NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
HAZARDOUS SITE MITIGATION ADMINISTRATION
BUREAU OF INDUSTRIAL SITE EVALUATION

ENVIRONMENTAL CLEANUP RESPONSIBILITY ACT (ECRA)

APPLICATION FOR ECRA REVIEW
INITIAL NOTICE

11-25-85

SITE EVALUATION SUBMISSION (SES)

This is the second part of a two-part application submittal and must be submitted within 30 days following public release of the decision to close operations or execution of an agreement of sale or option to purchase.

DATE November 21, 1985

NAME OF INDUSTRIAL ESTABLISHMENT Engelhard Corporation - Speciality Chemical Division

ADDRESS 429 Delancy Street

CITY OR TOWN Newark ZIP CODE 07105

MUNICIPALITY City of Newark COUNTY Essex

NAME OF PROPERTY OWNER Engelhard Corporation

FIRM:

ADDRESS: 33 Wood Avenue

TY OR TOWN: Edison ZIP CODE: 08818

MUNICIPALITY Woodbridge Township COUNTY Middlesex

SUBMIT THE ORIGINAL PLUS TWO COPIES OF THE FOLLOWING:
(NOTE: ITEM FOURTEEN (14) REQUIRES THREE COPIES)

9. A scaled site map identifying all areas where hazardous substances or wastes have been or currently are generated, manufactured, refined, transported, treated, stored, handled or disposed, above or below ground.
IS THIS MAP ENCLOSED? ☒ YES (See Appendix # A) ☐ NO

10. A detailed description of the most recent operations and processes at the industrial establishment organized in the form of a narrative report designed to guide the Department step-by-step through a plant evaluation, with particular emphasis on areas of the process stream where hazardous substances and wastes are generated, manufactured, refined, transported, treated, stored, handled or disposed on site, above or below ground. Also identify any floor drains with their points of discharge, septic systems if applicable, seepage pits and dry wells. Please note that establishments which ceased production prior to December 31, 1983, but are subject to ECRA because of on-going storage beyond that date, must provide details on past operations.

IS THIS REPORT ENCLOSED? ☒ YES (See Appendix # B) ☐ NO

IF YOU HAVE CHECKED "NO", STATE THE REASON(S):

FOR DEP USE ONLY

Notice No.

PAA000001

11. A. A description of the types, age (installation date), construction material, capacity, contents, and locations of storage vessels, surface impoundments, landfills, or other types of storage facilities, including drum storage, containing hazardous substances or wastes.

ARE THESE FACILITIES IDENTIFIED ON YOUR SITE MAP OR DESCRIBED IN A NARRATIVE REPORT?
☒ YES (See Appendix # C) ☐ NO

IF YOU HAVE CHECKED "NO", STATE THE REASON(S): _____

B. The integrity of all underground tanks which contain hazardous wastes or substances must be verified. This may be accomplished in one of several ways: a) Performance of a satisfactory leak test in conformance with Criterion 329 of the National Fire Protection Association, or; b) Performance of subsurface soil investigation (soil borings and analysis), or; c) Excavate and remove the tank and establish the absence of contamination, or; d) other methods approved by the NJDEP.

ARE THE RESULTS OF THE LEAK DETECTION TEST OR THE SUBSURFACE INVESTIGATION ENCLOSED?
☒ YES (See Appendix # C) ☐ NO

IF YOU HAVE CHECK "NO", STATE THE REASON(S): _____

12. A complete inventory of hazardous substances and wastes, including description and locations of all hazardous substances or wastes generated, manufactured, refined, transported, treated, stored, handled or disposed on site, above and below ground, and a description of the location, types and quantities of hazardous substances and wastes that will remain on site. (Attach additional sheets if necessary.) Review N.J.A.C. 7:1E, Appendix A and N.J.A.C. 7:26-8 prior to completing to ensure that all defined hazardous materials are included.

MATERIAL	QUANTITY	LOCATION	STORAGE METHOD	TO REMAIN ON SITE (Yes or No)
	See	Appendix D		

13. A. A detailed description, date and location on a scaled map of any known spill or discharge of hazardous substances or wastes that occurred during the historical operation of the site and a detailed description of any remedial actions undertaken to handle any spill or discharge of hazardous substances or wastes. (Attach additional sheets if necessary.)

IS THIS INFORMATION ENCLOSED? ☒ YES (See Appendix # E) ☐ NO

IF YOU HAVE CHECKED "NO", STATE THE REASON(S): _____

ARE THE SPILLS IDENTIFIED ABOVE INDICATED ON THE SCALED SITE MAP? ☒ YES ☐ NO

IF YOU HAVE CHECKED "NO", STATE THE REASON(S): _____

13. B. If this facility has an approved Spill Prevention Control and Countermeasure Plan (SPCC), enclose a copy with this submittal.

IS YOUR SPCC PLAN ENCLOSED? ☒ YES (See Appendix # E)
☐ NO, this facility is not required to have an SPCC plan

14. A. A detailed sampling or other environmental evaluation measurement plan which includes proposed soil, groundwater, surface water, surface water sediment, and air sampling determined appropriate for the site. (This sampling plan must be developed in conformance with ECRA Regulations N.J.A.C. 7:1-3.14 et seq., and Quality Assurance Guidelines as developed by DEP)

ARE THREE COPIES OF THE SAMPLING PLAN ENCLOSED? ☒ YES (See Appendix # E)
☐ NO

IF YOU HAVE CHECKED "NO", STATE THE REASON(S): _____

14. B. If the sampling plan includes groundwater sampling and/or the installation of monitoring wells, the applicant must complete a "Request for Hydrogeologic Assessment" form (blank form attached).

IS GROUNDWATER SAMPLING PROPOSED? ☐ YES ☒ NO

IS THE "REQUEST FOR HYDROGEOLOGIC ASSESSMENT" FORM ATTACHED? ☐ YES (See Appendix # _____)
☒ NO

IF YOU HAVE CHECKED "NO", STATE THE REASON(S): Sampling plan does not include groundwater sampling.

15. A detailed description of the procedures to be used to decontaminate and/or decommission equipment and buildings involved with the generation, manufacture, refining, transportation, treatment, storage, handling, or disposal of hazardous wastes or substances including the name and location of the transporter, the ultimate disposal facility, and any other organizations involved.

IS THE DETAILED DESCRIPTION ENCLOSED? ☒ YES (See Appendix # G) ☐ NO

IF YOU HAVE CHECKED "NO", STATE THE REASON(S): _____

6. Copies of all previous soil, groundwater and surface water sampling results, including effluent quality monitoring, conducted at the site of the industrial establishment during the history of ownership/operation by the owner or operator. Also include a detailed description of the location, collection, chain of custody, methodology, analyses, laboratory, quality assurance/quality control procedures, and other factors involved in preparation of the sampling results.

HISTORICAL RESULTS ENCLOSED? ☒ YES (See Appendix # H) ☐ NO

IF YOU HAVE CHECKED "NO", STATE THE REASON(S): _____

7. List any other information you are submitting or which has been formally requested by this agency:

None

I hereby certify that the information furnished on this application and any attachments is true. I am aware that false swearing is a crime in this State. I am cognizant that providing false information is a violation under ECRA and that I may be personally liable for penalties up to $25,000 per day.

Russell E Oiler
Signature

November 21, 1985
Date

Russell E. Oiler
Name (Print or Type)

Director of Operations
Title

APPENDIX A

LEGEND

FIGURE A-1 and A-2

HAZARDOUS SUBSTANCES/WASTE AREAS

1. Fuel Oil Storage - Underground Tank (prior owner)
2. Hazardous Substance Storage Area
3. Hazardous Subtance Tank Storage
4. Hazardous Waste Tank Storage
5. Hazardous Substance Drum Storage
6. Hazardous Substance Drum Storage
7. Waste Oil Storage - Underground Tank (prior owner)
8. Hazardous Substance Drum Storage Area
9. Hazardous Substance Tank Storage
10. Hazardous Substance Tank Storage
11. Hazardous Substance Tank Storage
12. Hazardous Substance Tank Storage
13. Hazardous Substance Tank Storage
14. Fuel Oil Storage - Underground Tanks (former)
15. Diesel Oil Tank Storage
16. Hazardous Substance Tank Storage
17. Hazardous Substance Tank Storage
18. Fuel Oil Storage - Underground Tanks
19. Gasoline Storage - Underground Tank (abandoned)
20. Hazardous Substance Tank Storage
21. Hazardous Substance Tank Storage
22. Hazardous Substance Drum Storage
23. Hazardous Substance Drum Storage
24. Hazardous Substance Tank Storage
25. Hazardous Substance Tank Storage
26. Fuel Oil Tank Storage
27. Gasoline Storage - Underground Tanks (abandoned)
28. Hazardous Waste Drum Storage
29. Hazardous Substance Tank Storage
30. Hazardous Waste Tank Storage (former)
31. Hazardous Substance Tank and Drum Storage
32. PCB Transformer/PCB Contaminated Transformers*
33. PCB Contaminated Transformer
34. PCB Transformer (former)
35. PCB Contaminated Transformer
36. PCB Transformer/PCB Contaminated Transformer
37. PCB Transformer
38. PCB Contaminted Transformer
39. PCB Contaminated Transformer
40. PCB Transformer/PCB Contaminated Transformer
41. PCB Transformer
42. PCB Transformer (former)
43. Hazardous Substance Drum Storage
44. Hazardous Substance Drum Storage

APPENDIX B

INTRODUCTION

Engelhard Corporation (Engelhard) has operated its Delancy Street facility in Newark since April, 1954. The recovery and refining of precious metals (primarily platium group metals, gold and silver) as well as the manufacture of catalysts using such precious metals for the chemical, petroleum, pharmaceutical and automotive industries have been the two primary activities at the Delancy Street facility. The current manufacturing facility consists of approximately twenty-five buildings spread across the forty-two acre site. A site plan of the facility is shown on Figure B-1 of this Appendix.

