIRGIN FUEL

☒ OTHER: used Antifreeze

☐ SOIL THAT IS NOT PETROLEUM RELATED: EXPLAIN:

☐ SOIL CONTAMINATED WITH USED OIL

☐ SOIL CONTAMINATED WITH VIRGIN OIL

☐ SOIL FROM UST REGULATED BY 40 CFR, PART 280

NON-HAZARDOUS CERTIFICATION

I, the undersigned, under penalty of law do hereby certify to the best of my knowledge, the recyclable material submitted for acceptance to International Petroleum Corporation is not a listed hazardous waste and does not exhibit any of the characteristics of a hazardous waste as defined in 40 CFR 261 of the toxicity characteristic revision rules as specified in the March 28, 1990 Federal register. I further certify that the recyclable material submitted for acceptance to International Petroleum Corporation is classified as non hazardous in its state of generation, and that I am authorized to execute this document.

TOXIC SUBSTANCE CONTROL ACT

I, the undersigned, under penalty of law do hereby certify that the materials submitted for acceptance to International Petroleum Corporation does not contain any detectable concentrations of PCB's as defined in Section 6 (E) of TSCA (ISUSC2605) and (40 CFR Part 761).

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or these persons responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Moody Truck Center
COMPANY: Robert H. Brown
AUTHORIZED SIGNATURE: Service Manager

TITLE

DATE

4/17/97

INTERNATIONAL OIL SER

TRANSPORTATION AND RECEIVING MANIFEST

110002

DIV. OF INTERNATIONAL PETROLEUM CORP. STATE CERTIFIED RECYCLER, TRANSPORTER AND COLLECTION FACILITY

EPA I.D. No. FLD 065680613
SO 29-181143

LAD 092096106

MOD 98114051
LA I.D. No. GT-186

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TAMPA, FL
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FAX 1 (813) 754-3789

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(800) 222-2511

IDENTIFICATION

moody Truck Center Date Shipped 4-17-97
4600 Phillips Hwy
JAX FL 32207 Phone 739-1154
CITY STATE ZIP

INFORMATION

PROPER SHIPPING NAME	HAZARD CLASS	IDENTIFICATION NUMBER	PACKING GROUP	N.A.E.R.G.
COMBUSTIBLE LIQUID, N.O.S. (CONTAINS PETROLEUM OIL)	COMBUSTIBLE LIQUID	NA 1993	III	128
SOURCE TYPE (USED OIL) CO/A Anti-Freeze (P.O. 56081) PCW				
SPECIAL HANDLING INSTRUCTIONS END USE CODE MINI/SR		EMERGENCY RESPONSE NUMBER CHEMTREC 1-800-424-9300		

CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

This is to further certify under penalty of law that the above-named materials have not been mixed with hazardous waste according to the rules of the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection.

X GENERATOR'S SIGNATURE DATE

TRANSPORTER No. 2 SIGNATURE & DATE
4-17-97

97-PC-19888

MANIFEST DOCUMENT NO.

White - Original Yellow - Receiving Facility

prestige printing pp-2004R 7/96

CONTAINERS	QUANTITY	UNIT
1 TT	188	GAL
No. TYPE		

DEDUCTIONS

NET GALLONS 188

PRICE PER GALLON .354

FREIGHT

TOTAL \$65.80

☐

CASH

☒

CHARGE
(INVOICE
TO FOLLOW)

Pink - Transporter

Grid - Generator

INTERNATIONAL OIL SERVICE

TRANSPORTATION AND RECEIVING MANIFEST

DIV. OF INTERNATIONAL PETROLEUM CORP. STATE CERTIFIED RECYCLER, TRANSPORTER AND COLLECTION FACILITY

EPA I.D. No. FLD 065680613
SO 29-181143

LAD 092096106

MOD 981114051
LA I.D. No. GT-186

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TAMPA, FL
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- USED ANTIFREEZE
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IDENTIFICATION

Moody Truck Co Date Shipped 6-11-97
GENERATOR/SHIPPER
4600 Phillips Hwy Time
ADDRESS
JAX FLA 32207 Phone 739-1654
CITY STATE ZIP

INFORMATION

PROPER SHIPPING NAME	HAZARD CLASS	IDENTIFICATION NUMBER	PACKING GROUP	N.A.E.R.G.
COMBUSTIBLE LIQUID, N.O.S. (CONTAINS PETROLEUM OIL)	COMBUSTIBLE LIQUID	NA 1993	III	129
SOURCE TYPE (USED OIL) CO/A				
SPECIAL HANDLING INSTRUCTIONS END USE CODE MINI/SR		EMERGENCY RESPONSE NUMBER CHEMTREC 1-800-424-9300		

Waste Anti-freeze & Waste Water @ .35¢ Per

CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

This is to further certify under penalty of law that the above-named materials have not been mixed with hazardous waste according to the rules of the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection.

X [Signature] DATE

GENERATOR'S SIGNATURE

[Signature] DATE

TRANSPORTER No. 2 SIGNATURE & DATE

97-PC 18705

MANIFEST DOCUMENT NO.

White - Original Yellow - Receiving Facility

prestige printing pp-2004R 7/96

CONTAINERS		QUANTITY	UNIT
1	TT	400	GAL.
No.	TYPE		

DEDUCTIONS _____

NET GALLONS _____

PRICE PER GALLON _____

FREIGHT _____

TOTAL \$140.00



CASH



CHARGE
(INVOICE
TO FOLLOW)

Pink - Transporter

Green - Generator



PHOSLAB

Phone 813-682-5897

806 W. Beacon Road • Lakeland, Florida 33803

Fax 813-683-3279

Client: International Petroleum Corporation
105 South Alexander Street
Plant City, Florida 33566

Attn: Mr. Chris Markey
P. O. #: M-A-10-2
Project: Moody Truck
Reference: Used Antifreeze

Sampled By: A.M. Malatino
Sample Date: 10-02-97
Date Received: 10-02-97
Analysis Date: 10-02/05-97
Analyzed By: GJF/JMC

CERTIFICATE OF ANALYSIS

TOXICITY CHARACTERISTIC LEACHING PROCEDURE
EPA METHOD 1311

Sample ID: Used Antifreeze

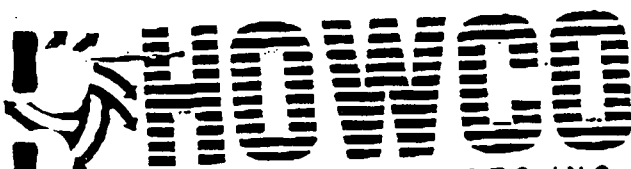
	<u>Conc., mg/L</u>	<u>Regulatory Limit</u>
Tetrachloroethene	0.377	0.70
Trichloroethene	<0.010	0.50



QA OFFICER



CHEMIST



ENVIRONMENTAL SERVICES INC.

"...conserving limited natural resources through recycling while
protecting the environment and public health and welfare."™

August 17, 1994

HOWCO NUMBER: 1613

Mr. Gary Scott
Florida Clarklift
115 South 78th Street
Tampa, FL 33619

MATRIX: Antifreeze

DATE RECEIVED: 8/12/94

DATE COMPLETED: 8/16/94

CERTIFICATE OF ANALYSIS

ELEMENT	RESULT	DET. LIMIT
Lead	38.1 mg/l	.1 mg/l
Benzene	BDL	10 µg/l
Perchloroethylene	BDL	10 µg/l
Trichloroethylene	BDL	10 µg/l

REMARKS: BDL = Below detection limit
All analyses were performed in accordance with E.P.A., A.S.T.M., Standard Methods or other F.D.E.R.
approved procedures.

Respectfully submitted,

Gregory Spencer
Lab Manager

cc: Accounting

INTERNATIONAL PETROLEUM CORPORATION
GENERATOR'S WASTE MATERIAL
PROFILE SHEET

A. GENERAL INFORMATION

GENERATOR NAME: Florida LIFT System
CITY ADDRESS: 115 So 78th St
Tampa 33619

TRANSPORTER: 705
TRANSPORTER PHONE: _____
GENERATOR US EPA ID#: _____
GENERATOR STATUS: CE 526
PHONE: 21-1000 FAX: _____

TECHNICAL CONTACT: Gray Scott TITLE: MGR

NAME OF WASTE: Used Anti Freeze

PROCESS GENERATING WASTE: Auto LIFT Repair

QUANTITY: 2.55 gal

B. PHYSICAL CHARACTERISTICS OF WASTE

Color: Grn ODOR: ☐ NONE ☒ MILD ☐ STRONG
DESCRIBE: Rubbery
Yellow
PHYSICAL STATE @ 70°F LAYERS
☒ SOLID ☐ SEMI-SOLID ☐ MULTILAYERED
☒ LIQUID ☐ POWDER ☐ BI-LAYERED
☐ SINGLE PHASED
FREE LIQUIDS
☐ YES
☐ NO
VOLUME: _____ %
pH: ☐ < 2 ☐ 7.1-10 SPECIFIC GRAVITY
☐ 2-4 ☐ 10.1-12.5 ☐ < .8 ☐ 1.3-1.4
☐ 4.1-6.9 ☐ > 12.5 ☐ .8-1.0 ☐ 1.6-1.7
☐ 7 ☐ N/A ☐ 1.1-1.2 ☐ > 1.7
☐ EXACT _____ ☐ EXACT _____
FLASH POINT
☐ < 70°F ☐ > 200°F
☐ 70°F - 100°F ☐ NO FLASH
☐ 101°F - 139°F ☐ EXACT _____
☐ 140°F - 200°F ☐ CLOSED CUP
☐ OPEN CUP

C. CHEMICAL COMPOSITION (TOTALS MUST ADD TO 100%)

(mg/L)

_____%
_____%
_____%
_____%
_____%
_____%
_____%
_____%

D. METALS

☐ TOTAL (ppm) ☐ EPA EXTRACTION PROCEDURE

ARSENIC (as) _____ SELENIUM (se) _____
BARIUM (ba) _____ SILVER (ag) _____
CADMIUM (cd) _____ COPPER (cu) _____
CHROMIUM (cr) _____ NICKEL (ni) _____
MERCURY (hg) _____ ZINC (zn) _____
LEAD (pb) _____ HALLIUM (ti) _____
CHROMIUM-HEX (cr + 6): _____

CHECK ONE BOX

- ☐ SOLIDS OR SLUDGES THAT ARE NOT PETROLEUM RELATED: EXPLAIN: _____
☐ SOLIDS OR SLUDGES CONTAMINATED WITH USED OIL:
☐ SOLIDS OR SLUDGES CONTAMINATED WITH VIRGIN PETROLEUM OIL
☐ WASTE WATER THAT IS NOT PETROLEUM RELATED: EXPLAIN: _____
☐ WASTE WATER CONTAMINATED WITH USED OIL
☐ WASTE WATER CONTAMINATED WITH VIRGIN OIL
☐ WASTE WATER CONTAMINATED WITH FUEL
☐ USED OIL
☐ VIRGIN FUEL
☒ OTHER: used Anti Freeze
☐ SOIL THAT IS NOT PETROLEUM RELATED: EXPLAIN: _____
☐ SOIL CONTAMINATED WITH USED OIL
☐ SOIL CONTAMINATED WITH VIRGIN OIL
☐ SOIL FROM UST REGULATED BY 40 CFR, PART 280

NON-HAZARDOUS CERTIFICATION

I, the undersigned, under penalty of law do hereby certify to the best of my knowledge, the recyclable material submitted for acceptance to International Petroleum Corporation is not a listed hazardous waste and does not exhibit any of the characteristics of a hazardous waste as defined in 40 CFR 261 of the toxicity characteristic revision rules as specified in the March 28, 1990 Federal register. I further certify that the recyclable material submitted for acceptance to International Petroleum Corporation is classified as non hazardous in its state of generation, and that I am authorized to execute this document.

GLS
INITIAL

TOXIC SUBSTANCE CONTROL ACT

I, the undersigned, under penalty of law do hereby certify that the materials submitted for acceptance to International Petroleum Corporation does not contain any detectable concentrations of PCB's as defined in Section 6 (E) of TSCA (ISUSC2605) and (40 CFR Part 761).

GLS
INITIAL

CERTIFICATION

I, the undersigned, under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or these persons responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Florida LIFT Systems
COMPANY

Gray Scott
AUTHORIZED SIGNATURE

Quality Assurance Dept
TITLE

1-7-97
DATE

INTERNATIONAL OIL SERVICE

TRANSPORTATION AND RECEIVING MANIFEST

DIV. OF INTERNATIONAL PETROLEUM CORP.
STATE CERTIFIED RECYCLER, TRANSPORTER AND COLLECTION FACILITY

EPA I.D. No. FLD 065680613
SO 29-181143

LAD 092096106

MOD 981114051
LA I.D. No. GT-186

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(800) 282-9585
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- USED OIL
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6305 E. LOMBARD ST.
(800) 222-2511

IDENTIFICATION

Florida Left Supply 73178 Date Shipped 5/7/97
115 S. 78th St. H Generator/Shipper
ADDRESS 73619 Time 9:15 PM
CITY STATE ZIP Phone 813-621-1000
Hillborn

INFORMATION

PROPER SHIPPING NAME	HAZARD CLASS	IDENTIFICATION NUMBER	PACKING GROUP	N.A.E.R.G.
COMBUSTIBLE LIQUID, N.O.S. (CONTAINS PETROLEUM OIL)	COMBUSTIBLE LIQUID	HA 1993	III	128

SOURCE TYPE (USED OIL)
CO/A

Used Antifreeze

SPECIAL HANDLING INSTRUCTIONS
END USE CODE MINI/SR

EMERGENCY RESPONSE NUMBER
CHEMTREC 1-800-424-9300

CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

This is to further certify under penalty of law that the above-named materials have not been mixed with hazardous waste according to the rules of the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection.

Signature of Generator/Shipper 5/7/97
DATE

Signature of Transporter No. 2 5/7/97
DATE

SIGNATURE DATE

97-PC 7337

MANIFEST DOCUMENT NO.

White - Original

Yellow - Receiving Facility

Pink - Transporter

Green - Generator

prestige printing pp-2004R 7/96

CONTAINERS		QUANTITY	UNIT
1	TT	200	GAL.
No.	TYPE		

DEDUCTIONS

NET GALLONS 200

PRICE PER GALLON 35

FREIGHT

TOTAL 70.00



CASH



CHARGE
(INVOICE
TO FOLLOW)

INTERNATIONAL OIL SERV.

FLU

TRANSPORTATION AND RECEIVING MANIFEST

DAVA

DIV. OF INTERNATIONAL PETROLEUM CORP.
STATE CERTIFIED RECYCLER, TRANSPORTER AND COLLECTION FACILITY

EPA I.D. No. FLD 065680613
SO 29-181143

LAD 092096106

MOD 981114051
LA I.D. No. GT-186

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TAMPA, FL
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(302) 421-9307

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6305 E. LOMBARD ST.
(800) 222-2511

IDENTIFICATION

F3B78 Fluid Lift System
Date Shipped 8/4/97
115 781th ST S
ADDRESS
CITY STATE ZIP
Phone (813) 621-1000

INFORMATION

PROPER SHIPPING NAME	HAZARD CLASS	IDENTIFICATION NUMBER	PACKING GROUP	N.A.E.R.G.
COMBUSTIBLE LIQUID, N.O.S. (CONTAINS PETROLEUM OIL)	COMBUSTIBLE LIQUID	NA 1993	III	128
SOURCE TYPE (USED OIL) CO/A				
Used oil + A/F				
SPECIAL HANDLING INSTRUCTIONS END USE CODE MINI/SR		EMERGENCY RESPONSE NUMBER CHEMTREC 1-800-424-9300		

CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

This is to further certify under penalty of law that the above-named materials have not been mixed with hazardous waste according to the rules of the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection.

X Paul A. [Signature] 8/4/97
GENERATOR'S SIGNATURE DATE

[Signature] 8/4/97
TRANSPORTER'S SIGNATURE DATE

SIGNATURE DATE

CONTAINERS		QUANTITY	UNIT
1	TT		GAL
No.	TYPE		

DEDUCTIONS OLL A/F
NET GALLONS 200 200
PRICE PER GALLON A/C 25
FREIGHT 50.00
TOTAL



CASH



CHARGE
(INVOICE
TO FOLLOW)

97-PC 12355
MANIFEST DOCUMENT NO.

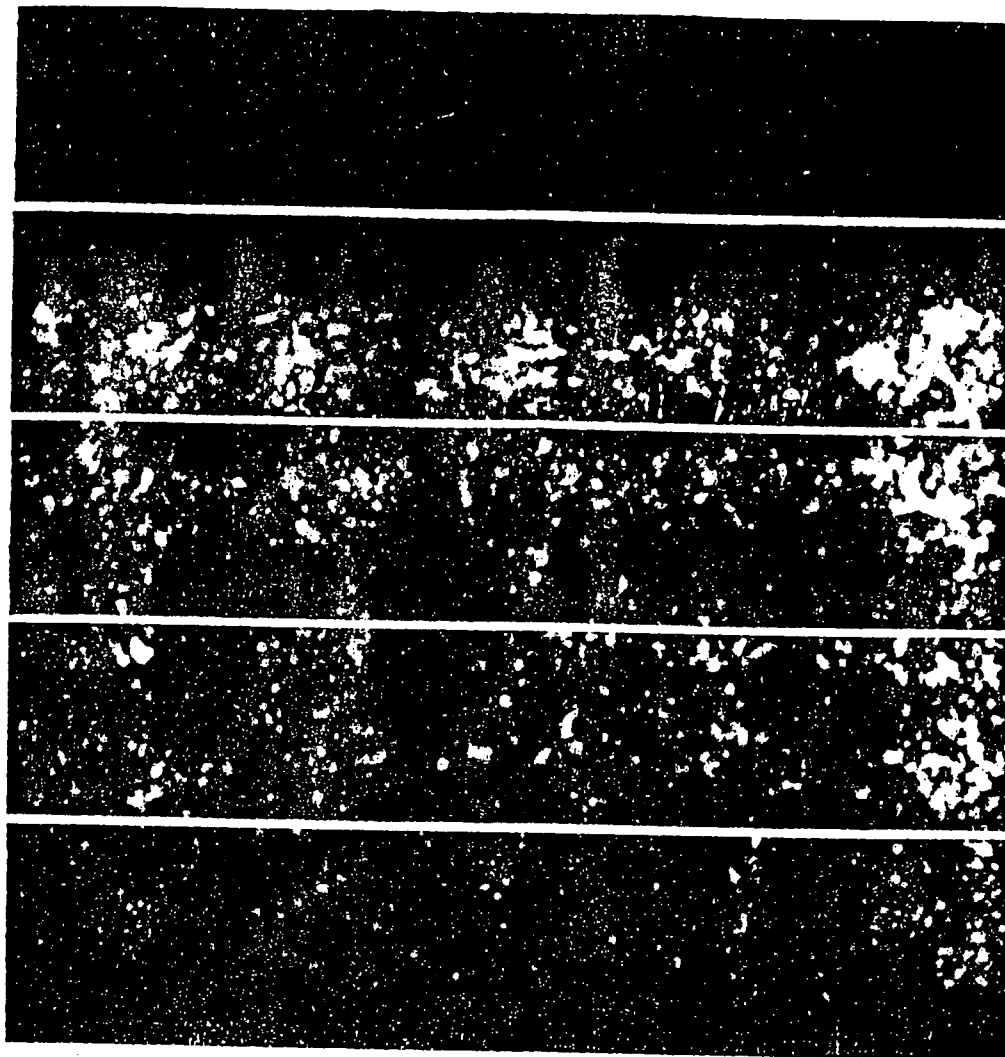
White - Original

Yellow - Receiving Facility

Pink - Transporter

Green - Generator

prestige printing pp-2004R 7/96



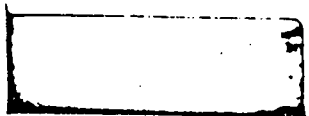
Large amount

of material

in the sample

*20 samples - 2 were contaminated
containers provided + instru*

and analyzed them



DAMES & MOORE

Antifreeze Study Results Report
New Jersey Automobile Dealers Association

August 9, 1993
Job No. 16976-002-150



DAMES & MOORE

Cranford, New Jersey

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1.0 INTRODUCTION

This Waste Antifreeze Study was conducted by Dames & Moore for the New Jersey Automobile Dealers Association (NJADA) to evaluate whether samples of used antifreeze from automobiles serviced at automobile dealerships had the characteristics of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). The study utilized NJADA-member automobile dealerships as sources of used antifreeze. This study was undertaken with guidance from the New Jersey Department of Environmental Protection and Energy (NJDEPE), Division of Hazardous Waste Regulation who reviewed and commented on the study scope of work. The study was undertaken concurrently with a similar study conducted by the NJDEPE and was designed in part to compliment the NJDEPE study.

2.0 BACKGROUND

Ethylene glycol-based antifreeze is widely used as an engine coolant. Recent studies on the characteristics of used antifreeze have shown differing results regarding the hazardous nature of the material. Several studies (References 1 and 2) have shown that the material may be considered hazardous under regulations due to the presence of metals, petroleum constituents, and solvents at concentrations exceeding the RCRA thresholds for hazardous compounds. Another study (Reference 3), however, concluded that the contamination it found in antifreeze was due to cross contamination from drainage pans used to collect the antifreeze, storage containers, or to poor materials management practices. Yet another study conducted by the USEPA and Battelle, in cooperation with the NJDEPE and the New Jersey Department of Transportation (Reference 4) showed an absence of these compounds or the presence of the compounds at concentrations well below the RCRA thresholds for hazardous wastes.

This study assesses the waste characteristics of used antifreeze caused by its use in automobiles. Efforts were made to minimize the effects of cross-contamination from sources such as collection pans, storage vessels, and transport vehicles. This was accomplished by providing dealerships participating in the study with: 1) 16-gallon steel drums provided by a major disposal company to be dedicated by the dealerships for the collection of used antifreeze; and 2) a set of instructions outlining the methods and equipment to be used to collect, transfer and store the used antifreeze.

The study represents a cross-section of the antifreeze used in automobiles. Antifreeze was collected from a variety of dealerships, including large, multi-brand dealerships. Based on consultations with the NJDEPE, a sample size of nine samples was selected for the study, and, consequently, nine dealerships were chosen to participate in the study. The nine dealerships, henceforth referred to as AF-1 through AF-9, were located in northeast New Jersey, as shown on Figure 1.

3.0 METHODS

3.1 ANTIFREEZE SAMPLE COLLECTION

Prior to the collection of the antifreeze samples, one 16-gallon steel drum was distributed to each dealership and antifreeze was collected until the drum was full. Precautions were taken during collection to limit cross-contamination of the antifreeze. Such precautions included limiting the use of the drums to the collection of antifreeze, and using clean, dedicated drain pans to collect and transfer the antifreeze from the automobiles to the drums. Once the drums were full, samples of the antifreeze were collected by immersing laboratory sample glassware directly into the antifreeze in the drums, filling the containers, then wiping, capping and labeling the glassware. The antifreeze samples were identified by location, as samples AF-1 through AF-9. In addition, two Quality Assurance/Quality Control (QA/QC samples), including one field blank and one trip blank, were collected.

The antifreeze samples were collected from dealerships designated as AF-1, AF-2, AF-3, AF-4, AF-6, AF-7 and AF-9 on March 3, 1993. During sampling, oil was observed floating on the antifreeze collected in the drums at locations AF-5 and AF-8. Based on the visual appearance, it is believed that the oil was waste motor oil mistakenly added to the drum. Due to the presence of the oil, samples of antifreeze were not collected, the drums of antifreeze were emptied, cleaned, filled again with used antifreeze, then sampled on March 12, 1993.

It was also observed during sampling that the resin coating present in drums at locations AF-4 and AF-9, was peeling into the antifreeze in the drum. Due to the presence of these coatings and to the anomalous presence of lead at concentrations exceeding the RCRA hazardous threshold in sample AF-9, drum AF-9 was emptied of its contents, lined with two polyethylene bags, then used to collect additional antifreeze. The drum at location AF-9 was resampled on June 24, 1993, the sample was identified as AF-9RE, and was analyzed for lead by TCLP. Samples of the resin coatings were also collected from AF-4 and AF-9, were identified as AF-4 Resin and AF-9RC, respectively, and were analyzed for total concentrations of lead. The resin was found to contain high levels of lead.

3.2 SAMPLE ANALYSIS

Following collection, antifreeze samples were transferred to a laboratory shuttle packed with ice, and delivered to a New Jersey-certified analytical laboratory where the samples were analyzed for the parameters listed below:

- Volatile organic compounds by the Toxicity Characteristics Leaching Procedure (TCLP);
- Semi-volatile organic compounds by TCLP;

- Metals by TCLP
- Resource Conservation and Recovery Act (RCRA) parameters - reactive cyanide and sulfide, corrosivity by pH, ignitability;
- Total petroleum hydrocarbons (TPH).

All antifreeze samples were analyzed following the Test Methods for Evaluating Solid Wastes (USEPA SW-846, 3rd Edition, November 1986). Sample AF-9A (AF-9 resampled) was analyzed for TCLP lead and the samples of the drum resin linings from AF-4 and AF-9 were sampled for total lead.

4.0 RESULTS

The findings of the sample analyses are summarized in Tables 1 through 4. The findings of the TCLP analyses are summarized below by parameter group.

Volatile Organic Compounds (VOCs)

- The TCLP VOC findings are summarized in Table 1.
- Sample AF-5 contained tetrachloroethene (PCE) at a concentration of 0.92 mg/l, a concentration which exceeded the RCRA threshold of 0.7 mg/l. Samples from two other locations, AF-6 and AF-7, contained PCE at concentrations of 0.12 mg/l and 0.025 mg/l, respectively. The mean and standard deviation of the PCE concentrations in these samples was 0.36 ± 0.40 mg/l.
- Benzene was detected in samples AF-1 and AF-6 at concentrations of 0.32 mg/l and 0.23 mg/l (the RCRA threshold is 0.5 mg/l).

- Chlorobenzene was detected in samples AF-6 and AF-7 at concentrations of 0.22 mg/l and 0.044 mg/l (the RCRA threshold is 100 mg/l).

Semi-Volatile Organic Compounds (Semi-VOC)

- The TCLP Semi-VOC findings are summarized in Table 2.
- No semi-volatile organic compounds were detected in any of the samples collected from the dealerships.

Metals

- The TCLP metals findings are summarized in Table 3.
- The analysis of samples AF-4 and AF-9, collected prior to the identification of the defective collection drums and resampling, showed the presence of lead at concentrations of 5.8 mg/l and 27.5 mg/l, respectively. Both exceeded the RCRA hazardous threshold of 5.0 mg/l.
- The analysis of sample AF-9A, collected after lining the defective drum with polyethylene and collecting additional antifreeze using identical collection procedures, showed lead at concentrations of 0.19 mg/l, well below the RCRA hazardous threshold.
- The analysis of the resin samples collected from the drums at locations AF-4 and AF-9 showed the presence of lead at concentrations of 47.7 mg/kg and 216 mg/kg, respectively.

- The samples collected from AF-1 through AF-8 contained selenium at concentrations ranging from 0.28 mg/l to 0.62 mg/l. All concentrations were below the RCRA hazardous threshold for the metal.
- Lead and selenium were the only metals detected in the antifreeze samples.
- The results of the analysis of the samples for RCRA parameters indicated that the none of the samples exceeded the RCRA thresholds for reactive sulfide, reactive cyanide, corrosivity by pH, flashpoint, or TPH.

5.0 CONCLUSIONS

The results of the analyses of the antifreeze samples collected during the original round of sampling indicated that only samples AF-4 and AF-9 contained lead at concentrations exceeding RCRA hazardous thresholds. However, the analysis of sample AF-9, recollected after lining the drum with polyethylene and collecting additional antifreeze, showed that while lead was still present, it was present at concentrations well below the RCRA hazardous threshold. Given that lead was detected in resin coatings observed in both drums AF-4 and AF-9, but was not detected in any of the other antifreeze samples, it is apparent that the lead in the samples AF-4 and AF-9 originated from the resin coating in the drums.

The results of the sample analyses indicated that selenium was present in the antifreeze samples, but at concentrations well below the RCRA hazardous threshold. No other metals were detected in the samples.

Tetrachloroethene (PCE) was detected in three of the samples collected (AF-5, AF-6, and AF-7). Of these, one sample (AF-5) contained PCE at concentrations exceeding the RCRA hazardous threshold. Sample AF-5 was collected from a

drum in which waste oil was observed prior to sampling. The drum was cleaned and additional antifreeze collected. It is possible that the PCE detected in the sample originated from residual contamination (from materials such as degreasers) left in the drum after removing the oil and cleaning before sampling. The average concentration of PCE in the samples was 0.17 mg/l, which is below the RCRA hazardous threshold. In one half of the samples PCE was below the limit of detection.

Benzene and chlorobenzene were detected in some of the samples, but at concentrations well below the RCRA hazardous threshold. No other volatile organic compounds were detected in the samples. In addition, no semi-volatile organic compounds were detected in any of the samples.

The results of the antifreeze analyses indicate that antifreeze collected directly from automobiles lacks the characteristics of a hazardous waste.

Constituents of concern previously identified in samples of antifreeze likely originate from poor materials management practices, contact with contaminated collection and storage vessels, or transport vehicles. Based on the results of this study, when properly managed, and kept separate from other wastes, used antifreeze does not exhibit the characteristics of a RCRA hazardous waste.

To properly manage used antifreeze, as with all non-hazardous wastes, it is important that service automotive facilities follow Best Management Practices (BMP) to avoid cross-contamination with hazardous constituents. For used antifreeze accumulated by vehicle maintenance operations, such BMP should include:

1. Use of dedicated antifreeze collection equipment. Do not use solvents to clean collection funnels or drums.

2. Keeping stored antifreeze free of cross-contamination from waste oil, fuels, cleaners, solvents, etc. by providing a separate well-labeled plastic container (or other container free of hazardous coatings) and employee instruction.

TABLE 1

SUMMARY OF ANALYTICAL RESULTS - TCLP VOLATILES
NEW JERSEY AUTOMOBILE DEALERSHIP ASSOCIATION
ANTIFREEZE STUDY

Sample No. & Moore Sample No.	Quant. Limit mg/l	AP-1 80470 3/2/93 25 mg/l	AP-2 80471 3/2/93 25 mg/l	AP-3 80472 3/2/93 10 mg/l	AP-4 80473 3/2/93 50 mg/l	AP-5 80932 3/12/93 100 mg/l	AP-6 80474 3/2/93 25 mg/l	AP-7 80475 3/2/93 10 mg/l	AP-8 80933 3/12/93 10 mg/l	AP-9 80476 3/2/96 10 mg/l	FB-030293 80477 3/2/93 1 mg/l	TB-030293 80478 3/2/93 1 mg/l	TCLP Regulatory Limits mg/l
P Volatile Compounds													
Azene	0.005	0.32	0.05U	U	0.02J	U	0.23	U	U	U	U	U	0.5
Carbon Tetrachloride	0.005	U	U	U	U	U	U	U	U	U	U	U	0.5
Benzene	0.005	U	U	U	U	U	0.22	0.044	U	U	U	U	100
Chloroform	0.005	U	U	U	U	U	U	U	U	U	U	U	6.0
1,1-Dichloroethane	0.005	U	U	U	U	U	U	U	U	U	U	U	0.5
1,2-Dichloroethylene	0.005	U	U	U	U	U	U	U	U	U	U	U	0.7
Diethyl Ketone	0.01	R	R	0.57J	R	R	R	R	0.1J	R	R	R	200
1,1,1-Trichloroethylene	0.005	0.036J	U	U	U	0.3J	0.12	0.025	U	0.04J	U	U	0.7
1,2-Dichloroethylene	0.005	U	U	U	U	U	U	U	U	U	U	U	0.5
Methyl Chloride	0.01	U	U	U	U	U	U	U	U	U	U	U	0.2

NOTES:

- U Compound was not detected
J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
UJ This analyte was not detected, but the quantitation limit is estimated due to limitations identified during the QA review.
R Result is unreliable - Analyte may or may not be present in this sample.
NI Non-Identifiable
s.u. Standard Unit
Exceeds the Regulatory Level
NA This parameter was not analyzed.

TABLE 2

**SUMMARY OF ANALYTICAL RESULTS - TCLP SEMI-VOLATILES
NEW JERSEY AUTOMOBILE DEALERSHIP ASSOCIATION
ANTIFREEZE STUDY**

Dames & Moore Sample No. Laboratory Sample No. Sampling Date: Dilution Factor: Unit:	Quant. Limit mg/l	AP-1 80470 3/2/93 2 mg/l	AP-2 80471 3/2/93 10 mg/l	AP-3 80472 3/2/93 10 mg/l	AP-4 80473 3/2/93 50 mg/l	AP-5 80932 3/12/93 25 mg/l	AP-6 80474 3/2/93 50 mg/l	AP-7 80475 3/2/93 10 mg/l	AP-8 80933 3/12/93 10 mg/l	AP-9 80476 3/2/93 50 mg/l	FB-830293 80477 3/2/93 1 mg/l	TCLP Regulatory Limits mg/l
TCLP Semi-Volatile Compounds												
1,4-Dichlorobenzene	0.1	U	U	U	U	UJ	U	U	U	U	U	7.5
2,4-Dinitrotoluene	0.1	U	U	U	U	UJ	U	U	U	U	U	0.13
Hexachlorobenzene	0.1	U	U	U	U	UJ	U	U	U	U	U	0.13
Hexachlorobutadiene	0.1	U	U	U	U	UJ	U	U	U	U	U	0.5
Hexachloroethane	0.1	U	U	U	U	UJ	U	U	U	U	U	3.0
Nitrobenzene	0.1	U	U	U	U	UJ	U	U	U	U	U	2.0
Pyridine	0.2	U	U	U	U	UJ	U	U	U	U	U	5.0
o-Cresol	0.1	U	U	U	U	UJ	U	U	U	U	U	200
m&p - Cresol	0.1	U	U	U	U	UJ	U	U	U	U	U	200
Pentachlorophenol	0.2	U	U	U	U	UJ	U	U	U	U	U	100
2,4,5-Trichlorophenol	0.1	U	U	U	U	UJ	U	U	U	U	U	400
2,4,6-Trichlorophenol	0.1	U	U	U	U	UJ	U	U	U	U	U	2.0

NOTES:

- U Compound was not detected
J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
UJ This analyte was not detected, but the quantitation limit is estimated due to limitations identified during the QA review.
R Result is unreliable - Analyte may or may not be present in this sample.
NI Non-ignitable
s.u. Standard Unit
Exceeds the Regulatory Level
NA This parameter was not analyzed.

TABLE 3

**SUMMARY OF ANALYTICAL RESULTS - TCLP METALS
NEW JERSEY AUTOMOBILE DEALERSHIP ASSOCIATION
ANTIFREEZE STUDY**

Dames & Moore Sample No.: Laboratory Sample No.: Sampling Date: Unit:	Quant. Limit mg/l	AP-1 80470 3/2/93 mg/l	AP-2 80471 3/2/93 mg/l	AP-3 80472 3/2/93 mg/l	AP-4 80473 3/2/93 mg/l	AP-4 Resin 84689 7/2/93 mg/kg	AP-5 80932 3/12/93 mg/l	TCLP Regulatory Limits mg/l
TCLP Metals								
Arsenic	0.5	U	U	U	U	NA	U	5.0
Barium	2.0	U	U	U	U	NA	U	100
Cadmium	0.10	U	U	U	U	NA	U	1.0
Chromium	0.2	U	U	U	U	NA	U	5.0
Lead	0.2*	U	U	U	5.4	47.7	U	5.0
Mercury	0.02	U	U	U	U	NA	U	0.2
Selenium	0.2	0.28	0.57	0.46	0.58	NA	0.62	1.0
Silver	0.10	U	U	U	U	NA	U	5.0

Dames & Moore Sample No.: Laboratory Sample No.: Sampling Date: Unit:	Quant. Limit mg/l	AP-6 80474 3/2/93 mg/l	AP-7 80475 3/2/93 mg/l	AP-8 80933 3/12/93 mg/l	AP-9 80476 3/2/93 mg/l	AP-9RB 83584 5/28/93 mg/l	AP-9RC 83585 5/28/93 mg/kg	FB-030293 80477 3/2/93 mg/l	TCLP Regulatory Limits mg/l
TCLP Metals									
Arsenic	0.5	U	U	U	U	NA	NA	U	5.0
Barium	2.0	U	U	U	U	NA	NA	U	100
Cadmium	0.10	U	U	U	U	NA	NA	U	1.0
Chromium	0.2	U	U	U	U	NA	NA	U	5.0
Lead	0.2 ¹	U	U	U	17.3	0.19	216	U	5.0
Mercury	0.02	U	U	U	U	NA	NA	U	0.2
Selenium	0.2	0.51	0.49	0.47	0.35	NA	NA	U	1.0
Silver	0.10	U	U	U	U	NA	NA	U	5.0

NOTES:

- U Compound was not detected
 J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
 UJ This analyte was not detected, but the quantitation limit is estimated due to limitations identified during the QA review.
 R Result is unreliable - Analyte may or may not be present in this sample.
 NI Non-ignitable
 S.U. Standard Unit
 Exceeds the Regulatory Level
 NA This parameter was not analyzed.
 1 The quantitation limit for samples AP-4 Resin and AP-9RC were 3.9 and 177.0 mg/kg, respectively.

