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DEPARTMENT OF
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October 13, 1993

Mr. Satish Kastury
Hazardous Waste Regulation Section
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Subject: Cleaner Copy of New Jersey Antifreeze Study

Dear Mr. Kastury:

The purpose of this letter is to provide you a cleaner and more readable copy of the New Jersey Antifreeze Study which I provided to your office last October 7, 1993. Enclosed are three copies for your office. I am also providing one copy to each Department district office.

If you have any questions, please do not hesitate to call me at (813)682-8094.

Sincerely,

for Victor L. San Agustin
Victor L. San Agustin, P.E.
Regional Environmental Manager
Tampa Region

cc: Michael Redig, BSHW
Bill Kellenberger, FDEP-NW
Gary Santti, FDEP-SW
Phil Barbaccia, FDEP-SF

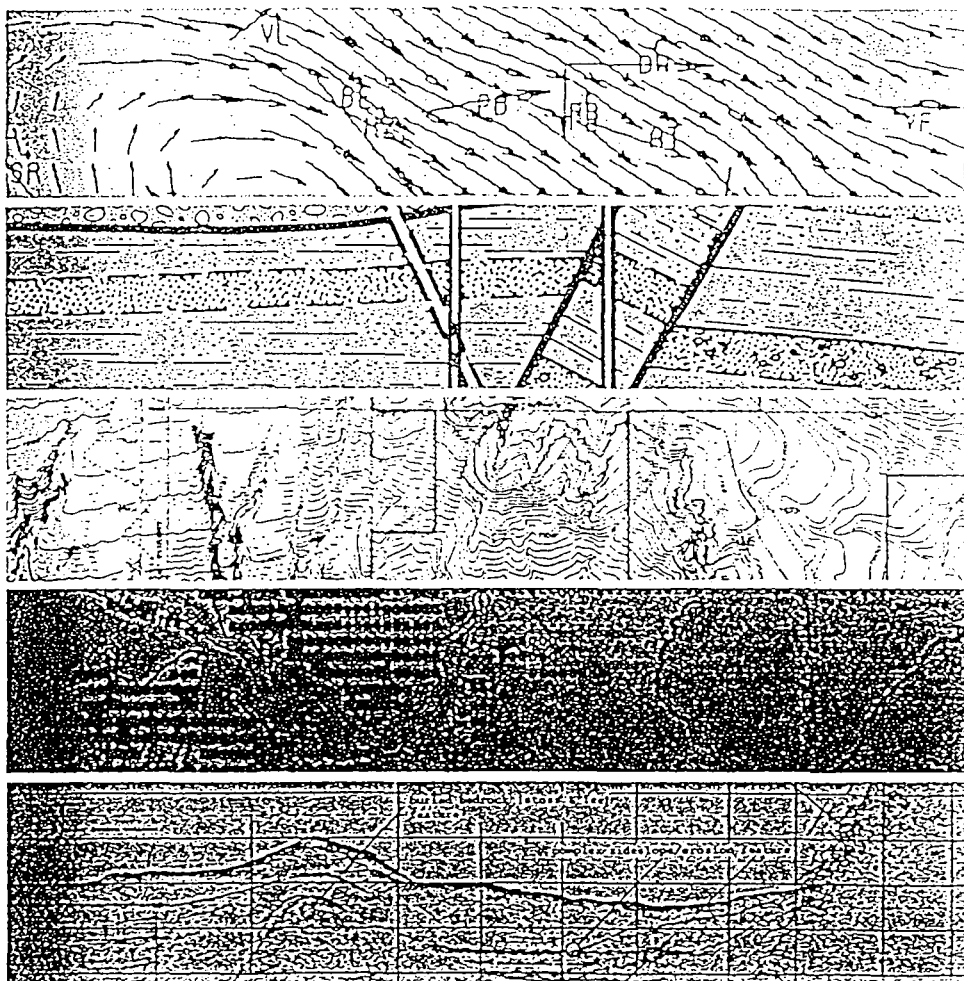
Michael Hatcher, BSHW
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Antifreeze Study Results Report
New Jersey Automobile Dealers Association

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

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OCT 11 1993

SAFETY-KLEEN CORP.
ENVIRONMENTAL ENGINEER
TAMPA REGION

DAMES & MOORE

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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

Dames & Moore Sample No.:		AP-1	AP-2	AP-3	AP-4	AP-5	AP-6	AP-7	AP-8	AP-9	113-030293	113-030293	TCLP
Laboratory Sample No.:		80470	80471	80472	80473	80932	80474	80475	80933	80476	80477	80478	Regulatory
Sampling Date:	Quant.	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	3/2/93	Limits
Dilution Factor:	Limit	25	25	10	50	100	25	10	10	10	1	1	mg/l
Unit:	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
TCLP Volatile Compounds													
Benzene	0.005	0.32	0.051J	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
Chlorobenzene	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
1,2-Dichloroethane	0.005	U	U	U	U	U	U	U	U	U	U	U	0.5
1,1-Dichloroethylene	0.005	U	U	U	U	U	U	U	U	U	U	U	0.7
Methyl Ethyl Ketone	0.01	R	R	0.57J	R	R	R	R	0.1J	R	R	R	200
Tetrachloroethylene	0.005	0.036J	U	U	U	0.02	0.12	0.025	U	0.04J	U	U	0.7
Trichloroethylene	0.005	U	U	U	U	U	U	U	U	U	U	U	0.5
Vinyl 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-Ignitable
 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.:		AP-1	AP-2	AP-3	AP-4	AP-5	AP-6	AP-7	AP-8	AP-9	173-030293	TCLP
Laboratory Sample No.:		80470	80471	80472	80473	80932	80474	80475	80933	80476	80477	Regulatory
Sampling Date:	Quant.	3/2/93	3/2/93	3/2/93	3/2/93	3/12/93	3/2/93	3/2/93	3/12/93	3/2/76	3/2/93	Limits
Dilution Factor:	Limit	2	10	10	50	25	50	10	10	50	1	Limits
Unit:	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	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:

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 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	5.8	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 ² 83585 5/28/93 mg/kg	PI3-030293 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	27.4	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:

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 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.
 2 Analyzed for total lead only.

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	173-030293	
Laboratory Sample No.:		80470	80471	80472	80473	80932	80474	80475	80933	80476	80477	
Sampling Date:	Quant.	3/2/93	3/2/93	3/2/93	3/2/93	3/12/93	3/2/93	3/2/93	3/12/93	3/2/76	3/2/93	Regulatory
Dilution Factor:	Limit	1	1	1	1	1	1	1	1	1	1	Level
Unit:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/l	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:

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Exceeds the Regulatory Level
NA This parameter was not analyzed.