When evaluating precious metal refining and manufacturing processes in terms of the hazardous substances and hazardous wastes released to the environment it is important to keep in mind the value of precious metals. Because of the value of these precious metals, extreme care is taken in each step of the refining process to insure that the maximum quantity of precious metal is recovered. The refining of floor sweepings from the processing areas, the refining of spills and associated residues, the multiple processing of any process solution prior to discharge and the processing of equipment and facilities that have been in contact with these precious metals upon ceasing refining procedures are all practices common to precious metal industry.

REFINING OPERATIONS

In general, the refining process for precious metals entails a number of specific steps. These steps are material preparation, precious metal recovery and precious metal refining. In the material preparation phase, materials containing trace amounts of precious metals are subject to physical processing to render them amenable to recovery. Operations normally conducted during physical processing include screening, grinding, crushing, melting, and incineration. In the recovery of the precious metals, the materials containing the precious metals are subject to chemical processing to extract the precious metal from the material. Chemical processing may include acid leaching and acid dissolving. The extracted precious metal solution is then subject to any one of a number of refining processes which may include precipitation and electrolysis.

At the Delancy Street facility, the refining operations have been or are currently conducted in Buildings 4,5,6,7,12,14,16,18 and 19. The portions of these buildings that were used for the refining operations are denoted on Figure B-1 and are described in more detail below. Portions of these buildings not used for refining operations are used for offices, laboratories, warehouses or other plant services.

1. Material Preparation - materials to be refined, such as spent catalysts, sludges, and ores are usually received in drums from an off-site source and transported to Building 16. In Building 16, some of these materials are screened, ground and sampled. Similar dry operations are also conducted in Building 7 and have been

conducted in the past in Building 6. Materials amenable to incineration are processed in the tray furnaces to burn off the carbon and organic fraction prior to any dry processing. These tray furnaces are located in Building 7A, 18, 18B and 18C. Some of these materials are melted and sampled in a portion of Building 12 prior to being subject to further refining.

2. Recovery - After the preparation operations, the materials are transferred in drums, to the recovery operations. These operations have been and/or are currently conducted in Buildings 4/4A, 14 and 18. Since the mid 1960s, a portion of Building 14 has been used for the leaching of ground catalyst with hydrochloric acid. In Building 14B, a bead catalyst has been leached with nitric acid since this building was constructed in the early 1970s. During the mid 1960s and early 1970s, a matte was electrolytically refined in Building 18. During the same time frame, copper from the Building 4 operation was redissolved with sulfuric acid for further processing in a portion of Building 18A and 18B. Buildings 4 and 4A were used for the acid leaching of a crushed catalyst from the early 1960s to mid 1982 when these operations were shut down. An aluminum dissolving operation, to produce aluminum chloride for catalyst manufacturing was also conducted in the area south of Building 4/4A for a period of time in the late 1960s and early 1970s.

3. Refining - Major refining operations have been and/or are currently conducted in Buildings 5,6,12,14 and 18. Some of the leached solutions from Building 14 were electrolytically treated to refine

silver in Buildings 5 and 6. The aqueous solutions remaining after the electrolytic treatment were subject to further refining.

Solutions from the process in Building 18 were electrolytically treated in Building 18A during the mid 1960s and early 1970s. Copper and nickel were recovered in these operations. Aqueous solution remaining after the electrolytic treatment were also subject to further refining.

In the mid 1970s, Buildings 18, 18A and 18B were converted to high grade refining operations and Buildings 18D, E,F and G were constructed to house other high grade refining operations. The precious metals refined in these operations included gold and platinum group metals.

Silver salts and silver chemicals have been or are currently produced as part of the refining operations at Delancy Street. Leached solutions from the Building 14B leaching process have been precipitated in a portion of Building 14 to produce silver salts and silver chemicals. The finished products from this process are in a powder form and are either used on-site in the catalyst manufacturing or are shipped off-site. The aqueous solutions remaining after this production operation are subject to additional processing for precious metal recovery.

Currently, solutions from the refining operations which have been reprocessed for precious metal recovery are discharged. These process solutions are held in these tanks until it has been determined that it is

not possible to recover any additional precious metals from these solutions. These solutions are then pumped to the on site neutralization facility located in Building 25 for neutralization and subsequent discharge to the municipal sewer system. In the early 1970s, process solutions from the Building 5,6,14 and 18 operations were discharged to the municipal sewer while process solutions from the Building 4/4A operations were discharged to an on-site ditch located south of Building 4/4A. In the early 1970s, this ditch, which discharged to the storm water ditch south of the facility, was filled in and two sumps were constructed in the area of Building 4/4A. These sumps, one of which is still active, convey stormwaters and wastewaters to one of the holding tanks where it is subsequently discharged to the municipal sewer system. The former location of the ditch is shown on Figure A-2.

In the course of conducting the refining operations at this site for approximately 30 years, minor spills and leaks have occured from the process piping, tanks and sewers. The highest percentage of spills and leaks from process piping and tanks would be expected to occur in the tank farm south of Building 18 and in the processing area of Building 4/4A. These two areas involve processes which entailed a significant amount of transfer and treatment of process solutions and residuals.

During the 30 years of operations at the Delancy Street facility, it is probable that periodic discharges of process solutions and wastewaters did occur to the ditch south of the property and to Pierson's Creek. It is possible that some of the spills and leaks from the Building 18 tank farm reached the storm sewers in this area which discharge to the ditch.

Acids are the most common hazardous substances used in the refining operations. As previously described, acids are used primarily for leaching and dissolving of the precious metals. The majority of the acids used in these operations are stored in bulk quantities at tank farms located north of Building 6 and south of the Building 18 complex. Bulk deliveries of these acids are received in tank trucks and unloading occurs adjacent to the tanks. These acids are conveyed to the process areas by overhead pipelines. Other hazardous substances, such as the cyanides used in the production of silver cyanides, as well as some acids are handled in drums. The drums of hazardous substances are delivered to the facilities central receiving area and are transported to the processing area for storage and use.

Some of the precious metal containing spent catalysts, sludges and other materials received at the Delancy Street facility for refining may contain hazardous substances. As stated previously, these materials are usually received in drums and are stored on site and conveyed to the processing areas in drums. Any spillage of these materials during storage, handling, and refining is immediately cleaned up and all residues subject to reprocessing.

All drains in Buildings 5 and 6 discharge to closed sumps. All floor drains in the Building 14 and 18 complexes, have in the past and currently drain to the plants process sewer system. In the area of the plant where Buildings 14 and 18 are located, all process sewers discharge to the process sump located between Buildings 14 and 18.

From the sump, these wastewaters are pumped to the City sewer system. Acid and alkaline wastewaters have been segregated and are pumped to the neutralization facility for treatment prior to discharge to the City sewers.

A septic system was constructed just south of Building 4/4A in the early 1950s. This septic system, which was used for only sanitary wastes, served the office in Buildings 4/4A from the mid 1950s until these buildings were shut down in 1982. The Building 4/4A septic system is shown on Figure A-2.

CATALYST MANUFACTURING OPERATIONS

The manufacturing operations associated with catalyst production include the production of the catalyst substrates, the production of the precious metal salts and solutions used in catalyst manufacture and the actual production of the catalysts. Catalyst manufacturing activities have been conducted at the Delancy Street facility in Buildings 1,8,11,14,20, 22,23,24 and 26. The portions of these buildings used for catalyst manufacturing operations are denoted on Figure B-1 and are described in more detail below:

1. Substrate Manufacture - the substrates for catalyst manufacture are either manufactured on site or received from an off site supplier. Activities associated with substrate manufacture were and in some case still are conducted in Buildings 14,20,23,23A and 26. In the southern portion of Building 14, aluminum oxide beads are

manufactured for on site use. This operation started in the mid 1960s. Aluminum powder was previously produced in Building 20 by melting aluminum bars and atomizing the molten solution. The aluminum powder from Building 20 was slurried with water in Building 23A and this slurry was pumped to Building 23 where it was reacted with formic acid. The slurry from Building 23 was conveyed to Building 26 where it was blended with other materials, spray dried and calcined. The resulting material was used for on-site catalyst manufacture. The Building 20 operations was shut down in 1982. Purchased material is now used as the feed into Building 26.

2. Catalyst Manufacture - activities associated with catalyst manufacture were and in some cases still are conducted in Buildings 1,8,11,22 and 24. Since the early 1960s, chemical salts and solutions for use in on site catalyst manufacture as well as off site sale have been produced in Building 1. Precious metals, acids, ammonia and select drummed chemicals are used in this manufacturing process. Effluents from this process are either returned to the refining operations for precious metal recovery or are treated for precious metal recovery through the addition of zinc and/or aluminum. Subsequently, the effluents from the process are discharged to the Building 25 neutralization facility.

   Since the early 1960s, carbon supported catalysts have been manufactured in Building 11. Precious metal solutions from Building 1, carbon supports and formic acid are used in this manufacturing process. Effluents from this process are treated for precious metal recovery and discharged to the sewer.

In the early 1970s, Building 8, a research and office building constructed in 1957, was converted to house an automotive catalyst manufacturing operations. Ceramic substrates, precious metal solutions and acetic and nitric acids were used in the manufacturing process. This operation was shut down and dismantled in 1982. It is known that an overflow from a sump in Building 8 did at one time discharge to Pierson's Creek. This sump was originally provided to collect and hold any precious metal effluents resulting from the research operations prior to discharge to the sanitary sewer. This sump continued to collect some wastewaters from the automotive catalyst operations in Building 8 when these operations were started in the early 1970's. The overflow from the sump was sealed off in the late 1970's.

In the early 1970s, Building 22 was constructed to house a specialized catalyst operation. Catalyst substrates, precious metal solutions and formic acid were used in the manufacturing process. All washwaters from this operation were treated for precious metal recovery prior to discharge.