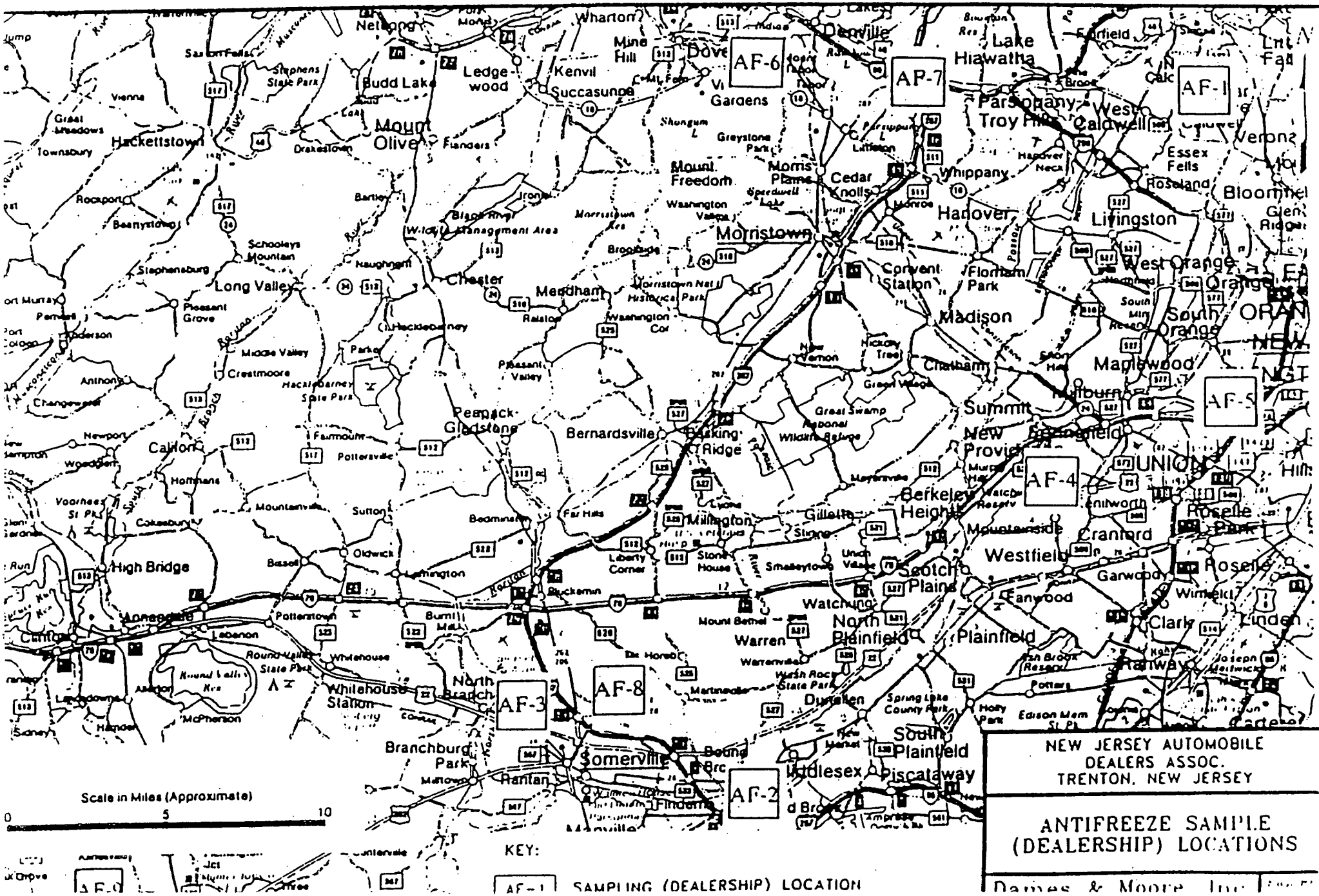
TABLE 4

SUMMARY OF ANALYTICAL RESULTS - RCRA PARAMETERS
NEW JERSEY AUTOMOBILE DEALERSHIP ASSOCIATION
ANTIFREEZE STUDY

Dames & Moore Sample No.:		AP-1	AP-2	AP-3	AP-4	AP-5	AP-6	AP-7	AP-8	AP-9	FB-030293	
Laboratory Sample No.:		80470	80471	80472	80473	80932	80474	80475	80933	80476	80477	
Sampling Date:		3/2/93	3/2/93	3/2/93	3/2/93	3/12/93	3/2/93	3/2/93	3/12/93	3/2/96	3/2/93	
Dilution Factor:		1	1	1	1	1	1	1	1	1	1	
Unit:	Quant. Limit mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/l	Regulatory Level mg/kg
Conventional Parameters												
Reactive Sulfide	20	U	U	U	U	U	U	U	U	U	U	500
Reactive Cyanide	25	U	U	U	U	U	U	U	U	U	U	250
Corrosivity by pH	(s.u.)	8.0J	8.17J	8.12J	7.69J	8.25J	8.54J	8.37J	8.38J	8.49J	5.84J	< 2.0 & > 12.5
Flashpoint	> 160 (°F)	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	> 140 (°F)
Total Petroleum Hydrocarbons	5.0	15	17.2	6.5	U	U	U	50.3	U	U	U	30,000

NOTES:

- U Compound was not detected
 J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
 UJ This analyte was not detected, but the quantitation limit is estimated due to limitations identified during the QA review.
 R Result is unreliable - Analyte may or may not be present in this sample.
 NI Non-Ignitable
 s.u. Standard Unit
 Exceeds the Regulatory Level
 NA This parameter was not analyzed.



Reference 1

Wunder, Laurie, "Waste Antifreeze Characterization Study", Washington State
Department of Ecology, Olympia, WA Aug. 1991

WASTE ANTIFREEZE CHARACTERIZATION STUDY

by
Laurie Wunder

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Toxics, Compliance, and Ground Water Investigations Section
Olympia, Washington 98504-6814

August 1991

ABSTRACT

Waste antifreeze was tested at six sites (3 generators and 3 recyclers) in Washington between February and March, 1991. Samples were collected in both eastern and western Washington and encompassed a broad range of vehicle types. Analyses included: metals; semi-volatiles and volatile organic compounds using the Toxicity Characteristic Leaching Procedure (TCLP); halogenated hydrocarbons; percent ethylene glycol; and two acute toxicity tests (static acute salmonid bioassay and acute oral rat bioassay). Barium, and lead were detected at low levels in the recycler samples. Barium was the only metal detected in the generator samples. Benzene was found at levels exceeding the TCLP regulatory limit at one of the generator sites and was present at non-regulated levels in two of the three recycler samples. Tetrachloroethylene exceeded the TCLP regulatory limit in two of the recycler samples. Halogenated hydrocarbons were present at concentrations below the regulatory threshold in all samples. Bioassay results indicated that waste antifreeze was not acutely toxic to salmonids or rats. The mean concentration of ethylene glycol was 37% by volume. High levels of tetrachloroethylene found in some of the recycler samples suggests that generators are not adequately segregating their waste-streams.

ACKNOWLEDGMENTS

The author would like to thank all those individuals, both within and outside of the Department of Ecology, who assisted in this study. Special thanks are due to Lee Bagley of Ecology's Southwest Regional Office, and to each of the five businesses who cooperated with the study.

INTRODUCTION

Ethylene glycol-based antifreeze is widely used in Washington State as a motor vehicle coolant. Strand and Uvelli (1986) estimated that annual antifreeze usage approached 3.36 million gallons in the state in 1980. Spent antifreeze therefore represents a substantial waste-stream that may be of concern from a regulatory and waste management standpoint.

Used antifreeze has been tested for metals, organics, and aquatic toxicity in several states (San Bernardino, California, Water Department, 1988; California Department of Health Services, 1986, 1987; Washington Department of Ecology, 1982a, 1990). Available data have suggested that waste antifreeze may sometimes contain elevated levels of lead and possibly other metals (California Department of Health Services, 1986, 1987).

Waste antifreeze with ethylene glycol concentrations greater than 10% is identified as a dangerous waste under Chapter 173-303-084 WAC. However, the limited data available have not been sufficient to fully characterize this waste-stream under the Washington State Dangerous Waste Regulations (Chapter 173-303 WAC), primarily because the methodologies, data collection, and sampling procedures used were either not recorded in sufficient detail, or were not standardized. In addition, extensive testing of waste antifreeze using the Toxicity Characteristic Leaching Procedure (TCLP) had not yet been conducted.

Clarification of the status of waste antifreeze under Chapter 173-303 WAC, and the Federal Toxicity Characteristic Rule (FRCR) rule is an important step in establishing a statewide waste antifreeze management policy. Ecology's Solid and Hazardous Waste Program, therefore, requested the Toxics Investigations Section to perform a study with the following objectives: 1) collect data to clarify the status of waste antifreeze under Washington State Dangerous Waste Regulations (Chapter 173-303 WAC), and the FRCR; and 2) evaluate whether waste management practices influence contaminant levels found in waste antifreeze.

COMPOSITION AND USE OF ANTIFREEZE

Ethylene glycol is by far the most common base for antifreeze, although propylene glycol and certain alcohols (methoxypropanol) are occasionally used in some antifreeze formulations. Typical automotive coolant, as purchased over the counter, contains between 80-95% ethylene glycol, with lesser amounts of diethylene glycol (0-10%) and triethylene glycol. Other constituents include: 1-5% water and a variety of additives (1-5%). Toxicities associated with diethylene and triethylene glycols are lower than those recorded for ethylene glycol (Brown, *et al.*, 1963). Additives function as corrosion inhibitors, dyes, anti-foaming agents, scale inhibitors, and surfactants. Table 1 lists some of the additives commonly found in antifreeze. The only metallic salts currently added to antifreeze are sodium and potassium salts. Neither mercury nor benzene are known to be incorporated into coolant additive packages. The pH of new antifreeze is typically basic, ranging between 7.5-11. As ethylene glycol breaks down over time into organic acids, the pH of the coolant tends to drop. Lower pH can facilitate engine

corrosion (particularly solder degradation). This is a likely explanation for the high concentrations of dissolved metals found in coolant that has not been changed for a long period of time. Ethylene glycol breakdown products include various organic acids (acetic, formic, and glycolic acids). In Washington, antifreeze is typically used in a 50:50 mixture with water; however, actual concentrations in vehicles may be highly variable.

Diesel engines may require different coolant usage and procedures than gasoline engines due to differences in engine construction, average annual mileage, loading, and other factors. As a result of these differences, some diesel fleets use heavy duty antifreeze and/or supplemental additive packages in their vehicles (Hudgens and Bugelski, 1990). Many of the additives used in heavy duty coolants are similar to those found in standard automotive coolants, but differ in the relative concentrations of some of the additives. Nitrites, polyacrylates, and detergents are commonly found in heavy duty coolants, but are generally missing from most automotive antifreeze (see Table 1). A 50:50 ratio of antifreeze and water is also generally used in diesel engines.

Table 1. Antifreeze additives commonly found in different types of regular automotive and heavy duty diesel antifreeze. (Hudgens and Bugelski, 1990; Hudgens, 1991).

Compound ¹	Function
benzoic acid	corrosion protection
benzotriazole	" "
mono and di-carboxylates	" "
sodium (or potassium) nitrate	" "
sodium (or potassium) nitrite*	" "
sodium silicate	" "
sodium molybdate*	" "
sodium mercaptobenzothiazole	" "
tolyltriazole (sodium salt)	" "
triethanolamine phosphate	buffer
sodium borate/ boric acid	buffer, corrosion protection
sodium or potassium diphosphate/phosphoric acid	buffer component
sodium hydroxide	chelating agent, scale inhibitor
organophosphate*	scale inhibitor
organophosphonate/ phosphino-carboxylate*	" "
polyacrylates*	oil dispersant
detergents*	surfactant
xylene sulfonate*	anti-foaming agent
silicone	

¹Compounds marked with an asterisk are more commonly found in heavy duty coolants than in standard automotive coolants.

METHODS

Sampling

To characterize waste antifreeze under Washington's Dangerous Waste regulations and the FTCR, representative samples were collected from a wide range of motor vehicle types in two regions of the state. Samples were analyzed for TCLP metals and organics, halogenated hydrocarbons, and percent ethylene glycol. A static acute fish toxicity test and an acute oral rat toxicity test were also run. The role of waste management practices in the potential contamination of waste antifreeze was assessed by sampling at two points in the waste-stream: 1) directly from the vehicles; and 2) at the point of delivery to recycling facilities.

Site Selection. A total of 6 sites were sampled during the course of the study. At three of the sites (generators), samples were taken directly from vehicle radiators. The remaining three sites (recycler sites) were all recycling facilities and samples were taken either from tanker trucks or 55 gallon collection drums. Generator sampling sites included: 1) an automobile service station; 2) a radiator repair shop; and 3) a diesel fleet facility. Two of the sites were located in western Washington and the third was located in the eastern part of the state. Two of the three recycling sites were also located in western Washington while the third was located in eastern Washington (Spokane). Sampling locations are shown in Table 2.

The following criteria were used in selecting vehicular (generator) sampling sites;

- sample a variety of business expected to produce waste antifreeze;
- facilities located in different regions of the state;
- high volume of business; and
- wide variety of models (foreign, domestic) and ages of vehicles available.

Facilities that used chelating agents to enhance radiator flushing, were eliminated from consideration. Where possible, vehicle owners were asked to fill out a questionnaire, which was used to help assess the history of the vehicles being sampled. Data on the sources of antifreeze sampled at each of the vehicle and recycle sites is included in Appendix A.

Only two large-scale antifreeze recyclers currently serve Washington state. One of these (Clean Care Corp., Tacoma, WA) picks up antifreeze from both eastern and western Washington. At the time of sampling, the other recycler (Antifreeze Environmental Service Corp., Tacoma, WA) served only western Washington. Samples were collected from both western Washington (Tacoma) facilities, as well as at an eastern Washington (Spokane) collection location.

Table 2. Site Locations for Waste Antifreeze Study.

Type of Site	Site Name	Site Location	Date	# of vehicles sampled per site
Radiator Shop	Walt's Radiator & Muffler	517 E. 4th Ave. Olympia, WA	2/27/91	5
Diesel Fleet Service	Pacific Coast Truck Center	2312 Milwaukee Way, Tacoma, WA	2/28/91	6
Service Station	Firestone	W. 305 3rd Ave. Spokane, WA	3/7/91	6
Recycler	Antifreeze Environmental Service Corp.	1400 15th St. E. Tacoma, WA	3/6/91	4
Recycler	Clean Care Corp. Tacoma, WA	224 Port of Tacoma Rd. Tacoma, WA	3/5/91	6
Recycler	Clean Care Corp. Tacoma, WA	Spokane, WA	3/7/91	5

Collection Methods. All samples were collected within the two-week period from February 2 1991 - March 8, 1991. At each location, samples were collected during a single day and were composited upon return from the field. Chain of custody procedures were followed for collections. All samples were stored on ice at 4°C until being transported to the Ecology/EI Environmental Laboratory at Manchester, Washington.

Vehicles were sampled as they came into the facility, without regard to model, age, or mileage. Preferentially, vehicles which had come in specifically to have their antifreeze changed were sampled. In other cases, samples were taken from vehicles which had come into the facility for other reasons. In the case of vehicles on site for reasons other than an antifreeze change, they were sampled if they met the following criteria: 1) they were not in the shop for an engine problem that could have contaminated the coolant system; and 2) the estimated time of the last antifreeze change was one year or more. All samples were grabs taken directly from the radiator petcock or radiator hose. Coolant was allowed to run out of the radiator briefly before a sample was collected. Samples were collected directly into priority pollutant cleaned glass containers with teflon-lined lids supplied by I-Chem, Hayward, California. Half-gallon jars were used for semivolatiles and 40 mL glass containers with teflon septa were used to collect volatiles. With the exception of the VOAs, composite samples (each representing equal aliquots)

from 5-6 individual vehicles) were homogenized in a priority-pollutant cleaned one-gallon glass container. Homogenization was accomplished by stirring with a stainless steel spoon. The composite sample was then split into subsamples for analysis. Spoons used in compositing samples were pre-cleaned with sequential washes of: LiquiNox® detergent, hot tap water, 10% nitric acid, deionized water, pesticide-grade acetone, and air dried and wrapped in foil until used. Equal aliquots from the individual VOA samples were composited into 125 mL glass VOA containers with teflon septa. Mixing was achieved by inverting the sealed 125 mL VOA containers several times.

Recycler samples were collected directly from trucks that had just come in from making antifreeze collections. Trucks generally go out several times a week to pick up antifreeze from generators. Each truck-load includes waste antifreeze from an average of 3-5 generators. One of the recyclers (Antifreeze Environmental Service, Tacoma, WA) collects waste antifreeze in a tanker truck. The other recycler (Clean Care Corp., Tacoma, WA) picks up 55 gallon drums of waste antifreeze from generators. Samples were therefore collected either from a tanker truck or out of drums, using a 2-inch diameter bottom emptying teflon bailer, lowered to the bottom of the tanker chamber or drum. Each drum sampled represented a pick-up from a different generator. A single bailer was used to sample from all drums at any one site. Prior to sampling, solution from the drum being sampled was used to rinse out the bailer. Samples were composited and split as described above for the vehicle sites. All sampling equipment (bailers, spoons) used for homogenizing samples was pre-cleaned prior to use, as described above for vehicle samples. Sample storage and handling procedures were identical to those described for the vehicle samples.

Analyses

The following analytical tests were carried out on each composite sample: TCLP (metals, volatiles, and semivolatile organics), halogenated hydrocarbons, total solids, and percent ethylene glycol. No analyses were carried out for TCLP pesticides and herbicides. Two bioassays were also run on each composite sample: a static acute fish toxicity test (one concentration: 1000 mg/L, test organism: *Oncorhynchus mykiss*); and, an acute oral rat toxicity test (one concentration: 5000 mg/kg). A Beckman 21 pH meter with combination electrode was used to test the pH of individual samples in the field prior to compositing. A complete list of analytes, analytical methods and laboratories used in the study are listed in Table 3.

Quality Assurance

Quality control samples included field duplicates, method blanks, matrix spikes and spike duplicates, surrogate spike analyses, and reference standards.

Laboratory precision, calculated as matrix spike/matrix spike duplicate relative percent difference (RPD) values (range as percent of mean), was excellent for TCLP metals and VOAs being $\pm 7\%$ and $\pm 17\%$ respectively. In the case of semivolatile analyses, some percent recoveries and all

Table 3. Analytical methods for waste antifreeze.

Analysis	Method	Reference	Laboratory
<u>TCLP</u>			
Volatiles Benzene, carbon tetrachloride, chlorobenzene, chloroform, 1,2 dichloroethylene, methyl-ethyl-ketone, tetrachloroethylene, vinyl chloride, trichloroethylene	GC/MS purge-trap (EPA SW846-1311)	Fed. Reg. 1990	Ecology/EPA Manchester Lab Manchester, WA
Semivolatiles m-cresol, o-cresol, p-cresol, 1,4 dichlorobenzene, dinitrotoluene, hexachloro-1,3-butadiene, hexachloroethane, nitrobenzene, pyridine, pentachlorophenol, 2,4,5 trichlorophenol, 2,4,6 trichlorophenol	GC/MS (EPA SW 846-1311)	"	Ecology/EPA Manchester Lab
Metals arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver	ICP, CVAA (EPA SW846-1311)	"	Sound Analytica Services, Tacoma WA
% Solids	pressure filtration (EPA SW 846-1311)	"	Ecology/EPA Manchester Lat
Halogenated Hydrocarbons	extraction/combustion ISE probe	Ecology, 1982b	North Creek Analytical Bothell, WA
% Ethylene glycol/ diethylene glycol	GC, FID detector	Manchester in-house	Ecology/EPA Manchester La
pH	pH meter	-	field

Table 3. (Continued)

Analysis	Method	Reference	Laboratory
BIOASSAYS			
Acute fish (1 conc./1000mg/L)	static acute 96-hr.	Ecology, 1981	Ecology/EPA Manchester Lab
Oral rat (1 conc./5000mg/kg)	14-day	Ecology, 1981	Bio-Technics Laboratories Los Angeles, CA

RPD values calculated for matrix spike/matrix spike duplicates exceeded Contract Laboratory Program (CLP) QC control limits for one set of matrix spike samples due to severe matrix spike interference. RPD values and percent recoveries for the other set of matrix spike samples exceeded CLP control limits for 1,4-dichlorobenzene, hexachloroethane, and hexachlorbutadiene only. Overall precision (sample collection + laboratory), calculated from field duplicates (a single sample homogenized and split in the field) was good for percent ethylene glycol (RPD = $\pm 27\%$). RPD values for field duplicates analyzed for halogenated hydrocarbons were quite variable and ranged from 9%-110% (see organics discussion below).

The quality of TCLP metals data was reviewed by Craig Smith of the Ecology/EPA Manchester Laboratory. In the opinion of the reviewer, all the metals data were acceptable for use without qualifications.

TCLP organics data were reviewed by Dickey Huntamer of the Ecology/EPA Manchester Laboratory. Water surrogate spike recoveries for the semivolatiles were within normal CLP limits with the exception of d5-phenol and d10-pyrene. Surrogate recoveries for the VOAs were within CLP limits with the exception of 1-bromo-2-fluoroethane in one sample. CLP recovery limits are not intended for use with TCLP, and therefore should be considered to be only advisory in nature. Low levels of methyl-ethyl-ketone were found in the laboratory blanks for the VOA. The EPA "five times" rule was applied to all target compounds found in the blanks.

Poor recoveries and elevated detection limits obtained for several of the semivolatile organics are most likely related to preferential partitioning of the analytes between ethylene glycol and the extraction solvent (i.e. as the percentage of ethylene glycol increased extraction efficiency of the solvent decreased). Interferences from the oil and large amounts of benzoic acid in some samples also contributed to lower recoveries and higher detection limits. In addition, difficulties associated with homogenizing an oily matrix are probably responsible for the variable results noted above for duplicate analysis.

EPA Method 1311 (TCLP) Section 8.2.5 states that measured values should be corrected for analytical bias. Matrix spike recovery bias corrections are not shown for any of the TCLP data. In the opinion of the Manchester Lab Quality Assurance Section, recovery correction applied to samples with differing matrices may introduce significant error in the reported concentration. For comparison when recovery corrections are applied to the data, no additional values were found to exceed the regulatory limits.

All samples were analyzed within the recommended holding times for TCLP metals and semivolatiles. In the case of the volatile analyses, re-analysis of two samples for high levels of tetrachloroethylene exceeded holding times. One set of matrix spikes were analyzed after the holding time, but since these values are used to determine matrix effects on the analysis, additional holding time should have no significant effect on the spike recoveries. Volatile organics in sample 10-8081 were analyzed after the holding time. A "J" or estimated value qualifier was added to all data for which holding times were exceeded (Table 6).

Halogenated hydrocarbons were analyzed by North Creek Analytical of Bothell, Washington using the method described in WDOE 83-13, "Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulation." The quality of the data was reviewed by Stuart Magoon of the Ecology/EPA Manchester Laboratory. In the opinion of the reviewer, the results can reliably be used to assess whether the samples exceeded the regulatory limit of 100 ppm. Values below 100 ppm are considered estimates only, due to method blank contamination. In an attempt to quantify halogenated hydrocarbon levels below 100 ppm, Seacore Analytical Services of Tacoma, Washington, performed a modified version of the test which included a solvent extraction and coulometric titration. These results confirmed that halogenated hydrocarbon levels were below the 100 ppm regulatory level in all samples tested.

The LC_{50} for the reference toxicant used in the static acute fish toxicity test was within the normally expected range of values for the species used. Weight changes were comparable between control and test groups of Sprague-Dawley rats used in the acute oral rat toxicity bioassay.

Case narratives and quality assurance reviews of all data are included in Appendix B.

RESULTS

Samples taken at generator sites included vehicles ranging in age from 3-25 years, and mileages ranging from 35,000 to 530,000 miles (diesel truck). Both domestic and foreign vehicles were represented, as well as both copper-brass and aluminum radiator types. Recycled samples included waste antifreeze collected from car dealers, fleets, heavy equipment and marine transportation sources. Estimated quantities of new antifreeze used at vehicle repair shops ranged from 10-165 gallons per month. Recyclers reported collecting from 1000 to 10000 gallons of waste antifreeze per month (Appendix C).

The results of halogenated hydrocarbons, percent ethylene/diethylene glycol and pH analysis are summarized in Table 4.

Table 4. Summary of halogenated hydrocarbons, percent ethylene glycol/diethylene glycol and pH analyses for waste antifreeze study.

Site Name/Sample #	Total Halogens (ppm)	% ethylene glycol	pH range*
Vehicle sites			
Walt's Radiator, Olympia 09-8083	20 JB	49	7.9-10.2
Pacific Coast Truck, Tacoma 09-8084	37 JB	43	8.5-9.8
Firestone, Spokane 10-8085	18 JB	51	7.8-9.3
Recycler Sites			
Antifreeze** Environmental, Tacoma 10-8080/8086	40 JB	19	7.4
Clean Care, Tacoma** 10-8081/8087	43 JB	36	8.0-9.0
Clean Care, Spokane** 10-8082/8086	52 JB	41	7.8-8.5

* pH values represent range of values found in waste antifreeze from the individual generators making up each composite sample.

** Halogenated hydrocarbon and percent ethylene glycol values for all 3 recycler sites reported as mean of field duplicates.

U = not detected at detection limit shown

J = Estimated value

B = Also detected in method blank

All values for organic chloride were below the regulatory limit of 100 ppm (.01%). While concentrations below 100 ppm are considered to be estimates only, some trends in the data may be observed. Halogenated hydrocarbons were lowest in the vehicle site samples. Among the recycler samples, the highest values were measured in samples from in the Clean Care, Spokane.

The mean percent ethylene glycol by volume for all samples was 37% (range: 17%-51%). Higher values were found in the vehicle samples (mean=48%) than in the recycler samples (mean=31%). Samples from eastern Washington had slightly higher values (mean=44%) than those from western Washington (34%). A sample of new (unused) Texaco antifreeze taken directly from a fresh container, yielded a concentration of 97% ethylene glycol.

pH values measured in the field ranged from 7.4-10.2 for all samples. Values did not appear to differ markedly between vehicle and recycler sites.

The results of TCLP metals analyses are presented in Table 5. Only lead, and barium were found at detectable levels in antifreeze samples. Barium occurred at low levels in all samples (range= 0.1-0.6 mg/L). The highest concentration of barium (0.6 mg/L, reported as the mean of duplicate samples) was found in one of the recycler samples (Antifreeze Environmental Service). Lead levels in recycler samples ranged from <0.5-2.8 mg/L, while lead was not detected in any of the vehicle samples (0.1 mg/L detection limit). The highest levels of lead were present in samples from Clean Care Corp., (Tacoma and Spokane samples). Mean concentrations for Clean Care were 2.7 mg/L and 2.8 mg/L for Tacoma and Spokane, respectively. All values for TCLP metals were at concentrations below the regulatory thresholds.

Results of TCLP organics analyses of waste antifreeze samples are shown in Table 6. TCLP organic compounds were detected in waste antifreeze samples. These included o-cresol, benzene, methyl-ethyl-ketone, and tetrachloroethylene. o-Cresol and methyl-ethyl-ketone were each detected in 1 out of 9 samples (490 µg/L, 520 µg/L, respectively). Benzene was found in 3 out of 9 samples (range=2.5-630 µg/L) and tetrachloroethylene occurred in 2 of 9 samples (2300 and 2600 µg/L). Benzene was found at one of the vehicle sites and in two of the recycler samples. Tetrachloroethylene and methyl-ethyl-ketone (both solvents) were only detected in recycler samples. Only one sample exceeded the TCLP regulatory limit for benzene (630 µg/L, Walt's Radiator and Muffler, Olympia). Two samples exceeded the TCLP regulatory limit for tetrachloro-ethylene (Clean Care, Tacoma and Spokane sites; 2300 and 2600 µg/L, respectively). The remaining two analytes detected were well below regulatory limits.

No mortality was observed in the trout bioassay for any of the vehicle samples and occurred in two of the recycler samples. 26.7% mortality was observed in the Clean Care Spokane sample (8 deaths out of 30). These results indicate that the LC₅₀ was greater than 1000 mg/L for all samples. The samples therefore do not designate as a dangerous waste under Chapter 173-303-101 WAC as determined by this test.

No mortality was observed in the oral rat bioassay for any of the samples. Physiological and behavioral changes in the test animals were also not observed for any of the samples. Pathological abnormalities were not evident. The acute LD₅₀ for all samples was greater than 5g/Kg body weight. The samples would, therefore, not be considered to be a dangerous waste under Chapter 173-303-101 WAC, as determined by this test.

Table 5. Results of analyses for TCLP metals in waste antifreeze (mg/L).

Vehicle Sites				
Site Sample #	WR 09-8083	PT 09-8084	FS 10-8085	Regulatory Limit
Arsenic	0.2 U	0.2 U	0.2 U	5.0
Barium	0.2	0.2	0.1	100.0
Cadmium	0.1 U	0.1 U	0.1 U	1.0
Chromium	0.1 U	0.1 U	0.1 U	5.0
Lead	0.1 U	0.1 U	0.1 U	5.0
Mercury	0.02 U	0.02 U	0.02 U	0.2
Selenium	0.3 U	0.3 U	0.3 U	1.0
Silver	0.1 U	0.1 U	0.1 U	5.0
% solids	0.5 U	0.5 U	0.5 U	-

Recyclers			
Site Sample #	AE* 10-8080/8086	CCW* 10-8081/8087	CCE* 10-8082/8088
Arsenic	0.2 U	0.2 U	0.2 U
Barium	0.6	0.2	0.4
Cadmium	0.1 U	0.1 U	0.1 U
Chromium	0.1 U	0.1 U	0.1 U
Lead	0.5 U	2.7	2.8
Mercury	0.02 U	0.02 U	0.04 U
Selenium	0.3 U	0.3 U	0.3 U
Silver	0.1 U	0.1 U	0.1 U
% Solids	0.5 U	0.5 U	0.5 U

* = Reported as mean of duplicate analyses.

U = Not detected at detection limit shown.

Key to site names:

WR = Walt's Radiator, Olympia

PT = Pacific Coast Truck, Tacoma

FS = Firestone, Spokane

AE = Antifreeze Environmental Service, Tacoma

CCW = Clean Care, Tacoma

CCE = Clean Care, Spokane truck

Results of TCLP Organics Analyses for Waste Antifreeze Study. All values in $\mu\text{g/L}$.

Sample #	Vehicle Samples			Recycler Samples			Detection Frequency	TCLP ¹ Limit	No. of Exceedances
	Walt's Radiator Repair 09-8083	Pacific Coast Truck Center 09-8084	Firestone 10-8085	Antifreeze* Environmental 10-8080/10-8086	Clean Care* Tacoma 10-8081/10-8087	Clean Care* Spokane 10-8082/10-8088			
Acetone	50 U	50 U	500 U,J	150 U,J	380 U,J	380 U,J	0/9	200,000	0
Benzene	40 U	490	400 U	120 U	300 U	300 U	1/9	200,000	0
Bromobenzene	40 U	40 U	400 U	120 U	300 U	300 U	0/9	200,000	0
Bromotoluene	40 U	40 U	400 U	110 U,J	300 U	300 U	0/9	7,500	0
Chlorobenzene	40 U	40 U	400 U	110 U,J	300 U	300 U	0/9	130	0
Chlorophenol	100 U	100 U	1,000 U	300 U	750 U	750 U	0/9	500	0
Diethylbenzene	100 U	100 U	1,000 U	300 U	750 U	750 U	0/9	3,000	0
Dibenzene	40 U	40 U	400 U	120 U	300 U	300 U	0/9	2,000	0
Dibromobenzene	40 U	40 U	400 U	120 U	300 U	300 U	0/9	100,000	0
Dibromophenol	200 U	200 U	2,000 U	600 U	1,500 U	1,500 U	0/9	5,000	0
Dichlorophenol	25 U	25 U	250 U	70 U	190 U	190 U	0/9	400,000	0
Trichlorophenol	200 U	200 U	2,000 U	600 U	1,500 U	1,500 U	0/9	2,000	0
Trichlorophenol	100 U	100 U	1,000 U	300 U	750 U	750 U	0/9	500	1
Tetrachloroethene	630	50 U	50 U	30 U,J	370 J	190	5/9	500	0
Tetrachloroethene	50 U	50 U	50 U	35 U	30 U,J	50 U	0/9	100,000	0
Trichloroethene	50 U	50 U	50 U	35 U	30 U,J	50 U	0/9	6,000	0
Trichloroethene	50 U	50 U	50 U	30 U,J	30 U,J	50 U	0/9	500	0
Trichloroethene	50 U	50 U	50 U	35 U	30 U,J	50 U	0/9	700	0
Trichloroethene	50 U	50 U	50 U	35 U	30 U,J	50 U	0/9	200,000	0
Trichloroethene	50 U	50 U	50 U	35 U	30 U,J	50 U	0/9	700	3
Trichloroethene	280 U,J	180 U,J	50 U	60 U	2,300 J	2,600 J	5/9	200	0
Trichloroethene	50 U	50 U	50 U	35 U	30 U,J	50 U	0/9	500	0
Trichloroethene	50 U	50 U	50 U	35 U	30 U,J	50 U	0/9	500	0
Trichloroethene	50 U	50 U	50 U	35 U	30 U,J	50 U	0/9	500	0

Values in bold print exceed the regulatory limit for that analyte.

Qualifiers

DISCUSSION

Table 7 summarizes all TCLP analytes detected or exceeding regulatory levels in the present study including several additional waste antifreeze samples taken by the Department of Ecology's Southwest Regional Office (SWRO).

Of the nine samples analyzed during the present study, benzene in one vehicle sample (sample no. 09-8083) and tetrachloroethylene in three of the six recycler samples (sample nos. 10-8087) and 10-8082/8088) were the only TCLP constituents that exceeded regulatory limits in waste antifreeze. All values for halogenated hydrocarbons were below the regulatory limit. The LC_{50} was greater than 1000 mg/L for all samples, as indicated by the static acute fish toxicity bioassay. The LD_{50} exceeded 5gm/Kg body weight for the oral rat toxicity test. Waste antifreeze would therefore not be classified as a dangerous waste, based upon these two bioassays alone. The mean percent ethylene glycol for all samples was 37%. Percent solids as determined under TCLP were below 0.5% in all but one sample.

In December, 1990, Ecology's Southwest Regional Office (SWRO) took three waste antifreeze samples at a recycling facility located in Tacoma, Washington (Northwest Processing). In general, results from these samples confirm the results found in the present study. Benzene and tetrachloroethylene were the only two compounds that caused one of the three samples to designate as a dangerous waste under Chapter 173-303 WAC.

Barium and lead were detected at low levels (0.4-0.5 mg/l and <0.1-3.6 mg/l, respectively) in the SWRO samples, when analyzed under TCLP. Silver and chromium were also detected at low levels (<0.1-0.6 mg/l and <0.1-0.4 mg/l, respectively).

TCLP organics analysis found benzene (2600 ug/L) and tetrachloroethylene (950 ug/L) to be present at levels exceeding the TCLP regulatory limits (500 ug/l and 700 ug/l, respectively) in one of the samples collected by the SWRO. This sample (#507254) was taken from a 10,000 gallon waste antifreeze storage tank, that contained antifreeze which had been processed through an oil-water separator. Methyl-ethyl-ketone was also detected in sample #507254 at low levels (500 ug/l). Seven other organic compounds typically used as solvents but not on the TCLP organics list, were also detected in some or all of the SWRO samples. These included: acetone (1400-4800 ug/l), xylene (<250-7400 ug/l), 1,1,1-trichloroethane (750 - 50,000 ug/l), methylene chloride (<250-960 ug/l), toluene (<250-22,000 ug/l), ethylbenzene (<250-1200 ug/l), and 4-methyl-2-pentanone (<500-1900 ug/l). Halogenated hydrocarbons were detected at low levels in one of three SWRO samples (13 mg/l).

An acute oral rat bioassay performed on the SWRO samples determined that the acute LD_{50} greater than 5g/Kg body weight. The samples would therefore not be considered a dangerous waste under Chapter 173-303-101 WAC, based upon the results of this test alone.

Table 7. Summary of TCLP compounds detected in waste antifreeze samples.

Location/ Sample Number.	Metals (mg/l)					Organics (ug/l)			Tot Cres
	Barium	Lead	Mercury	Silver	Chromium	Benzene	Methyl- ethyl- ketone	Tetra- chloro- ethylene	
Regulatory ¹ Limit	100	5.0	0.2	5.0	5.0	500	200,000	700	200,0
I. Vehicles									
Walt's 09-8083	0.2	0.1 U	0.02 U	0.1 U	0.1 U	630	280 UJ	50 U	40
Pacific Truck 09-8084	0.2	0.1 U	0.02 U	0.1 U	0.1 U	50 U	180 UJ	50 U	490
Firestone 10-8085	0.1	0.1 U	0.02 U	0.1 U	0.1 U	50 U	50 U	50 U	40x
II. Recyclers									
Antifreeze Environmental* 10-8080/8086	0.6	0.5 U	0.02 U	0.1 U	0.1 U	30 UJ	150 UJ	60 U	12
Clean Care Tacoma* 10-8081/8087	0.2	2.7	0.02 U	0.1 U	0.1 U	370 J	70 U	2300 I	30
Clean Care Spokane* 10-8082/8088	0.4	2.8	0.04 U	0.1 U	0.1 U	190	520	2600 I	30
SWRO Samples- Northwest Processing, Tacoma									
507251	0.5	3.3	.009	0.3	0.1 U	250 U	500 U	400	20
507252	0.4	0.1 U	.006	0.6	0.1 U	250 U	500 U	250 U	20
507254	0.4	3.6	.005	0.1 U	0.4	2600	500	950	3

¹ = Values in bold print exceed the TCLP regulatory limit for that analyte.

U = not detected at the detection limits are not shown here.

* = Reported as mean of field duplicates.

J = Estimated value.

Previous studies have suggested that elevated levels of metals (particularly lead) might be present in waste antifreeze (California Department of Health Services, 1986, 1987; Hudgens, 1991). Our results indicated that although lead was detectable in waste antifreeze, it was not present at concentrations exceeding regulatory thresholds. Similar results were found in the samples taken by SWRO. Trace amounts of barium were also found in some samples. Interestingly, no lead was detected in samples of antifreeze taken directly out of vehicle radiators, although lead was detected in samples taken at recycling facilities. A sample taken by SWRO from a 10,000 gallon waste antifreeze storage tank and analyzed using TCLP, contained lead at concentrations below regulatory limits (3.6 ppm). This sample presumably represented a broad cross-section of the waste-stream, and confirmed the results of the present study. These data suggest that waste antifreeze may not generally designate as a dangerous waste for metals. At the present time, most radiators are constructed of copper and brass, with a lead-based solder. As the production and use of aluminum radiators and welded (rather than soldered) copper-brass radiators increases, the amount of lead getting into used antifreeze should decrease correspondingly.

Benzene was present at concentrations exceeding the TCLP regulatory limit at one of the three generator sites (sample #09-8083), but was not detected at the remaining two sites. Hudgens (1991), has found benzene in samples taken directly out of diesel truck radiators by Fleetguard Corp. an estimated 15% - 20% of the time. Since benzene is not an additive in antifreeze, it is probable, that the source of benzene in sample #09-8083 was an engine or oil cooler problem in one or more of the cars included in the composite sample. Cars were screened to insure that they were not at the shop for an engine-related problem, but this would not have precluded the inclusion of some vehicles with engine or oil cooler problems unknown to the owner. Benzene was present in all three recycler samples, although not at regulated levels. Engine difficulties in the contributing vehicles and poor shop management practices probably were both factors in these findings. Incidental observations made at service stations during the study, indicated that oily pans were sometimes used to catch antifreeze. With the exception of benzene, no other TCLP organics occurred at regulated levels in any of the samples taken directly from vehicles.

Tetrachloroethylene, a solvent, was found at regulated levels in two of the three recycler samples. Since tetrachloroethylene is not an antifreeze additive, solvents were probably getting into the antifreeze as a result of poor waste management practices. This interpretation is supported by handling practices observed during sampling. A thick layer of oil was visibly present on all of the recycler samples, although no oil was visible on any of the samples taken directly from vehicle radiators. Although oil can end up in antifreeze from an engine or oil cooler problem, this again strongly suggests the existence of poor waste management practices. Waste management practices followed at each site are described in Appendix D.

None of the samples designated on the basis of the halogenated hydrocarbon or bioassay results. Results obtained by SWRO concurred with these findings.

CONCLUSIONS

1. Barium and lead were detected in waste antifreeze at levels below TCLP regulated levels.
2. Benzene and Tetrachloroethylene were the only two organic compounds found to exceed TCLP limits in waste antifreeze. Benzene exceeded TCLP regulatory limits in one vehicle sample, while tetrachloroethylene exceeded TCLP limits in three of the six recycler samples. Consequently, 44% of the samples tested designate as a dangerous waste, based on TC organics results.
3. The presence of solvents in recycler samples and the lack of these compounds in vehicle samples suggests that waste management practices are, in fact, influencing contaminant levels found in waste antifreeze. Thick layers of oil found in the recycler samples also tend to support this conclusion.

RECOMMENDATIONS

1. Segregate spent antifreeze from other waste streams to reduce contaminant levels.
2. The samples collected included a broad range of vehicle types and ages and are probably representative of the antifreeze waste-stream as a whole. Results indicate the status of the antifreeze, but fall short of full characterization of the entire waste-stream due to limitations in the number of samples. Additional studies with larger sample sizes would be required to answer specific questions including the actual proportion of waste antifreeze likely to designate as a dangerous waste based on concentrations of benzene and tetrachloroethylene or some other compound.

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Appendix A

Data on Sources of Antifreeze Sampled at Vehicle
and Recyclers Sites

Appendix 1a. Sources of antifreeze making up vehicle samples.

Site Name/ Sample #	Av. Age of vehicles (yrs)	Av. mileage of vehicles	pH range of anti- freeze	Vehicle types	Radiator types
Watts Radiator, Olympia 09-8083	11 (range: 5-16)	100,000 (range: 40,000- 200,000)	7.9- 10.2	all domestic	all copper- brass
Firestone Spokane 10-8085	17 (range: 3-25)	90,000 (range: 35,000- 115,000)	7.8- 9.3	33% foreign 67% domestic	17% aluminum 83% copper brass
Pacific Coast Truck Ctr Tacoma 09-8084	11	230,000 (range: 100,000- 530,000)	8.5- 9.8	all domestic	all copper- brass

Appendix 2a. Sources of antifreeze making up Recycler samples.

Recycler Name	Sample No.	Sources	Vol. of antifreeze collected from each source (gal)	% of total
Antifreeze Environmental Tacoma	10- 8080,	marine	720	76
		heavy equipment	130	14
	10- 8086	fleet	50	5
		car dealer(foreign)	50	5
		Total =	950	
Clean Care Tacoma	10- 8081,	car dealer(domest.)	110	18
		car dealer (foreign)	495	82
	10- 8087		Total =	605
Clean Care Spokane truck	10- 8082	car dealer (foreign)	480	73
		fleet	65	10
	10- 8088	heavy equipment	115	17
		Total =	660	

Appendix B.

Case narratives and quality assurance reviews of data.

WASHINGTON STATE DEPARTMENT OF ECOLOGY
MANCHESTER ENVIRONMENTAL LABORATORY
Manchester, Washington 98353

DATA REVIEW

By: Craig Smith, Chemist
PROJECT: Waste Antifreeze
Lab Sample No: 098083-84, 108080-82, 85-88
Mn. La.

Report 04-11-91

HOLDING TIME:	Collected	To Manchester	Analyzed
	02-27	03-04	
	03-08	preserved 03-04	04-03-91
		preserved 03-11	
		preserved 03-11	04-03-91

Metals

Digestion: TCLP - Ethylene Glycol

HOLDING TIME: Analysis for all parameters were performed within the holding time limits.

REAGENT BLANK: The method blank showed no analyte values above the reporting detection limit.

MATRIX SPIKE: The targeted accuracy of matrix spikes is $\pm 25\%$ of the true value. All values were within the targeted limits.

SPIKE DUPLICATE: The target limits are $\pm 20\%$, or ± 1 detection limit for samples less than 5 times the detection limit. All values were within the targeted limits.

LABORATORY CONTROL SAMPLE The target is a $\pm 20\%$ recovery control limit. All values were within the targeted limits.

The data is acceptable for use without qualifications.

The results for all samples submitted gave no values above the maximum allowable concentration for TCLP.

The only parameters observed above the reporting detection limit were Pb, Ba, and in one sample, Hg. The Pb concentrations in two samples, 108081 and 108082, were 3.2 mg/L and 3.7 mg/L, respectively.

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive SE, Port Orchard Washington 98366

CASE NARRATIVE

June 5, 1991

Subject: Waste Antifreeze Project - TCLP
Samples: 91-098083, 098084, 108080, 108081, 108082, 1080885, 108086, 108087 and 108088.
Case No. DOE-268Z
Officer: Laurie Wunder
Dale Norton
By: Dickey D. Huntamer (DJ)
Organics Analysis Unit

TCLP-SEMIVOLATILE ORGANICS

ANALYTICAL METHODS:

The samples were prepared following the EPA SW 846 Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). A 50 mL aliquot of the TCLP preparation was diluted with 450 mL of organic free water to enhance the separation of the methylene chloride and ethylene glycol mixture. The semivolatil TCLP compounds were extracted using the Manchester modification of the EPA CLP procedure with capillary GC/MS analysis of the sample extracts. All of the samples except 108086 contained less than <0.5 % solids and therefore did not have to undergo the TCLP leaching. The 0.7 um filtrate was used for analysis. Sample 108086 was just over the 0.5 % residue level after filtration due to the oil in the sample. Consequently it required the TCLP leaching procedure and was prepared, along with an extraction blank, B9082. Due to the small field sample provided, less than 2.0 liters, a proportional amount of extraction fluid was used for the TCLP leaching procedure. Normal CLP QA/QC procedures were performed on the samples.

HOLDING TIMES:

The TCLP holding times allow fourteen days from date of collection to preparation of the TCLP leachate. An additional seven days is allowed from TCLP leaching to analytical extraction, then forty days until analysis. All antifreeze samples, 098083 and 098084 and the waste antifreeze samples, 108080 to 108088 and associated matrix spikes were analyzed within specified holding times.

BLANKS:

No significant blank contamination was detected in the laboratory blanks or the TCLP extraction blank.

SURROGATES:

TCLP surrogate recovery limits have not been officially established. The recommended CLP surrogate recovery limits are used as guidelines.

Water surrogate spike recoveries were within normal CLP limits for samples 098083 and 098084 except for d5-Phenol in sample 098083 which was 98 %, 4 % over the limit. Surrogate recoveries for samples 108080 through 108088 were within CLP limits for all but d10-pyrene in samples 108081 and 108082, d5-phenol in samples 108081, 108087, 108088, 108085, and matrix spikes 108080Y and 108080Z. No additional data qualifiers were added due to surrogate recoveries since the high recovery was probably due to matrix interferences.

MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

Matrix spike and matrix spike duplicate recoveries for the TCLP compounds have not been officially established however the Contract Laboratory Program QC limits have been used as guidelines. The antifreeze matrix spikes, 098084Y and Z were affected by severe matrix spike interferences resulting in the wide variation in recoveries. Compounds 1,4-dichlorobenzene, hexachloroethane and hexachlorobutadiene were outside recommended CLP limits for both recoveries and relative percent differences (RPD). The presence of benzoic acid, an antifreeze additive, caused considerable interference with the cresol (methylphenols) recovery.

Seven out of thirteen percent recoveries exceeded the CLP limits for samples 098084Y and Z. All Relative Percent Differences (RPD) were also out of CLP control limits. The poor recoveries are probably due to the high ethylene glycol concentrations in the sample.

The waste antifreeze sample, 108080 was used for matrix spikes. Spike recoveries for three compounds, 1,4-dichlorobenzene, hexachloroethane and hexachlorobutadiene were outside recommended CLP limits for both recoveries and Relative Percent Differences (RPD). The cleanest waste antifreeze sample was selected for matrix spikes but it still contained significant oil residues but much less than was present in some of the other samples where good spike recoveries would be impossible.

All other compounds in the waste antifreeze were within acceptable CLP limits for both recovery and RPD for both sets of matrix spikes. No additional data qualifiers were added to the data based on matrix spike recovery.

The concentration of ethylene glycol in sample 098084 was greater than 42 % while the waste antifreeze sample matrix spike, 108080 contained only 17 % ethylene glycol. The remaining waste antifreeze samples ranged from <0.1 % to 50+ %. If the spike results above are any indication the concentration of ethylene glycol can significantly affect the matrix spike recovery. Under TCLP, however the spike recoveries for 108080 would be used to correct the recoveries for the other waste antifreeze samples. If the ethylene glycol does affect the spike recovery then it is obvious that significant error could be introduced in the reported concentrations. An additional factor is the presence of varying amounts of lubricating oil in some of the samples and the oil's effect on spike recovery. The solution is to analyze individual matrix spikes for each sample. Obviously making spike recovery corrections would end up introducing greater errors than it purports to correct.

Due to the controversial nature of matrix spike recovery correction none of the data presented has been corrected. If the project officer desires to apply recovery correction to the data the formula is given in the TCLP procedure; Federal Register/Vol. 55, No 126/Friday June 29, 1990/ Rules and Regulations Section 8.2.5.

SPECIAL ANALYTICAL PROBLEMS:

The following notes apply to the analysis for the indicated sample.

91- 108080Y	3- and 4-methylphenol co-eluted, therefore the values reported are one-half the total of the two.
91- 108080	Benzoic acid (very high concentrations), phenol and 1,2-dichlorobenzene, (94 ug/L) was also detected in the sample.
91- 108081	Benzoic acid (massive amounts) and 1,2-dichlorobenzene (19 ug/L).
91- 108082	Benzoic acid (massive amounts) and phenol were detected.
91- 108083	Benzoic acid and Benzyl alcohol were detected.
91- 108084	Benzoic acid.
91- 108085	Benzoic acid (massive amounts)
91- 108086	Benzoic acid (high concentrations) and 1,2-dichlorobenzene (48 ug/L) and phenol were detected.
91- 108087	Benzoic acid (massive amounts) and 1,2-dichlorobenzene (21 ug/L)
91- 108088	Benzoic acid (massive amounts), phenol and benzyl alcohol.

Both the antifreeze and the waste antifreeze samples presented analytical challenges. The antifreeze, samples 098083 and 098084 contained about 50% ethylene glycol plus other additives such as benzoic acid and had to be diluted with organic free water before extraction. Without dilution the extraction solvent, methylene chloride, was too miscible and poor solvent recoveries resulted. The waste antifreeze samples, 108080 to 108088, in addition to the ethylene glycol also contained significant amounts of petroleum products including gasoline and lubricating oil. Some chlorinated hydrocarbons were also detected which along with the presence of the petroleum products reflects poor recycling technique and combining of wastes streams during recycling. The elimination of the oil from the waste antifreeze would also simplify the TCLP analysis. Very little particulate matter was found in the samples but the retention of the lubricating oil on the filters caused one sample to undergo TCLP leaching when the 0.5% residue limit was exceeded.

The type of samples represented by the antifreeze samples and waste antifreeze samples in which significant levels of TCLP compounds are unlikely to be found are prime candidates for total analysis allowed in the TCLP procedure with subsequent TCLP analysis if warranted. The total analysis also provides the advantage of determining the TCLP compound concentrations and allow matrix spiking appropriate concentrations, permitting better spike recoveries.

TCLP-VOLATILE ORGANICS

ANALYTICAL METHODS:

The samples were first prepared following the SW 846 Method 1311 TCLP procedure and the filtrates/leachates were then analyzed for volatile organics using Manchester modification of the EPA CLP purge-trap procedure with capillary GC/MS analysis. Normal CLP QA/QC procedures were performed on the samples.

BLANKS:

Low levels of 2-Butanone were detected in the laboratory blanks. The EPA five times rule was applied to all target compounds which were found in the blank. Compounds that were found in the sample and in the blank were considered real and not the result of contamination if the levels in the sample are greater than or equal to five times the amount of compounds in the associated method blank.

SURROGATES:

Surrogate recoveries were within CLP limits for all of the samples except for 1-Bromo-2-fluoroethane in sample 108083D (dilution) which exceeded the recommended CLP limits by 4%. Since the CLP limits are not intended for TCLP analysis the recovery limits should be considered advisory. No additional qualifiers were added to the data based on the surrogate recoveries.

HOLDING TIMES:

All samples were analyzed within the recommended 14 day holding time for water samples after the TCLP extraction except for 108082A, 108087A, reanalysis of samples, 108082 and 108087 for high levels of tetrachloroethene which were analyzed within holding times. Two other samples, the matrix spikes, 108082Y and 108082Z were analyzed, six days after the holding time but since these are used primarily to determine matrix effects on the analysis the additional holding time should have no significant effect on the spike recoveries. The TCLP extraction blank, AVW1119 and sample 108081 were also over holding times and the values reported have all been given the "J" qualifier indicating an estimated value. The "J" qualifier was also added to the tetrachloroethene concentrations in samples 108082 and 108087 since the values were taken from the diluted 108082A and 108087A samples which were analyzed past holding times.

MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

No spike recovery limits have been established for matrix spikes in TCLP analysis. Two sets of matrix spikes using samples, 098084 and 108082, were analyzed. All of the TCLP VOA compounds were added to the samples. The spike recoveries ranged from 74% to 136% and the Relative Percent Difference (RPD) ranged from 0% to 17%.

SPECIAL ANALYTICAL PROBLEMS:

No special problems were encountered in the VOA analysis. Several TCLP compounds were detected in the samples. These included 2-butanone, chloroform, benzene and tetrachloroethene along with traces of

several other compounds. None of these compounds would normally be expected to be present in antifreeze, particularly in sample 098083 which was a composite sample taken from several car radiators. This could indicate possible cross contamination between the engine coolant and gasoline (the most likely source). The presence of the compounds in the week ten (108080-108088) samples is probably the result of poor recycling technique, allowing different waste streams, antifreeze and oil/gasoline to be mixed. Several of the waste antifreeze samples had a noticeable gasoline odor.

ETHYLENE GLYCOL

ANALYSIS:

The ethylene glycol was analyzed by direct injection capillary Gas Chromatography using a Flame Ionization Detector. Concentrations (percent by volume) were calculated from a calibration curve prepared by analyzing ethylene glycol standards.

HOLDING TIMES:

No holding times have been established for this method.

SURROGATES:

Not applicable to this method.

MATRIX SPIKES:

Not applicable to this analysis.

SPECIAL ANALYTICAL PROBLEMS:

No special problems were encountered with this analysis. The results are presented as the percent (%) ethylene glycol by volume. Sample 91 8000BG was a sample of Texaco Antifreeze taken from a bottle and was 97% ethylene glycol.

<u>Sample Number</u>	<u>% Ethylene Glycol by Volume</u>
91 - 098083	49.4
91 - 098084	42.6
91 - 108080	17.0
91 - 108081	32.7
91 - 108082	46.7
91 - 108083	0.09U
91 - 108085	50.8
91 - 108086	20.7
91 - 108087	38.7
91 - 108088	35.5
91 - 8000BG	97.0

DATA QUALIFIER CODES:

- U - The analyte not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated value.
- D - Signifies that the associated value was derived from a secondary dilution.
- B - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- R - The data are unusable for all purposes. The presence of the analyte has not been verified.
- NAR - No Analytical Result.

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. E Port Orchard, WA. 98366

Data Review
May 13, 1991

Project: Waste Antifreeze

Samples: 108080 108081 108082 098083 098084
108085 108086 108087 108088

Laboratory: Sound Analytical Services
North Creek Analytical

By: Stuart Magoon *sm*

Halogenated Hydrocarbons

These samples were collected on February 27 & 28 and March 8, 1991.

These analyses were reviewed for qualitative and quantitative accuracy, validity usefulness.

Sound Analytical Services analyzed these nine samples using an adaptation of the Washington Dangerous Waste procedure. The analysis utilizes the petroleum extraction solvent as required by the Dangerous Waste procedure. However, the sample was only extracted once instead of three times, and analyzed using coulometric titration.

North Creek analytical extracted these samples as per the Washington State Dangerous Waste Procedure and then analyzed them with an ISE probe.

The results from North Creek Analytical are unreliable because the method contained a significant amount of chloride in relation to the samples. Since no method blank was performed it is not possible to determine whether or not this contamination is representative of the level of contamination that may be present in the sample analyses.

Results from Sound Analytical Services are more reliable, however, they were not performed in strict accordance to the Dangerous Waste Procedure.

Both results adequately demonstrate that there is no organic chloride present in any of these samples above 100 ppm (.01%).

This data is can be used to determine that these samples do not classify as dangerous waste under chapter 173-303 WAC.



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Post Office Box 307 • Manchester, Washington 98353-0346 • (206) 895-4740

March 27, 1991

TO: Laurie Wunder
FROM: Scott Noble ^{SN}
SUBJECT: Waste Antifreeze
Results of Salmonid Bioassay

SAMPLE IDENTIFICATION

Laboratory Reference Number: 09-8083 and 09-8084
Date Sample Collected: 2/27-28/91
Sample Description: 09-8083 "WR1; Waste Antifreeze;
2/27/91; 1500; LW"
Green liquid with yellow
sludge on bottom

09-8084 "CHNS-1; Waste Antifreeze;
2/28/91; 1800; LW"
Green liquid with yellow
brown sludge on bottom

METHODS

Testing for toxic properties was in accordance with the Department of Ecology procedure for "Static Acute Fish Toxicity Test." The test organism was rainbow trout (*Oncorhynchus mykiss*). The sample was tested at 1000 ppm (mg/L) by weight in water. Ten trout were added to fifteen liters of sample/water mixture in each aquarium. Dechlorinated Manchester city water was used for dilution of samples, and as a control. Three replicates were run at each concentration. Cadmium chloride (EPA/EMSL, Cincinnati) was used as a reference toxicant. Test duration was 96 hours. Length, weight, and loading data were based on measurements of control organisms at the end of the test.

TEST RESULTS

A full report of test data is attached. Mortality is summarized below.

09-8083 1000 ppm (mg/L) - 00/30 fish died = 00% mortality
09-8084 1000 ppm (mg/L) - 00/30 fish died = 00% mortality
Control - 00/30 fish died = 00% mortality

The LC50 for the cadmium chloride reference toxicant was estimated a 5.1 ug/L using the graphical method. This is within the range of values normally expected for this organism.



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Post Office Box 307 • Manchester, Washington 98353-0346 • (206) 895-4740

March 27, 1991

TO: Laurie Wunder
FROM: Scott Noble *SN*
SUBJECT: Waste Antifreeze
Results of Salmonid Bioassay

SAMPLE IDENTIFICATION

Laboratory Reference Number:	10-8080, 10-8081, 10-8082, 10-8085
Date Sample Collected:	3/8/91
Sample Description: 10-8080:	"AE-1; waste antifreeze; 3/8/91; 1600; LW" Cloudy yellow brown liquid with rust colored sludge
10-8081:	"CCW-1; waste antifreeze; 3/8/91; 2100; LW" Cloudy green brown liquid with rust colored sludge
10-8082:	"CCE-1; waste antifreeze; 3/8/91; 1900; LW" Dark green brown liquid with light brown colored sludge
10-8085:	"FS-1; waste antifreeze; 3/8/91; 1600; LW" Bright green liquid with pale yellow, fine precipitate

METHODS

Testing for toxic properties was in accordance with the Department of Ecology procedure for "Static Acute Fish Toxicity Test." The test organism was rainbow trout (*Oncorhynchus mykiss*). The sample was tested at 1000 ppm (mg/L) by weight in water. Ten trout were added to ten liters of sample/water mixture in each aquarium. Dechlorinated Manchester city water was used for dilution of samples, and as a control. Three replicates were run at

each concentration. Cadmium chloride (EPA/EHSL, Cincinnati) was used as a reference toxicant. Test duration was 96 hours. Length, weight, and loading data were based on measurements of control organisms at the end of the test.

TEST RESULTS

A full report of test data is attached. Mortality is summarized below.

10-8080	1000 ppm (mg/L)	- 00/30 fish died = 00 %mortality
10-8081	1000 ppm (mg/L)	- 00/30 fish died = 00 %mortality
10-8082	1000 ppm (mg/L)	- 8/30 fish died = 26.7% mortality
10-8085	1000 ppm (mg/L)	- 00/30 fish died = 00 %mortality
	Control	- 00/30 fish died = 00 %mortality

The LC50 for the cadmium chloride reference toxicant was estimated at 3.65 ug/L using the graphical method. This is within the range of values normally expected for this organism.

DATA REVIEW

BY: Margaret Stinson *MS*

FOR: Waste Antifreeze Study

DATE: April 12, 1991

7 was
7 Antifreeze
BioTechnics Laboratories, Inc., has submitted the attached result of Acute Oral Rat Toxicity Tests on two samples from the Waste Antifreeze Study (Sample Numbers 09-8083 and 09-8084). The samples were tested at 5 gm/Kg body weight as defined by the Washington State Department of Ecology *Biological Testing Methods*, DOE 80-(1981). No physical or behavioral changes were noted during the fourteen day test. Necropsies conducted at termination of test showed no evidence of gross pathological abnormalities. Weight changes in controls and test organisms were similar.

DATA REVIEW

BY: Margaret Stinson ^{MS}
FOR: Waste Antifreeze Study
DATE: April 24, 1991

↑ AE ↑ CEW ↑ CCE ↑ FSI
BioTechnics Laboratories, Inc., has submitted the attached results of Acute Oral Rat Toxicity Tests on samples from the Waste Antifreeze Study (Sample Numbers 10-8080, -8081, -8082, and -8085). The samples were tested at 5 gm/Kg body weight as defined by the Washington State Department of Ecology *Biological Testing Methods*, DOE 80-12 (1981). No physical or behavioral changes were noted during the fourteen day test. Necropsies conducted at termination of testing showed no evidence of gross pathological abnormalities. Weight changes in controls and test organisms were similar.

Appendix C.

Estimated Quantities of New Antifreeze Used at Vehicle Sites and
Waste Antifreeze Handled at Recycler Sites

Appendix 1c. Antifreeze usage at vehicle sites. *

Site Name	No. vehicles serviced/wk	Vol. (gal) of antifreeze used/mo.	Peak Months	Antifreeze dilution used
Walt's Radiator, Olympia	15-20	20-30	all yr.	50:50
Firestone Tire, Spokane	1-20	10**	Oct-Jan	50:50
Pacific Coast Truck Center, Tacoma	unknown	165	all year	50:50

* Information in this table represents a compilation of estimates made by store managers at each site.

** This store uses an on-site antifreeze recycling system.

Appendix 2c. Quantities of antifreeze handled at recycling sites. *

Site Name	No. of Pick-up Sites/wk	Volume of Antifreeze per month (gal)	Peak Months	Antifreeze Sources
Antifreeze Environmental Tacoma	3-5	2500-3000	all yr.	mainly fleets and car dealers; a few service stations, radiator shops, marine operations, airports
Clean Care, Tacoma	35	9000-15,500	Nov-Jan	car dealers, fleets, service stations
Clean Care, Spokane truck	5	1000-2500	Nov-Jan	car dealers, fleets, service stations

* Compilation of estimates made by recycling facility managers.

Appendix D

Waste Antifreeze Management Practices at Sampling Sites

Appendix 1d. Waste antifreeze management practices at sampling sites.

Vehicle Sites

Walt's Radiator and Muffler - According to the store manager, drainage pans were only used for antifreeze and not for used oil. Drainage pans observed at the site did not appear to have oil in them.

Pacific Coast Truck Center - The store manager stated that drained antifreeze was caught in pans, which they tried to keep separate from pans used for oil. However, pans used to drain antifreeze at the site were observed to be oily. Used antifreeze was stored at the site in 55 gallon drums, which were picked up and recycled by Clean Care Corp., Tacoma.

Firestone- This site used an "in-house" antifreeze recycling system (Wynn Oil Company Mark X Recycling System). Coolant is pumped out of the radiator and filtered and treated (with various additives) by the system. The processed antifreeze is then returned to the radiator. According to the store manager, any additional antifreeze that was collected at the site was put into a 55 gallon drum and stored on site. It was eventually picked up by a hazardous waste company. Shop workers stated that they mixed waste streams in the storage drum. Waste oil and transmission fluid thus probably contaminate this drum. Some of the pans used to collect drained antifreeze were coated with oil or had oil filters sitting in the pans.

Recycler Sites

A thick layer of oily material was visibly present on all the recycler samples.

Antifreeze Environmental Service- A tanker truck was used to pick up and deliver antifreeze. Many of their customers use a polyethylene container provided by the company to collect their waste antifreeze at the site. Customers were told to use clean drain pans to collect antifreeze and to segregate their waste streams.

Clean Care Corp.- Customers collected waste antifreeze in 55 gallon drums. Drums were picked up by Clean Care when they were full. Customers were told to keep their waste-streams separate.

Reference 2

"Waste Antifreeze TCLP Data", Safety-Kleen Corporation, June 1991



4411 CND-14
2-10-92
Anna - FLS
Dave

February 4, 1992

Ms. Sylvia K. Lowrance
Director, Office of Solid Waste
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Sylvia:

In July of 1991, I sent a report to Don Clay regarding data we generated on used antifreeze using the Toxic Characteristic Leaching Procedure (TCLP) (copy of report is enclosed). Late last year we republished that report incorporating more information on how the data was generated. A copy of this report, dated November 1991, is enclosed for your use. Since this data was generated in an effort to evaluate the waste Safety-Kleen collects, we took the samples from containers at customers facilities. Consequently, the samples represent a mixture of used antifreeze taken from a number of different automobile radiators.

I appreciate your interest in this issue. Should you or your staff have any questions, please feel free to contact me.

Sincerely,


Basil G. Constantelos
Director - Environmental Affairs

BGC/bb

Enclosures

cc: U.S. EPA Hazardous Waste Management Division Directors - Regions I - X

SAFETY-KLEEN CORPORATION

MANTEUFFEL TECHNICAL CENTER
ELK GROVE VILLAGE, IL

WASTE ANTIFREEZE TCLP DATA

JUNE 1991

SAFETY-KLEEN CORPORATION

MANTEUFFEL TECHNICAL CENTER
ELK GROVE VILLAGE, IL

WASTE ANTIFREEZE TCLP DATA

JUNE 1991



July 17, 1991

Mr. Don R. Clay
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Don Clay:

During 1991 Safety-Kleen Corp. began handling all waste antifreeze as hazardous waste due to preliminary data generated using the Federal Toxicity Characteristic Leaching Procedure (TCLP). We have now completed our study and have enclosed a copy of our report for your agency's use. The report summarizes data from over 100 samples which show that antifreeze is TCLP hazardous for lead and perchloroethylene. Specifically, 47% of the samples tested hazardous for lead, while 39% were hazardous for perchloroethylene. In combination 58% of all samples taken were hazardous for lead, perchloroethylene, or both.

Safety-Kleen has notified its antifreeze customers that we will handle the waste antifreeze only as hazardous waste, unless they can provide TCLP data which establishes that the specific shipment is not.

I would very much appreciate any efforts you might take to disseminate this information within your organization, since some of our customers have had difficulty in obtaining RCRA identification numbers necessary to allow the handling of these wastes. It appears that some states and regional offices have not granted I.D. numbers because they do not believe antifreeze is hazardous waste.

Should you or your staff have any questions about these results, please contact me.

Sincerely,


Basil G. Constantelos
Director - Environmental Affairs

BGC/bb
Enclosure

cc: Sylvia K. Lowrance, Director - Office of Solid Waste
U.S. EPA Hazardous Waste Division Directors Regions 1 - 10
State Solid and Hazardous Waste Directors

The results on lead and perc are not surprising. Though it is being phased out of new radiator production, lead remains a common component of radiator solder. Perc is commonly used by auto manufacturers as a degreaser of radiators prior to installation.

Note that even the average values of lead and perc each exceed the EPA threshold. The computed data upper limit (using the Weibull distribution) greatly exceeds the threshold for both contaminants.

ASTM Data

Data on waste vehicular antifreeze published independently by the ASTM D15 Committee on Engine Coolants are shown in Exhibit 2. Note that over 60% of samples tested contained lead at a levels exceeding the EPA threshold. Both the shape of the data distribution and the percentage of samples that are hazardous compare similarly to Safety-Kleen's data.

Other Contaminants

Other hazardous contaminants, such as benzene, were found present in a few of the samples tested. The prevalence of benzene in auto shops via gasoline and solvents will, through cross-contamination, cause some batches to occasionally exceed its EPA threshold.

Conclusion

Lead and perc are typical contaminants of waste vehicular antifreeze. Both are naturally present in the manufacture of automobiles. Both Safety-Kleen and independent ASTM data show that more than 50% of randomly collected antifreeze samples were found to be TCLP-hazardous. In addition, other hazardous contaminants from gasoline and commonly used solvents may be present due to cross contamination in auto shops.

The preponderance of data supports the conclusion that waste antifreeze must in general be considered a hazardous waste. In view of this information, to dispose of a given batch of waste antifreeze as a non-hazardous waste without proving it so via TCLP analysis would appear to violate the EPA regulation. Due to the high cost of TCLP testing it is impractical to test small quantities of used antifreeze under the TCLP protocol. Safety-Kleen sees no other option than to manage used antifreeze as a TCLP-hazardous waste.

The results on lead and perc are not surprising. Though it is being phased out of new radiator production, lead remains a common component of radiator solder. Perc is commonly used by auto manufacturers as a degreaser of radiators prior to installation.