In the early 1970s, Building 24 was constructed to house a bead catalyst operation. Bead catalyst substrates and precious metal solutions were used in the manufacturing process. All washwaters from this operation were treated for precious metal recovery prior to discharge. Operations were curtailed in 1979 but still continue sporadically.

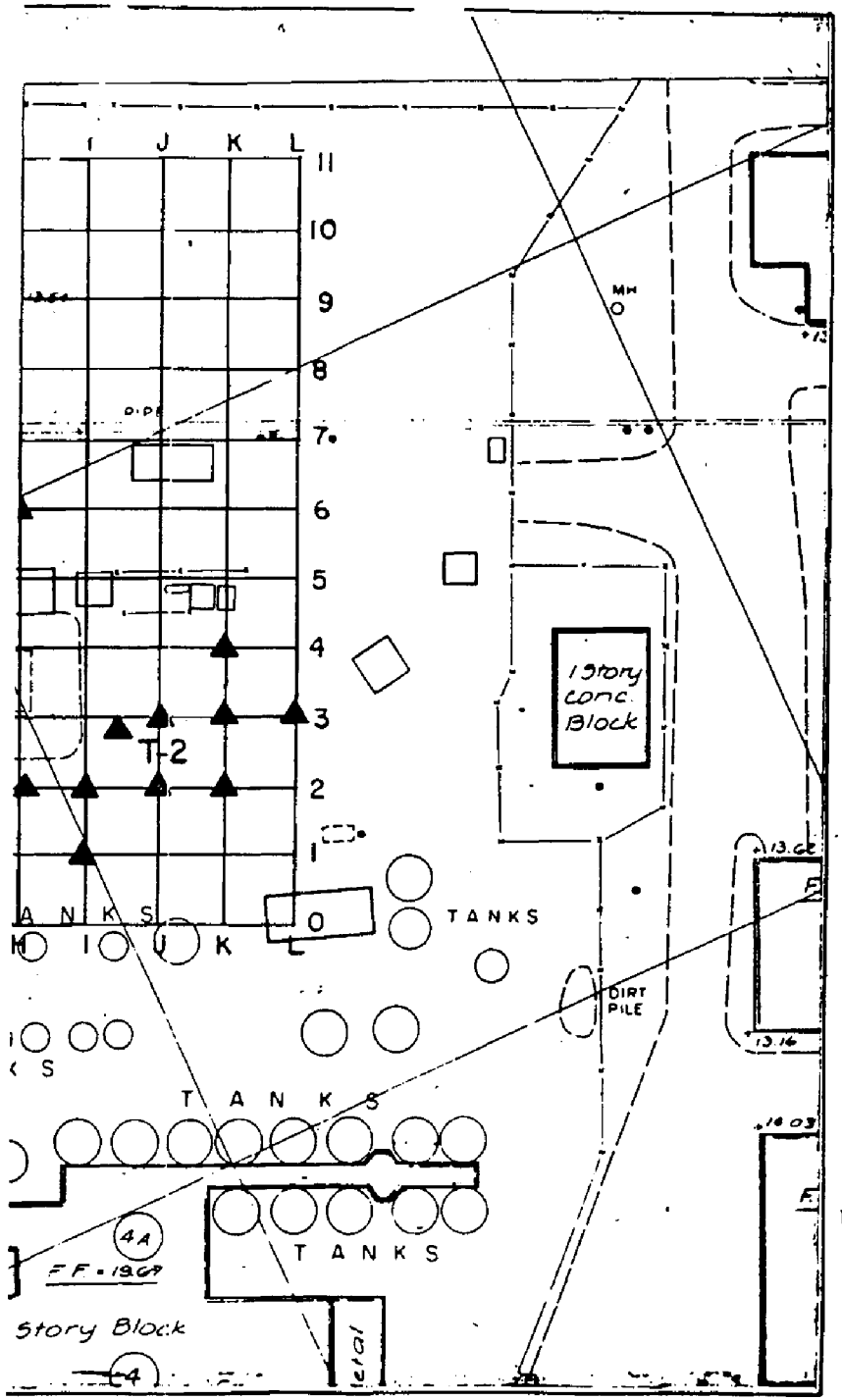
Acids are the most common hazardous substances used in the catalyst manufacturing operations. The acids used in the manufacturing operations in Buildings 1 and 11 are stored in bulk. The acids used in the Building 1 operations are stored in the tank farm on the west side of the building and the tank farm on the south while the ammonia used in the Building 1 operations and the acids used in the Building 11 operations are stored in the tank farm south of Building 1. Bulk deliveries to these tanks are made by tank trucks and unloading occurs adjacent to the tanks. The acids used in the Building 8,22 and 24 operations were drummed and stored at the production location.

The only hazardous wastes routinely generated as a result of the catalyst manufacturing operation are waste caustic sulfide solutions from the air emission scrubbers associated with the Building 8 (former) and Building 11 operations. These waste scrubber solutions are stored in bulk tanks adjacent to the production operations for subsequent off-site disposal.

It is common at Delancy Street to use closed sumps in all production areas where precious metal solutions are used. Any floor drains in Building 1,8 and 11 not connected to a closed sump, discharge directly to the municipal sanitary sewer. From 1970 until 1974, the sanitary wastewaters from Building 22 discharged to septic systems located south of Building 22. A system just south of Building 22 was used from 1970 until 1972 when it was abandoned in place at the time of the construction of Building 22A. A system just south of Building 22A was used until 1974 when the drains from Building 22 were connected to the sanitary sewer system. This system was abandoned in place at that time.

Process wastewaters from the Building 22 operation discharge to a dry well located to the east of Building 22. This dry well was connected to the sanitary sewer system in 1974. The location of these two septic systems and the dry well are shown on Figure A-2.

FIGURE C-



LEGEND

▲ SOIL BORING - PETROLEUM HYDROCARBON ANALYSIS

ENGELHARD CORPORATION
DELANCY STREET FACILITY
FUEL TANK ASSESSMENT

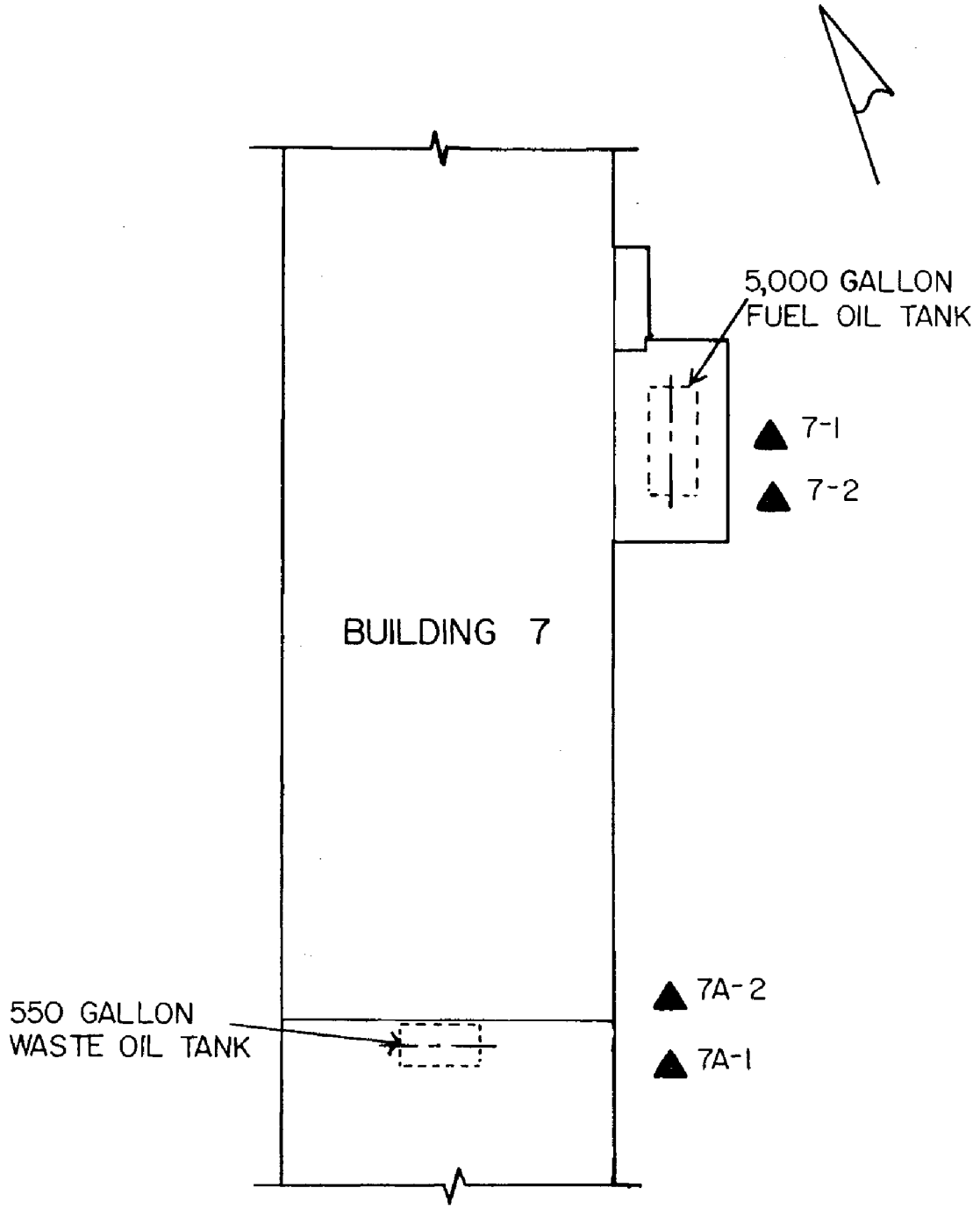
SOIL BORING LOCATION PLAN

1" = 40' 40 0 40

O'BRIEN & GERE

TIERRA-B-016493

FIGURE C-1



SCALE: 1"=40'

ENGELHARD CORPORATION-DELANCY ST.

O'BRIEN & GERE ENGINEERS, INC.

SUBSURFACE INVESTIGATION
BUILDING 7/7A TANKS

SOIL BORING LOCATIONS

FILE NO.
DATE
DWG NO

TIERRA-B-016494

The results of the petroleum hydrocarbon analyses shows only one sample, 7A-1 with a value in excess of 100 mg/l. Since this sample shows a value of only 160 mg/l, it is reasonable to conclude that a significant amount of hydrocarbons have not been released from these tanks.

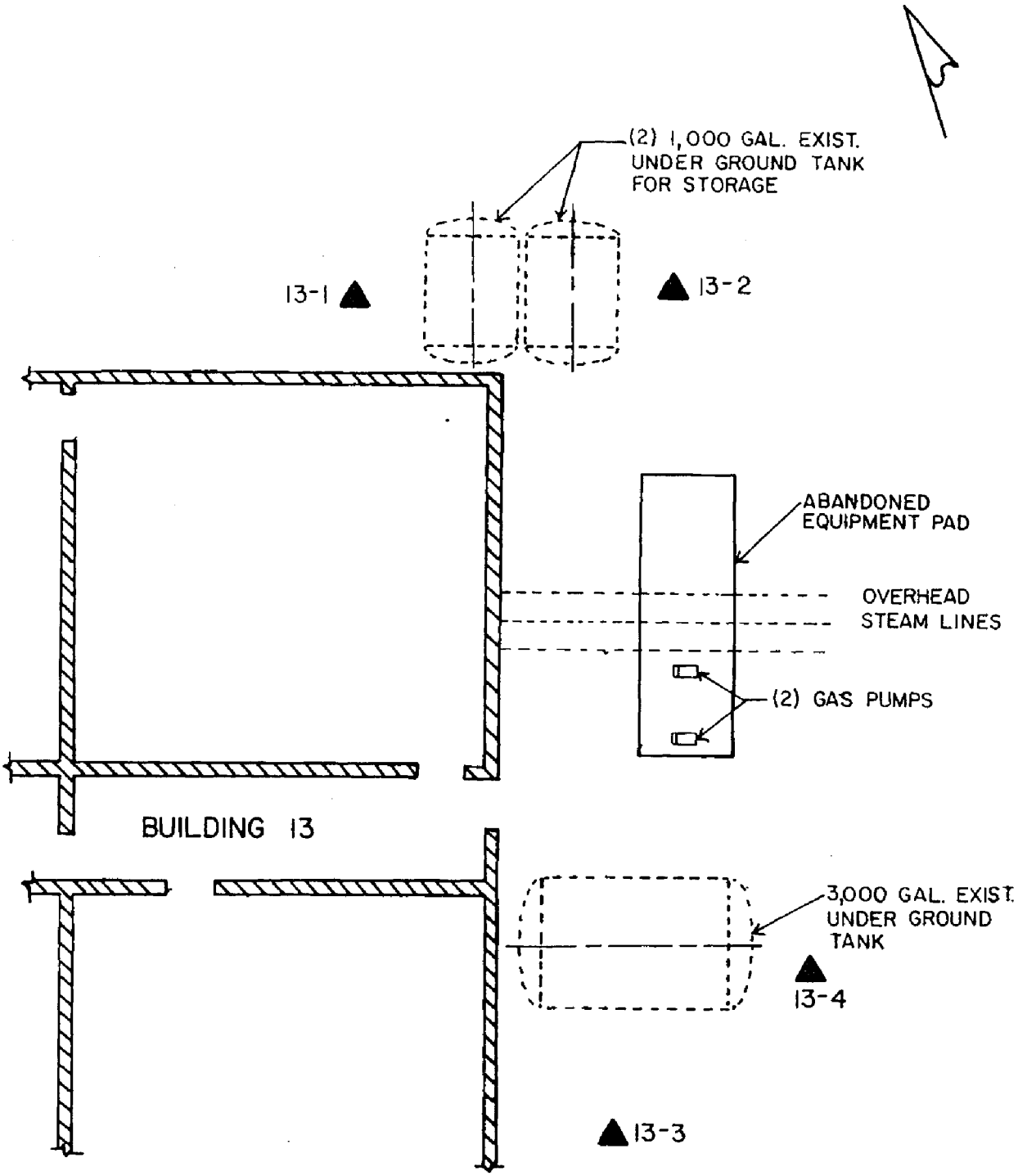
2. Building 13 Tanks

Two 1,000 gallon underground gasoline tanks were installed just north of Building 13 in 1963 and a 3,000 gallon underground gasoline tank was installed just southeast of Building 13 in 1973. All three tanks were abandoned in place in 1980. The approximate locations of these tanks is shown on Figure C-2.

To confirm the integrity of these three gasoline tanks, in May, 1985, four borings were installed around the tanks. The locations of these borings are shown on Figure C-2. Borings were located in accessible areas in proximity to the underground tanks. Access was limited to these tanks due to buildings, equipment and overhead steam and electric lines. Borings 13-1 and 13-2 were taken to a depth of 10 feet while Borings 13-3 and 13-4 were taken to a depth of 12 feet. These depths should correspond to the elevation of the bottom of the tanks. These elevations were established from drawings prepared for the tank installations.

One sample was selected from each boring for petroleum hydrocarbon analysis. The results of these analyses is presented on Table C-2. The results of the petroleum hydrocarbon analyses showed three samples with

FIGURE C-2



SCALE: 1/8" = 1'-0"

ENGELHARD CORPORATION-DELANCY ST.

O'BRIEN & GERE ENGINEERS, INC.

SUBSURFACE INVESTIGATION
BUILDING 13 GASOLINE TANKS

SOIL BORING LOCATIONS

FILE NO.

DATE

DWG NO.

TIERRA-B-016496

petroleum hydrocarbon concentrations in the range of 100-120 mg/l and one sample less than 100 mg/l. Based on these test results, it is concluded that an insignificant amount of petroleum hydrocarbons have been released from these tanks.

3. Fuel Oil Storage Tanks

Two active 50,000 gallon tanks contain No. 4 fuel oil which currently provides a backup energy supply to the facility's boilers. The two tanks, both twelve feet in diameter, are of carbon steel construction and were installed in 1964. During the installation of these tanks, which are partially in ground, the tanks were backfilled with lime and sand and covered with stone and tar to protect the tanks from corrosion. Feed and return lines from these tanks run underground to the boiler house located in Building 2. The fill station for these tanks is located adjacent to the tanks. The location of the tanks, the fill and return lines, and the fill station is shown on Figure C-3.

Prior to the installation of these two tanks in 1964, two 20,000 gallon underground tanks were used for fuel oil storage. These two tanks were removed subsequent to the installation of the two 50,000 gallon tanks. Additionally, a 2,000 gallon gasoline storage tank is located immediately west of the two active fuel oil tanks. The gasoline tank has been abandoned in place. The location of the former 20,000 fuel oil tanks and the gasoline tank are also shown on Figure C-3.

In February 1985, three soil borings were installed in the area of the two active fuel oil tanks. These borings were installed to a depth of eight feet. The location of these three borings, designated as T-1,T-2

and T-3 are shown on Figure C-3. One sample from each boring, all being 6-8 feet below ground surface, was selected for analysis for petroleum hydrocarbons. Samples were selected from the 6-8 foot depth since this elevation corresponds to the bottom of the two active tanks. The results of this analysis showed petroleum hydrocarbon concentrations of approximatley 6,100 mg/l and 1,600 mg/l in samples from borings T-1 and T-2, respectively. The sample from boring T-3 had a petroleum hydrocarbon concentration less than 100 mg/l. The results of these analyses is presented in Table C-2.

In response to the results of the February work efforts, additional subsurface investigations were undertaken around these tanks in May 1985. This investigation centered on identifying the source or sources of the petroleum hydrocarbons identified in the February work efforts. As discussed above, there are five potential sources of petroleum hydrocarbons in the area of the two active fuel tanks. A twenty foot grid pattern was established in the area of the five potential sources and a total of 19 soil borings were installed on this grid pattern. The location of these additional 19 borings are shown on Figure C-4.

One sample was selected from each boring for petroleum hydrocarbon analysis. Samples from borings L-3, H-7, I-1, E-1, E-8, C-2, B-6, B-1, K-2, K-4, C-6, F-6, J-2, I-2, K-3, D-5 and C-7 were taken from a depth of 6-8 feet. Also included for analysis were a sample from boring J-3 at 8-10 feet and a sample from boring E-6 taken at a depth of 12-14 feet.

The results of the petroleum hydrocarbon analysis of these 19 samples are presented on Table C-2. Based on these analytical results it is probable that the two 50,000 gallon tanks are not a source of petroleum hydrocarbon release. This conclusion is supported by the analytical results from the borings around the tanks. The four major excursions(T-1 6,100 mg/l, T-2 1,600 mg/l, E-1 6,500 mg/l and F-6 2,500 mg/l) may be attributed to the tars used in soaking of the gravel cover of the tanks. This conclusion is further supported by inventory and level checks conducted by Engelhard within the previous few months.