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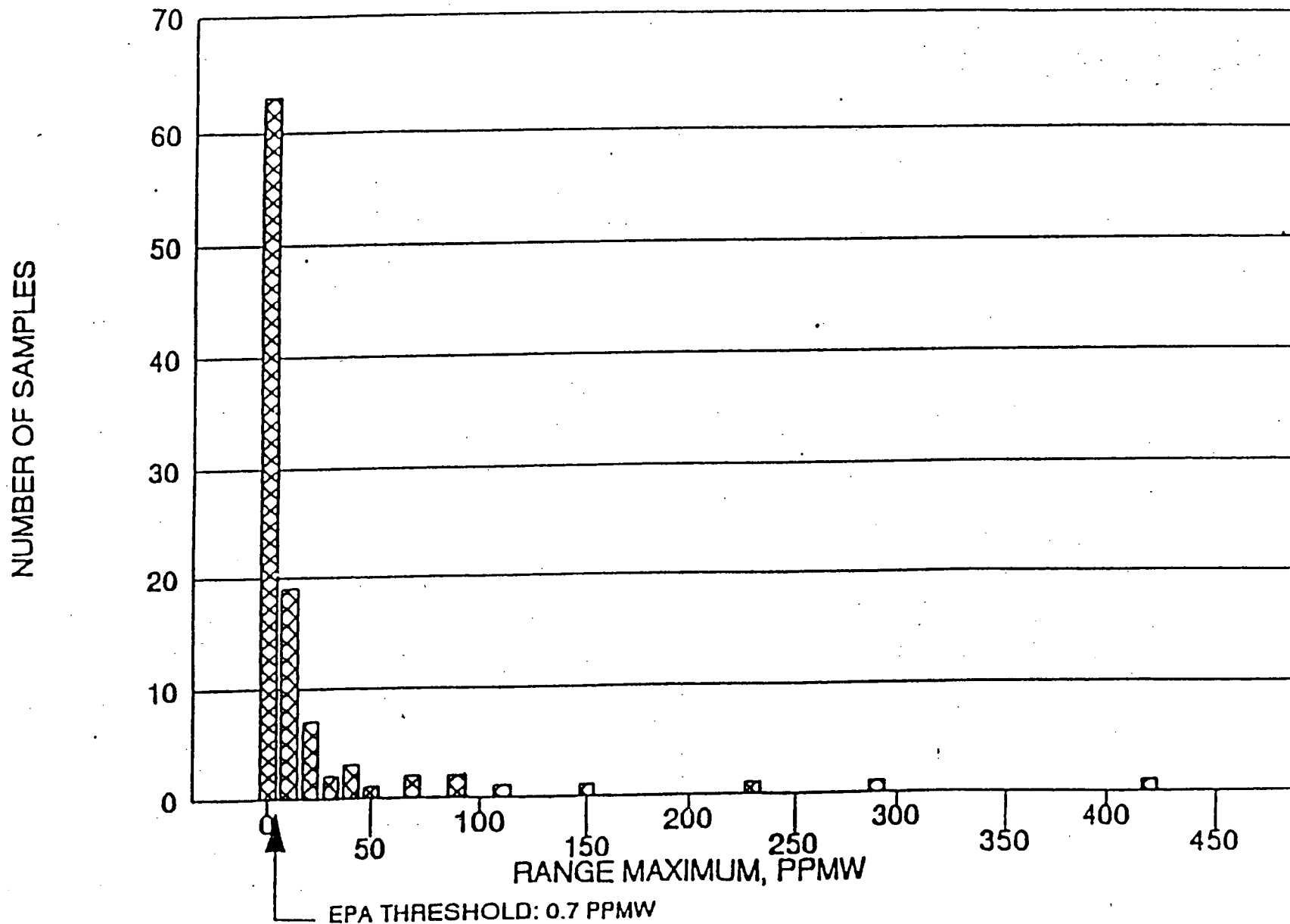
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SAFETY-KLEEN ANTIFREEZE TCLP DATA, 1991

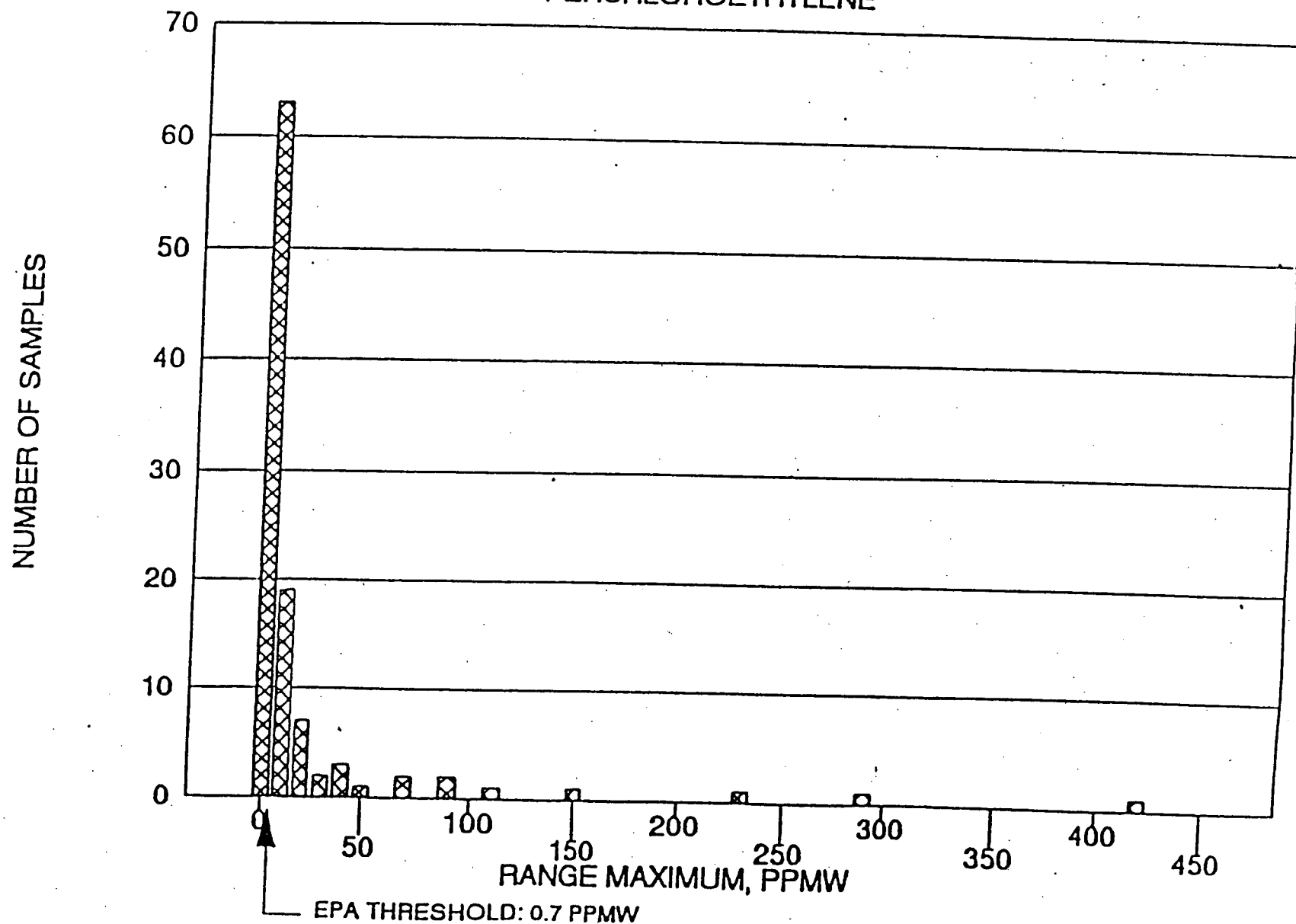
EXHIBIT 1.2 PERCHLOROETHYLENE



SAFETY-KLEEN ANTIFREEZE TCLP DATA, 1991

EXHIBIT 1.2

PERCHLOROETHYLENE



**SAFETY-KLEEN CORPORATION
MANTEUFFEL TECHNICAL CENTER
ELK GROVE VILLAGE, IL**

WASTE ANTIFREEZE TCLP DATA

**Paul H Dittmar
Manager, Process and Product Development**

November, 1991

Contributors

**Carol Chow, Senior Chemist
Mark Hartwig, TCLP Laboratory Manager
David Reese, Laboratory Quality Assurance Manager (Corporate)
John Schmitz, Corporate Laboratory Manager
Rita Shah, Inorganic Group Leader
Mohi Shaikh, Laboratory Quality Control Manager (Technical Center)
Steve Vlk, Product Analyst**

**SAFETY-KLEEN CORPORATION
MANTEUFFEL TECHNICAL CENTER
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WASTE ANTIFREEZE TCLP DATA

**Paul H Dittmar
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November, 1991

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disassembled and thoroughly cleaned with acetone and paper towels between samples. The samples were labeled, packed in ice in coolers and shipped to Safety-Kleen's Technical Center for analysis.

Analytical Methodology

EPA analytical methods were used to analyze the samples. No samples had sufficient solids content to warrant the extraction procedure. It was also considered unnecessary to analyze for herbicides and pesticides. The focus was on heavy metals (particularly lead) and volatile organic compounds (particularly perchloroethylene).

EPA Method 7420 for lead was followed as written, including all QA/QC procedures, without exception.

EPA Method 8240 for perchloroethylene was used with the following minor deviations:

- 1) Matrix spikes were done approximately 1 in every 20 samples, rather than for each analytical batch.
- 2) Not all TCLP compounds were spiked.

There were several samples with perchloroethylene results below the practical quantitation limits at the dilutions used. These were reported as "0" perchloroethylene and were not re-run at lower dilution to determine whether any were above the EPA threshold. Nevertheless, there were still more than enough perchloroethylene results in the total data set far above the threshold to conclude that the waste stream is TCLP-hazardous because of perchloroethylene.

Statistical Data Treatment

The SW846 procedure for statistical data handling assumes the data follow a normal or "bell-shaped" distribution. It is not necessarily the case that data will follow this ideal type of distribution. In fact, all available data on waste antifreeze are best fit by a Weibull distribution. Therefore, the data upper limits (which are compared to the EPA threshold to determine whether a stream should be considered TCLP-hazardous) were computed using the Weibull data distribution.

Results

Results on the total of 104 samples are summarized below and shown graphically in Exhibits 1.1 and 1.2.

	<u>Lead</u>	<u>Perc</u>	<u>Overall</u>
Concentration, ppmw			
EPA threshold	5	0.7	
Average	11	18	
Maximum value observed	444	420	
Upper limit (Weibull)	36	25	

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Statistical Data Treatment

The SW846 procedure for statistical data handling assumes the data follow a normal or "bell-shaped" distribution. It is not necessarily the case that data will follow this ideal type of distribution. In fact, all available data on waste antifreeze are best fit by a Weibull distribution. Therefore, the data upper limits (which are compared to the EPA threshold to determine whether a stream should be considered TCLP-hazardous) were computed using the Weibull data distribution.

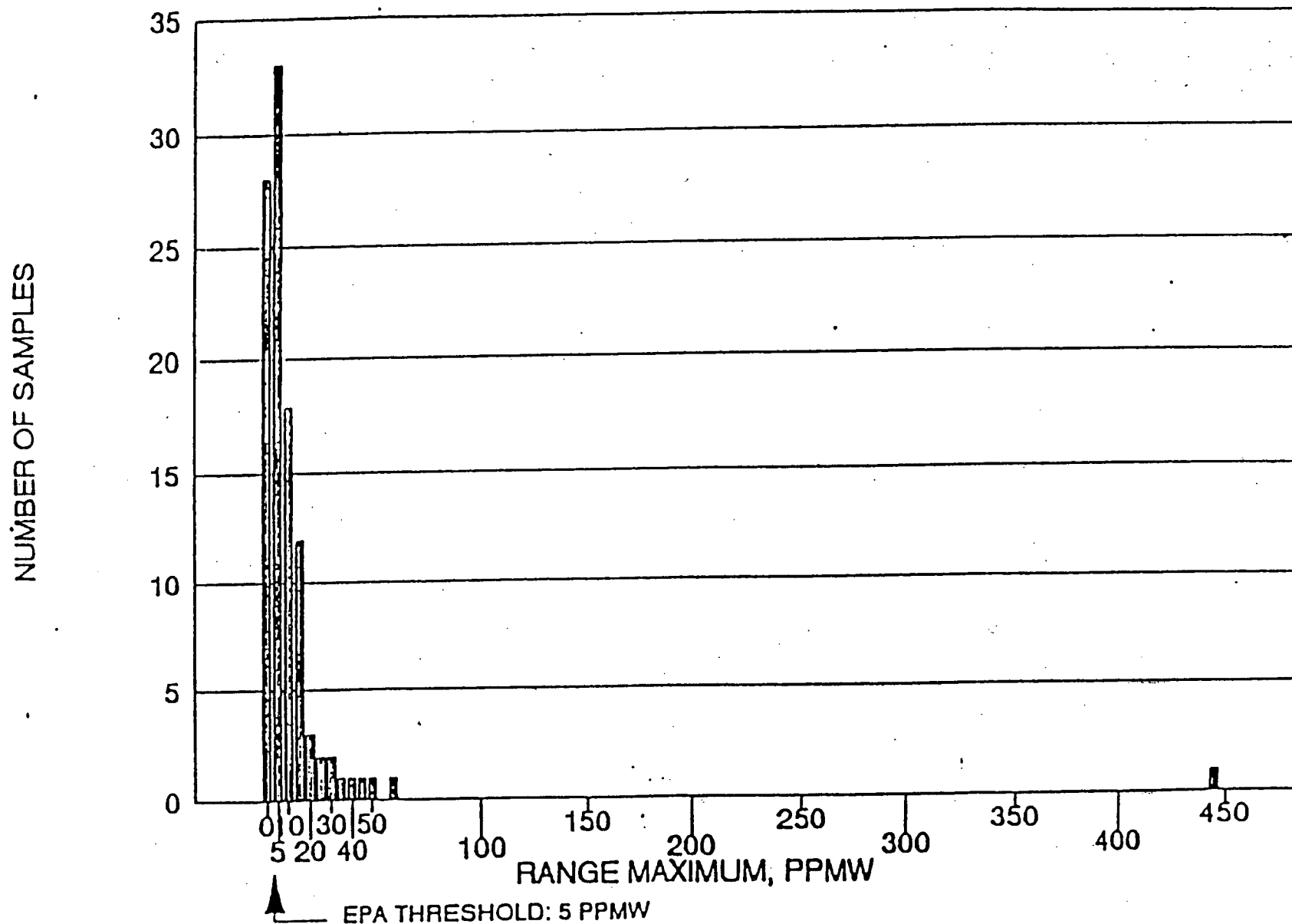
Results

Results on the total of 104 samples are summarized below and shown graphically in Exhibits 1.1 and 1.2.

	<u>Lead</u>	<u>Perc</u>	<u>Overall</u>
Concentration, ppmw			
EPA threshold	5	0.7	
Average	11	18	
Maximum value observed	444	420	
Upper limit (Weibull)	36	25	
Samples exceeding threshold	43%	39%	58%

SAFETY-KLEEN ANTIFREEZE TCLP DATA, 1991

EXHIBIT 1.1 LEAD



SAFETY-KLEEN ANTIFREEZE TCLP DATA, 1991

EXHIBIT 1.1 LEAD

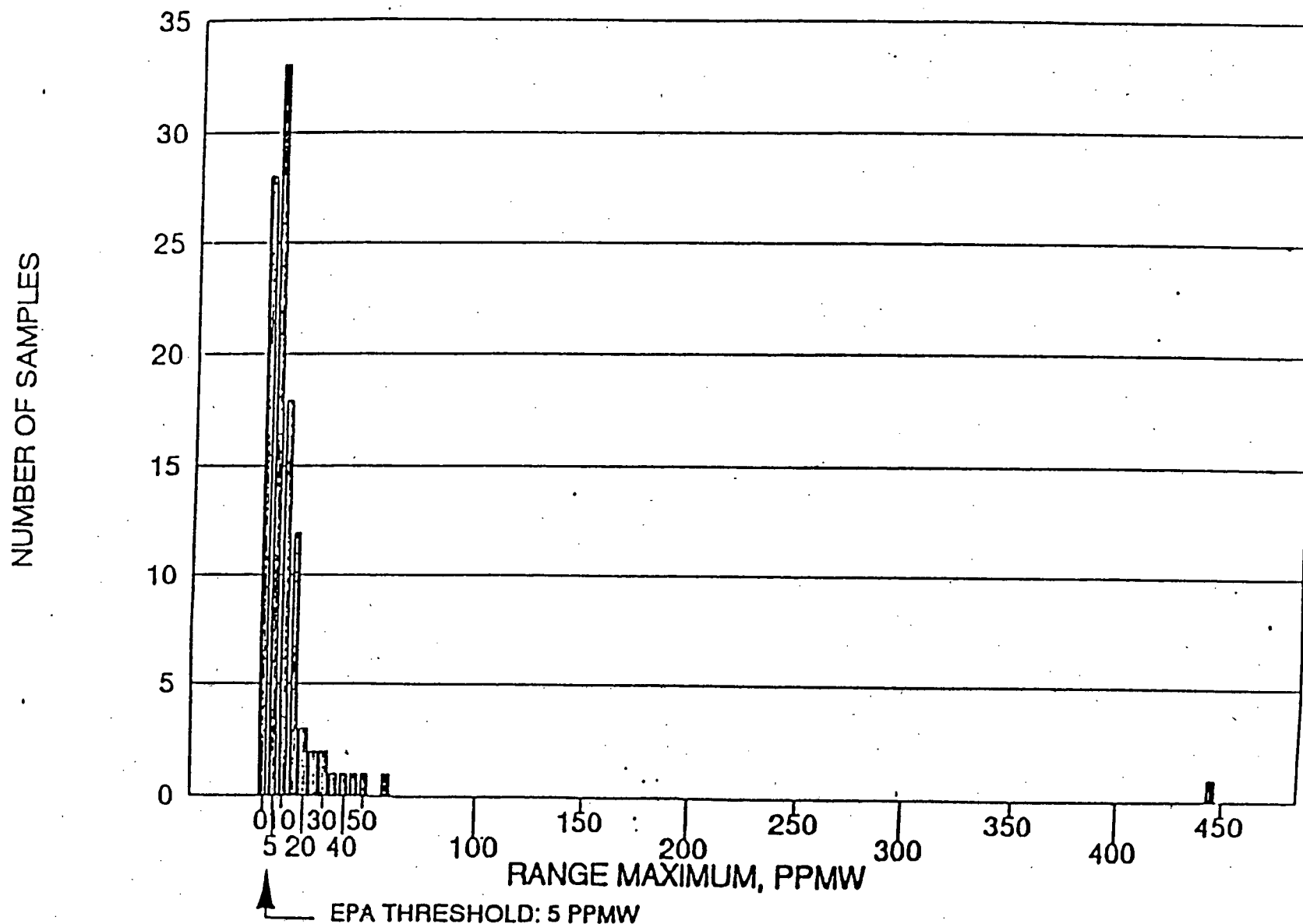


EXHIBIT 1.3

SAFETY-KLEEN TCLP DATA, 1991

	TOTAL	LEAD	PERC
MEAN	11.52	18.17	
EPA THRESHOLD, PPM	5	0.7	
MAXIMUM VALUE	444	420	
NUMBER	104	104	104
N EXCEEDING EPA TH	60	45	41
% EXCEEDING EPA TH	58	43	39

										HAZARDOUS	
LAB	RND	SN	LOC	LEAD	PERC	CONTROLS	B-Pb	B-PE	HAZ?	Pb	P
G	1	1	IL	0	0				0	0	
G	1	2	IL	0	0				0	0	
G	1	3	IL	5	3				1	1	
G	1	5	IL	8	4.6				1	1	
G	1	6	IL	12	40				1	1	
G	1	7	IL	0	0.98				1	0	
G	1	8	IL	0	0				0	0	
G	1	9	IL	0	0				0	0	
G	1	10	IL	0	0				0	0	
G	1	11	IL	7	150				1	1	
G	1	12	IL	0	2				1	0	
G	1	13	IL	1.9	290				1	0	
G	1	14	IL	20	0				1	1	
G	2	1	IL	0	0				0	0	
G	2	2	OH	10	82				1	1	
G	2	3	OH	0	2.2				1	0	
G	2	4	OH	1.3	110				1	0	
G	2	5	OH	0	2.4				1	0	
G	2	8	FL	0	0				0	0	
G	2	9	FL	0	0				0	0	
G	2	10	FL	0	0				0	0	
G	2	11	VA	0	0				0	0	
G	2	12	IL	0	0				0	0	
S	2	14	IL	14	13				1	1	
S	3	101	OH	3.4	12	93799-8		10	1	0	
S	3	102	OH	2.1	0	93800-1			0	0	
S	3	103	OH	2	11	93801-3		10	1	0	
S	3	106	FL	0	0	93804-9			0	0	
S	3	107	FL	2.6	0	93805-2			0	0	

EXHIBIT 1.3

SAFETY-KLEEN TCLP DATA, 1991

	TOTAL LEAD	PERC
MEAN	11.52	18.17
EPA THRESHOLD, PPM	5	0.7
MAXIMUM VALUE	444	420
NUMBER	104	104
N EXCEEDING EPA TH	60	41
% EXCEEDING EPA TH	58	39

LAB	RND	SN	LOC	LEAD	PERC	CONTROLS	B-Pb	B-PE	HAZ7	Pb	PE
G	1	1	IL	0	0				0	0	0
G	1	2	IL	0	0				0	0	0
G	1	3	IL	5	3				1	1	1
G	1	5	IL	8	4.6				1	1	1
G	1	6	IL	12	40				1	1	1
G	1	7	IL	0	0.98				1	0	1
G	1	8	IL	0	0				0	0	0
G	1	9	IL	0	0				0	0	0
G	1	10	IL	0	0				0	0	0
G	1	11	IL	7	150				1	1	1
G	1	12	IL	0	2				1	0	1
G	1	13	IL	1.9	290				1	0	1
G	1	14	IL	20	0				1	1	1
G	2	1	IL	0	0				0	0	0
G	2	2	OH	10	82				1	1	1
G	2	3	OH	0	2.2				1	0	1
G	2	4	OH	1.3	110				1	0	1
G	2	5	OH	0	2.4				1	0	1
G	2	8	FL	0	0				0	0	0
G	2	9	FL	0	0				0	0	0
G	2	10	FL	0	0				0	0	0
G	2	11	VA	0	0				0	0	0
G	2	12	IL	0	0				0	0	0
S	2	14	IL	14	13				1	1	1
S	3	101	OH	3.4	12	93799-8		10	1	0	1
S	3	102	OH	2.1	0	93800-1			0	0	0
S	3	103	OH	2	11	93801-3		10	1	0	1
S	3	106	FL	0	0	93804-9			0	0	0
S	3	107	FL	2.6	0	93805-2			0	0	0

											HAZARDOUS	
LAB	RND	SN	LOC	LEAD	PERC	CONTROL#	B-Pb	B-PE	HAZ7		Pb	PE
S	3	153	OH	5.4	2	94645-3	426		1		1	1
S	3	154	FL	1.2	0	94646-5			0		0	0
S	3	155	FL	1.3	0	94647-7			0		0	0
S	3	156	FL	7	16	94648-9	425	17	1		1	1
S	3	157	IL	2.4	12	94649-2		17	1		0	1
S	3	158	VA	1.3	0	94651-5			0		0	0
S	3	159	FL	0	1	94652-7			1		0	1
S	3	160	CT	3.3	4	94653-9			1		0	1
S	3	161	IL	16	15	94971-4	501	18	1		1	1
S	3	162	FL	3.9	4	94972-6			1		0	1
S	3	163	VA	22	44	94973-8	426	18	1		1	1
S	3	164	VA	1.1	0	94974-1			0		0	0
S	3	165	CT	1.3	0	94975-3			0		0	0
S	3	166	CT	2	0	94977-7			0		0	0
S	3	167	CT	8.1	0	94978-9	426		1		1	0
S	3	168	CT	13	0	94979-2	426		1		1	0
S	3	169	VA	0	0	94980-3			0		0	0
S	3	170	VA	1.4	0	94981-5			0		0	0
S	3	171	FL	0	0	94983-9			0		0	0
S	3	172	FL	1.5	0	94984-2			0		0	0
S	3	173	FL	1.6	0	94985-4			0		0	0
S	3	174	FL	0	0	94986-6			0		0	0
S	3	175	CT	13	0	94988-1	501		1		1	0
S	3	176	CT	22	0	94989-3	501		1		1	0
S	3	177	FL	0	0	94990-4			0		0	0
S	3	178	FL	1.7	0	94991-6			0		0	0
S	3	179	CT	11	0	94993-1	501		1		1	0
S	3	180	CT	0	0	94994-3			0		0	0
S	3	181	CT	5.1	8	96206-4	501	21	1		1	1
S	3	182	FL	15	83	96207-6	501	21	1		1	1

99

LAB	RND	SN	LOC	LEAD	PERC	CONTROL#	B-Pb	B-PE	HAZ7	HAZARDOUS
S	3	153	OH	5.4	2	94645-3	426			Pb
S	3	154	FL	1.2	0	94646-5			1	1
S	3	155	FL	1.3	0	94647-7			0	0
S	3	156	FL	7	16	94648-9	425	17	0	0
S	3	157	IL	2.4	12	94649-2		17	1	1
S	3	158	VA	1.3	0	94651-5			1	0
S	3	159	FL	0	1	94652-7			0	0
S	3	160	CT	3.3	4	94653-9			1	0
S	3	161	IL	16	15	94971-4	501	18	1	0
S	3	162	FL	3.9	4	94972-6			1	1
S	3	163	VA	22	44	94973-8	426	18	1	0
S	3	164	VA	1.1	0	94974-1			1	1
S	3	165	CT	1.3	0	94975-3			0	0
S	3	166	CT	2	0	94977-7			0	0
S	3	167	CT	8.1	0	94978-9	426		0	0
S	3	168	CT	13	0	94979-2	426		1	1
S	3	169	VA	0	0	94980-3			1	1
S	3	170	VA	1.4	0	94981-5			0	0
S	3	171	FL	0	0	94983-9			0	0
S	3	172	FL	1.5	0	94984-2			0	0
S	3	173	FL	1.6	0	94985-4			0	0
S	3	174	FL	0	0	94986-6			0	0
S	3	175	CT	13	0	94988-1	501		0	0
S	3	176	CT	22	0	94989-3	501		1	1
S	3	177	FL	0	0	94990-4			1	1
S	3	178	FL	1.7	0	94991-6			0	0
S	3	179	CT	11	0	94993-1	501		0	0
S	3	180	CT	0	0	94994-3			1	1
S	3	181	CT	5.1	8	96206-4	501	21	0	0
S	3	182	FL	15	83	96207-6	501	21	1	1

Reference 3

"Antifreeze Sampling and Analysis, Summary Report", USEPA by Science Applications International Corporation, McLean, VA., May 1991

ANTIFREEZE SAMPLING AND ANALYSIS
SUMMARY REPORT

Submitted to:

U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Submitted by:

Science Applications International Corporation
8400 Westpark Drive
McLean, VA 22102

MAY 22, 1991

EPA Contract No. 68-WO-0027, WA No. 17
SAIC Project No. 1-825-03-147-10

ANTIFREEZE SAMPLING AND ANALYSIS

SUMMARY REPORT

1. PURPOSE

The antifreeze solution used in automobile engines is a mixture of ethylene glycol, water, and trace additives. In normal use, antifreeze is replaced in an automobile engine system about every 30,000 miles. About 2 gallons of antifreeze are used in a change over. Ethylene glycol of itself is not controlled under subtitle C of RCRA, however, it has come to the EPA's attention that used antifreeze may exhibit the Toxicity Characteristic (TC).

This sampling and analysis study was undertaken primarily to explore the possibility that used antifreeze solution will exhibit the TC for two target analytes, benzene and lead. These two analytes were targeted from knowledge of the waste and based on information submitted by industry. Exposure of antifreeze solution to gasoline, either in the automobile engine system or later as an adulterant during collection or storage, are likely sources of benzene contamination. Lead may be introduced into the antifreeze through several mechanisms; many radiators have lead solder seals, lead is a gasoline additive, and lead might be leached from metallic radiator systems. In addition, antifreeze is often stored with used oils after collection, and both lead and benzene may be transferred to the antifreeze as a result of co-storage. This sampling program has been developed to investigate contaminant levels found in antifreeze "as generated" vs. levels found in various storage environments; as well as contaminants found in commercial products from original sources.

2. LIMIT OF THE STUDY

This preliminary study focused on obtaining a limited number of samples collected over a short period of time. The following 19 samples were collected and analyzed.

- 11 automobiles - "as generated" samples
- 2 flush products
- 4 commercial waste storage facilities - "as stored" samples
- 2 water blanks (distilled and tap)

See Appendix A for a description of each sample source. The auto samples were selected on the basis of various autos ages and different frequencies of antifreeze replacement.

A sample of new antifreeze was evaluated during the analytical method development study and is not included in the analytical report. New antifreeze did not contain the TC targets above the MDL of the analytical instruments used.

Samples were obtained within days of the initial EPA request. To meet these deadlines, all sampling was performed in the McLean area. However, samples from commercial antifreeze storage facilities, automobiles, and commercial products were readily available in this area.

3. ANALYTICAL PROCEDURES

All laboratory analysis were performed at the SAIC Methods Development Center in Rockville, MD.

The samples collected were all liquids, it was assumed that they were 100% filterable. Therefore, the compositional analysis described below and the TC results (Method 1311) would be equivalent.

The analysis for benzene was accomplished by using a static head space extraction with a Hamilton syringe, followed by a direct injection into a SE30 GC column with a splitless injector port. FID detection was employed. The QA was checked with a blank and a check standard every 10 samples. A MS and MSD were run for each matrix. The analytical results are shown in Appendix A.

Lead was analyzed for by using SW-846 Methods 3110 and 6010. The detection limit for the ICP instrument was 0.7 ppm. The QA procedure is described in Method 6010. An interferant check sample was used. The analytical results are shown in Appendix A.

A generic Sampling and Analysis Plan is on file at SAIC which outlines sampling and analytical strategy.

4. RESULTS

The analytical results are tabulated in Appendix A. The TC regulatory limit for benzene is 0.5 mg/mL and 5.0 mg/mL for lead (CFR 40 Part 261.24 Table 1).

From the samples analyzed neither new antifreeze nor the unused flush products exhibited TC characteristics for either benzene or lead. However, several used antifreeze, "as generated" and "as stored", did exhibit the TC on occasion.

Benzene

~~No benzene was detected in antifreeze taken directly from auto engines. Two of the four samples from commercial antifreeze storage facilities exhibited the TC for benzene. The first facility, AF15 (6.54 ppm) stores the waste in 55 gal drums designated for antifreeze; contamination with gasoline is suspected. The second facility, AF16 (0.9 ppm) stores the waste in a 280 gal tank which contains a mixture of waste oil and antifreeze.~~ *

Lead

Three samples, taken directly from automobiles, exceeded the TC for lead, AF05, AF08 and AF10. One automobile, AF05, was noted by the owner to be running very poorly. This antifreeze was black with an oily sheen and had not been changed for over 40,000 miles. The other two owners reported no operating problems. In both of these cases, AF08 and AF10, the antifreeze was opaque and very dark.

Samples from two of the four commercial antifreeze storage facilities exhibited the TC for lead. Waste storage facility AF14 recycles antifreeze for customers by filtering it. The facility will do this as long as the antifreeze is not too dilute to recycle. This facility advertises itself as an environmentally conscience car repair facility. Waste facility AF16, a car repair, stores a mixture of antifreeze and waste oil in a 280 gal tank. This tank was over half filled with black oil.

5. CONCLUSIONS

From this preliminary and limited sampling selection, about 10 percent of the samples exhibited the TC.

Commercial waste storage facilities do not necessarily exhibit the TC. When antifreeze is removed from autos, it is collected in a pan which may already be contaminated with auto oils and/or other solvents. This pan introduces some oily material into the antifreeze waste storage tanks. Benzene contamination in these antifreeze samples may well be from the addition of solvents or gasoline other than motor oil to the waste. Commercial waste storage facilities who exhibit the TC for benzene, probably have some solvent contamination since benzene concentrations in used oil are usually low or below detection. Efforts were made to obtain antifreeze samples from two waste facilities who did not co-store waste antifreeze with waste and from two that did mix oil and antifreeze. This proved to be impossible since all antifreeze storage tanks contained some used oil due to the routine use of contaminated pans utilized for collecting and transporting the antifreeze to the waste container.

Lead contamination was the highest in the sample collected from the generator who recycles the antifreeze for his customers, AF14. This may suggest that repeated use and filtering of antifreeze concentrates lead in the waste. The other generator's sample contained lead, AF16, at just over the TC limit. That generator co-stored antifreeze and oily wastes.

Antifreeze taken directly from auto engines did not exhibit the TC for benzene. All auto engines analyzed for less than 0.1 ppm.

Auto AF05, which is running poorly, had the highest amount of lead contamination at 102.8 ppm. Both the other autos, AF08 (52.5 ppm) and AF10 (10 ppm) had dark antifreeze which had not been changed for two years. Both AF08 and AF10 had used flush products when their antifreeze was changed.

Antifreeze Sampling
Analytical Report

Sample #	Benzene	Lead	Description
AF01	<0.1	<D.L.	1984 Nissan, 67,000 mi, antifreeze changed 66,000 mi. Green translucent.
AF02	<0.1	<D.L.	1985 Honda, 53,000 mi, antifreeze changed 1989 40,000. Dark blue-black.
AF03	<0.1	<D.L.	1990 Ford, 16,500 mi, antifreeze from factory. Blue-green.
AF04	<0.1	2.7	1983 Plymouth, 114,000 mi, antifreeze topped off in fall 1990.
AF05	<0.1	102.8	1987 Honda, 83,500 mi, antifreeze changed by dealer 40,000. Black thick with oily sheen.
AF06	<0.1	1.7	1972 Jeep, 100,000 mi, antifreeze change fall 1990 (flushed) (used solder seal for leak) 90,000 mi. Thin black opaque liquid.
AF07	<0.1	<D.L.	1986 Isuzu, 85,000 mi, antifreeze changed (flushed) 1990 76,000 mi. Very clean-clear.
AF08	<0.1	52.5	1986 Chevy, 68,000 mi, antifreeze changed 1989 (flushed). Dark.
AF09	<0.1	3.3	1981 Honda, 60,000 mi, antifreeze changed 1990 (flushed) 58,000 mi. Green translucent.
AF10	<0.1	10	1986 Acura, 78,500 mi, antifreeze changed 1989 (flushed). Dark Brown.
AF11	<0.1	<D.L.	Field Blank Distilled Water
AF12	<0.1	<D.L.	Field Blank Tap Water
AF13	<0.1	<D.L.	Prestone Super Flush
AF14	<0.1	56.4	Auto repair facility, 55 gal. drums. Waste hauled monthly. Facility recycles antifreeze.
AF15	6.54	<D.L.	Auto repair facility, 55 gal drums. Waste hauled monthly.
AF16	0.9	5.9	Auto repair facility, 280 gal. tank. mixed with oil. Waste hauled every 2 months.
AF17	0.13	<D.L.	Gas Station, 55 gal drum. Waste hauled every 2 months
AF18	<0.1	<D.L.	Flush, Radiator Specialty Co. Contains 2-butoxy-1-ethanol and EDTA.
AF19	<0.1	<D.L.	1978 Toyota, 108,000 mi, antifreeze changed summer 1988. Dark green.

ENVIRONMENTAL CHEM-TEST INC.
590 SOUTH STREET EAST
RAYNHAM, MA 02767
(508)-823-7202 F (508)-824-3014

January 31, 1991

David Topping
Environmental Protection Agency
1400 M Street S.W.
Washington, D.C. 20460

Mr. Topping:

Following samples were taken directly from various automobile radiators located at Olson's Greenhouses for analysis on January 30, 1991. The year and models of automobiles plus the lead results are as follows:

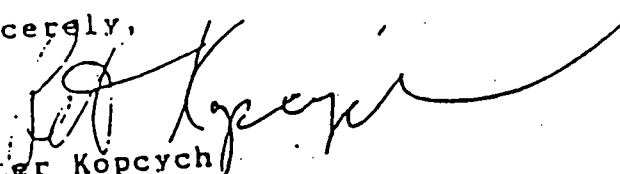
AUTOMOBILE (Analysis by X-Ray) LEAD RESULT

1977 GMC 90 Series Truck	25 ppm	} below MOL?
1978 Ford Fairmount	37 ppm	
1980 Ford Bronco	1 ppm	
1981 Ford Escort	26 ppm	
1983 Buick Regal	15 ppm	
1983 Toyota Corolla	29 ppm	
1987 Hyundai	0 ppm	
1989 Mercury Lincoln	0 ppm	
1990 Volkswagon Fox	362 ppm	
1991 Buick Regal	0 ppm	

~~with a method standard at 100 ppm resulting in a detection of 100 ppm.~~ Results are in total lead concentration and does not reflect leaching but very well could. Virgin antifreeze was sampled and there was no lead concentration in the result.

Enclosed are the actual analytical results and graphs for each automobile cited above. If you have any questions or problems please feel free to contact me at (508)-823-7202.