ECRA NOTIFICATION - DELANCY STREET FACILITY
DESCRIPTION OF STORAGE FACILITIES

TYPE	INSTALLATION DATE	CONSTRUCTION MATERIAL	CAPACITY	CONTENTS	LOCATION	STATUS
Tank - Underground	1964	Carbon Steel	50,000 gallon	No. 4 Fuel Oil	South of Bldg. 2	Active
Tank - Underground	1964	Carbon Steel	50,000 gallon	No. 4 Fuel Oil	South of Bldg. 2	Active
Tank - Underground	1952	Carbon Steel	5,000 gallon	Fuel Oil	East of Bldg. 7	Abandoned in Place - mid 1950's
Tank - Underground	1952	Carbon Steel	550 gallon	Waste Oil	North Wall Bldg. 7A	Abandoned in Place - mid 1950's
Tank - Underground	1973	Carbon Steel	3,000 gallon	Gasoline	East of Bldg. 13	Abandoned in Place - mid 1980's
Tank - Underground	1963	Carbon Steel	1,000 gallon	Gasoline	Northeast Bldg. 13	Abandoned in Place 1980
Tank - Underground	1963	Carbon Steel	1,000 gallons	Gasoline	Northeast of Bldg. 13	Abandoned in Place 1980

TYPE	INSTALLATION DATE	CONSTRUCTION MATERIAL	CAPACITY	CONTENTS	LOCATION	STATUS
Tank - Underground	1953	Carbon Steel	20,000 gallon	Fuel Oil	South of Bldg. 2	Removed 1964
Tank - Underground	1953	Carbon Steel	20,000 gallon	Fuel Oil	South of Bldg. 2	Removed 1964
Tank - Underground	1965	Carbon Steel	2,000 gallon	Gasoline	South of Bldg. 2	Abandoned in Place
Tank - Above Ground	1975	Steel	4,000 gallons	Sodium Hydroxide	South of Bldg. 8	Inactive
Tank - Above Ground	1975	Steel	4,000 gallons	Waste Caustic	South of Bldg. 8	Closed RCRA Facility 1984
Tank - Above Ground	1978	Steel	8,000 gallons	Acetic Acid	West of Building 1	Active
Tank - Above Ground	1978	Steel	8,000 gallons	Potassium Hydroxide	West of Building 1	Active
Tank - Above Ground	1976	Steel, Rubberlined	1,500 gallons	Scrubber Solution	East of Bldg. 11	Permitted RCRA Facility
Tank - Above Ground	1976	Steel, Rubberlined	1,500 gallons	Scrubber Solution	East of Bldg. 11	Permitted RCRA Facility
Tank - Above Ground	1954	Steel	13,000 gallons	Anhydrous Ammonia	South of Bldg. 1	Active
Tank - Above Ground	1954	Steel	13,000 gallons	Anhydrous Ammonia	South of Bldg. 1	Active
Tank - Above Ground	1954	Steel, Rubberlined	10,000 gallons	Hydrochloric Acid	South of Bldg. 1	Active

TYPE	INSTALLATION DATE	CONSTRUCTION MATERIAL	CAPACITY	CONTENTS	LOCATION	STATUS
Tank - Above Ground	1954	Steel, Rubberlined	10,000 gallons	Formic Acid	South of Bldg. 1	Active
Tank - Above Ground	1978	Steel, Rubberlined	1,500 gallons	Formic Acid	South of Bldg. 1	Active
Tank - Above Ground	1960	Steel	13,500 gallons	Sulfuric Acid	North of Bldg. 6	Active
Tank - Above Ground	1982	Steel	500 gallons	Diesel Fuel	South of Bldg. 2	Active
Tank - Above Ground	1960	Steel	5,000 gallons	Nitric Acid	North of Bldg. 6	Active
Tank - Above Ground	1974	Steel, Coated	13,000 gallons	Sulfuric Acid	South of Bldg. 18	Active
Tank - Above Ground	1976	Steel, Rubberlined	3,000 gallons	Formic Acid	South of Bldg. 18	Active
Tank - Above Ground	1976	Steel	1,000 gallons	Anhydrous Ammonia	South of Bldg. 18	Active
Tank - Above Ground	1962	Steel	550 gallons	No. 2 Fuel Oil	Building O	Empty
Tank - Above Ground	1962	Steel	300 gallons	No. 2 Fuel Oil	Buidling O	Empty
Tank - Above Ground	1962	Steel	300 gallons	No. 2 Fuel Oil	Southwest Bldg. 13	Empty
Tank - Above Ground	1962	Steel	300 gallons	No. 2 Fuel Oil	Southwest Bldg. 13	Empty
Tank - Above Ground	1982	Stainless Steel	10,000 gallons	Sodium Hydroxide	South of Bldg. 25	Active
Tank - Above Ground	1982	Steel	8,000 gallons	Sulfuric Acid	South of Bldg. 25	Active
Tank - Above Ground	1978	Steel	13,000 gallons	Sodium Hydroxide	South of Bldg. 2	Active

TYPE	INSTALLATION DATE	CONSTRUCTION MATERIAL	CAPACITY	CONTENTS	LOCATION	STATUS
Tank - Above Ground	1978	Steel	13,000 gallons	Sodium Hydroxide	South of Bldg. 2	Active
Tank - Above Ground	1975	Stainless Steel	5,000 gallons	Nitric Acid	South of Bldg. 18	Active
Tank - Above Ground	1975	Steel, Rubberlined	10,000 gallons	Hydrochloric Acid	South of Bldg. 18	Inactive
Tank - Above Ground	1975	Steel, Rubberlined	10,000 gallons	Hydrochloric Acid	South of Bldg. 18	Inactive
Tank - Above Ground	1975	Steel, Rubberlined	10,000 gallons	Hydrochloric Acid	South of Bldg. 18	Active
Tank - Above Ground	1980	Steel, Rubberlined	6,000 gallons	Hydrochloric Acid	East of Bldg. 14	Inactive
Tank - Above Ground	1972	Steel, Coated	4,800 gallons	25% Caustic	South of Bldg. 18	Active
Tank - Above Ground	1975	Steel	7,000 gallons	50% Caustic	South of Bldg. 18	Active
Tank - Above Ground	1976	Steel, Rubberlined	2,000 gallons	Ammonia Chloride - Solution	Bldg. 18F Internal	Inactive
Tank - Above Ground	1976	Steel, Rubberlined	2,000 gallons	Ammonia Chloride - Solution	Bldg. 18F Internal	Inactive
Tank - Above Ground	1964	Steel	500 gallons	Sodium Hydroxide	Building 2 Internal	Active
Tank - Above Ground	1964	Steel	500 gallons	Hydrochloric Acid	Building 2 Internal	Active
Tank - Above Ground	1970	Steel	2,000 gallons	Sodium Hydroxide	Buildign 14 Internal	Active
Tank - Above Ground	1970	Steel, Rubberlined	6,000 gallons	Formic Acid	Building 23 Internal	Active
Drum Storage-Staging Area for precious metal reclamation	N/A	Concrete	N/A	Hazardous Substances	Bldg. 16 - Internal	Active
Drum Storage of Test Materials	N/A	Asphalt, Concrete	N/A	Hazardous Substances	North of Bldg. 22	Active

TYPE	INSTALLATION DATE	CONSTRUCTION MATERIAL	CAPACITY	CONTENTS	LOCATION	STATUS
Drum Storage	N/A	Concrete	N/A	Hazardous Wastes	Bldg. 5B	Permitted RCRA Facility
Drum Storage	N/A	Asphalt	N/A	Acids	North of Bldg. 23	Active
Drum Storage	N/A	Asphalt	N/A	Acids	Southeast of Bldg. 14A	Active
Drum Storage	N/A	Asphalt	N/A	Acids	South of Bldg. 29	Active
Drum Storage	N/A	Asphalt	N/A	Acids	Bldg. 29 - Internal	Active
Drum Storage	N/A	Asphalt	N/A	Hazardous Substance	South of Bldg. 8	Active
Drum Storage	N/A	Asphalt	N/A	Hazardous Substance	South of Bldg. 13	Active

Table C-2

ENGELHARD CORPORATION - DELANCY STREET FACILITY
FUEL TANK ASSESSMENT

PETROLEUM HYDROCARBON ANALYSIS

Tank	Sample No.	Sample Depth (ft)	Petroleum Hydrocarbons (mg/kg) dry wt.
Fuel Oil	7-1	3-5	lt 100
Fuel Oil	7-2	3-5	lt 100
Waste Oil	7A-1	3-5	lt 100
Waste Oil	7A-2	3-5	lt 100
Fuel Oil	T-1	6-8	6,100
Fuel Oil	T-2	6-8	1,600
Fuel Oil	T-3	6-8	lt 100
Fuel Oil	B-1	6-8	520
Fuel Oil	B-6	6-8	380
Fuel Oil	C-2	6-8	370
Fuel Oil	C-6	6-8	210
Fuel Oil	C-7	6-8	lt 100
Fuel Oil	D-5	6-8	lt 100
Fuel Oil	E-1	6-8	6,500
Fuel Oil	E-6	12-14	900
Fuel Oil	E-8	6-8	300
Fuel Oil	F-6	6-8	2,500
Fuel Oil	H-6	6-8	300
Fuel Oil	I-1	6-8	lt 100
Fuel Oil	I-2	6-8	lt 100
Fuel Oil	J-2	6-8	lt 100
Fuel Oil	J-3	8-10	170
Fuel Oil	K-2	6-8	lt 100
Fuel Oil	K-3	6-8	lt 100
Fuel Oil	K-4	6-8	lt 100
Fuel Oil	K-3	6-8	lt 100
Gasoline	13-1	8-10	lt 100
Gasoline	13-2	8-10	100
Gasoline	13-3	10-12	110
Gasoline	13-4	10-12	120

Notes:
1. ND - Not detected - detection limit 100 mg/l dry wts.
2. lt - less than
3. Analytical method used for petroleum hydrocarbon anlaysis
   SW 846 - Method 3,550 - Extraction
   Analytical Handbook - NYS Dept. of Health - 1980
   Method 310-13 Petroleum Products (Hydrocarbons)

APPENDIX C

STORAGE FACILITIES

A description of the types, ages (installation date), construction material, capacity, contents and locations of bulk storage facilities containing hazardous substances or wastes is presented in Table C-1.

INTEGRITY TESTING

There are a total of ten underground tanks which contain or have contained hazardous substances at the Delancy Street facility. Detailed descriptions of these ten tanks are provided in Table C-1. The integrity testing of these tanks have been completed using subsurface soil investigation. These integrity investigations have been conducted in three separate programs as required by the locations of the tanks. The results of these integrity testing programs are discussed below:

1. Building 7/7A Tanks

A 5,000 gallon underground fuel oil tank and a 550 gallon underground waste oil tank were installed by the previous owner of the Building 7 facility in the early 1950s. Subsequent to Engelhard purchasing this property in the mid 1950s, these tanks were abandoned. No records are available as to the exact locations of these tanks or the steps taken to empty or remove the contents of these tanks. Since that time,

extensions to the Building 7 have been constructed over both tanks. The approximate locations of both these tanks is shown on Figure C-1 presented at the back of this Appendix.

To confirm the integrity of the underground fuel oil storage tank east of Building 7, in February, 1985 two soil borings were taken. The location of the borings is shown on Figure C-1. These borings were placed in accessible areas in proximity to the underground storage tanks. Boring 7-1 extended to approximately five feet below the surface. Boring 7-2 which also extended to five feet below ground surface was drilled approximately fifteen feet south of Boring 7-1. Samples at the five foot depth were selected for analysis from both Borings 7-1 and 7-2. This depth was selected as it corresponded to the approximate level of groundwater and any product loss from the tanks would be expected to be found at that location. Both samples were analyzed for petroleum hydrocarbons and the results of these analyses are presented on Table C-2.

To confirm the integrity of the underground waste oil tank two borings, 7A-1 and 7A-2, were drilled in February, 1985. The location of these borings is shown on Figure C-1. Again, these borings were placed in accessible areas in proximity to the underground storage tanks. Both borings extended to a depth of five feet. Samples at the five foot depth were selected for petroleum hydrocarbon analyses from both Borings 7A-1 and 7A-2. Again, this depth was selected as it corresponds to the approximate level of groundwater. The results of this analyses is presented on Table C-2.

SECTION 1 - INTRODUCTION

1.01 Previous Studies

In February 1985, Engelhard retained O'Brien & Gere Engineers, Inc. for the purpose of developing and implementing an environmental sampling and analysis program at the Delancy Street facility. A report was prepared presenting the sampling and analysis program and the results of this program. A copy of this report is presented in Appendix H of this ECRA Notice. It is recommended that this report be reviewed prior to the review of this sampling plan as the work efforts of this proposed sampling plan are meant to supplement those previous work efforts.

The results of the environmental sampling and analysis program completed in February indicate that residues of heavy metals, most notably lead, zinc, nickel and copper are present in the soils and sediments of the site. In most cases, it is not possible to confidently distinguish between metals resulting from Engelhard's activities and previous activities or contributions from off-site sources. Analysis of groundwater in the site indicates that the groundwater flowing through the site has not been severely impacted by Engelhards' activites, previous activities or any off-site sources. For the most part, it is thought that this is due to the chemical character of the heavy metals which do not favor movement in the groundwater on-site.

SECTION 2 - PROPOSED SAMPLING PLAN

2.01 Basis for Sampling Plan

The sampling plan being proposed as part of the ECRA Notice Requirements has been developed so as to provide data to supplement that acquired as part of the February 1985 sampling program. A review of the February 1985 sampling program and the site information presented within this notice indicates that sampling should be completed in the areas of the PCB Transformers and PCB Contaminated Transformers (PCB concentration in excess of 50 ppm) to supplement the existing data base.

Substations at the site which have or currently contain PCB transformers or PCB contaminated transformers are as follows:

a. Building 1
b. Building 6
c. Building 7
d. Building 8
e. Building 12
f. Building 14
g. Building 14A
h. Building 16
i. Building 18
j. Building 22
k. Main Substation

As part of the work efforts of the February 1985 sampling program, sampling and analysis for PCB contamination was only completed in the area of the PCB transformers at the main substation. Therefore, sampling and analysis for PCB contamination at the remaining ten substations will be conducted as part of this plan.

2.02 Sampling and Analysis Program

The specific sampling and analysis to be conducted at each of the substations is discussed in this section. The sampling and analysis plan for these substations will entail the analysis of the PCB content of soil samples from around the substations. In the cases where the PCB Transformers or PCB Contaminated Transformers have been or are located in areas not suitable for soil sampling, such as on the roof of Building 16, where practicable surface samples of materials and residuals will be taken at the location of these transformers. Since no signs of oil leaks or spills exist on the concrete pads supporting the transformers and since no PCB spills or leaks have been reported at these transformers, the concrete pads will not be tested.

For substations located on the ground external to buildings, a total of four soil samples will be obtained from around each of the substations and analyzed for PCB. The soil samples will extend to a depth of one foot below ground surface or one foot below the bottom of the asphalt. For the Building 16 substation, four surface samples will be obtained in the area of the former PCB Transformer. The sample locations are shown on Figures F-1 and F-2.

Soil samples will be obtained by use of a hollow stem auger and split spoon or a hand power auger and post hold digger. The hollow stem auger will be used for all samples except where the sampling locations are not accessible to the drill rig. All samples and analysis conducted as part of this sampling program will be in accordance with the sampling and analytical protocols presented in Section 3.

APPENDIX D

INVENTORY

The Delancy Street facility is currently an active production faciltity. As a result of this, the inventory of hazardous substances and wastes vary on a daily basis. Because of this, the inventory presented within this Appendix represents the maximum inventory of hazardous substances and wastes which may be on site at any one time. The inventory for the Delancy Street facility is presented on Table D-1 at the end of this Appendix. At the time of site closure, no hazardous substances or wastes will be left at the site.

HAZARDOUS SUBSTANCES/WASTE INVENTORY

LOCATION	MATERIAL	QUANTITY	STORAGE METHOD	TO REMAIN ON SITE
Building 1	PCBs	**	Transformer	*
West of Bldg. 1	Acetic Acid	8,000 gallons	Tank	No
West of Bldg. 1	Potassium Hydroxide	8,000 gallons	Tank	No
South of Bldg. 1	Hydrochloric Acid	10,000 gallons	Tank	No
South of Bldg. 1	Ammonia	13,000 gallons	Tank	No
South of Bldg. 1	Ammonia	13,000 gallons	Tank	No
South of Bldg. 1	Formic Acid	10,000 gallons	Tank	No
South of Bldg. 1	Formic Acid	1,500 gallons	Tank	No
Bldg. 1 Loading Dock	Potassium Hydroxide	550 pounds of pellets	Drums	No
Bldg. 1 Loading Dock	Sodium Cyanide	1,600 pounds	Drums	No
Bldg. 1 Loading Dock	Ammonium Chloride	100 pounds	Drums	No
Bldg. 1 Loading Dock	Antimony Trioxide	750 pounds	Bags	No
Bldg. 1 Loading Dock	50% Sodium Hydroxide	150 gallons	Drums	No
Bldg. 1 Loading Dock	Sulfuric Acid	675 pounds	Carboys	No
Bldg. 1 Loading Dock	Sodium Hydrochlorite	440 gallons	Drums	No
Bldg. 1 Loading Dock	Thorium Nitrate	13 pounds	Bottles/Drums	No
Bldg. 2	Hydrochloric Acid	500 gallons	Tank	No
Bldg. 2	Sodium Hydroxide	500 gallons	Tank	No
South of Bldg. 2	Sodium Hydroxide (50%)	13,000 gallons	Tank	No
South of Bldg. 2	Sodium Hydroxide (25%)	13,000 gallons	Tank	No
South of Bldg. 2	Fuel Oil	50,000 gallons	Tank	*
South of Bldg. 2	Fuel Oil	50,000 gallons	Tank	*
South of Bldg. 2	Diesel Fuel	500 gallons	Tank	No
South of Bldg. 2 - Cylinder Storage Shed	Chorine	900 pounds	Cylinders	No
South of Bldg. 2 - Cylinder Storage Shed	Anhydrous Ammonia	450 pounds	Cylinders	No
South of Bldg. 2 - Cylinder Storage Shed	Hydrogen Sulfide	450 pounds	Cylinders	No
Bldg. 6	PCBs	**	Transformer	*
North of Bldg. 6	Sulfuric Acid	13,500 gallons	Tank	No
North of Bldg. 6	Nitric Acid	5,000 gallons	Tank	No
Bldg. 7	PCBs	**	Transformer	*
Bldg. 8	Formic Acid	1,540 gallons	Drums	No
South of Bldg. 8	Sodium Hydroxide	4,000 gallons	Tank	No
East of Bldg. 11	Waste Caustic - Sulfide Solution	1,500 gallons	Tank	No
East of Bldg. 11	Waste Caustic - Sulfide Solution	1,500 gallons	Tank	No
Bldg. 12	PCBs	**	Transformer	*
Southwest of Bldg. 13	Fuel Oil	300 gallons	Tank	No
Southwest of Bldg. 13	Fuel Oil	300 gallons	Tank	No
Bldg. 14	Sodium Hydroxide	2,000 gallons	Tank	No
Bldg. 14	PCBs	**	Transformer	*
Bldg. 14 Leach	Hydrochloric Acid	6,000 gallons	Tank	No
Bldg. 14A	PCBs	**	Transformer	*