Sincerely,


Peter Kopczyk
President

Enclosure

USED : TYPE
ANALYSIS METHOD : QUADRATIC

TUBE CURRENT : 0.13 MA
LIVETIME : 100 SEC

	ELEMENT	CONCENTRATION	ERROR
WITIFREEZE PB		0.100 PPM +/-	2.7377

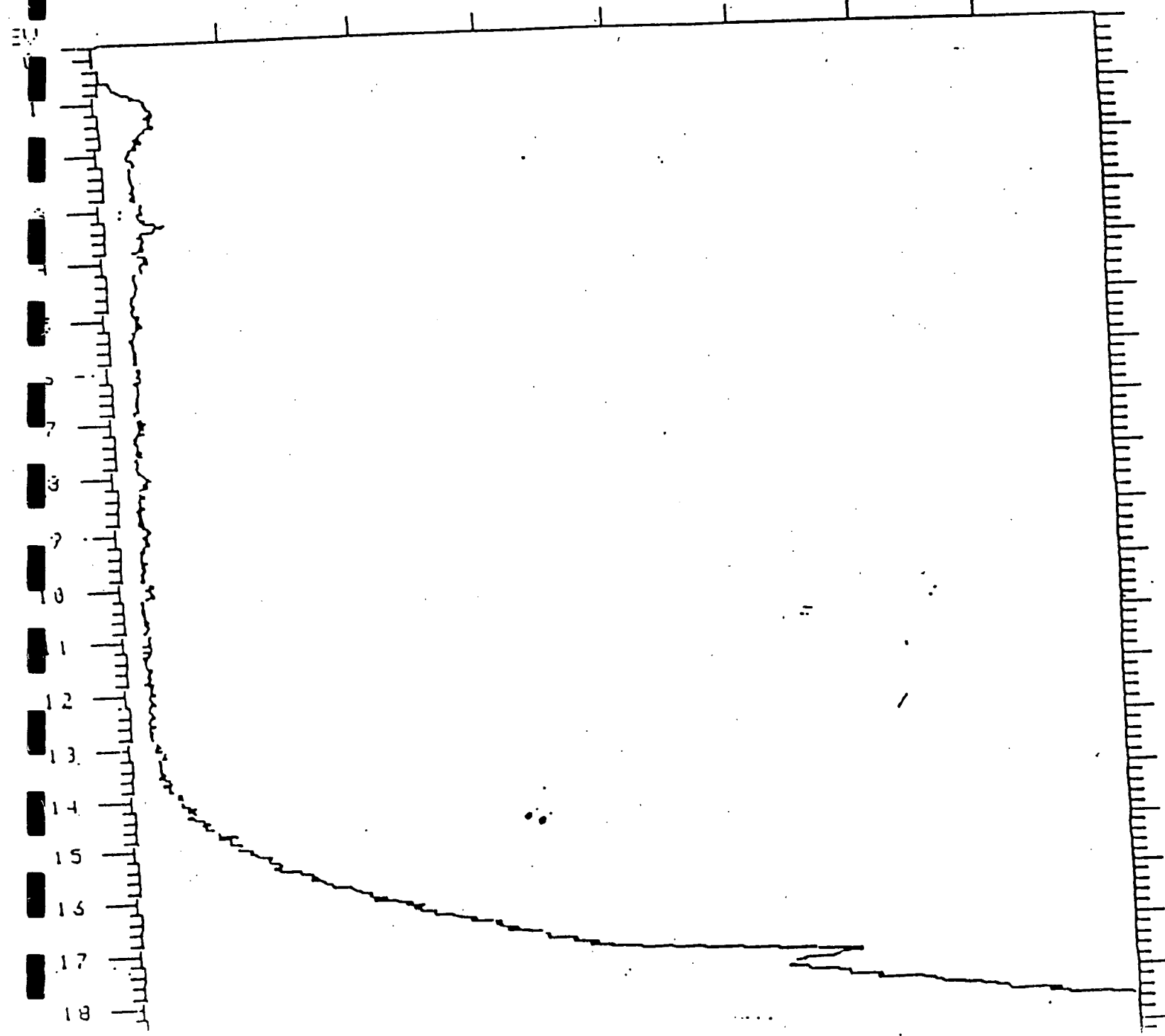
TRACOR-XRAY SPECTRAL PLOT

SPECTRUM: WITIFREEZE

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S. = 2K

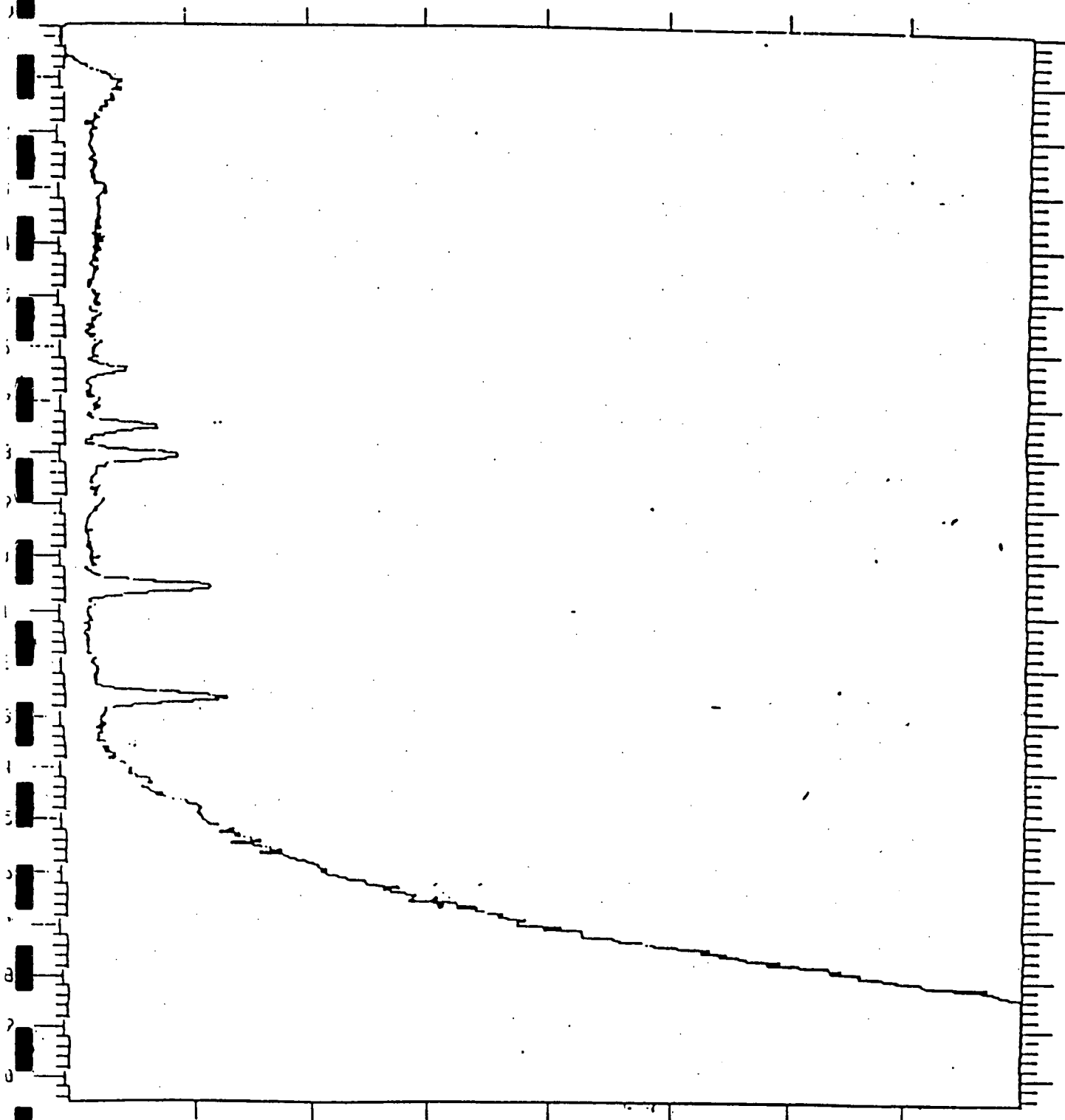


SPECTRUM: 100PFM15TD

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S. = 2K



USED : FIVE
METHOD : QUADRATIC

LIVETIME : 100 SEC

	ELEMENT	CONCENTRATION	ERROR
1991BUICK	PB	0.100 PPM +/-	2.7377

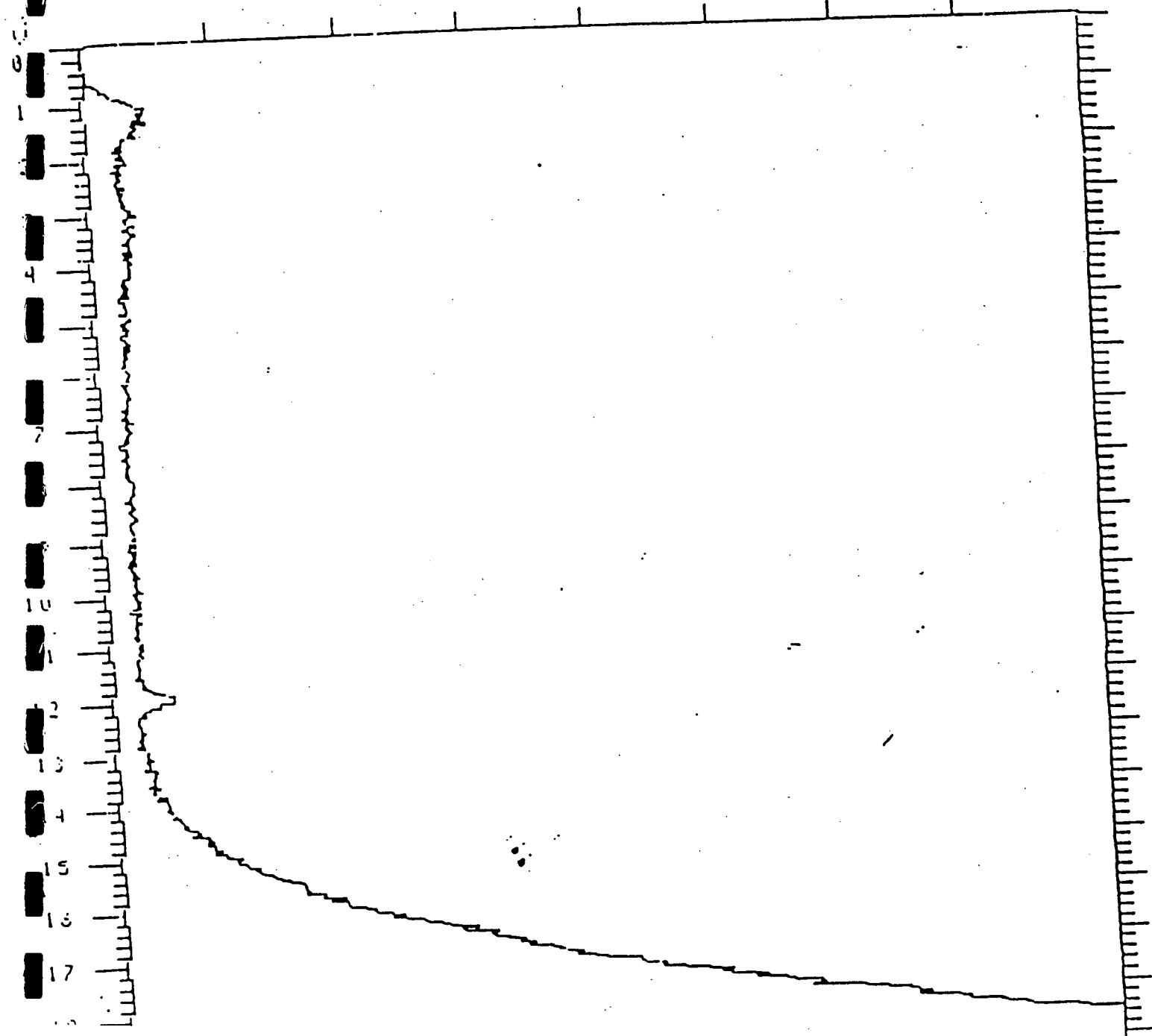
TRACOR-XRAY SPECTRAL PLOT

SPECTRUM: 1991BUICK

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S. = 2K



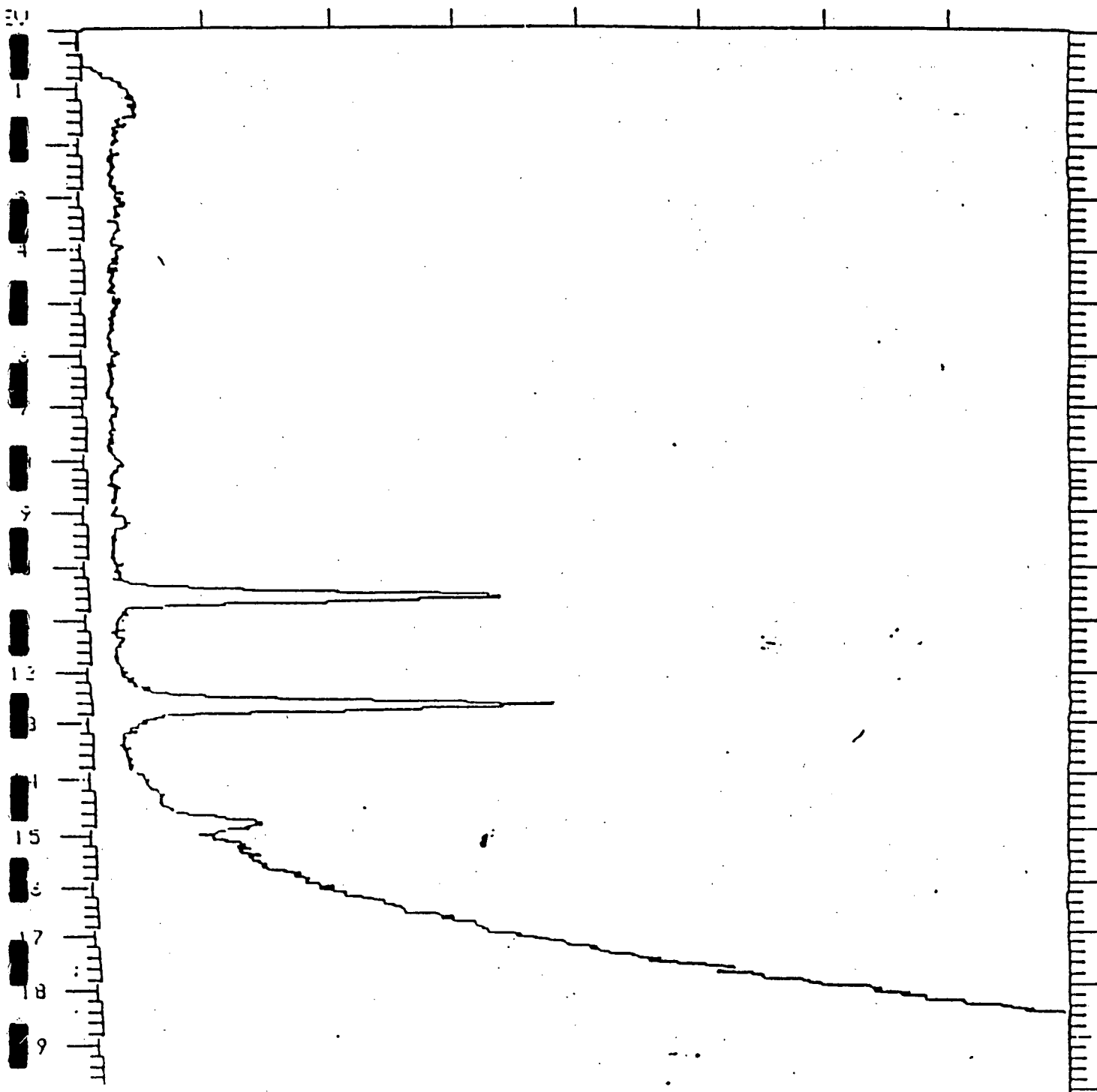
FILE	ELEMENT	CONCENTRATION	ERROR
900VOLTSMAG0	PB	332.744 PPM +/-	5.3217

TRACOR-XRAY SPECTRAL PLOTSPECTRUM: 1290VOLTSMAG0

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S.= 2K



ANALYSIS METHOD : QUADRATIC

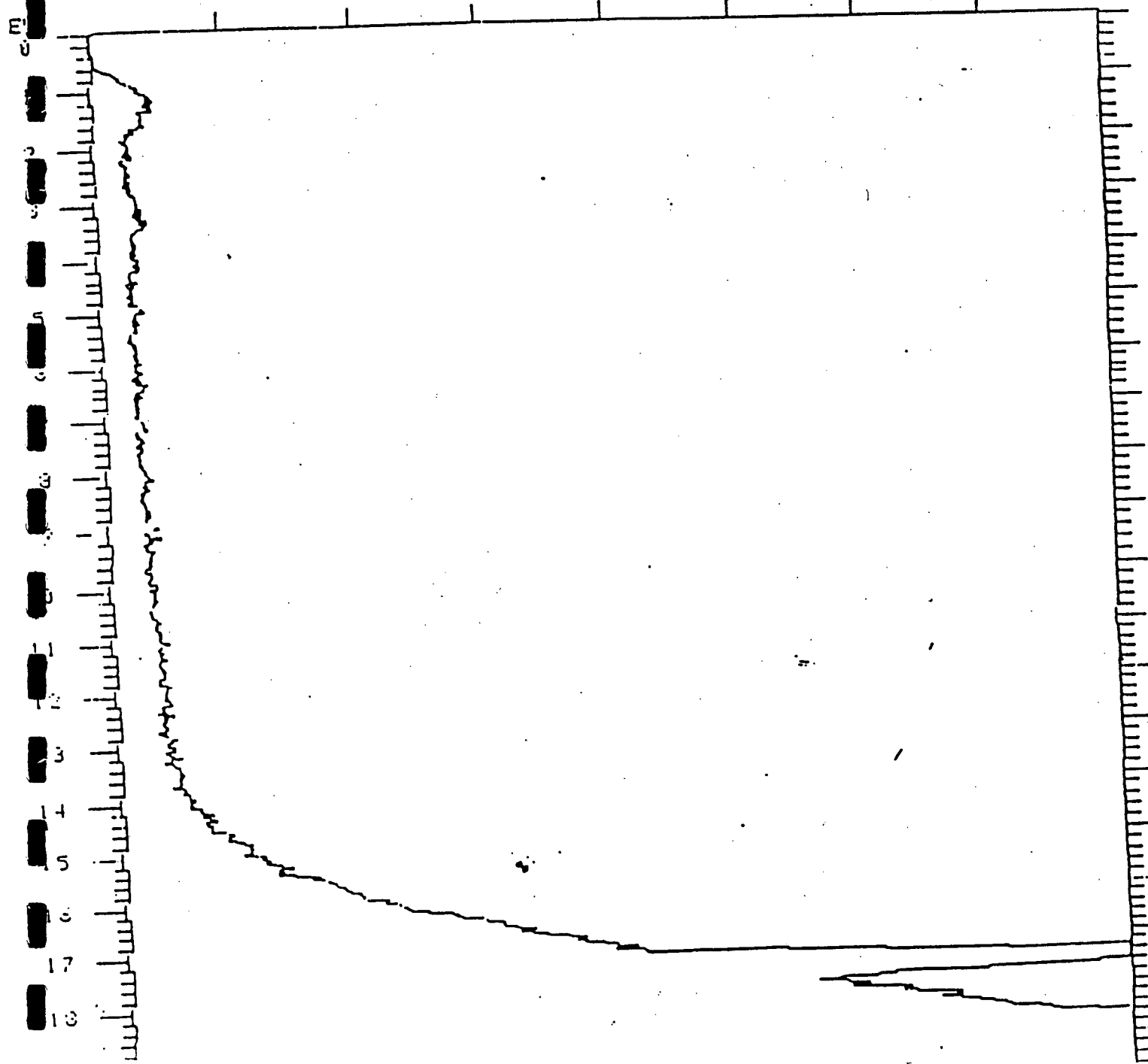
FILE	ELEMENT	CONCENTRATION	ERROR
1939LINCOLN	PB	0.100 PPM +/-	2.7377

TRACOR-XRAY SPECTRAL PLOT:SPECTRUM: 1939LINCOLN

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S.= 2K



FILE	ELEMENT	CONCENTRATION	ERROR
ST1110101	FB	0.122 PPM +/-	9.1019

1501
1111
1111
1111

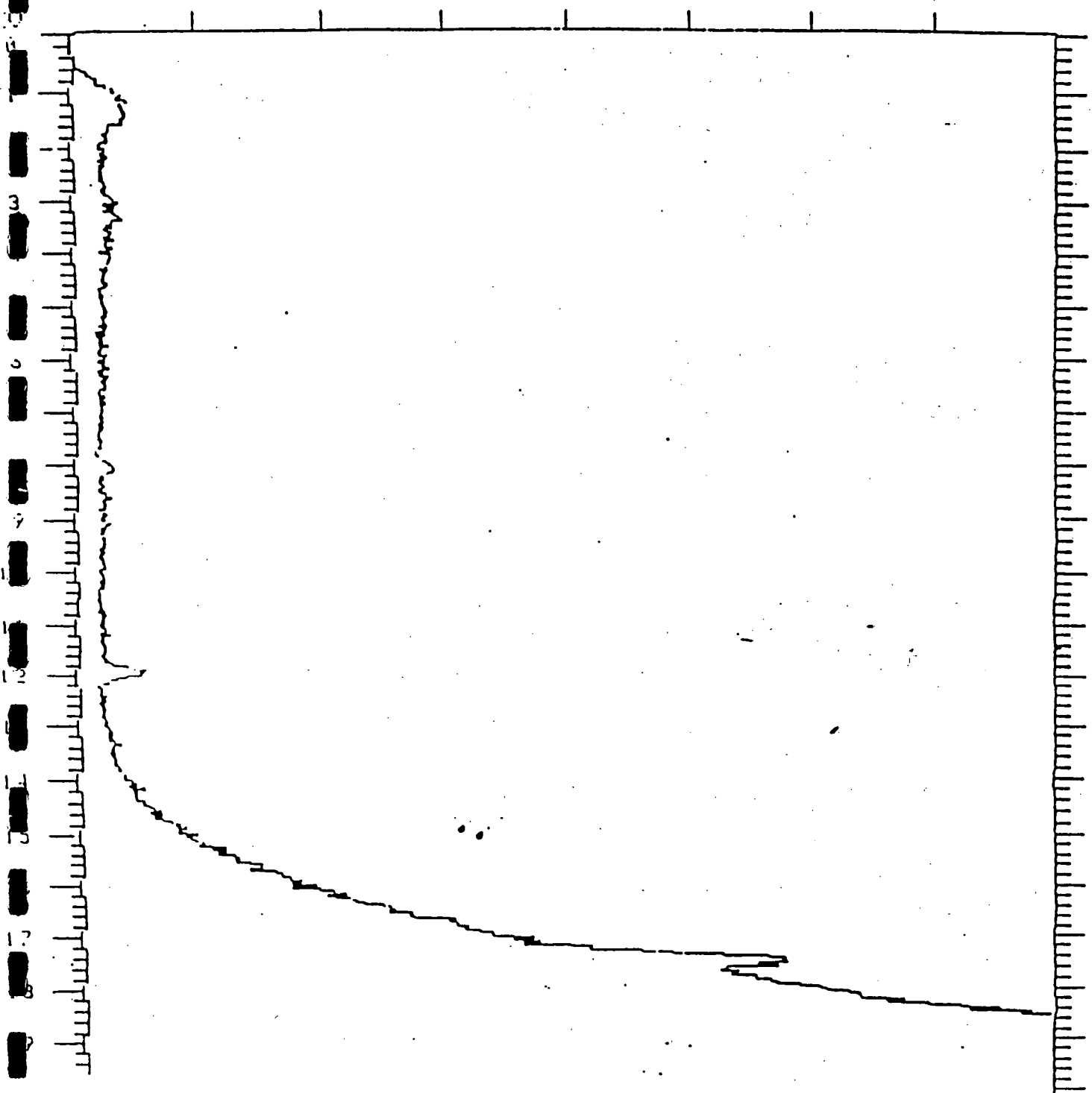
TRACOR-XRAY SPECTRAL PLOT

SPECTRUM: 1737HYUNDAI

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S. = 2K



ROMITOTYCOROL FB
1983

29.525 PPI +/-

3.2311

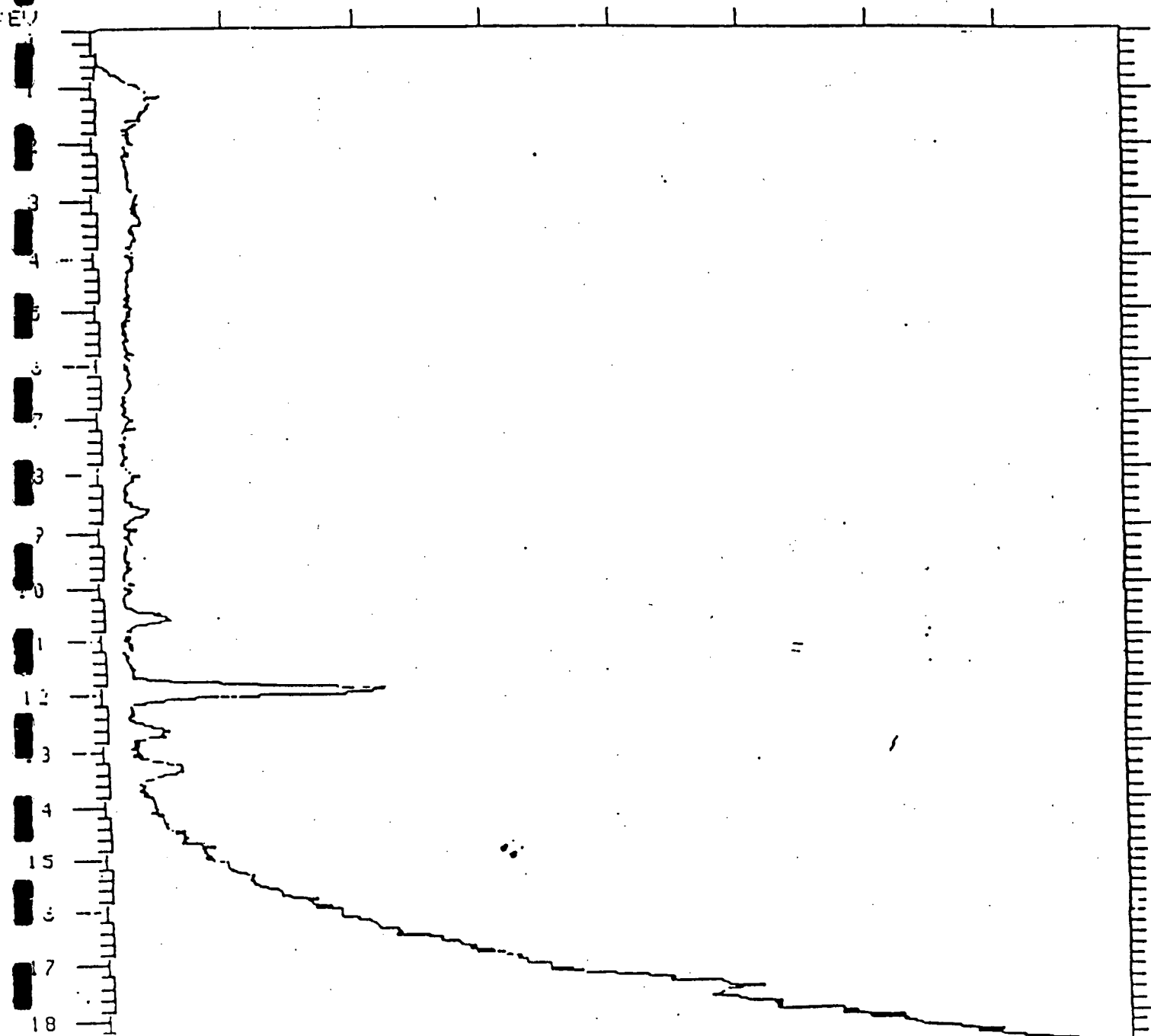
TRACOR-XRAY SPECTRAL PLOT

SPECTRUM: EROMITOTYCOROL

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S.= 2K



933EUICK

PE

15.842

PPM +/-

3.1818

ERROR

TRACOR-XRAY SPECTRAL PLOT

SPECTRUM: 1933EUICK

TUBE VOLTAGE : 30 KV

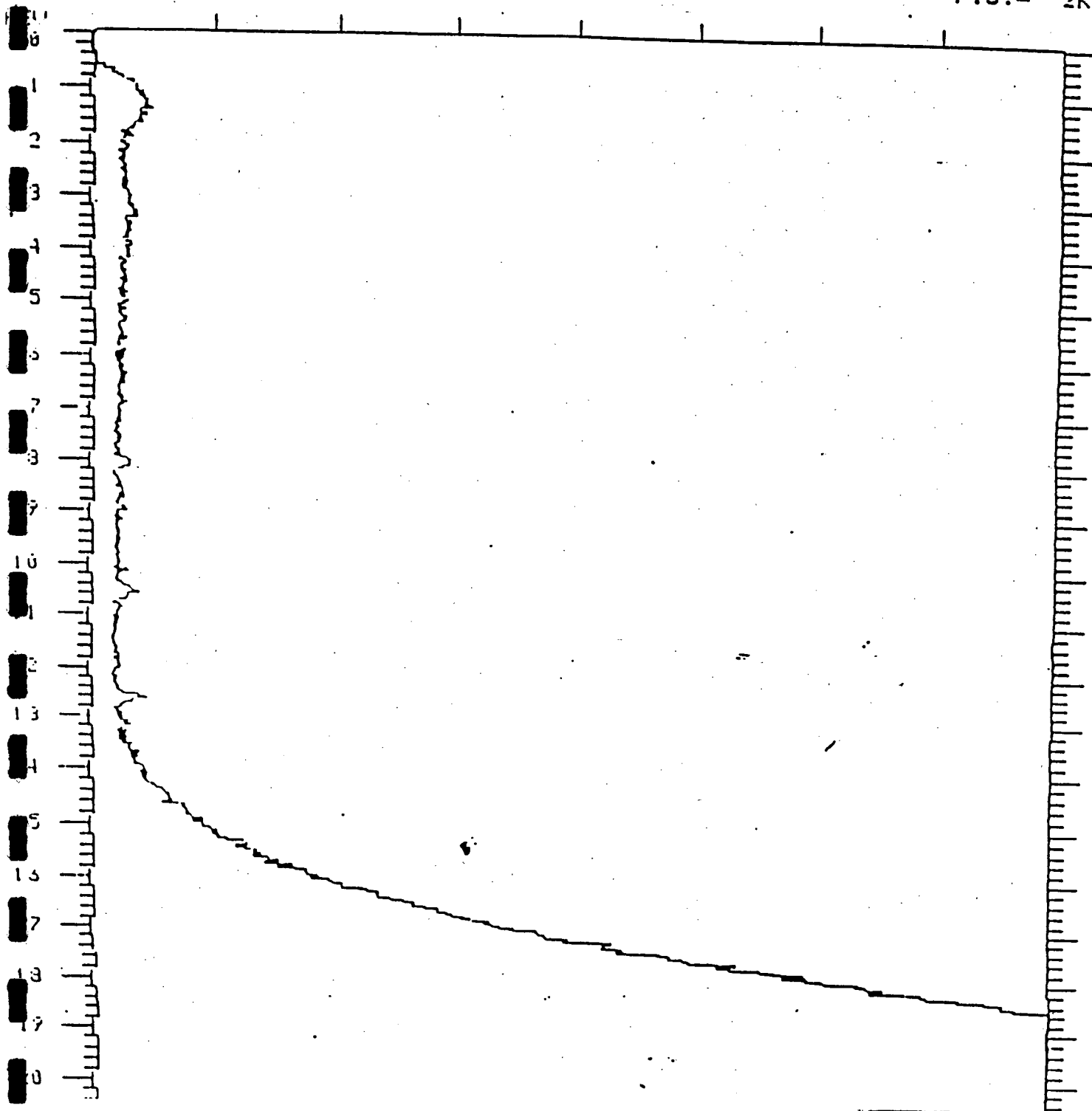
TUBE CURRENT : 0.13 MA

ATMOSPHERE : AIR

FILTER USED : FIVE

LIVETIME : 100 SEC

F.S. = 2K



SAMPLE : LEAD WASTE OIL
FILTER USED : FIVE
ANALYSIS METHOD : QUADRATIC

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
LIVETIME : 100 SEC

	ELEMENT	CONCENTRATION	ERROR
1	ESCORT	PB	26.527 PPM +/- 3.2681

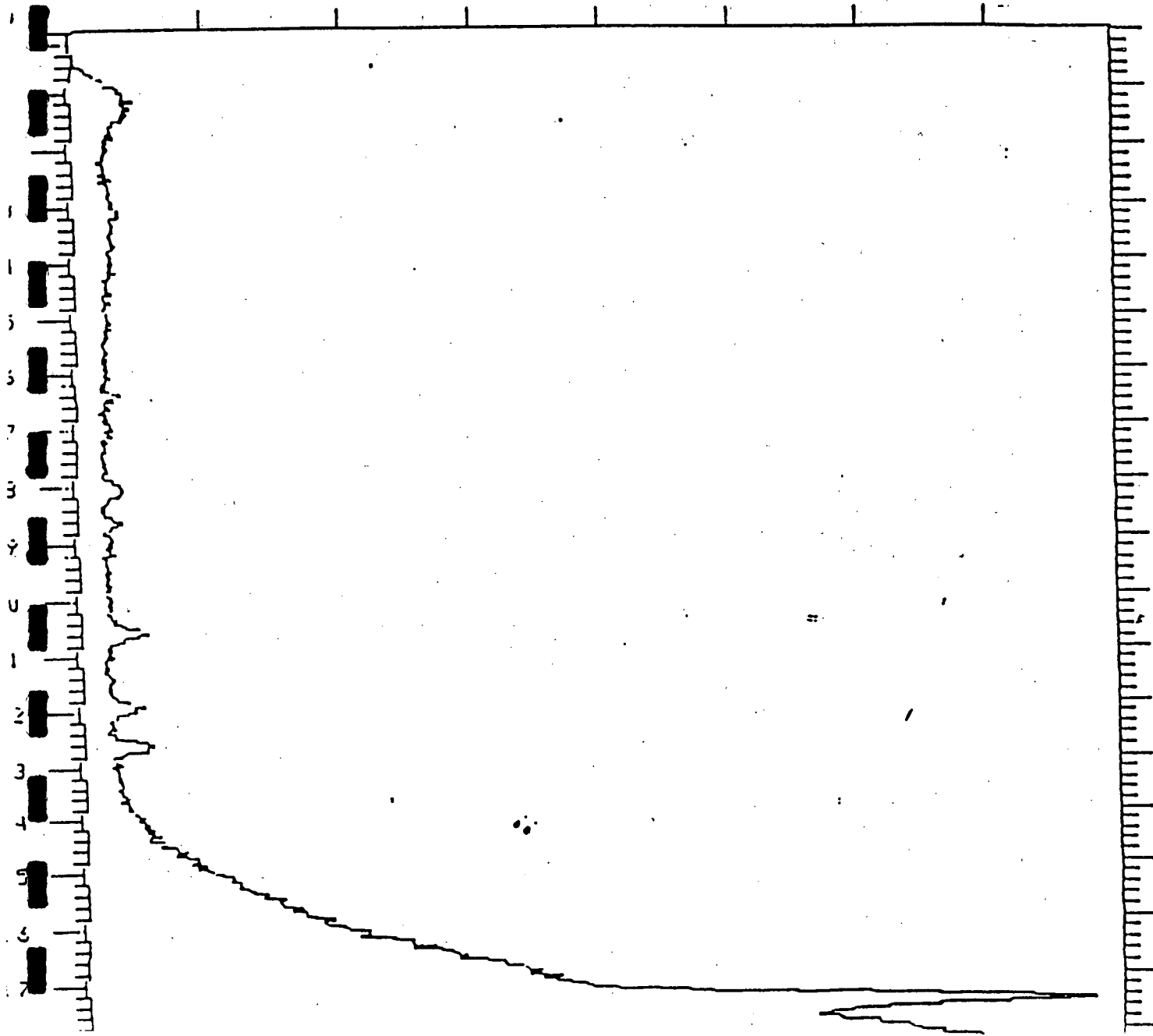
TRACOR-XRAY SPECTRAL PLOT

SPECTRUM: 1981ESCORT

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S. = 2K



FILE	ELEMENT	CONCENTRATION		ERROR
19806RONCO=1	PE	1.752	PPM +/-	3.1160

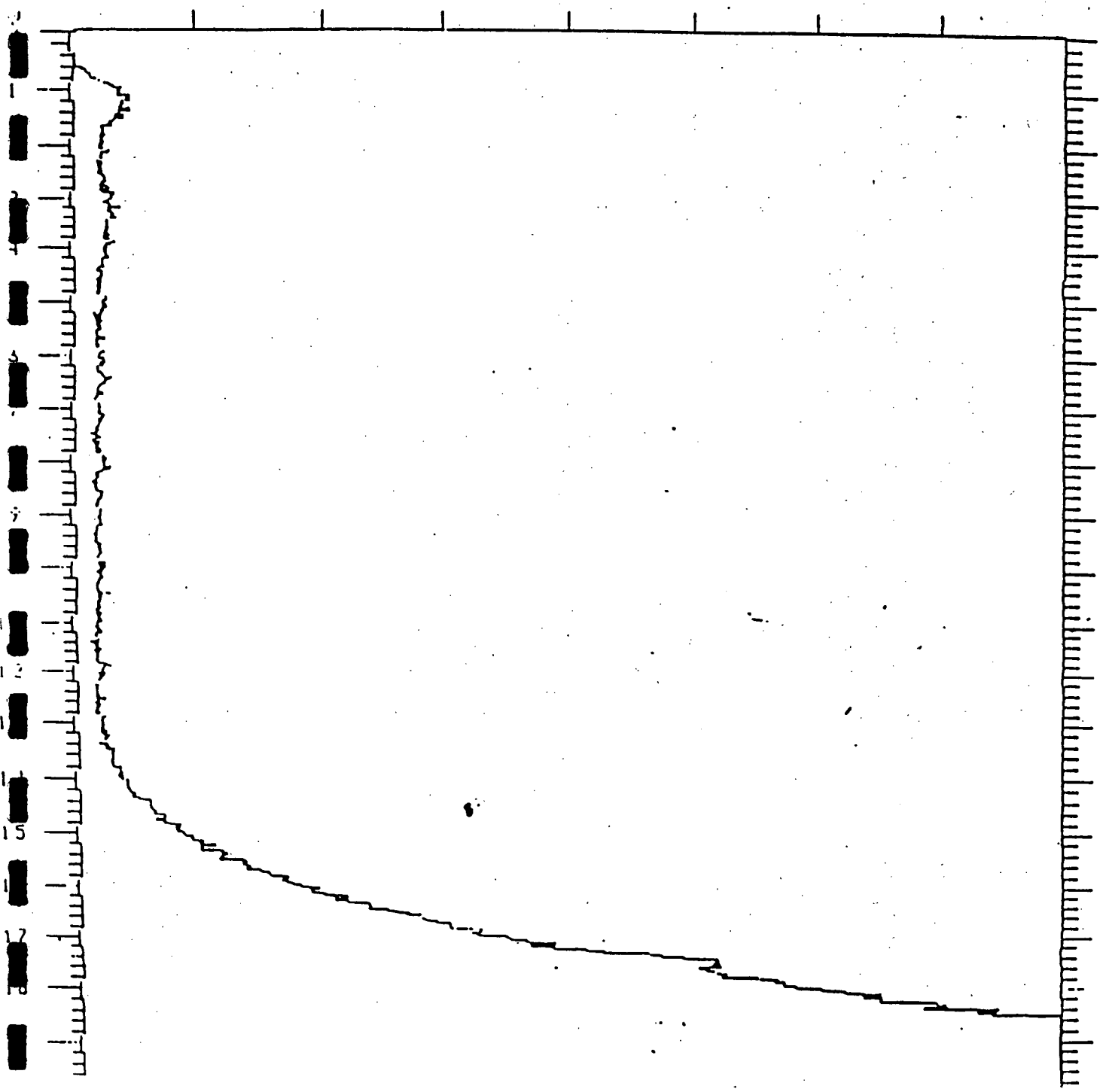
19806
11/18/76

SPECTRUM: 19806RONCO=1

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S.= 2K



FORD

FE

37.304

PPH 17-

3.3280

TRACOR-XRAY SPECTRAL PLOT

SPECTRUM: 1978FORD

TUBE VOLTAGE : 30 KV

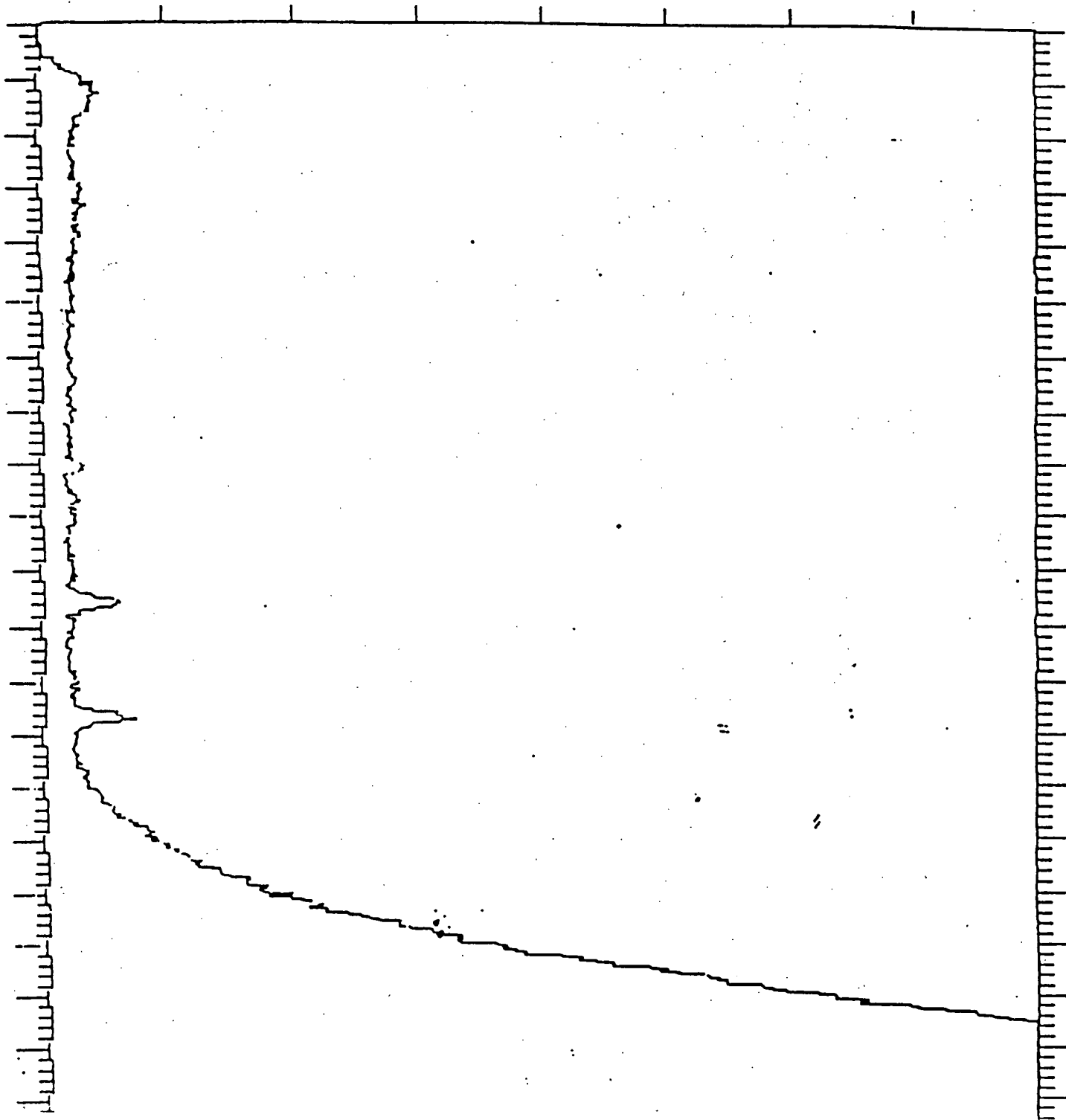
FILTER USED : FIVE

TUBE CURRENT : 0.13 MA

LIVETIME : 100 SEC

ATMOSPHERE : AIR

F.S.= 2K



ELEMENT

CONCENTRATION

ERROR

LEADERTRUC . PB

25.239 PPM +/-

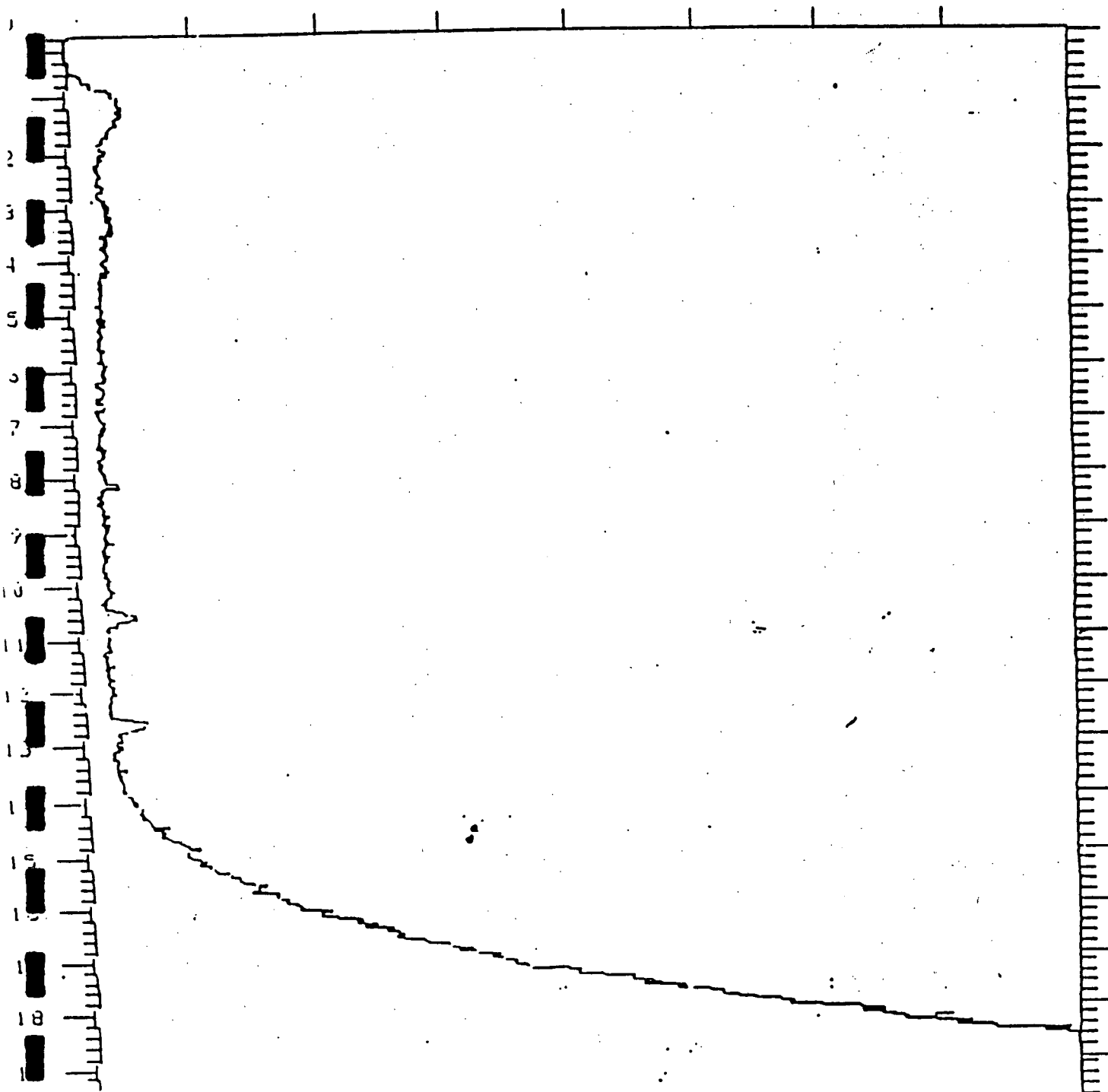
3.2022

TRACOR-XRAY SPECTRAL PLOTSPECTRUM 77 DAYFLOWERTRUC

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.13 MA
ATMOSPHERE : AIR

FILTER USED : FIVE
LIVETIME : 100 SEC

F.S.= 2K





F. SCOTT MYERS
Manager, Environmental Affairs
(606) 357-7884

July 29, 1994

RE: Spent Antifreeze Characterization

As you know, Valvoline has recently conducted a study of spent antifreeze generated at its Valvoline Instant Oil Change (VIOC) facilities. The purpose of this study was to characterize the nature of this waste stream (hazardous -vs- non-hazardous). Characterization was performed per the requirements of 40 CFR 262.11. Testing methods identified in Subpart C of 40 CFR Part 261 combined with generator knowledge were used to evaluate this waste stream.

The evaluation consisted of the analysis of 95 spent antifreeze samples collected from service centers selected to provide a representative sample of the overall distribution of service centers, the various areas of operation, the storage methods and to a limited degree the demographics.

Waste characterization was limited to evaluation of TCLP lead levels only (based on generator knowledge that there are no chlorinated solvents present in the VIOC service centers). Using this generator knowledge and the results of the characterization for lead, we conclude that the used antifreeze generated at the VIOC service centers may be managed as a non-hazardous waste.

Sampling Protocol

A total of 95 service centers located in six different VIOC Regions were sampled. Sampling was performed by VIOC Region and Area Managers. A sample kit containing (1) tank thief, (1) drum thief, sample bottles, labels, and mailer boxes was mailed to each Region. The following protocol was followed at all but (3) of

the service centers sampled. This protocol is consistent with the methods established under 40 CFR 261 Appendix I and "Test Methods for the Evaluation of Solid Waste. Physical/Chemical Methods" U.S. Environmental Protection Agency, Office of Solid Waste.

1) Decontamination: Before each sample is taken, the sample thief must be cleaned (you will need to purchase a non-phosphate cleaner, bottled water, and a soft brush). Using the cleaner and brush, the sampling device (thief) must be thoroughly cleaned. After cleaning, the sampling device should be triple rinsed using bottled water. The sampling device should be wrapped in foil after decontamination and between sampling events.

2) Sampling Equipment: Some of the service centers utilize tanks for storage of spent antifreeze, others utilize drums. Therefore, each sampling kit includes a 6' tank thief and a 3' drum thief. Listed below are operating instructions for these sampling devices:

- Loosen the plastic nut located on the top of the thief and remove the plastic chock.
- Depress the plastic rod/nut assembly. This action should open the lower (stopper) end of the sampling device.
- With the stopper end open, lower the sampling device into the tank/drum to be sampled.
- After obtaining a representative sample from the tank/drum, pull back on the plastic rod/nut assembly, replace the plastic chock, and tighten the plastic nut. This action should close the lower (stopper) end of the sampling device.
- Remove the sampling device from the tank/drum and fill (1) sample bottle with material contained in the sample thief.

3) Labels: After filling each sample bottle, complete one of the enclosed sample labels and place the label on the sample bottle.

4) Mailer Boxes: Included in the sampling kit are mailer boxes. The lids should be screwed securely on top of each filled and properly labeled sample bottle. The bottles should then be placed in the mailer boxes. The mailer boxes must be posted and mailed from your local post office.

Chemical Analysis

A total of (95) samples were sent to the Ashland Petroleum Analytical Laboratory (APAL) for analysis. Total Lead. The analysis was performed under the supervision of Mr. Alvin Schmutz by methods outlined under 40 CFR 261 Appendix III. As mentioned above, three of the samples were removed from the study due to inconsistencies with the approved sampling protocol.

Laboratory reports summarizing the total lead analysis from the remaining (92) samples were studied (see attached). It was determined that TCLP analysis should be performed on eight samples with total lead concentrations exceeding 5 ppm. All eight of the samples remaining in the study contained less than 5 ppm lead per TCLP analysis (see attached laboratory report).

Sincerely,


Scott Myers

cc: M.J. Duffy
J. Fielding
T.P. Gerring
C.A. Moughler
B.L. Tollett

Valvoline Instant Oil Change
Lead and Solids in Used Anti-Freeze

Bottle#	ppm Lead	TCLP Lead wt. ppm	% Solids	Location/Source	Date	Appearance
1	<5		0.007	#4-42	2/16/94	Lt. brown, slight sed.
2	<5		0.002	#06-44	2/2/94	Green, no sed.
3	<5		0.001	#01-61	2/19/94	Dark green, no sed.
4	<5		0.009	VIOC#01-033, 1420 Civic Center Dr. NW Rochester MN 55901	1/18/94	Dark green, slight sed.
5	<5		0.237	0309 Airport Hwy, Toledo, OH	2/15/94	Green, slight sed., thick scum
6	<5		0.045	03064 G-4435 W., Pierson Rd., Flint Mi	1/25/94	Green-brown, some sed., scum
7	<5		0.505	VIOC 02-73 2181 Delaware Ave. Buffalo, NY	2/10/94	Lt. green, some sed.
8	<5		1.225	#06-03	1/28/94	Dark green, heavy sed.
9	9		0.08	#06-07	1/21/94	Dark, some sed.
10	<5			#01-62	2/19/94	Lt. green, no sed.
11	<5			#02-20 VIOC	2/22/94	Lt. green, no sed.
12	<5		0.02	VIOC 02-18	2/16/94	Green-brown, slight sed.
13	<5			#02-63	2/24/94	Lt. brown, no sed.
14	<5		0.09	VIOC 02-24	2/16/94	Dark green, some sed.
15	10	0.7	1.67	#02-09	2/24/94	Dark, heavy sed.
* 16				VIOC 4-35	2/22/94	Dark green, slight sed.
17	9		0.01	VIOC 4-32	2/22/94	Lt. green-brown, no sed.
18	10	0.5	0.01	Region 4 Centre 3 4700 Preston Hwy Lou. KY	2/15/94	Lt. green-brown, no sed.
19	<5			#03-46	2/16/94	Blue-green, slight sed.
20	<5			#4-77	2/11/94	Dark green, slight sed.
21	<5			I-71 Downers Grove, ILL.	2/9/94	Green, slight sed.
22	9		0.03	Region 4 Center 8 7401 Third St., Lou., KY	2/15/94	Green-brown, slight sed.
23	<5			Region 4 Center 4 2114 State St. New Albany, Ind.	2/15/94	Green, slight sed., scum
24	<5			#06-08	2/2/94	Green, slight sed.
25	<5	<0.01		#02-08	2/25/94	Lt. brown, no sed.
26	5		0.05	2400 Frankfort Ave., Louisville KY	2/15/94	Dark, slight sed., scum
27	8		0.18	#06-08	1/21/94	Lt. green, some sed.
28	6	0.7	0.33	#03-78 1115 S. Saginaw Rd., Midland, Mi 48640	1/25/94	Green-brown, slight sed., scum
29	<5			#03-67 Allen Park, Mich.	2/9/94	Green-brown, no sed.
30	<5		0.01	#4-37 by D. Merideth	2/11/94	Dark green, slight sed.
31	7		0.21	#03-25 Southgate, Mich.	2/9/94	Green, slight sed., scum
32	<5			#6-46 Warren, Ohio	1/18/94	Green, no sed.
33	6	2.4	<0.01	#06-63 From used antifreeze holding drum	2/6/94	Lt. green, no sed.
34	<5		0.27	#03-73 Hayes Rd, Frazer, Mich.	2/9/94	Brown-green, slight sed., scum

* Samples rejected due to improper sampling technique.

Valvoline Instant Oil Change
Lead and Solids in Used Anti-Freeze

35	<5			#03-56 2121 28th St.SW, Wyoming, Mi		Dark green, no sed., scum
36	6		0.06	#06-73 Holding tank had 1/4" oil slick left from pick up truck	2/6/94	Brown-green, no sed., scum
37	<5			#06-28	1/22/94	Dark green, slight sed.
38	<5			#01-040 Fairbank, MN Retaining tank has oil on top.	1/25/94	Lt. green, no sed.
39	<5			#6-0072 Bridgeville, PA	2/11/94	Lt brown, no sed.
40	<5			#4-80 D.Merideth	2/11/94	Dark green, no sed.
41	<5			#03-49 7501 E. Main Jenison	2/16/94	Dark green, no sed., scum
42	<5			#06-40	2/2/94	Brown, no sed.
43	<5			#06-18 55 gall drum VIOC	1/21/94	Green, no sed.
44	20	<0.3	<0.01	#1-52 56320 Da?? Road	2/3/94	Dark green, slight sed.
45	<5			Barrel Antifreeze #5-48 B. Brewer	1/25/94	Lt. green
46	<5			#4-49	2/16/94	Lt. green
47	<5			#01-63	2/19/94	green
48	<5		0.21	#03-70 Trenton, Mich	2/9/94	Brown-green, slight sed., scum
49	8	0.8	0.01	VIOC 06-52	1/26/94	Brown, some sed.
50	<5			Barrel #5-23 B. Brewer	1/25/94	Lt. green, no sed.
51	<5			Region 4 Store 33	2/11/94	Lt. green, no sed.
52	<5			#03-11 #11 Jackson, Mi	1/28/94	Green, slight sed., scum
53	<5			#06-56 Canton OH	1/26/94	Green, slight sed.
54	<5		0.05	11813 Shelbyville Rd,Louisville, KY 40243 #4-13 Chuck Runyon	2/16/94	Brown-green, some sed.
55	<5			#4-48	2/18/94	Brown-green, slight sed.
56	<5		0.39	#03-84, Novi, Mich	2/16/94	Dark green, some sed., scum
57	9		0.02	Liberty, Ohio #6-57	1/18/94	Brown, some sed.
58	<5			#06-62, From used antifreeze holding drum	2/6/94	Lt. green, no sed.
59	<5			#03-31, 28033 John R, Madison Hts, Mich	2/9/94	Lt. green, no sed., scum
60	<5			#1-54, 5522 W. V?iversiz, Mad????	2/3/94	Brown-green, no sed.
61	<5			#03-76, 16335 Mack, Detroit, Mich.	2/9/94	Brown-green, no sed.
* 62				#06-12, 55 Gall Drums, VIOC	1/21/94	Brown-green, no sed.
63	<5		0.04	Barrel 7, #5-26, B. Brewer	1/25/94	Lt. green, no sed.
64	<5		0.01	#03-48, 1200 Plainfield Grand Rapids, Mo	2/16/94	Dark green, no sed.
65	<5		0.01	#03-58, 3234 Plainfield Grand Rapids, Mo	2/16/94	Green, no sed.
66	<5		0.01	#02-64,Cieero NY	2/25/94	Green, no sed.
67	<5		1.37	VIOC #02-40	3/7/94	Dark green, heavy sed.
68	<5		0.1	#02-06 North Syracuse NY	3/3/94	Dark green, slight sed.
69	12	0.9	0.3	VIOC #02-42	3/7/94	Dark green, slight sed., scum
70	10	0.4	0.03	VIOC #02-47		Dark green-brown, slight sed.
71	<5			VIOC #05-28 13411 Olive, Chesterfield, Mo. 63017		Dark green, no sed., scum

Valvoline Instant Oil Change
Lead and Solids in Used Anti-Freeze

72	<5	0.01	Region 5 Store 41		Green, slight sed.
73	<5		Region 5 Store 7		Green, no sed.
74	<5		Region 5 Store 2		Lt. brown, no sed.
75	<5		VIOC #05-14, 2020 Old Highway 94 S, St. Charles, Mo. 63303		Green, no sed.
76	<5		#02-12 Syracuse NY Thompson Rd	3/3/94	Dark green, no sed.
77	<5	0.85	#4-22-4181 Bates Creek Rd., Lexington, KY 40515	2/8/94	Dark, some sed., scum
78	5	0.07	St. Louis Region 5 Store 46		Dark green-brown, slight sed., scum
79	<5		St. Louis Region 5 Store 9		Green, no sed., scum
80	<5	0.03	VIOC 05-04, 304 Midreivers Mall Dr., St. Peters, Mo. 63376		Green, slight sed.
81	<5		St. Louis Region 5 Store 21		Lt. brown, no sed.
82	<5		VIOC 05-08, 9620 St. Charles Rock Rd., Breckenridge Hills, Mo 63114		Green, no sed., scum
83	<5		#06-05, 55 gall drum, VIOC	1/19/94	Green-brown, no sed.
* 84			VIOC 02-74, 2218 Sheridan Dr., Tonawanda, NY. Tank nearly empty	2/10/94	Dark green, some sed.
85	<5		#0312, Hill Rd., Flint, Mi.	1/25/94	Green-brown, some sed.
86	<5		VIOC 02-78, 5895 Transit Rd., Lockport, NY. Tank nearly empty.	2/10/94	Dark, some sed.
87	<5	0.1	#03-80 Glendale- Toledo, Ohio	2/15/94	Dark green, some sed.
88	<5	2.23	#03-82 #83 Waverly Rd., Lansing, Mi.	1/28/94	Lt. green, no sed., thick scum
89	<5		#03-68 Oak Park, Mi.	2/9/94	No sample left
90	<5	6.42	#03-72, 5 Mile & Merriman ??????	2/9/94	Dark sludge
91	<5		#4-26, 530 Lexington Rd., Versailles, KY	2/10/94	Lt. brown, no sed.
92	<5	0.07	#03-50, 925 Leona Rd., Grand Rapids, Mi	2/16/94	Green, slight sed.
93	<5		#03-40, 13th & Ryan, Warren, Mich	2/9/94	Lt. green, no sed., scum
94	5	0.5	#02-01, 300 gal tank	2/24/94	Dark, some sed.
95	<5		#01-010, Man?ato, Mn	3/3/94	Green, slight sed.

**State of New Jersey**

DEPARTMENT OF ENVIRONMENTAL
PROTECTION AND ENERGY
Hazardous Waste Regulation Program
CN 421

CHRISTINE TODD WHITMAN
Governor

Trenton, NJ 08625-0421
Tel. #609-633-1418

ROBERT C. SHINN, JR.
Commissioner

Position on the Management of Used Antifreeze

Effective date: **11 20 1994**

Approval: *[Signature]*

NJ Applicable Rule (citation): N.J.A.C. 7:26-8.5 (Hazardous waste determination-generator responsibility)
N.J.A.C. 7:26-8.9 through 8.12 (TCLP characteristics)

Federal Rule Equivalent: 40 CFR part 262.11 and 40 CFR parts 261.20-261.24

1) Purpose:

The Present environmental purpose for the above regulations is to identify solid wastes that exhibit one or more of the hazardous characteristics of Ignitability, Corrosivity, Reactivity, and Toxicity which may pose a hazard to human health or the environment when they are improperly treated, stored, transported, and disposed.

2) Basis and Background:

The Hazardous Waste Regulation Program has established the following position on the management of used antifreeze (ethylene glycol). This position is supported by a study conducted by the New Jersey Automobile Dealers Association (NJADA) and a 1992 Technical and Administrative Guidance Memorandum/Technical Manual from the New York State Department of Environmental Conservation (NYSDEC).

The study conducted by the NJADA included used antifreeze that was collected and stored in antifreeze-only containers prior to characteristic testing. The used antifreeze in this study was analyzed for the following characteristics: TCLP metals, TCLP volatiles and semi-volatiles, total petroleum hydrocarbon content, reactive sulfide and cyanide, corrosivity (pH), and ignitability (flashpoint). When samples were taken from antifreeze which was not cross contaminated, this study revealed that no characteristics exceeded regulated hazardous waste levels. Therefore, any handling practices which could minimize the cross contamination of used antifreeze would be supported by the NJADA study.

The above study and the NYSDEC Technical Manual both conclude that new (unused) antifreeze (ethylene glycol) is not a listed hazardous waste, however, used antifreeze may become hazardous from cross contamination. In an effort to minimize cross contamination, the NJDEP, in agreement with the NJADA and the NYSDEC, suggests that generators of used antifreeze follow these management practices:

1. Use dedicated collection equipment, including collection funnels, transfer buckets, and storage drums or tanks.

2. Do not use chlorinated solvents or any solvent that is potentially hazardous to clean antifreeze collection equipment. It is recommended that the dealership or used antifreeze generator refrain from using chlorinated or listed hazardous solvents for any purpose; and that no chlorinated or listed hazardous solvents be on site.

3. Prevent potential contamination of collected antifreeze by educating mechanics as to the need to keep collected used antifreeze free from exposure to petroleum wastes, cleaning solvents, and other potentially solvent-containing materials.

4. Provide a well-labeled collection container such as a plastic drum. The labelling should indicate that only used antifreeze should be allowed to enter the collection container, and that chlorinated solvents can not be used to clean the collection container. In addition, the drums should be kept closed except when emptying or filling.

5. These management practices must be conspicuously posted at the collection container, and at each work station where used antifreeze may be collected.

3) Intent:

Used antifreeze, when improperly managed, may become contaminated. Therefore, when N.J.A.C. 7:26-8.5 was promulgated, the intent was to give the generator of a solid waste the responsibility to determine whether or not the generated waste was hazardous. This could be done by the generator using knowledge of the waste or by the generator testing for characteristics. When N.J.A.C. 7:26-8.9 through 8.12 (40 CFR parts 260.20 through 260.24) were promulgated, the intent was to be able to identify materials that display hazardous characteristics, which thereby pose a threat to human health, especially when improperly managed.

4) Application:

It is the opinion of the Hazardous Waste Regulation Program that cross contamination by such contaminants as petroleum wastes, cleaning solvents, and other solvent-containing materials is a major factor in used antifreeze testing above the regulatory level for hazardous characteristics.

5) Position:

The best way to minimize cross contamination of used antifreeze would be to utilize the management practices for the handling and storing of used vehicle antifreeze that are mentioned in the "Basis and Background" section of this paper. Practicing these handling and storage procedures should eliminate the need for generators to test their used antifreeze for TCLP characteristics (N.J.A.C. 7:26-8.9 through 8.12), as set forth at N.J.A.C. 7:26-8.5.

If you have any questions concerning our position on this subject, please contact the Hazardous Waste Regulation Program at (609) 633-1418.

PR91,70(S1):rjw
7/19/94 (revised)

[t]he [CMA] Petition falsely claims that Ethylene Glycol is "highly essential" to airline passenger safety.

In support of this allegation ARCO says:

an alternate product, propylene glycol, is as effective in assuring safety and is less toxic. ARCO Chemical Company and others supply this product to users throughout the U.S. and it is used almost universally in Europe.

ARCO submitted two Environment Canada reports in support of its claims¹.

CMA claims in its petition that "ethylene glycol plays a highly essential role in the safety of all airline passengers....," and not, as stated by ARCO, that it is "highly essential to airline passenger safety." Because ethylene glycol is widely used in the United States and elsewhere as a deicing and anti-icing agent for aircraft, it is true that ethylene glycol does play a "highly essential role" in removing ice from aircraft surfaces and in prevention of ice formation. As ARCO claims, ethylene glycol is not the only material available that may play this role.

ARCO's principal thesis in its response to the CMA petition is that application of the secondary criterion of biodegradability to ethylene glycol is not supported by reliable literature data. As a result, ARCO claims that the RQ for ethylene glycol should not be adjusted upward to 5000 pounds from its primary criterion RQ of 1000 pounds. In the paragraphs below a re-examination of the literature concerning the biodegradability of ethylene glycol is discussed and the conclusion is reached that under certain circumstances in the environment it is likely that the biodegradation half life for ethylene glycol is less than five days, which is the threshold for an upward RQ adjustment.

A secondary claim found in the ARCO response proposes that propylene glycol, an alternative aircraft deicer and anti-icer produced by ARCO and others, is less toxic than ethylene glycol. This claim does not affect the RQ adjustment for ethylene glycol; however, the literature concerning this subject was examined and it is concluded that this claim by ARCO is not entirely supported. An

¹MacDonald, D.D., I.D. Cuthbert, and P.M. Outridge, Canadian Environmental Quality Guidelines for Three Glycols used in Aircraft De-Icing/Anti-Icing Fluids: Ethylene Glycol, Diethylene Glycol, and Propylene Glycol. Workshop Draft prepared for the EcoHealth Branch, Environment Canada and Environmental Services, Airports Branch, Transport Canada. July, 1992.

Sabeh, Y., Evaluation of the Impact of De-Icing Products on the Environment and on Health. A translation with no citation data provided. Undated.

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John J. Rigby

TEL (703) 841-1100

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October 23, 1997

Ms. Gail Cooper
Office of Solid Waste
Environmental Protection Agency
Washington, D.C. 20460

Dear Ms. Cooper:

As we discussed, I am enclosing information concerning the potential environmental impact of ethylene glycol. The enclosed documents show that government agencies have repeatedly concluded that ethylene glycol presents little environmental concern.

For example, when increasing the Reportable Quantity of ethylene glycol under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to the maximum 5,000 pound level, the Environmental Protection Agency (EPA) concluded that "Neither ethylene glycol nor propylene glycol exhibit a high degree of . . . aquatic toxicity. . . ." EPA Memorandum to the Record, "Evaluation of the RQ to be Proposed for Ethylene Glycol" (May 5, 1993) (enclosed).

As another example, the Federal Aviation Administration (FAA) analyzed the environmental impact of ethylene-glycol based deicing fluid, which is very similar to antifreeze, in an Environmental Assessment. The FAA, under the National Environmental Policy Act (NEPA) made a Finding of No Significant Impact (FONSI) for its Aircraft Ground Deicing and Anti-Icing Program.

In its Finding of No Significant Impact, the FAA concluded that: "The characteristics of glycols which are the active component in Type I and Type II deicing/anti-icing fluid (e.g., low toxicity, low volatility, high biodegradability) lead to minor environmental and public health impacts." FAA FONSI at 2 (enclosed).

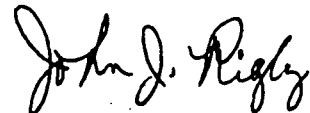
The FAA's Environmental Assessment addressed the release of ethylene glycol to bodies of water, stating that: "Glycols, the basic component in deicing/anti-icing fluids, biodegrade quickly and, therefore, likely decompose into their most oxidized form (i.e., carbon dioxide and water) soon after entering a surface water body. Therefore, no long-term adverse impacts on surface water bodies would be expected." FAA Environmental Assessment at 10 (enclosed).

The FAA Environmental Assessment also addressed the discharge of ethylene glycol to Publicly-Owned Treatment Works (POTWs). It stated that a "second potential route for glycols to enter the water environment would be through storm sewers that drain into POTWs. Under this scenario, the decomposition of glycols would take place in a POTW, where sewage is aerated during treatment. No adverse effects on POTW operations are predicted. In fact, compounds with high BOD can increase the productivity of POTW operations where biological treatment is frequently used." FAA Environmental Assessment at 11 (enclosed).

EPA reached a similar conclusion in a Federal Register notice on stormwater discharges. In discussing disposal of ethylene glycol from deicing fluids to a POTW, EPA stated that: "Because glycols are readily biodegradable, runoff can be treated along with sanitary sewage." 58 Fed. Reg. 61146, 61361-63 (November 19, 1993).

In short, both the EPA and the FAA have concluded that ethylene glycol presents little environmental concern. Please feel free to contact me if you have any questions.

Sincerely,



John J. Rigby

Enclosures



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 5 1992

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Evaluation of the RQ to be Proposed for Ethylene Glycol

FROM: Gerain Perry, Chief *Gerain Perry*
Response Regulations Development Section

TO: The Record

On November 22, 1991, the Chemical Manufacturers Association Ethylene Glycol Panel (CMA) submitted a petition to the Agency requesting the expedited adjustment of the reportable quantity (RQ) of ethylene glycol under section 102 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended. The Agency has been in the process of preparing a proposed rule for the RQ adjustment of ethylene glycol and 46 other hazardous substances added to the CERCLA list by the Clean Air Act Amendments of 1990 since these amendments were signed into law on November 15, 1990.

After evaluation of the information available concerning ethylene glycol, it became the intention of the Agency to adjust the RQ for this hazardous substance to 5000 pounds on the basis of the primary criterion of chronic toxicity and the secondary criterion of biodegradation. Information supporting this adjustment is summarized in the draft technical background document supporting the proposed rulemaking. The CMA petition provides information concerning the toxicity of ethylene glycol and its potential for biodegradation in the environment. This information substantially agrees with the information in the Agency's possession and arrives at the same conclusion as the Agency; the proposed adjusted RQ for ethylene glycol should be 5000 pounds on the basis of chronic toxicity and the potential for biodegradation in the environment.

On September 18, 1992, the Agency received an undated response to the petition to adjust the RQ for ethylene glycol from ARCO Chemical Company (ARCO). In this response ARCO opposes the use of the secondary criterion of biodegradation in adjusting the RQ of ethylene glycol. ARCO claims that reliable literature data show that ethylene glycol does not biodegrade at the minimum rate necessary to warrant upward adjustment of the RQ. ARCO also notes that:

analysis of ethylene glycol and propylene glycol toxicities can be found in Appendix A.

Biodegradability of Ethylene Glycol

ARCO claims in its response to the CMA petition that "[r]eliable literature data show that Ethylene Glycol does not biodegrade at the minimum rate to warrant an upward adjustment in level." ARCO further claims that "[o]nly unpublished internal company reports appear to show five-day BOD values above the 50 percent threshold." ARCO submitted a summary of five-day biological oxygen demand (BOD₅) data in support of this claim. This summary is attached as Appendix B.

Table 1 expands upon the information provided by ARCO in its summary containing BOD₅ data for ethylene glycol and includes literature not cited by ARCO and not cited by CMA. There is no agreement in the literature, nor is there agreement between unpublished tests done in corporate laboratories, on the rate of degradation of ethylene glycol. There exists considerable evidence in the open literature for rapid degradation (BOD₅ greater than 50 percent) and in reports from corporate laboratories. The differences in rates observed may be due to differing inoculum, varying acclimatization of seed, or lag periods engendered by shock to the degrading organisms. A conclusion of great interest for natural degradation of ethylene glycol is that found in a study by Evans et al. (1974) indicating that it is rapidly degraded in four different river waters by naturally occurring organisms. As expected, degradation proceeds much more slowly at lower temperatures. This is most probably true for all hazardous substances.

Information submitted by ARCO concerning BOD for Texaco deicing fluids [Harding (1991)] and included here as Appendix C provides a side-by-side comparison of the biodegradation of a propylene glycol deicer (PG Deicer) and an ethylene glycol deicer (EG Deicer). Not only is the variability in degradation rate with temperature made clear by this exhibit, but the erratic nature of the BOD test is also evident. For example, PG Deicer is reported to have a BOD₅ at 10° Celsius (C) of 35 percent and at 15°C of 10 percent. This result is unlikely and is probably indicative of uncertainty in the results. Harding (1991) concludes that the two "products biodegrade essentially the same" and that the "BOD test is erratic."

ARCO's claim concerning the reliance of the CMA petition on unpublished reports is untrue. CMA cites both published and unpublished data to support its contention that ethylene glycol is readily biodegradable in the environment. Based on the data available, it is not possible to confidently provide an environmental half life for ethylene glycol. However, based on reliable literature data, it is possible to state that, under

Appendix A

TOXICITY OF ETHYLENE GLYCOL AND PROPYLENE GLYCOL

ARCO's claim that propylene glycol is less toxic than ethylene glycol is sweeping and may not be entirely accurate. It is difficult to compare the toxicities of different substances unless the comparison is made "side-by-side" by the same experimenter in the same laboratory using the identical experimental protocol. When comparing ethylene and propylene glycol, both having relatively low toxicities, in different experiments, the differences in toxicities must be very great to be meaningful.

Acute Mammalian Toxicity

The oral and dermal toxicities of propylene glycol appear to be lower than that of ethylene glycol in separate experiments. The toxicities of both substances are very low. An inhalation toxicity measure for propylene glycol has not been found in the available literature. The acute mammalian toxicities of propylene and ethylene glycol are summarized in Table A-1.

Table A-1

Acute Mammalian Toxicity for Ethylene and Propylene Glycols

Administration	LD ₅₀ or LC ₅₀ [*] (Data from the Registry of Toxic Effects of Chemical Substances, RTECS)	
	Ethylene Glycol	Propylene Glycol
Oral (rat)	4.7 gm/kg	20 gm/kg
Dermal (rabbit)	9.5 gm/kg	20.8 gm/kg
Inhalation (rat)	> 198 mg/m ³	Not Available

* Dose or concentration lethal to 50 percent of test animals in grams per kilogram (gm/kg) or milligrams per cubic meter (mg/m³).

Application of these data to the methodology for RQ adjustment provides a primary criterion RQ for both substances of 5000 pounds based on exceeding the maximum level for adjustment.

certain circumstances (e.g., some natural river waters at 20°C), the half life of ethylene glycol is less than 5 days.

Table 1
BOD₅ Data for Ethylene Glycol

Reference	Cited by ARCO	Cited by CMA	BOD ₅ Value
Gloyna (1963) (Complete Reference Not Available)	Yes	No	12.5%
Price et al., JWPCF, 46(1):63-77 (1974)	Yes	Yes	34% (fresh water) 20% (salt water)
Shah (1990) - Union Carbide Presentation	Yes	No	34%
Bridie et al., Water Research, 13:627-630 (1979)	Yes	Yes	36% (unacclimated seed) 63% (acclimated seed)
Conway et al., Env. Sci. Tech., 17:107-112 (1983)	Yes	Yes	39%
Harding (1991) - Texaco SAE Report	Yes	No	40%
Lund, Industrial Pollution Control Handbook (1971)	Yes	Yes	48%
Union Carbide Internal Report	Yes	Yes	51%
HSDB, National Library of Medicine (1989)	No	Yes	>50% (half life = 3 days)
Howard, Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume II: 253-257 (1990)	No	Yes	>50% (Degradation essentially complete in 1-4 days)
Dow Internal Report	Yes	Yes	60.5%
Union Carbide Internal Report	Yes	Yes	68%
Pitter, Water Research, 10:231-235 (1976)	No	Yes	96.8% (based on Chemical Oxygen Demand, COD)
Evans et al., Water Research 8(2):97-100 (1974)	No	Yes	100%
Haines et al., Applied Microbiology, 29(5):621-625 (1975)	No	Yes	100%

Summary of Biodegradation Data

Biodegradation of ethylene glycol has been extensively studied and reported privately and in the open literature. There is some disagreement in the rate of degradation with BOD₅ results ranging from 12 percent to 100 percent. Most authors acknowledge, however, that ethylene glycol is readily degraded in the environment. Biodegradation, as expected, is

highly temperature dependent; occurring at slower rates in colder water. The CMA petition cites three original research articles published in the open literature (Pitter, 1976; Evans et al., 1974; and Haines et al., 1975) providing BOD₅ or COD data demonstrating complete or nearly complete degradation of ethylene glycol in less than 5 days. ARCO's contention that the CMA petition relies upon unpublished data to reach its conclusion concerning the upward adjustment in the RQ for ethylene glycol is, therefore, unfounded.