LOCATION	MATERIAL	QUANTITY	STORAGE METHOD	TO REMAIN ON SITE
Bldg. 18	PCBs	**	Transformer	*
South of Bldg. 18	Sulfuric Acid	13,000 gallons	Tank	No
South of Bldg. 18	Hydrochloric Acid	10,000 gallons	Tank	No
South of Bldg. 18	Hydrochloric Acid	10,000 gallons	Tank	No
South of Bldg. 18	Hydrochloric Acid	10,000 gallons	Tank	No
South of Bldg. 18	Ammonia	1,000 gallons	Tank	No
South of Bldg. 18	Formic Acid	3,000 gallons	Tank	No
South of Bldg. 18	Nitric Acid	5,000 gallons	Tank	No
Bldg. 18 South Yard	Zinc	740 pounds	Bars & Powder	No
Bldg. 18 A/B	Litharge	7,500 pounds	Drums	No
Bldg. 18 A/B	50% Caustic	500 gallons	Drums	No
Bldg. 18 A/B	Hydrochloride Acid	440 gallons	Drums	No
Bldg. 18 A/B	Granular Caustic	2,500 pounds	Drums	No
Bldg. 18 A/B	Ammonium Chloride	26,800 pounds	Bags	No
Bldg. 18 A/B	Ethylene Diamine	275 gallons	Drums	No
Bldg. 18 A/B	Chlorine	1,200 pounds	Cylinders	No
Bldg. 18 F	Ammonium Chloride Solution	4,000 gallons	Tank	No
Bldg. 18 G	Ammonium Acetate	1,200 pounds	Drums	No
Bldg. 18 F Yard	Ammonium Hydroxide	220 gallons	Drums	No
South of Bldg. 18	Caustic (50%)	7,000 gallons	Tank	No
South of Bldg. 18	Caustic (25%)	4,800 gallons	Tank	No
Bldg. 22	PCBs	**	Transformer	*
Bldg. 22 Yard	Zinc	9,600 pounds	Bars	No
Bldg. 22 Yard	Nitric Acid	275 gallons	Drums	No
Bldg. 22 Yard	Sulfuric Acid	165 gallons	Drums	No
Bldg. 22 A	50% Caustic	210 gallons	Drums	No
Bldg. 22 A	Copper Nitrate	200 pounds	Drums	No
Bldg. 22 A	Aluminum Sulfate	1,680 pounds	Drums	No
Bldg. 22 A	Ammonium Sulfamate	100 pounds	Drums	No
Bldg. 22 A	Ammonium Hydroxide	275 gallons	Drums	No
Bldg. 23	Formic Acid	6,000 gallons	Tank	No
South of Bldg. 25	Sulfuric Acid	8,000 gallons	Tank	No
South of Bldg. 25	Sodium Hydroxide	8,000 gallons	Tank	No
Bldg. 0	Fuel Oil	550 gallons	Tank	No
Bldg. 0	Fuel Oil	300 gallons	Tank	No
Main Substation	PCBs	**	Transformer	*
At the following drum storage locations: West of Bldg. 31 North of Bldg. 23 West of Bldg. 14A South of Bldg. 29 Bldg. 29 - Internal	Miscellaneous Acids	500 drums	Drum	No
At the following drum storage locations: Bldg. 16 - Internal South & East of Bldg. 25 Yard of Bldg. 22/22A Bldg. 5B South Bldg. 8 Bldg. 14	Miscellaneous	500 drums	Drum	No

* determination to be made by Engelhard during closure of facility.

** see Table A-1 for additional information on the PCB Transformers and PCB Contaminated Transformers within these areas.

APPENDIX E

A review of the historical operations at the Delancy Street facility have identified four (4) spills of a hazardous substance. These include 1) a hydrochloric acid spill north of Building 4/4A in the mid 1950s 2) a hydrochloric acid spill west of Building 5 in 1956; 3) a PCB spill north of Building 20 in 1982; and 4) a PCB spill at Building 16 in 1982. A description of these spill events and corrective actions taken to rectify the situation is presented below.

1. Hydrochloric acid spill - Building 4/4A - In the mid 1950's, approximately 3,000 gallons of hydrochloric acid was spilled in an area north of Building 4/4A. The approximate location of this spill is shown on Figure A-2. This spill was the result of a ruptured pipeline. No reported remedial actions were undertaken to address any spill residuals although it is likely that the acid residuals were neutralized.

2. Hydrochloric acid spill - Building 5 - In 1956, approximately 10,000 gallons of hydrochloric acid was spilled in an area west of Building 5. The approximate location of this spill is shown on Figure A-2. This spill was the result of a ruptured tank car hose. It is reported that the acid residuals from this spill were neutralized with lime.

3. PCB Spill - Building 20 - In 1982, a leak of PCB fluid was identified from an inactive capacitor being stored north of Building 20. The approximate location of this spill is shown on Figure A-2. In response

to this leak, the asphalt pavement and soil below the pavement was excavated and disposed of at an approved off site facility.

4. PCB Spill - Building 16 - In 1982, a leak of PCB fluid was identified from the transformer located on the roof of Building 16. This PCB fluid leaked into a special containment tray placed under the PCB transformer. The approximate location of this spill is shown on Figure A-2. In response to this spill, all PCB fluids were drained from the containment tray and the containment tray was decontaminated. All residuals from this spill were disposed of at an approved off site facility. Subsequent to this spill, this transformer was removed from service and disposed of at an approved off-site facility.

In addition to the above described spills, in 1980, the City of Newark dredged Pierson's Creek from Delancy Street to the culvert just south of this property. This dredging was conducted for the purpose of improving the storm water capacity of the Creek. This Creek has for many years conveyed stormwaters and industrial wastewaters from a significant portion of the City of Newark. The dredge spoils were disposed of on Engelhard's property in the field east of Pierson's Creek.

As noted in Appendix B, periodic discharges of wastewaters have probably occurred to the ditch south of Building 4/4A, the ditch south of the facility and Pierson's Creek.

ATTACHMENT E-1

DELANCY STREET FACILITY

SPCC PLAN

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

ENGELHARD CORPORATION
429 DELANCY STREET
NEWARK, NEW JERSEY

Prepared by: V. G. Morando, Jr.
Engelhard Corporation

Date: April, 1985

PROFESSIONAL ENGINEER'S CERTIFICATION

I, Philip A. Naderer, a certified professional engineer, having examined Engelhard Corporation's manufacturing facility at 429 Delancy Street, Newark, New Jersey, and being familiar with 40 CFR 112, the Oil Pollution Prevention regulations, hereby certify that the facility's Spill Prevention Control and Countermeasure Plan has been prepared in accordance with good engineering practices.

Philip A. Naderer
Signature

May 1, 1985
Date

27724
State Professional Engineer
License No., issued by
the State of New Jersey

TABLE OF CONTENTS

ENGELHARD CORPORATION
DELANCY STREET FACILITY

SPILL PREVENTION CONTROL & COUNTERMEASURE PLAN

I. Introduction

The Delancy Street facility of the Engelhard Corporation is a manufacturing concern that produces various precious metal-containing catalyst products and chemicals, and recovers and refines precious metals from spent catalysts and scrap materials.

The facility stores two grades of fuel oil on site: F.O. No. 4 in two (2) 50,000-gallon underground storage tanks, and diesel oil in a 550-gallon tank. F.O. No. 4 is used as secondary fuel for the facility's steam boilers whenever interruptible gas supply is not available. Diesel oil is stored for the stand-by power generator. Locations of these tanks are marked on the facility plot plan designated as Exhibit A-1.

Although the possibility of substantial spilled oil actually discharging to Pierson's Creek, or to the ditch south of the facility leading to Pierson's Creek, is quite remote, the Plan is nevertheless drawn up herewith to satisfy the letter of the law. To date, this facility had no oil spills or discharges to the creek or its tributary.

The objective of the Plan is to prevent oil from being discharged to the storm drain sewers, Pierson's Creek, or the ditch at the southern end of the facility leading to the creek.

The management of Engelhard's Delancy Street facility fully supports this program. A letter signed by senior management expressing commitment to the program described herein is found in the Appendix section as Exhibit A.

II. EQUIPMENT AND PROCEDURES

A. Containment

1. Above-ground Tank

The above-ground tank is the 550-gallon tank storing diesel oil, located south of Building 2. This tank is diked with a concrete system to contain the contents of the tank plus sufficient freeboard for precipitation. The containment system is equipped with a manual valve that is normally closed and sealed.

2. Underground Tanks

The two (2) 50,000 underground tanks do not have containment provisions. In lieu of containment, current procedures allow early detection of leaks and prevent ground spills to run off to storm drains or waterway. These leak detection procedures are outlined below under section (b).

(a) Minor Spills or Leaks

Pails or pans are used by oil delivery drivers to catch any dripping from delivery hoses and connections during filling and disconnecting. Absorbent materials are available in the boiler room and the maintenance shop when needed. Oil collected in the pail or pan is returned to the tanker or storage tank by the driver.

Other small leaks or spills are contained by using absorbent materials. Exhibit H lists the available absorbents and other containment equipment at the site. All used absorbent materials are to be collected in DOT 17C drums. Whenever oil or oil-contaminated materials are initially stored in a drum container, a properly completed hazardous waste label must be placed on the side of the drum (refer Exhibit B). These labels are available from the Environmental Engineer. The Environmental Engineer will be notified of the event by submitting a "Waste Profile Sheet" for the waste completed by the boiler room operator or his supervisor (refer Exhibit C).

(b) Major Spills or Leaks

A major spill can occur only when one of the underground storage tanks starts to leak. Six observation wells are provided to sample underground leaching of oil if a leak is suspected to occur.

Each underground tank is equipped with an air-pressure type level gauge located in the boiler room. Daily monitoring of these gauges are performed and the readings are logged down on "Oil Inventory Log" sheet (reference Exhibit E). These log sheets, when completed, are to be submitted to the Environmental Engineer for record-keeping. A copy must be furnished the Utilities Manager.

When the boilers are using fuel oil, their consumption as indicated by their individual totalizer flowmeters, and the length of time oil was used, are also logged down. Dipstick measurements are also carried out two times a week as a check on the gauges. From this information, a leak is detected at the initial stage by the level gauges and the dipstick measurements, and if the boilers are using fuel oil, through a material balance that can be established between oil usage and in storage.

When fuel oil is not used, level gauge readings and dipstick measurements are continued to be logged down all year round using the same log sheets.

Any signs of a leak, or discrepancies on the material balance that indicates loss of oil not accounted for, shall be immediately reported to the Utilities Department, and/or the Environmental Engineering Department. Representatives from these departments will evaluate the case on hand and determine the next action to take (see Containment).