The Proposed RQ Adjustment for Ethylene Glycol

Ethylene glycol has been found to be fetotoxic in the rat upon chronic dosage providing an effect rating value (RV_e) of 10 and a dose rating value (RV_d) of 1.² The product of the RV_d and the RV_e provides a composite score (CS) of 10 and a primary criterion RQ of 1000 pounds. Ethylene glycol biodegrades rapidly in the environment with a half life estimated to be five days or less. Thus, ethylene glycol is eligible for a one level increase in its RQ to 5000 pounds on the basis of the secondary criterion of biodegradation.

²Technical Background Document to Support Rulemaking Pursuant to CERCLA Section 102, Volume 7, Reportable Quantity Adjustments for Clean Air Act (CAA) Hazardous Air Pollutants Added as CERCLA Hazardous Substances. Draft, September 30, 1992.

Aquatic Toxicity

Aquatic toxicities for ethylene glycol and propylene glycol can be found in Table A-2. Application of the RQ adjustment methodology provides a primary criterion RQ of 5000 pounds for both substances based on exceeding the maximum level for adjustment. The aquatic toxicities of both ethylene and propylene glycol are the same for rainbow trout fry (*Oncorhynchus mykiss*) and the relative toxicities for several other species of amphibians, fish, crustaceans, and algae are undetermined.

Table A-2.

Aquatic Toxicity of Ethylene Glycol and Propylene Glycol

Class/Species	Aquatic Toxicity - LC ₅₀ (mg/L)* (from MacDonald, 1992)	
	Ethylene Glycol	Propylene Glycol
Amphibian <i>Xenopus laevis</i>	326 (48 hour)	Not Available
Osteichthyes <i>Oncorhynchus mykiss</i> (fry)	45,600 (96 hour)	45,600 (96 hour)
<i>Oncorhynchus mykiss</i> (large fry)	17,800 (96 hour)	Not Available
<i>Lepomis macrochirus</i>	> 10,000 (96 hour)	Not Available
<i>Pimephales promelas</i>	57,000 (96 hour)	Not Available
<i>Carassius auratus</i> **	> 5,000 (24 hour)	> 5,000 (24 hour)
Crustacea <i>Daphnia magna</i>	46,300 (48 hour)	> 10,000 (48 hour)
<i>Ceriodaphnia dubia</i>	25,800 (48 hour)	Not Available
<i>Procambarus sp.</i>	91,430 (96 hour)	Not Available
Algae <i>Scenedesmus quadricauda</i>	> 10,000 (192 hours)	Not Available
<i>Anacystis Aeruginosa</i>	2,000 (? hours)	Not Available

* Milligrams per liter (mg/L) with time of exposure in parentheses.

** Bridie, C.J., et al. The Acute Toxicity of Some Petrochemicals to Goldfish. Water Research, 13:623-626 (1979).

Chronic Toxicity.

Because of differences in administration route (subcutaneous vs. oral) direct comparisons of reproductive effects cannot be made. However, for both propylene glycol and ethylene glycol fetotoxicity (post-implantation fetal mortality) has been observed after treatment (RTECS). Fetal mortality is the endpoint used to establish an RV_e of 10 for ethylene glycol according to the methodology for RQ adjustment. An RV_d of one (the lowest possible value) was derived for ethylene glycol on the basis of the high doses necessary to cause the observed effect. A CS of 10 is derived from these two values leading to a primary criterion RQ of 1000 pounds for ethylene glycol. There is insufficient information available to determine a chronic toxicity score for propylene glycol.

Potential Carcinogenicity

Examination of RTECS and the Hazardous Substances Data Bank (HSDB) indicates that ethylene glycol shows no evidence of potential carcinogenicity and that it shows no significant mutagenic activity in the Ames test. The National Toxicology Program reported no evidence of carcinogenic activity in a two year feeding study of male and female mice.¹ HSDB reports that intraperitoneal administration of propylene glycol to mice produced chromosomal aberrations in spermatocytes. Both ethylene glycol and propylene glycol have been in consumer use for many years and there is no evidence to conclude that either substance is a potential carcinogen. For these reasons, both ethylene glycol and propylene glycol may be categorized as either category D (not classifiable as to human carcinogenicity) or category E (evidence for non-carcinogenicity for humans) potential carcinogens. Substances in either of these categories are not provided a hazard ranking and a proposed RQ must be based on other primary criteria.

Summary of the Toxicity Data

Neither ethylene glycol nor propylene glycol exhibit a high degree of acute toxicity, aquatic toxicity, or potential carcinogenicity. Propylene glycol may be somewhat less acutely toxic than ethylene glycol, at least through oral and dermal exposure routes. The two substances may be approximately equally toxic to aquatic species, though few experiments with propylene glycol have been reported. The observed fetotoxicity of propylene glycol *via* subcutaneous injection can not be used to derive a chronic toxicity score for this substance. Fetotoxicity through oral exposure for ethylene glycol can, however, be used to derive a chronic toxicity primary criterion RQ of 1000 pounds for this hazardous substance. There is no evidence for potential carcinogenicity in humans for either substance.

¹National Toxicology Program, 1992. Management Status Report. Division of Toxicological Research and Testing. Research Triangle Park, NC. July 22, 1992, p. 20.

ARCO's claim that propylene glycol is less toxic than ethylene glycol is not fully substantiated in the literature. Aquatic toxicities appear to be about equal, while fetotoxicity is observed for both substances albeit by different exposure routes. No information has been found concerning the inhalation toxicity of propylene glycol.



ETHYLENE GLYCOL BOD(5) DATA^{1/}

<u>Citation</u>	<u>Source</u>	<u>Cited in Petition</u>	<u>BOD(5) Value</u>
Gloyna (1963)	Report	No	12.5%
Price (1974)	Literature	Yes	34% (fresh water) 20% (salt water)
Shah (1990)	Union Carbide Presentation	No	34%
Bridie (1979)	Literature	Yes	36% (unacclimated seed) 63% (acclimated seed)
Conway (1983)	Literature	Yes	39%
Harding (1991)	Texaco SAE Report	No	40%
Lund (1971)	Literature	Yes	48%
Reference 43	Union Carbide Internal Report	Yes	51%
Reference 36	Dow Internal Report	Yes	60.5%
Reference 37	Union Carbide Internal Report	Yes	68%

^{1/} References are ordered from lowest to highest reported BOD values.

METHOD 507 OXYGEN DEMAND (BIOCHEMICAL)

	<u>93% PG DEICER</u>	<u>93% EG DEICER</u>
BOD ₅ @ 4°C	0%	0%
BOD ₅ @ 10°C	35%	3%
BOD ₅ @ 15°C	10%	10%
BOD ₅ @ 20°C	54%	40%
BOD ₂₀ @ 4°C	7%	6%
BOD ₂₀ @ 10°C	56%	38%
BOD ₂₀ @ 15°C	48%	43%
BOD ₂₀ @ 20°C	58%	53%

VALID SIDE-BY-SIDE COMPARISONS - DIFFERENT NUMBERS.

PRODUCTS BIODEGRADE ESSENTIALLY THE SAME.

BOD TEST IS ERRATIC.

REF: "BIOCHEMICAL OXYGEN DEMAND OF TEXACO DEICING
FLUIDS," DR. G. L. HARDING, JULY 18-19, 1991, SAE
AD HOC COMMITTEE MEETING.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
FINDING OF NO SIGNIFICANT IMPACT
FOR

Aircraft Ground Deicing and Anti-Icing Program
14 CFR Part 121, Final Rule

A. Introduction

The proposed rule requires operators of large cargo planes or aircraft with a capacity of more than 30 passengers (i.e., part 121 certificate holders) to develop and comply with an FAA-approved deicing/anti-icing program. Each program must include how the certificate holder determines that ground deicing/anti-icing procedures must be in effect, operational procedures, specific duties and responsibilities of personnel during deicing/anti-icing, and training in these duties and procedures. A carrier may operate without a deicing/anti-icing program only if critical aircraft surfaces are inspected within five minutes of takeoff from outside of the aircraft.

Two types of fluid, based on ethylene glycol, propylene glycol, or diethylene glycol, are used for deicing/anti-icing of aircraft. The fluid is effective for a period of time depending on weather conditions; this is called the holdover time (HOT). Type II fluid has a higher viscosity than Type I fluid, and typically has a longer HOT. Because deicing of aircraft and preflight inspections are currently required, the general operations at airports are not anticipated to change based on the proposed requirement for an approved plan. However, one new requirement is analysis of HOTs and if a HOT has been exceeded, a pretakeoff contamination check must be undertaken to show that critical surfaces are free of contamination, or the aircraft has been re-deiced. A variety of changes in deicing/anti-icing operations could result from implementing the proposed rule:

- Centralized application of Type I fluid, simplifying containment of fluids and potentially reducing the volume used;
- More frequent reapplication of Type I fluid, increasing the volume used. However, if the initial application of fluid is postponed until a plane is able to takeoff within the HOT, volume of Type I fluid used would remain constant or could decrease.
- Increased use of Type II fluid to lengthen HOT.

In the last 23 years, there have been 15 accidents related to the failure to deice the aircraft adequately before takeoff, resulting in fatalities and injuries, as well as the destruction of aircraft. These accidents and the recent International Conference on Airplane Ground Deicing indicate that, under present procedures, the pilot in command may be unable to effectively determine whether the aircraft's critical surfaces are free of all contamination prior to attempting takeoff. The two alternatives considered are no action, which leaves the current regulations unchanged, or the proposed rule requiring an FAA-approved deicing/anti-icing program.

B. Statement of Environmental Significance of the Proposed Action

After careful and thorough consideration of the facts contained herein and in the attached environmental assessment, the undersigned finds that the proposed Federal action is consistent with existing national environmental policies and objectives as set forth in Section 101(a) of the National Environmental Policy Act of 1969 (NEPA) and that it will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2) (C) of NEPA. Additionally, the FAA bases this finding on the following reasons.

C. Reasons

The following reasons support the Finding of No Significant Impact (FONSI):

- The proposed rule does not require specific changes to airport deicing/anti-icing operations;
- The baseline environment (as described in Section D of the EA) is already impacted by ongoing airport operations, including current deicing/anti-icing programs and the incremental impacts of the proposed rule are predicted to be minimal;
- The characteristics of glycols which are the active component in Type I and Type II deicing/anti-icing fluid (e.g., low toxicity, low volatility, high biodegradability) lead to minor environmental and public health impacts; and
- Mitigation measures for air (release reporting under the Clean Air Act) and water quality (storm water discharge NPDES permits) will reduce expected minor impacts even further, producing no significant impacts overall.

APPROVED: _____

DATE: 9/3/92

DISAPPROVED: _____

DATE: _____

**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ENVIRONMENTAL ASSESSMENT
for
Aircraft Ground Deicing and Anti-Icing Program
14 CFR Part 121; Final Rule**

August 1992

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LIST OF ACRONYMS

ATA	Air Transportation Association
ATC	air traffic control
BOD	biochemical oxygen demand
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOT	Department of Transportation
EIS	environmental impact statement
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
HOT	holdover time
ISO	International Organization for Standardization
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
NPRM	Notice of Proposed Rulemaking
OSHA	Occupational Safety and Health Administration
PET	polyethylene
POTW	publicly owned treatment works
ppm	parts per million
RQ	reportable quantity
SAE	Society of Automotive Engineers
SARA	Superfund Amendments and Reauthorization Act

A. Description of the Proposed Action

A.1 Summary of Proposed Rule

Part 121 certificate holders are those carriers certificated under part 121 of FAA regulations, that operate passenger aircraft with a capacity of more than 30 passengers or operate large cargo planes. The proposed rule would require part 121 certificate holders to develop and comply with an FAA-approved ground deicing/anti-icing program that includes procedures that must be followed whenever ground conditions exist that might result in frost, ice, or snow (contamination) adhering to critical aircraft surfaces. Each program would include a detailed description of how the certificate holder determines that ground deicing/anti-icing procedures must be in effect, the operational procedures for implementing ground deicing, and the specific duties and responsibilities of each operational position or group responsible for getting the aircraft safely airborne while such procedures are in effect. A carrier may operate without a deicing/anti-icing program only if, during ground conditions that may lead to contamination, it inspects the critical aircraft surfaces from outside the aircraft within five minutes of takeoff.

To be approved, a deicing/anti-icing program would include initial and recurrent ground training and qualification testing requirements for all flight crewmembers, and all other personnel such as aircraft dispatchers, maintenance crews, or contract personnel that the certificate holder uses in implementing its program. At a minimum, an individual would receive initial and recurrent training in the individual's specific responsibilities and duties as outlined in the certificate holder's program. In addition, training would have to cover the following areas:

1. Holdover times developed by the certificate holder, how the calculated holdover times are determined and used, and what variables might adversely affect the calculated holdover time;
2. Aircraft deicing/anti-icing inspection procedures and responsibilities to ensure that the aircraft's wings, control surfaces, and other critical surfaces are free of contamination;
3. Procedures for communication between flight crewmembers and other deicing/anti-icing personnel on the deicing/anti-icing procedures while being used;
4. Aircraft surface contamination and critical area identification and how it adversely affects aircraft performance and flight characteristics;
5. Deicing/anti-icing procedures including types of fluids, fluid characteristics, and concentration percentage of these fluids;
6. Cold weather preflight inspection procedures; and
7. Techniques for recognizing contamination on aircraft.

An approved deicing/anti-icing program would also specify how the certificate holder will apply holdover times (HOTs) to ensure the deicing/anti-icing fluid application is still effective at the time of takeoff. The carrier would have to develop and use approved procedures regarding its flight crewmembers' use of these tables. The procedures would include provisions for its flight crewmembers to determine holdover times following aircraft deicing/anti-icing and would prohibit takeoff following expiration of the holdover time unless approved alternative actions are taken. In addition, the certificate holder must develop procedures to allow flight crewmembers to increase or decrease the determined holdover time if changing conditions warrant, as well as procedures to allow a pilot in command to require a pretakeoff contamination check whenever the pilot in command believes one is warranted. Each approved deicing/anti-icing program would include complete pretakeoff check procedures for a variety of contingencies.

The proposed rule would not require any changes in deicing/anti-icing operations at airports; the rule basically addresses training requirements and assistance in decision making regarding HOTs to ensure safe takeoffs in adverse weather conditions.

A summary of comments and response concerning environmental issues raised during the comment period for the proposed rule is provided in Appendix A.

A.2 Overview of Deicing/Anti-Icing Fluids

Deicing/anti-icing operations at airports typically involve the use of two types of fluids, Type I and Type II, both of which are based on ethylene, propylene, or diethylene glycols. Type I aircraft deicing fluids are used for the removal of snow, ice, and frost accumulation (contamination) on critical aircraft surfaces. Typically, they are applied hot (sprayed from heated tank trucks) and result in a thin film less than one millimeter thick on the aircraft surface. Their effectiveness is shorter than that of Type II fluids. Type I fluids are deicing only and are not used for anti-icing because they do not exhibit the same kinematic viscosity of Type II fluids which makes them thick enough to shear off the aircraft when it is aerodynamically active during takeoff. Type II fluids are formulated for use primarily as anti-icing products, with viscosity modifications which render them non-Newtonian in flow behavior, allowing them to provide a thicker residual film on treated surfaces.

The following sections provide additional detail on the chemical characteristics and environmental fate of the glycols used in deicing/anti-icing formulations as well as information on application procedures.

A.2.1 Chemical Characteristics and Environmental Fate of Glycols

The following discussion addresses the chemical characteristics and environmental fate of ethylene and propylene glycol separately. The information provided for ethylene glycol also applies to diethylene glycol.

Ethylene Glycol. Ethylene glycol is produced in the U.S. by BASF Corp., Dow Chemical USA, Eastman Kodak Co., Hoechst Celanese Corp., Quantum Chemical Corp., Shell Oil Co., Texaco Inc., Union Carbide Corp., Occidental Petroleum Corp., and PD Glycol. It is used as an antifreeze in heating and cooling systems and in hydraulic brake fluids; in the

formulation of inks, stains, pesticides and adhesives; in the synthesis of elastomers, plasticizers, and other chemicals; and as an ingredient in deicing fluid for aircraft applications. A total of about 2.5 million tons of ethylene glycol were produced in the U.S. in 1991.¹ General consumption patterns have been characterized as follows: 39% for antifreeze; 26% for polyester fiber; 12% for export; 9% for polyethylene (PET) bottles; 5% for PET film; and 9% miscellaneous industrial and PET resin uses.²

Ethylene glycol is a slightly viscous, clear liquid which is odorless and has a sweet taste. It is miscible with water, acetone, and some alcohols, but practically insoluble in benzene, chlorinated hydrocarbons and oils. It has a low vapor pressure at 68°F, and an National Fire Protection Association (NFPA) flammability rating of 1 (i.e., materials that must be preheated before ignition can occur). It is relatively stable at ambient conditions and relatively non-toxic to humans. Ethylene glycol places both a biochemical and a chemical oxygen demand on receiving waters, but does not bioconcentrate in fish.

Ethylene glycol will not evaporate from water. If ethylene glycol does volatilize, it will react in the atmosphere with hydroxyl radicals with a half-life of about 1 day. It will biodegrade readily in water, with a half-life of about 3 days. Laboratory tests conducted in topsoil at 68°F with concentrations of 1,000 ppm indicated the half-life of ethylene glycol to be about 30 hours.³ No other data were found that report its fate in soils; that data should be acquired. In water, biodegradation is fast and the dominant removal mechanism. A large body of information confirms the biodegradability of ethylene glycol in aerobic systems using activated sludge, sewage, and soil bacteria, with biodegradation essentially complete in less than 1 to 4 days.⁴

Ethylene glycol has a threshold limit value set by the Occupational Safety and Health Administration (OSHA) and the American Council of Governmental Industrial Hygienists for an employee's exposure (Ceiling Limit = 50 ppm).

Propylene Glycol. Propylene glycol is manufactured in the U.S. by ARCO Chemical Co., Dow Chemical USA, Olin Corp. and Texaco Inc. It is used as a chemical intermediate in the synthesis of polyester resins, cellophane, and other chemicals; a solvent in food colors and flavors; a humectant in foods and tobacco; an emollient in cosmetic and pharmaceutical creams; and as an ingredient in aircraft deicing fluids. A total of about 231,000 tons of propylene glycol were produced in the U.S. in 1984.⁵ General consumption patterns have been characterized as follows: 46% for polyester resins, 18% for export, 8% for

¹ *Chemical and Engineering News*, 70 (15): 17 (4/13/92).

² *Chemical Marketing Reporter*, 237 (4): 42 (1990).

³ Air Transport Association, *Report to FAA Regarding Environmental Issues Associated with Airport Deicing Fluids*, August 1992.

⁴ *Hazardous Substance DataBank*, printout for ethylene glycol, National Library of Medicine, last revision May 29, 1992.

⁵ USITC., *Synthetic Organic Chemicals - U.S. Production/Sales 1984*, p.257.

pharmaceuticals and food, 7% for pet food, 5% for humectant for tobacco, 5% for polymeric plasticizers, 4% for paints and coatings, 3% for functional fluids, 2% for cellophane, and for 2% miscellaneous uses.⁶

Propylene glycol is a viscous, colorless liquid which is practically odorless and tasteless. It is soluble in water and alcohol, has a low vapor pressure at 68°F, and a low fire hazard potential. It is stable under normal conditions, although it tends to oxidize at high temperatures. It poses very little toxic hazard to humans; the probable oral lethal dose is more than 15 g/kg (i.e., about 2.2 pounds or more than a quart for a 150-pound person). Propylene glycol has a relatively high 5-day average biochemical oxygen demand (BOD₅ of 64% with standard dilution and sewage), and does not bioconcentrate.⁷

In water, propylene glycol is essentially non-volatile. If it is released to the atmosphere, it is degraded rapidly by reaction with photochemically produced hydroxyl radicals, with an estimated half life of 32 hours. It can also be physically removed from air by rainfall.

If released to water, propylene glycol is expected to degrade relatively rapidly via biodegradation. Aquatic hydrolysis, oxidation, volatilization, bioconcentration, and adsorption to sediment are not expected to be important degradative processes in the aquatic environment. If released to soil, relatively rapid biodegradation is also expected to occur. Significant leaching in soil can be predicted; however, concurrent biodegradation may proceed rapidly enough to diminish its importance.

A.2.2 Application Procedures for Deicing/Anti-Icing Fluids

Procedures are described below for application of Type I and Type II fluids. In some circumstances these two fluids may be used in series. Type I fluids are first used to deice an already contaminated aircraft. Although Type I fluids provide some anti-icing protection, subsequent application of Type II fluids increases the HOT due to their increased capability to prevent contamination build-up on critical aircraft surfaces.

Type I Fluids. Using deicing fluids, ice, snow, and frost can be removed from aircraft surfaces prior to dispatch or prior to application of anti-icing fluids. Most deicing occurs at the gate; therefore, at the point of application, Type I fluid runs off the aircraft surfaces and onto the paved surface below. As the fluid is sprayed on critical aircraft surfaces, approximately 16% will adhere to the surfaces, 49% will spill onto the apron, and 35% will be carried away by the wind.⁸ (Note: The percentage of applied fluid identified as "carried away by the wind" indicates an efficiency of application to a surface and is not a measure of the amount volatilized or emitted into the atmosphere.) Deicing fluids should be

⁶ Chemical Marketing Reporter, 231 (6): 50 (1987).

⁷ Hazardous Substance DataBank, printout for propylene glycol, National Library of Medicine, last revision January 21, 1991.

⁸ Transport Canada, State-of-the-Art Report on Aircraft Deicing/Anti-icing, AK-75-09-129, November 1985.

heated according to manufacturers guidelines and applied using equipment that has been thoroughly cleaned before fill to prevent fluid contamination. For maximum removal of ice, snow, and frost, heated fluids are applied close to the surface of the aircraft. This procedure minimizes heat loss. The nozzle setting that controls fluid spray is adjusted depending on the type of contamination. For example, to remove frost and light ice a coarse spray is used; to remove ice, a jet of hot fluid is directed at close range on one spot until bare metal is exposed. On certain aircraft parts such as wheels, brakes, and engine intakes, fluids should not be used.⁹

Studies were performed by two U.S. producers of deicing/anti-icing fluids¹⁰ that evaluated the amount of vaporization that can be expected during typical deicing operations for aircraft. The results showed that during a typical deicing operation, the amount of ethylene glycol that would be volatilized and emitted into the air is minimal. For example, only 0.031 pounds of ethylene glycol would vaporize into the air during a 15-minute deicing of a wide body aircraft at 32° F. At a temperature of 25° F, the same deicing procedure only releases 0.021 pounds of the chemical. Deicing of a narrow body plane results in less ethylene glycol released, as does a shorter deicing time.¹¹ The results of these studies indicate that little ethylene glycol would volatilize during deicing operations.

Although it is not normal operating practice, occasionally deicing occurs near the end of a runway. This may mean that increased amounts of deicing fluid will go into surface waters, ground waters, or the soil near the runway. The proposed rule may make the practice of deicing near the departure end of the runway more common.

Type II Fluids. Anti-icing fluids prevent ice, snow, or frost from adhering to or accumulating on critical aircraft surfaces. These fluids can be applied to aircraft surfaces at the time of aircraft dispatch when precipitation is falling, or preferably at the time of arrival for short turnarounds. The fluids can also be applied prior to the start of freezing precipitation. For maximum anti-icing protection, Type II fluids should be undiluted, unheated, and applied with a medium spray nozzle. The correct amount of fluid has been applied when fluid just begins to drop off leading and trailing edges. Type II fluids adhere to the surface of the aircraft because of their high viscosities, and are therefore, not expected to run off onto the pavement at the point of application. Further, there is little evaporation of the high viscosity Type II fluids.

Type II deicing fluids will "shear" off the surfaces of an aircraft during takeoff. The environmental fate of the majority of fluid is not known, and research is being considered to determine this fate. Some will fall onto the runway, and some may fall directly into surface water or onto unpaved land surfaces. Eventually the fluid that falls onto the runway may reach surface water or unpaved land surfaces. Insignificant amounts of fluid will remain in the

⁹ International Organization for Standardization, *Aerospace - Aircraft Deicing/Anti-icing Methods With Fluids*, ISO 11076: 1992(E).

¹⁰ Air Transport Association, *Report to FAA Regarding Environmental Issues Associated with Airport Deicing Fluids*, August 1992.

¹¹ ATA comments on NPRM.

atmosphere. During takeoff, some fluid may volatilize, some likely remains in liquid form when shearing off the surfaces of the aircraft. Fluids do not evaporate from the runway due to the low volatility of the glycols.

A.3 Potential Implications for Deicing/Anti-icing Operations

Under the current regulations, an aircraft may not takeoff with ice on critical surfaces. Because deicing/anti-icing fluids are currently generally applied during adverse weather conditions and pilots conduct preflight inspections, at most only minimal changes in deicing/anti-icing operations are anticipated based on the requirement for an approved deicing/anti-icing program. The new requirement is holdover time analysis: takeoff after the expiration of any holdover time would be permitted only if several criteria have been met, for example, a pretakeoff contamination check has shown that the "critical surfaces" are free of contamination, or the aircraft has been re-deiced. Although not required, some changes in deicing/anti-icing operations could result from implementing the proposed rule:

- ▶ Centralized/remote application of Type I fluids. Currently, deicing/anti-icing fluid is applied primarily at the gate. Centralized/remote application at a location nearer the departure end of the runway closer to the takeoff point would enable shorter HOT. This procedure would simplify containment of fluids and could reduce the volume used, thereby reducing the amount which could reach the environment.

- ▶ More (or less) frequent reapplication of Type I fluids. While the existing regulations require that deicing be done as often as is necessary to ensure that an airplane does not attempt takeoff with ice on critical surfaces, the proposed rule would require adherence to HOT developed by the certificate holder which could necessitate more frequent reapplication (either at the gate or closer to the runway). It is also possible, however, that the initial application of Type I fluid at the gates would be postponed until a plane is able to takeoff within HOT, thus the volume of Type I fluid used would remain constant or perhaps even be lower.

- ▶ Increased use of Type II fluids to lengthen HOT. Although the airline industry in the U.S. has already been moving toward Type II fluids,¹² the proposed regulation may accelerate the widespread use of Type II fluids to ensure meeting HOT requirements. This could result in an overall reduction in use of fluids since switching from Type I to Type II fluids can result in a reduction of as much as 60% in total glycol use.¹³

Training requirements would ensure that operators understand the properties of deicing/anti-icing fluids and proper application procedures, which would also tend to decrease the volume of fluids used.

¹² Prior to publication of the proposed rule, one major US carrier had committed to use of Type II fluids by placing orders for the necessary application equipment.

¹³ Dow Chemical Corporation, Presentation by William Foshee, July 1992.

B. Purpose and Need for the Proposed Action

In the last 23 years, there have been 15 accidents related to the failure to deice the aircraft adequately before takeoff. Over the first 15 years, there were five involving passenger carriers resulting in 135 fatalities and 66 serious injuries. In addition, four of the airplanes were destroyed and the other sustained substantial damage. In the past eight years, there have been three accidents involving large cargo aircraft, resulting in two fatalities, two serious injuries, two substantially damaged aircraft, and one destroyed aircraft.

This rule is necessary because these accidents and the recent International Conference on Airplane Ground Deicing indicate that, under present procedures, the pilot in command may be unable to effectively determine whether the aircraft's wings, control surfaces, and other critical surfaces are free of all frost, ice, or snow prior to attempting a takeoff.

The proposed rule is intended to provide an added level of safety to flight operations in adverse weather conditions. When considered with existing airport and air traffic control procedures, the rule would provide, to the extent possible, enhanced procedures to allow safe takeoffs during adverse weather conditions.

C. Alternatives Considered

C.1 No action

Under the no action alternative, deicing would take place under the current regulations. Section 121.629(a) of 14 CFR states that no one may dispatch an aircraft when either the pilot in command or the aircraft dispatcher believes that icing conditions are expected or met that might adversely affect the safety of flight. Section 121.629(b) of 14 CFR states that pilots may not takeoff when frost, ice, or snow is adhering to the wings, control surface, or propellers of the aircraft. These requirements have remained virtually unchanged for over 40 years. Currently, the airline industry is shifting toward Type II deicing/anti-icing fluids because they provide longer holdover times than Type I fluids.

C.2 Proposed Rule

The proposed rule requires an approved deicing/anti-icing program addressing: ground training and qualifications test requirements for all implementing personnel; procedures for use of HOTs; and deicing/anti-icing and preflight contamination check procedures. The rule does not require any changes in deicing/anti-icing operations, but rather provides for maximizing safety by providing better training of personnel involved with deicing/anti-icing operations and contamination checks, and the pilot in command with the best information possible to facilitate decision making regarding takeoffs in adverse weather.

C.3 Other Alternatives Considered

Other alternatives considered but not assessed further in this environmental assessment include extending the proposed requirements to operations under parts 125 and

135 as well as part 121, and applying the proposed rule to turbojet aircraft but not to turbopropeller aircraft.

Since icing conditions apply equally to smaller aircraft and larger aircraft and all are required to meet existing regulations regarding clean aircraft, there should be no difference in the level of safety required. The intent of the proposed rule is to put in place before the winter of 1992-1993 a rule to improve safety during icing conditions. Applying the rule to operations under part 121 would have the most far-reaching impact on safety with the least impact on existing operations and therefore, the least impact upon the environment. The FAA will continue to study part 125 and 135 operations to determine if future rulemaking is required.

Although most icing related accidents have involved turbojet aircraft, part 121 turbopropeller aircraft should be included in this rule since the very real potential for problems in icing conditions exists and there does not appear to be any technical reason for concluding that turbopropeller aircraft are immune from wing contamination related icing accidents. As stated in the preamble to the proposed rule, the rule is needed based on the prior accidents and on the recommendations of the Reston Conference, which were not limited to specific aircraft types.

D. Affected Environment

Because the proposed rule could involve all airports used by part 121 certificate holders, a wide range of environments could potentially be affected throughout the country. At these locations the current environment is already impacted by airport operations including aircraft takeoff and landing, aircraft fueling, maintenance activities, and deicing/anti-icing of critical aircraft surfaces during adverse weather conditions. Below is a description of land, water, and air environments surrounding a typical airport.

D.1 Land environment

Airports that serve part 121 certificate holders generally require large amounts of land, because aircraft that weigh 300,000 pounds or more require long runways to gain sufficient speed for takeoff and to slow down after landing. Additional flat and unobstructed areas usually surround runways. In addition to runways, airports have many acres of paved surfaces. Aircraft gates, maintenance areas, deicing/anti-icing pads, and aircraft taxi ways require large, flat, unobstructed paved areas. Airports may also have expansive short-term and long-term parking areas with capacities for thousands of cars, and parking areas for rental cars.

Airports used by part 121 certificate holders are usually located in urban areas, or in suburban areas close to urban areas. Airports need to be accessible and therefore, may be situated on or near major roadways and mass transit systems. Airports serving major metropolitan areas may also have support services such as hotels and restaurants nearby.

D.2 Surface water and ground water environment

National and international airports are often located near rivers and coasts, as urban areas are often situated on or near navigable waters. Some airports, such as LaGuardia in the New York City metropolitan area and National in the Washington D.C. vicinity, are situated next to major waterways. Airports may also be in close proximity to surface and ground water drinking sources that serve nearby urban areas.

Storm water that falls on paved areas can be collected through drainage systems, treated and discharged; or it may be drained through storm sewers to publicly-owned treatment works (POTW) or directly to surface water. Storm water can also reach surface water directly via sheet runoff. Storm water falling on unpaved areas around runways can soak into the ground.

During adverse weather conditions requiring deicing/anti-icing operations, runoff from paved surfaces likely contains low concentrations of ethylene, propylene, or diethylene glycol depending on the fluid type. Concentration reaching surface water will depend on several factors such as airport location, fluid application location, volume of fluid applied, and runoff collection procedures.

D.3 Air environment

The air quality around an airport is impacted by emissions from aircraft takeoffs and landings, fueling operations, and maintenance activities (e.g., painting, use of cleaning solvents), as well as emissions from vehicles transporting passengers to and from the airport. For example, during the month of June, 1992 there were 26,232 takeoffs and landings at National Airport, and 23,750 at Dulles International airport.¹⁴ Other airports, such as O'Hare in Chicago, are "hubs" for large commercial carriers and average an even greater number of takeoffs and landings. In addition, airports may have thousands of parking spaces and extensive passenger drop-off areas. Assuming that five vehicles arrive at an airport for each flight (i.e., either to drop off departing passengers or to pick up those arriving),¹⁵ about 4,000 vehicles per day will drive through an airport like Dulles. Emissions from all these activities, including current deicing/anti-icing operations, comprise the baseline air quality in the vicinity of an airport prior to any changes in deicing/anti-icing operations as a result of the proposed rule.

¹⁴ This information is from the Air Carrier Affairs Office at National Airport, which can be reached through Public Affairs. The number of takeoffs and landings include taxi, general aviation, and military flights as well as commercial airlines.

¹⁵ Five people per flight seems conservative, but since the total number of takeoffs and landings includes the smaller and military planes, it may not be.

E. Environmental Impacts of the Proposed Action and Alternatives

E.1 Potential Environmental Impacts of Proposed Action

In the discussion of potential environmental impacts, impact areas with similar considerations are grouped into subsections below. Impact areas assessed are from the listing in FAA Order 1050.1D. Potential impacts in this section do not consider mitigation actions which are discussed in Section E.3.

E.1.1 Potential Impacts to Noise and Compatible Land Use

Baseline noise levels are dominated by aircraft engine noise and current deicing/anti-icing operations are not significant contributors to this baseline. Since few, if any, changes in deicing/anti-icing operations are expected as a result of the proposed rule, essentially no increase in noise over the level produced by current deicing/anti-icing operations is expected. This also applies to impacts on compatible land use.

E.1.2 Potential Air Quality Impacts

As discussed in Section A.2, the volatilization of glycols during both aircraft deicing/anti-icing operations and aircraft takeoff is expected to be minimal. The baseline air quality in the vicinity of an airport that serves part 121 certificate holders has already been impacted by deicing/anti-icing operations under existing requirements as well as by aircraft and other vehicular emissions. During deicing/anti-icing operations only small amounts of glycols volatilize and subsequently react rapidly in the atmosphere. Deicing/anti-icing operations currently occur on only a few days of during the year (i.e., during icing conditions) and this would not change under the proposed rule. Thus no incremental increase in impacts on air quality under implementation of the proposed rule is expected.

E.1.3 Potential Impacts to Water Quality and Biotic Communities

Deicing/anti-icing fluids currently enter surface water bodies either by direct runoff or via sewers that drain directly into surface water bodies. Glycols, the basic components in deicing/anti-icing fluids, biodegrade quickly and, therefore, likely decompose into their most oxidized form (i.e., carbon dioxide and water) soon after entering a surface water body. Therefore, no long-term adverse impacts on surface water bodies would be expected. However, as they decompose, glycols exhibit a high BOD, and could potentially deplete a significant portion of oxygen in a water body. This short-term water quality impact would be significant if the water became anaerobic and biotic communities (aquatic flora and/or fauna) were impaired. Oxygen depletion could lead to localized decreases in aquatic flora and fauna populations. For several reasons, impacts of this magnitude are not predicted to be widespread. Most deicing/anti-icing operations take place in winter months, when biological activity is reduced due to colder temperatures, and during precipitation events, when oxygen would be resupplied by aeration of the surface from impinging precipitation and by the dissolved oxygen present in that precipitation. If for a particular airport, adverse impacts to surface water bodies were anticipated, the storm water discharge permit program (see E.3.1) could establish permit limitations that would mitigate these effects.

A second potential route for glycols to enter the water environment would be through storm sewers that drain into POTWs. Under this scenario, the decomposition of glycols would take place in a POTW, where sewage is aerated during treatment. No adverse effects on POTW operations are predicted. In fact, compounds with high BOD can increase the productivity of POTW operations where biological treatment is frequently used.

If fluid reaches the soil surface, the biodegradation rate of ethylene glycol in soil is rapid, eliminating the chemical. Laboratory tests conducted in topsoil at 68°F with concentrations of 1,000 ppm indicated the half-life of ethylene glycol to be about 30 hours.¹⁶ Similar or improved results would be expected with propylene glycol due to its similar structure and characteristics. Consequently, soil contamination from either ethylene or propylene glycol is expected to dissipate rapidly.

The only route for glycols to reach ground water is by percolating through unpaved surfaces (e.g., vegetated areas adjacent to runways or other paved airport areas) into ground water aquifers below. Although glycols biodegrade rapidly in soil, indicating that they would not reach ground water supplies, they also move rapidly through the soil column. The likelihood of reaching ground water depends on the site-specific distance to aquifer and the soil conditions (e.g., temperature and percent saturation) at the time that deicing/anti-icing fluids reach the soil. In most instances, biodegradation will be complete before ground water is reached.¹⁷ If glycols do reach a shallow aquifer, they would likely biodegrade in ground water by the same mechanisms as in surface water. Further, glycols have low toxicities and thus would pose little to no threat to public health or the aquatic environment.

Under existing regulations deicing/anti-icing fluids have not created significant adverse impacts on water quality or biotic communities. Since at most minimal changes in deicing/anti-icing operations are expected under the proposed rule, no increase in impacts over the current baseline are anticipated.

E.1.4 Potential Solid Waste and Potential Construction Impacts

Under implementation of the proposed rule continuing use of deicing/anti-icing fluids under current application procedures is expected with no additional construction. Under current application procedures, no solid waste is generated and therefore, no additional solid waste impacts would be expected under the proposed rule.

One possibility under the proposed rule discussed in Section A.3 would be an increase in centralized/remote deicing/anti-icing. Such centralized application at certain airports, such as Chicago O'Hare, Washington Dulles International Airport, and Denver Stapleton, already takes place. At these airports, centralized application occurs on a construction pad that allows for collection of fluids, particularly excess Type I fluids, that wash over an aircraft. Depending on the NPDES discharge permit conditions of the airport, this

¹⁶ Air Transport Association, Report to FAA Regarding Environmental Issues Associated with Airport Deicing Fluids, August 1992.

¹⁷ Ibid.

overwash may need to be treated prior to discharge. Therefore, if centralized application increases, there may be requirements for pad construction and solid waste possibly generated from treatment.

FAA believes that airports that would elect to construct remote deicing/anti-icing pads would most likely have the land available within the existing airport complex, so no DOT Act Section 4 (f) properties would be involved. Depending on the location of the airport and the availability of land for construction, permits could be required from the U.S. Army Corps of Engineers under the CWA, section 404 for activities in wetlands. Construction would likely be localized in discrete, previously disturbed, industrial areas, and site-specific permit requirements, particularly for pads larger than five acres, would require permits (including National Pollutant Discharge Elimination System [NPDES] permits required under the Clean Water Act [CWA], and any additional state and/or local permits required prior to obtaining authority to construct) that would establish mitigation in the unlikely event that nearby-sensitive environments could be impacted. Any increase in solid waste impacts would be accompanied by a lower likelihood of other impacts (e.g., surface water and/or ground water). Therefore, any impacts due to construction, solid waste generation, or DOT Section 4 (f) lands are expected to be minimal.

E.1.5 Potential Impacts to Site-Specific Sensitive Environments

As described in Section D, the typical airport is located near an urban area, perhaps in an industrial park, and the local environment, particularly its air quality and noise levels, is influenced by the presence of the airport. Guidance concerning environmental assessment of airport actions is provided in FAA Order 5050.4A (10/8/85). This guidance addresses assessment of impacts of airport operations including deicing/anti-icing operations, on the following:

- Historic, Architectural, Archeological, and Cultural Resources
- Endangered and Threatened Species of Flora and Fauna
- Wetlands
- Floodplains
- Coastal Zone Management Program
- Coastal Barriers
- Wild and Scenic Rivers
- Farmland

Airports could elect to implement the program required by the proposed rule in a way that avoids impacts to any sensitive environments that may be nearby by not implementing any new on-site construction of centralized/remote pads and continuing to perform deicing/anti-icing at the gate. Since, at most, minimal changes in deicing/anti-icing operations are expected, mitigation measures currently in place for the use of deicing/anti-icing fluids (e.g., routing of runoff into storm sewers to avoid wetland areas) are expected to be sufficient to mitigate any potential impacts from changes in fluid use patterns.

E.1.6 Potential Impacts to Energy Supply and Natural Resources

Because only minimal amounts of energy and natural resources relative to the overall energy and natural resource demands of baseline operations at a typical airport are required to carry out deicing/anti-icing operations under existing regulations, no additional impacts over the current baseline are expected in these areas to implement the program under the proposed rule.

E.2 Impacts of No Action

Under no action, deicing would continue essentially as before under the current regulations. This would result in no additional impacts to the environment over the existing baseline. However, there would also be no expected enhancement of procedures (i.e., training and HOT analysis) to ensure safe takeoffs during adverse weather conditions.

E.3 Mitigation

E.3.1 Storm Water Permit Requirements

Although the chemicals that serve as a base for deicing/anti-icing fluids have not been identified as toxic pollutants under section 307(a) of the Clean Water Act, they are nevertheless considered pollutants which may not be discharged into the waters of the United States from a point source unless the discharge is authorized by an NPDES permit. Any changes in operations selected by airports to implement the proposed rule would need to meet any existing NPDES permit requirements for point source discharges.

In 1987, Congress amended the Clean Water Act to require NPDES permits for storm water discharges. Since glycols are typically associated with storm water discharges from aircraft deicing/anti-icing operations, the new storm water regulations require that glycols be addressed in NPDES storm water permits. These permit requirements are expected to reduce impacts on water bodies under existing regulations and with no changes in deicing/anti-icing operations, would provide this same level of impact reduction under the proposed rule.

E.3.2 Clean Air Act Requirements

Ethylene glycol became a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substance as a result of its inclusion on the CAA's list of hazardous air pollutants. Under CERCLA and the Superfund Amendments and Reauthorization Act (SARA) Title III, ethylene glycol is required to be reported if released in a reportable quantity (RQ) into the environment (all media). Because EPA has yet to designate the RQ for ethylene glycol, the RQ is automatically set at one pound. To determine whether or not a release of ethylene glycol must be reported, the person in charge of the facility must determine whether or not a quantity equal to or exceeding one pound has been released in a 24-hour period. Since the amount of ethylene glycol used under the proposed rulemaking would stay constant, or decrease, the rule would impose no new reporting requirements.

E.3.3 Site-Specific Mitigation

Site-specific environmental impact statements (EISs) that have been developed for airport construction or expansion would document the presence of unique site-specific sensitive environments and identify mitigation measures to eliminate or minimize potential impacts on these environments. Information about how to view or obtain copies of applicable site-specific EISs may be obtained by contacting APP600, the Community and Environmental Needs Division of FAA at (202) 267-3263. The potential impacts of airport operations, including any from current deicing/anti-icing operations, on unique site-specific environments would be mitigated as specified in applicable EISs as well as required Federal, state, and/or local construction permits. For example, if an airport is located near an ecologically sensitive area, such as a wetland or important habitat, site-specific mitigation measures would likely already be in place (as per CWA, section 404) which avoid impacts from glycols used during deicing/anti-icing operations under existing regulations (e.g., by collecting glycols from pavement areas where they are applied and disposing of them through storm sewers to a POTW). Since no changes in deicing/anti-icing application procedures are required by the proposed rule, no additional impacts are expected on sensitive environments.

E.4 Cumulative Impacts

The proposed rule is not expected to have any substantial cumulative impacts on the environment because the impacts on water quality and aquatic communities, on air quality, and on site-specific sensitive environments under existing regulations are either minimal or mitigation measures are in-place that minimize impacts. Since no changes in deicing/anti-icing operations are required under the proposed rule, little, if any, incremental increase in impacts is anticipated due to implementation of the proposed rule. For example, under the current rule any fluids that reach surface water would readily biodegrade, would not bioconcentrate, and would not be toxic to aquatic life or pose a threat to human health. In terms of air quality, glycols exhibit low volatility and the small amount that does vaporize reacts readily with photochemically-active species in the atmosphere to produce harmless products (e.g., carbon dioxide and water). Because these glycols have such low ecotoxicities, few if any, sensitive environments (e.g., wetlands) would be adversely affected. Given that little, if any, change is expected from current operations, the above observations would also be true under the proposed rule. The following summary table shows these results by impact area.

F. Summary

The summary table on the next page discusses the impact areas, potential impacts, mitigation actions, and cumulative impacts associated with the proposed rule. Few, if any, additional impacts to the environment beyond those under the current regulations would be expected with implementation of the proposed rule; however, in the event that some change in fluid use patterns do occur, FAA has considered these as indicated in the summary table.

SUMMARY TABLE

Potential Impact Area	Potential Impact	Mitigation	Cumulative Impacts
Noise/Compatible Land Use	None expected over baseline	None required	None expected over baseline
Air Quality	None expected over baseline <i>In scenario of increased glycol use: Very small increase in localized glycol emissions</i>	None required Reporting for ethylene glycol under CAA	None expected over baseline Minimal probability of release; minor consequences, therefore minimal impact
Water Quality and Biotic Communities	None expected over baseline <i>In scenario of increased glycol use: Possible oxygen depletion in receiving surface waters</i>	None required Specific limits on BOD may be required in storm water discharge permits; Diversion, collection, and/or treatment facilities may be required	None expected over baseline Moderate probability of release; minor consequences, therefore, minimal impact
Solid Waste and Construction	None expected over baseline <i>In scenario of centralized/remote deicing pad construction: Construction impacts for deicing pad; potential for solid waste impacts from collection and recycling of glycols</i>	None required Permit and site-specific environmental assessment may be required	None expected over baseline Unlikely probability of occurrence; minor consequences, therefore, minimal impact
Site-Specific Environmental Concerns	None expected over baseline <i>In scenario of centralized/remote deicing pad construction: Range of impacts for site-specific concerns listed in E.1.5 depends on airport location</i>	None required Site-specific permits and mitigation plans; no changes in operations are required by proposed rule	None expected over baseline Minor probability of involvement; minor consequences, therefore, minimal impact
Energy Supply and Natural Resources	None expected over baseline	None required	None expected over baseline

G. Persons and Agencies Contacted to Assist in the Preparation of the Environmental Assessment

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Washington Dulles International Airport
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APPENDIX A
SUMMARY OF COMMENTS AND RESPONSES ON ENVIRONMENTAL ISSUES

ENVIRONMENTAL ISSUES

Comment Summary

This rule is a federal action that is subject to National Environmental Policy Act (NEPA). Under applicable guidelines of the President's Council on Environmental Quality and agency procedures implementing NEPA, the FAA normally prepares an environmental assessment (EA) to determine the need for an environmental impact statement (EIS) or whether a finding of no significant impact (FONSI) would be appropriate. 40 CFR 1501.3 FAA Order 1050.1D appendix 7, par. 3(a). In the NPRM the FAA invited comments on any environmental issues associated with this proposed rule, and specifically requested comments on the following: (1) whether the proposed rule will increase the use of Type I deicing fluid, (2) whether the proposed rule will encourage the use of Type II deicing fluid, (3) the impact, if any, of using these deicing fluids on taxiways "just prior to takeoff," and (4) containment methods currently used that can be adapted to other locations on an airport. A summary of the comments received, the FAA's response and the findings of the FAA's Environmental Assessment follow.

Some commenters said that both Type I and Type II fluids cause environmental problems. One commenter said that the rule would require increased use of Type I fluids to clean aircraft wings prior to Type II application, and that this combination is environmentally hazardous.

Another commenter questioned what it characterizes as discussions in the United States that Type II fluids are less environmentally acceptable than Type I fluids since, as this commenter pointed out, both are based on glycols.

Another commenter questioned whether airports have the facilities to collect and recycle deicing fluids at takeoff points.

Two commenters believe that environmental constraints will inhibit the operation of remote deicing facilities and recommend that the FAA seek relief from EPA reporting requirements for remote facilities for one to two years. Alternatively, one commenter recommended that the FAA petition the EPA to raise the reportable quantity of ethylene glycol (Type I) from one pound to 1,000 pounds, or to exempt the airline industry from all ethylene glycol reporting due to critical safety requirements.

Other commenters also recommended that air carriers be exempt from state and local environmental regulations, which may be even more restrictive than EPA regulations.

One commenter recommended that current environmental constraints be reviewed and additional flexibility for deicing operations be provided in order for the rule's objectives to be met.

One commenter provided recommendations to reduce the discharge of deicing fluids into streams and states that an environmental impact statement should be required where such discharge seems likely.

FAA Response

An Environmental Assessment (EA) that supports a Finding of No Significant Impact (FONSI) is included in the docket for this rulemaking; therefore, no Environmental Impact Statement (EIS) is required. The EA discusses in detail the full potential effect of this rule and addresses in general terms the issues raised by the comments summarized above. The following discussion addresses the major issues raised by the commenters.

Presently Section 121.629(b) states that no person may takeoff an aircraft when frost, snow, or ice is adhering to the wings, control surfaces or propellers of the aircraft. As the NPRM preamble, the preamble to the final rule, and this EA point out, the rule is necessary because several accidents and recommendations of the 1992 Deicing Conference on Airplane Ground Deicing which was held as a result of these accidents, indicate that under present procedures, the pilot in command may be unable to determine effectively whether the aircraft's critical surfaces are free of all frost, ice, or snow prior to attempting a takeoff. The rule addresses this problem by requiring increased training of appropriate personnel, the use of holdover times, and additional checks of the aircraft's surfaces, all of which are to ensure that an aircraft does not take off if critical aircraft surfaces are contaminated. In essence, the final rule, which is necessary before the winter of 1992-1993, requires certificate holders to develop a program that will provide the pilot in command with more complete information, which he or she needs for deciding whether takeoff can be safely accomplished. While the rule does not mandate additional use of either Type I or Type II fluids, because of the longer holdover times associated with Type II fluids, it could accelerate somewhat the existing trend for U.S. carriers to follow the European and Canadian practice of increased use of Type II fluids. Although Type II fluid has a higher BOD than Type I fluid, it requires approximately 75% less fluid to effectively deice and anti-ice a typical aircraft. Also the use of Type II fluids will significantly reduce the number of redeicings that would be required if Type I fluids were used. These factors along with improved air traffic control (ATC) and airport procedures should reduce the use of deicing/anti-icing fluids over the long term.

With respect to the potential environmental effects of both type fluids, as the EA discusses, because of their low volatilities, low ecotoxicities, low toxicity to humans, and biodegradability, at most only minimal impacts are expected over those already experienced for deicing/anti-icing operations carried out under the current regulations.

With respect to the issues of reporting requirements, relief from state and local environmental regulations, and the availability of collection/recycling facilities, certificate holders that presently use deicing fluids and the operators of airports at which these fluids are used, must already comply with all of these requirements as applicable. Since this rule requires no more than the existing clean aircraft requirement, if there are increases in the use of fluids that trigger environmental requirements, those requirements must be met by the airport operator, certificate holder, or other responsible party, as they would under the present rule. If any of these requirements, or the lack of facilities limit the use of deicing/anti-icing fluids, the result would be that the certificate holder would have to find another means of ensuring that the critical aircraft surfaces are clean before a takeoff is attempted or discontinue operations. Nonetheless, as part of its long term efforts, the FAA will work with certificate holders and with airport operators to monitor the actual and potential environmental effects of the rule and will take appropriate steps as necessary.

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637 7040

637-9178

CHANGES IN RADIATORS AND IMPACT ON ANTIFREEZE CONTAMINATION

- In the past, the typical motor vehicle cooling system included a copper/brass solder-on radiator, with lead solder.
- In recent years, the majority of new cars and light trucks have had radiators with aluminum cores and plastic tanks. These aluminum/plastic radiators have no lead solder.
- A minority of new cars and light trucks have copper/brass radiators. However, many of these have radiators with plastic tab-on or crimped-on tanks. Such radiators do not have lead solder in the tank to header seams, greatly reducing the possibility of lead contamination of antifreeze.
- By 1990, two-thirds of new cars and light trucks had radiators with plastic tanks. That year, aluminum cores were used in 57% of new cars and 44% of new light trucks.
- Modine, a leading radiator manufacturer has projected that 40% of total vehicles in operation in 1994 (i.e., cars and light trucks on the road) will have original equipment aluminum radiators. The percentage of vehicles in operation with aluminum radiators is projected to increase to 48.4% in 1996, 55.7% in 1998, and 61.6% in 2000. Further, many of the non-aluminum radiators will have plastic tanks with no lead solder in the tank to header seams.
- The use of aluminum cores and plastic tanks in radiators has significantly decreased the possibility of lead contamination of used antifreeze.
- The penetration of aluminum radiators has been somewhat slower in the heavy truck fleet. However, heavy trucks have different cooling systems, with timed release of corrosion inhibitors. In addition, commercial trucks are typically subject to more routine maintenance than passenger cars.

Professional Resource Management

PRM

Allen R. Forester
David F. Strahorn

RECEIVED

JUL 23 1998

Watkins, Tomasello & Caleen, PA

July 23, 1998

Mr. R. L. Caleen
Watkins, Tomasello & Caleen
1725 Mahan Drive Suite 201
Tallahassee, FL 32308

Dear Mr. Caleen:

Pursuant to your request, I have reviewed the criteria for deciding whether or not a material is a used oil. EPA has listed three basic tests:

1. Used Oil must be derived from crude oil or synthetic oil.

Antifreeze is ethylene glycol or propylene glycol and additives. Ethylene glycol is produced from ethylene which is produced from naphtha which is produced from crude oil. Used antifreeze meets this test.

2. Used Oil must have been used as a lubricant, coolant, heat transfer fluid, hydraulic fluid, or for a similar use.

Used antifreeze was used as an engine coolant and as a heat transfer fluid. Used antifreeze meets this second test.

3. Used Oil must be contaminated by physical or chemical impurities as a result of use.

Used antifreeze was contaminated by rust, wear metals, and degraded additives as a result of its use. Used antifreeze meets this last test.

It seems to me that used antifreeze meets all of EPA's criteria for the definition of Used Oil. Also, I note that burning recycled ethylene glycol with recycled oil for energy recovery is not sham recycling under EPA policy in that the ethylene glycol contributes 8,200 BTU per pound to the fuel, well above the EPA minimum.


I also note that ethylene is chemically related to many materials that are generally considered Used Oil. For example, brake fluid is composed primarily of triethylene glycol (a byproduct of making ethylene glycol) and ethylene glycol mono butyl ether (made from ethylene glycol and butyl alcohol). Also, ethylene glycol is a primary starting material in the manufacture of synthetic oils like polyethelene glycols which are used in speciality lubricants.

Lastly, I note that the contaminants that occasionally cause used antifreeze to fail TCLP are the same contaminants commonly found in Used Oil where they are exempt from classification as RCRA waste. The cause of these contaminants being in the used antifreeze is cross contamination with used oils by the generator when the same tools are used to remove the fluids. These contaminants were not in the used antifreeze when it was removed from the vehicle.

After considering all of the above, I see no basis for not including used antifreeze in the definition of Used Oil and managing it as such.

Please give me a call if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "D Strahorn", with a long, sweeping horizontal line extending to the right.

David Strahorn
California REA 220

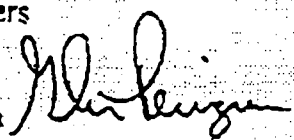
cc Mr. Garry Allen
Mr. Jerrold Blair

Memorandum

Florida Department of
Environmental Protection

TO: Antifreeze Recyclers and Handlers

FROM: Glen Perrigan
Hazardous Management Section



DATE: June 14, 1996

SUBJECT: Draft Guidance on the Management of Antifreeze Destined for Recycling

The purpose of this letter is to inform you of the Department's plans for the management of waste antifreeze destined for recycling.

The U.S. EPA published the final Universal Waste Rule in the Federal Register on May 11, 1995. This rule provides more flexible alternate management procedures for certain wastes (hazardous batteries, certain pesticides and mercury-containing thermostats) in lieu of the more stringent RCRA hazardous waste procedures. Florida adopted the Universal Waste Rule on September 7, 1995.

An important provision in the rule is that States can add other "universal" wastes (for example, antifreeze) to this management scheme. This is done through a petition process for allowing the addition of similar wastes. This option enhances flexibility for States without requiring the wastes to also be added at the federal level. Plans are underway by the Department to add hazardous waste antifreeze to its list of "universal" wastes in the near future.

While in the process of rulemaking, the Department will be issuing interim guidelines to promote the collection and recycling of waste antifreeze. The guidelines will be incorporated in the enclosed draft fact sheet "Best Management Practices for Managing Antifreeze Destined for Recycling." One important provision of these best management practices is that generators, recycling their waste antifreeze on-site or sending it off-site for recycling, will not be required to make a hazardous waste determination as required by 40 C.F.R., Section 262.11.

However, generators which dispose of their waste antifreeze, other than through legitimate recycling, will be subject to the hazardous waste determination requirements of 40 C.F.R., Section 262.11 and all other applicable regulatory requirements. The enclosed fact sheet "Florida Fact Sheet on the Management of Waste Antifreeze, 4/20/95" describes the management of waste antifreeze destined for disposal.

A new vendor list of antifreeze recyclers will be developed. This list will replace the current vendor list of antifreeze recyclers. If you are interested in being on this list, you will need to provide the Department with the business name, address, phone number, contact person and counties serviced as well as certification that your recycled antifreeze product, used as engine

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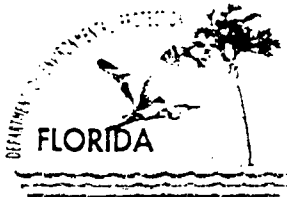
Memorandum
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June 14, 1996

coolant, meets the Standard Specification for Pre-Dilute Aqueous Ethylene Glycol (50% Volume), ASTM-D4656. Please submit this certification to me as soon as possible.

The best management practices apply only to antifreeze destined for recycling and will be in effect until the Department has adopted rules containing universal waste management standards for waste antifreeze.

Please contact me for any questions or comments you may have regarding this subject at (904) 488-0300 or write to me at FDEP, Hazardous Waste Management Section, MS 4555, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

enclosures



Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

FLORIDA FACT SHEET ON THE BEST MANAGEMENT PRACTICES FOR MANAGING ANTIFREEZE DESTINED FOR RECYCLING

Container Management, Handling and Storage

- Use dedicated antifreeze collection equipment. This would include collection funnels, transfer pans or buckets, and storage containers (drums or tanks). Transfer used antifreeze immediately to a dedicated storage container.
- Keep stored antifreeze free from cross-contamination by oil, fuels and degreasers by providing a separate, well-labeled container meeting DOT specifications/UN performance criteria.
- Containers must be in good condition. Replace leaking containers immediately.
- Containers must be compatible with the antifreeze stored in them.
- Keep antifreeze containers closed at all times except when emptying or filling.
- Inspect containers at least weekly to check for signs of leaks or deterioration caused by corrosion or other factors.
- Antifreeze containers must be protected from the elements and located in a secured area.
- Tanks used to hold used antifreeze must meet the requirements of the Title 40 Code of Federal Regulations (C.F.R.), Part 265, Subpart J regulations.

Labeling/Marking

- Label used antifreeze collection equipment and containers with the words "Used Antifreeze".
- Label reconditioned or recycled antifreeze containers with the words "Reconditioned or Recycled Antifreeze".
- Mark used antifreeze containers with the starting date of accumulation.

Accumulation Time Limits

Do not accumulate used antifreeze for longer than 180 days.

Filter Management

A hazardous waste determination must be made on the waste antifreeze filters generated from the recycling process equipment as specified in 40 C.F.R., Section 262.11.

August 6, 1996

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Record Keeping

Keep all receipts of used antifreeze shipments and filter management. The written receipts or records must include:

- Name and address of the generator and the recycling facility for off-site shipments;
- The amount of used antifreeze shipped off-site or recycled on-site;
- The amount of waste antifreeze filters shipped off-site; and the
- Date of shipment or recycling.

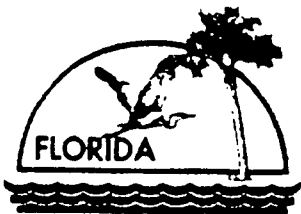
Recycling and the Resale of Reconditioned/Recycled Antifreeze

- Currently, the Florida Department of Agriculture and Consumer Services does not register "recycled" antifreeze/coolant products. However, you are subject to registration if your antifreeze/coolant product is marketed and distributed by brand name in a sealed package unit. Contact the Florida Department of Agriculture and Consumer Services, Division of Standards at (904) 488-9740 for additional information.
- The mixing of used antifreeze with used oil for the purpose of burning this commingled material for energy recovery is not considered to be "recycling" that is covered by these guidelines.

For additional information on the waste management requirements for the automotive industry, call or write the:

**Small Quantity Generator Coordinator, MS 4555
Hazardous Waste Management Section
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399-2400
Phone: (904) 488-0300
Information Line
1-800-741-4DEP
Internet site:
<http://www.dep.state.fl.us/>**

August 6, 1996



Lawton Chiles
Governor

Department of Environmental Protection

Twin Towers Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherel
Secretary

FLORIDA FACT SHEET ON THE MANAGEMENT OF WASTE ANTIFREEZE

4/20/95

Improper disposal of antifreeze can cause environmental problems. Antifreeze is made up of water and ethylene or propylene glycol. Neither of these unused ingredients would be regulated as a hazardous waste. However, heavy metal contaminants such as lead and organics such as benzene, tetrachloroethylene (PERC) or trichloroethylene have been found in waste antifreeze at levels that would identify the waste antifreeze as hazardous. Under the federal and state hazardous waste regulations, any waste containing regulated levels of heavy metals or organics would be hazardous waste.

Each business that generates solid waste must make a hazardous waste determination as required by Title 40, Code of Federal Regulations (CFR), Section 262.11. A waste determination can be made by testing the waste using the Toxicity Characteristic Leaching Procedure (TCLP), Test Method 1311, or by applying knowledge of the waste in light of the materials or the processes used.

Since the quality and nature of waste antifreeze can be dependent upon conditions not in the control of the generator of the waste antifreeze (e.g., type of radiator, maintenance, additives, etc.), it may not be possible to use product or process knowledge without first testing to make a hazardous waste determination. A generator can establish product knowledge by initially testing to determine whether the waste antifreeze is, or is not, hazardous waste. If the testing indicates the waste antifreeze does not exhibit a characteristic of hazardous waste, product knowledge (based on initial testing) may be used until the process changes.

If the generator determines that the waste is, or is not, hazardous waste based on product knowledge of the waste, then all supporting data used to make this determination must be retained on site in the generator's files. If a generator determines that the waste is, or is not, hazardous waste based on testing this waste or an extract developed using the TCLP, Test Method 1311, all waste analysis data must be retained on-site in the generator's files. The testing and analysis must be repeated if the process generating the waste has changed. TCLP testing can be limited to the contaminants that are most likely to be found in the waste antifreeze. These include lead, benzene, tetrachloroethylene (PERC) and trichloroethylene.

Copies of all notices, certifications, waste analysis data, and other documentation must be retained for five years from the date that the waste was last sent to recycling facility or an on site or off site treatment, storage, or disposal facility.

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Facilities generating 220 pounds per month or greater of all hazardous waste (including many recyclable wastes such as antifreeze) are subject to the requirements of 40 CFR, Parts 262 through 268, 270 and the notification requirements of Section 3010 of RCRA. These facilities (SQGs and LQGs) cannot offer waste antifreeze that is hazardous waste to an unregistered hazardous waste transporter. Also, the generator and recycler must comply with the Clean Water Act pretreatment standards and related locally based discharge limits for discharges to the sewer.

Under the hazardous waste regulations, facilities generating less than 220 pounds of hazardous waste per month and accumulating no more than 2,200 pounds of hazardous waste at any time are not subject to the requirements of 40 CFR, Parts 262 through 268, 270 and the notification requirements of Section 3010 of RCRA provided they comply with 40 CFR, Section 261.5, "Special requirements for hazardous waste generated by conditionally exempt small quantity generators (CESQGs)". These CESQG facilities must assure delivery of hazardous waste to a proper recycling or treatment, storage, or disposal facility. They do not have to use a registered hazardous waste transporter. CESQGs which choose to send their hazardous waste to a recycling facility or an off-site treatment, storage or disposal facility shall document delivery of the hazardous waste through written receipts or other records which are retained for at least three years. The written receipts or other records shall include names and addresses of the generator and the recycling, treatment, storage or disposal facility, the type and amount of hazardous waste delivered, and the date of shipment.

The Department encourages the proper recycling of waste antifreeze. There are waste antifreeze service companies that will service and recycle your antifreeze.

For additional information or to receive a copy of "Summary of Hazardous Waste Regulations" or "Florida's Handbook for Small Quantity Generators of Hazardous Waste" contact:

**Hazardous Waste Management or Regulation Sections
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399-2400
(904) 488-0300**

TO: Directors of District Management
Waste Program Administrators

FROM: John M. Ruddell, Director *JMR*
Division of Waste Management

DATE: August 6, 1996

SUBJECT: Interim Guidance on the Management of Antifreeze
Destined for Recycling

The U.S. EPA published the final Universal Waste Rule in the Federal Register on May 11, 1995. This rule provides more flexible alternate management procedures for certain wastes (hazardous waste batteries, pesticides and mercury-containing thermostats) in lieu of the more stringent RCRA hazardous waste procedures. Florida adopted the Universal Waste Rule on September 7, 1995.

An important provision in the rule is that states can add other "universal" wastes (for example, antifreeze) to this management scheme. This option enhances flexibility for states without requiring the wastes to also be added at the federal level. Plans are underway by the Department to add hazardous waste antifreeze to its list of "universal" wastes in the near future.

While in the process of rulemaking, the Department is issuing interim guidelines, effective immediately, to promote the collection and recycling of used antifreeze by generators and handlers. The interim guidelines are incorporated in the attached fact sheet entitled "Best Management Practices for Managing Antifreeze Destined for Recycling." One important provision of these best management practices is that a generator or handler that is recycling used antifreeze on-site or sending it off-site for recycling will not be requested to make a hazardous waste determination as required by 40 C.F.R., Section 262.11.

However, generators and handlers disposing of waste antifreeze, other than through legitimate recycling, will be subject to the hazardous waste determination requirements of 40 C.F.R., Section 262.11 and all other applicable regulatory requirements. Mixing antifreeze with used oil for the purpose of energy recovery is not considered legitimate recycling. The

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August 6, 1996

additional attached fact sheet entitled "Florida Fact Sheet on the Management of Waste Antifreeze, 4/20/95" describes the management of waste antifreeze destined for disposal.

JMR/gp

Attachments



Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

VENDOR LIST OF ANTIFREEZE RECYCLERS

February 12, 1998

The Florida Department of Environmental Protection (DEP) maintains the following list of antifreeze recyclers and collectors as a service to Florida businesses and generators of waste antifreeze. The information was voluntarily supplied by the companies and is not a complete list of available services and a company's absence from the list does not imply prejudice or impropriety. The DEP does not endorse any specific antifreeze recycler or collector. The DEP, by providing this list, does not imply that the companies are in compliance with applicable laws. The DEP cautions generators of hazardous waste to personally evaluate the services and compliance status of any company they use. The list is updated periodically and subject to change without notice. The DEP welcomes information from companies who wish to have their products or services listed. Send your list to the Hazardous Waste Management Section at the above address.

Mobile Antifreeze Recycling Services
21ST CENTURY ANTIFREEZE RECYCLING, INC.
3692 Lakeview Blvd.
Delray Beach, Florida 33445
800-506-2158
(561) 637-9932

ANTIFREEZE RECYCLERS, INC.
P.O. Box 1527
Eustis, Florida 32727-1527
1-888-209-8142 (toll free)
(850) 309-2335
(352) 483-2220
Fax: (352) 483-2260
Servicing Northwest Florida

ARCTIC COOLANT REMANUFACTURING, INC.
1836 SW 44th Terrace
Ft. Lauderdale, Florida 33317-5748
(888) 797-1488 toll free
(954) 614-4455 mobile
(800) 427-8396 beeper
e-mail: acool@gate.net
Servicing Statewide

CENTRAL FLORIDA HI-TECH
13453 NW 50th Avenue
Cheifland, Florida 32626
(850) 493-2354
800-330-6945
Servicing Citrus, Alachua, Levy, Dixie, Marion and Gilchrist

COOLANT RECYCLERS, INC
1675 Fiske Blvd. # 242 J

Rockledge, Florida 32955
(407) 867-7505
Servicing Brevard County

ECOSYSTEM INTERNATIONAL CORP.
9735 Ravenna Road
Twinsburg, Ohio 44087
800-721-5665
Fax (216) 487-5154

EL DORADO, INC.
133 East Bay Street
Jacksonville, Florida 32202
(904) 350-9602
Servicing Duval, Nassau, Baker, St. Johns, Clay, Bradford, Union and Columbia counties

FLORIDA FILTER & FLUID RECYCLING
5100 95th St. N., Suite 5
St. Petersburg, Florida 33708
(813) 399-2875

GREENTHUMB RECYCLING
1660 Ridgecrest Street
Valdosta, Georgia 31601
(912) 244-2880
Servicing Northwest Florida

HARPER RECYCLING SERVICES
6101 Rowland Road
Valdosta, Georgia 31601
(912) 247-8636

Servicing Jefferson, Madison, Taylor, Lafayette, Hamilton and Suwannee counties

HARRIS MOBILE RECYCLING
118 Maple Hill Drive
Deland, Florida 32724
(904) 734-6770

HI-TECH RECOVERY
129 Maple Lane
Lake Helen, Florida. 32744
(904) 228-9721
Servicing Volusia county

HI-TECH RECYCLING
1135 SW 25th Avenue
Boynton Beach, Florida 33426
(800) 251-5642
(407) 735-4162
Servicing Palm Beach, St. Lucie, Indian River, Okeechobee, Martin and Broward counties

JINGLE ROAD ENTERPRISES
PO Box 55
Christmas, Florida 32709
800-JINGLE9
(407) 568-6569

MMT TECHNOLOGIES, INC.
P.O. Box 450879
Kissimmee, Florida 34745-0879
(407) 851-5577, Orange County
(407) 870-5511, Osceola County

ON-SITE RECYCLING
4408 North Gulf Circle

VENDOR LIST OF ANTIFREEZE RECYCLERS

Page two

North Fort Myers, Florida 33903
(941) 995-3553
800-872-9185
Servicing Lee, Collier and
Charlotte counties

RECYCLE USA
8208 Cortex West
Bradenton, Florida 34210
(941) 792 7890
800-932-5111
Servicing Sarasota, Manatee,
Hardee, Highland, Desoto and
Hillsborough counties

SAFEWAY ANTI-FREEZE
RECYCLERS, CORP.
P.O. Box 47346
Jacksonville, Florida 32207
(904) 399-8636
Servicing Duval County and
surrounding area.

TOTAL ENVIRONMENTAL
SERVICES
9293 E. Windwood Loop
Inverness, Florida
800-254-1117
Serving Central Florida

WYNN OIL COMPANY
Professional Products Formula Div.
1050 West 5th St.
Azusa, California 91702
(818) 334-0231
800-989-8363

ZAMORA INTERNATIONAL
2201 Cordova Greens III
Largo, Florida 34647
(888) 777-8707

Antifreeze Recycling Collectors
FIRST RECOVERY
PO Box 14047
Lexington, Kentucky 40512-4047
(606) 357-7000
800-545-3520

LIDLAW ENVIRONMENTAL
SERVICES
5303 126th Avenue N.
Clearwater, Florida 34620
800-GOLAIDLAW

SAFETY KLEEN
129 South Kentucky Ave.
Suite 700

Lakeland, Florida 33801
800-769-5755

Antifreeze Recycling Equipment
CENTURY MFG. COMPANY
9231 Penn Avenue South
Minneapolis, Minnesota
(800) 328-2921
Product: Century Brand: Solar
Brand

FINISH THOMPSON INC. (FTI)
921 Greengarden Road
Erie, Pennsylvania 16501-1591
(814) 455-4478
800-934-9384
Product: BE Coolant Reclaimer,
Coolant Change 'N Clean

FPPF CHEMICAL COMPANY,
INC.
117 West Tupper Street
Buffalo, New York 14201-2193
(716) 856-9607
800-735-3773
Product: Glyclean

HI-TECH INDUSTRIES, INC.
6501 Park of Commerce Blvd.
Suite 230
Boca Raton, Florida 33487
800-231-6262

KLEER-FLO COMPANY
15151 Technology Drive
Eden Prairie, Minnesota 55344
(612) 934-2555
800-328-7942
Product: AF250

PENRAY COMPANIES
440 Denniston Ct.
Wheeling, Illinois 60090
Western Sales Office:
800-368-3723
Product: Antifreeze
Inhibitors/additives

PRO-SYSTEMS, INC.
6501 Park of Commerce Blvd.
Suite 230
Boca Raton, Florida 33487
800-231-6262
Product: Fast Flush Coolant
Changer

ROBINAIR
1224 Robinair Way
Montpelier, Ohio 43543
(419) 485-5561
Sales 800-628-6496
Tech support 800-822-5561
Product: Model 75250 FilterPro

WYNN OIL COMPANY
Professional Products Formula Div.
1050 West 5th St.
Azusa, California 91702
(818) 334-0231
800-989-8363
Product: Du-All