If it is determined that leak exists on the basis of monitoring data, a series of actions to be taken is activated. These are:

Action	By
1. Oil from the leaking tank will immediately be used in the operating boiler(s);	Boiler room operator or supervisor
2. Oil from the leaking tank will be transferred to the other underground tank if not full, and/or to tankers once available (see items 3 & 4, below);	Boiler room operator or supervisor
3. The oil supplier with whom Engelhard has a pre-arranged agreement to supply empty tankers to temporarily store the oil will be immediately notified and requested to provide the necessary number of tankers. A letter from our oil supplier, the Amerada Hess Corporation, acknowledging this agreement is attached as Exhibit I.	Utilities Manager
4. If necessary, rental tankers will be contacted and retained to augment the temporary oil storage capability.	Utilities Manager
5. Samples will be drawn out of six observation wells provided near the tanks to determine the extent and location of the leakage.	Environmental Engineer
6. Engelhard's Environment, Health and Safety will be notified as early as possible.	Environmental Engineer

7.	Regulatory agencies will be notified once all the necessary information is available.	Environment, Health and Safety
8.	Once emptied, subject tank will not be used until it is inspected, repaired and leak tested (or replaced, if necessary).	Utilities Manager

Exhibits F and G contain listings of plant personnel and governmental agencies for notification purposes.

B. Tank Truck Unloading Procedure

When an oil delivery is made, the tank truck proceeds to the storage tank area and contacts the boiler operator. The operator checks which tank should be filled. The volume of fuel oil to be delivered is specified in the order. The operator shows the driver where the fill pipe's nozzles are and which one the driver should hook up his hose to. The driver connects one end of the hose to his truck's discharge pipe and the other end to the fill pipe. He places a pail under each connection and turns open the proper valves. He now starts pumping the oil. The driver stays by the truck, watching out for leaks until pumping is completed. He shuts off the pump, disconnects the hose on both ends and replaces it in the truck's enclosed hose compartments. He collects the pails, and if filled, empties them into the storage tank. The driver notifies the operator that delivery is complete. the operator looks over the area for leaks or spills, checks his tank gauge for volume delivered, and signs the trip ticket of the driver.

C. Draining of Diked Area

The following procedures are to be performed whenever the dike servicing the diesel oil storage tanks is to be drained of accumulated contents.

1. When the dike contains spilled oil, in sufficient quantity to allow pumping, the spill will be transferred to drum container(s) (DOT 17E) by pumping the oil to the drum. Otherwise, absorbents will be used.

The pump transfer will be performed by Maintenance personnel upon request by the boiler operator or his supervisor. The boiler operator or his supervisor will notify the Environmental Engineer of the existence of the oil drum(s) by submitting a completed waste profile sheet. A hazardous waste label completed by the boiler operator shall be placed on the side of each oil drum. The boiler operator or his supervisor shall arrange for the drum(s) to be stored in the Hazardous Waste Storage Building, 5B. From here on, proper disposal will be handled by the Environmental Engineer.

2. After each rainfall, the boiler operator will inspect the retained rainwater in the dike for presence of oil. Oil is present if the accumulated rainwater exhibits an oily layer, film, or sheet on the surface of the water, or oily sludge or emulsions deposited beneath the water surface.

(a) If oil is present in the retained rainwater, a 500-ml. representative sample will be taken by the boiler operator and properly labelled showing sampling date, dike location and sampler's name. The retained rainwater in the dike shall be transferred to drum containers (DOT 17E). A waste profile sheet will be completed for the contents of the drum(s) and, with the sample, forwarded to the Environmental Engineer. the boiler operator completes a hazardous waste label and places it on the side of the drum.

(b) If the retained rainwater is free of an oily layer or sheen, it can be released, or pumped out if necessary, to the nearest sewer drain. This is the drain located on the ground directly south of Building 2.

3. If any valve seal is broken off to drain a dike, the valve shall be resealed.

All the above activities, whenever they occur, shall be logged down on the "Weekly Inspection Log Sheet" by the boiler operator or his supervisor. Completed "Log Sheets" shall be forwarded to the Environmental Engineer for recordkeeping. The boiler operator will also forward a copy of the "Log Sheet" to the Utilities Manager for information.

D. Inspection & Monitoring

1. Above-ground Tank

Weekly inspections will be conducted by the boiler room operator of the above-ground tank and its piping, flanges and valves for leaks or signs of leaks and for structural integrity. The inspection and monitoring sheets shall be completed and signed after each inspection (reference Exhibit D). Immediate notification is relayed to the operator's immediate supervisor, the Utilities Manager, or the Environmental Engineer, if a leak or sign of leak is detected.

2. Underground Tanks

The two 50,000-gallon underground tanks have 3/8-inch thick shells and are coated with an asphalt compound for corrosion protection. The tanks' contents are heated with steam coils constantly under pressure. Leaks on the coils will result in steam condensate to escape to the tank. A grab sample of the oil is taken before its use to determine whether water is present in the tank. If water is present, this will be pumped out to DOT 17E drums, samples taken from each drum and sent to Environmental Engineering for evaluation and proper disposal.

APPENDIX F

SAMPLING PLAN
INITIAL ECRA NOTICE - ITEM NO. 14

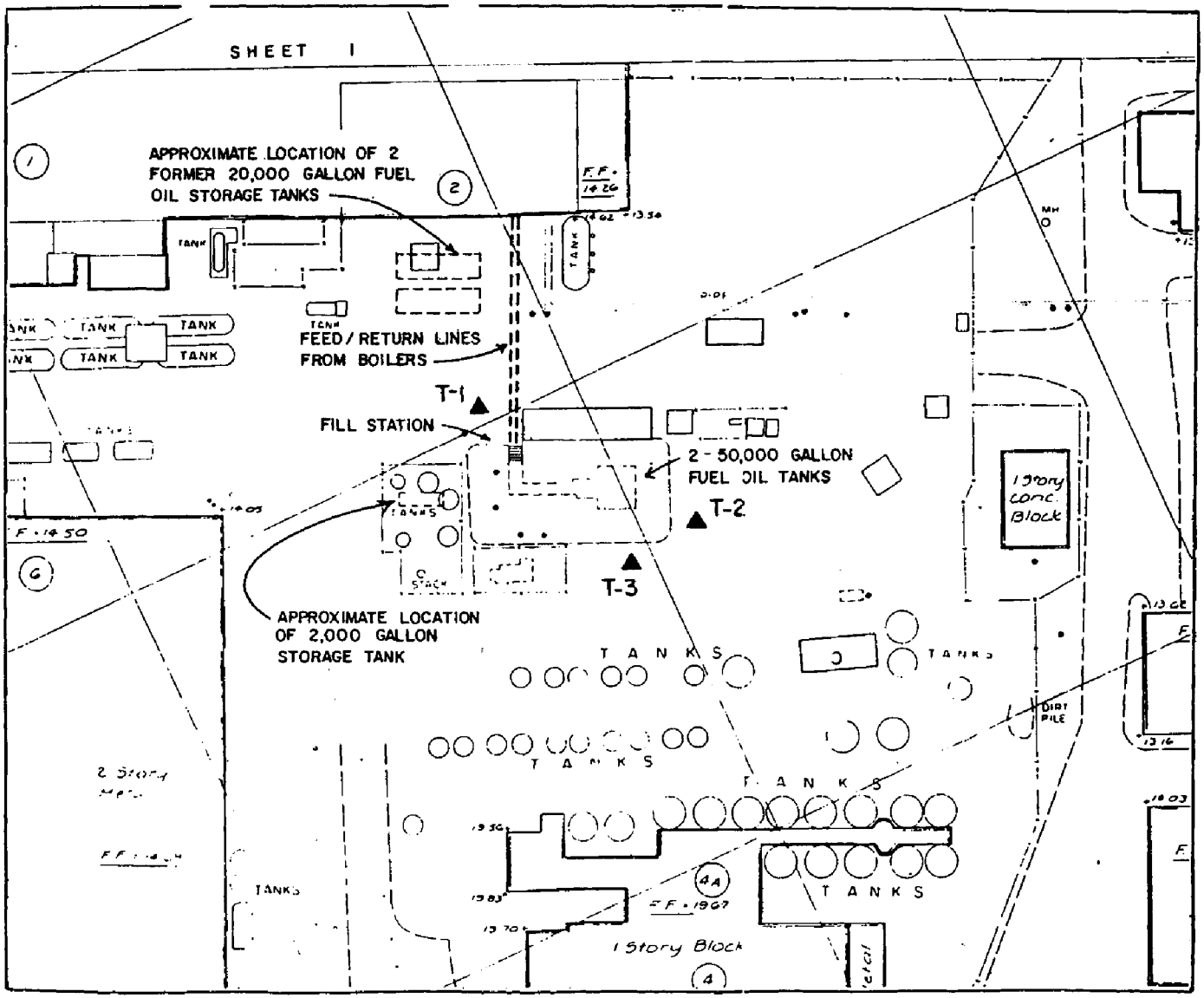
ENGELHARD CORPORATION
SPECIALITY CHEMICALS DIVISION

NEWARK, NEW JERSEY

JULY, 1985

O'BRIEN & GERE ENGINEERS, INC.
RARITAN PLAZA III
EDISON, NEW JERSEY

FIGURE C-3



ENGELHARD CORPORATION
DELANCY STREET FACILITY
FUEL TANK ASSESSMENT

SITE PLAN

1" = 40'

O'BRIEN & GERE

TIERRA-B-016530

ENGELHARD CORPORATION

SPCC - DELANCY STREET FACILITY

EXHIBIT A

I, Russell E. Oiler, Director of Operations of Engelhard's Delancy Street, Newark, New Jersey facility, after reviewing this Spill Prevention Control and Countermeasure Plan, fully approve and support this Plan, as required by 40 CFR 112, the Oil Pollution Prevention regulations. It is the intent of Engelhard Corporation's management to comply with all applicable environmental laws and regulations.

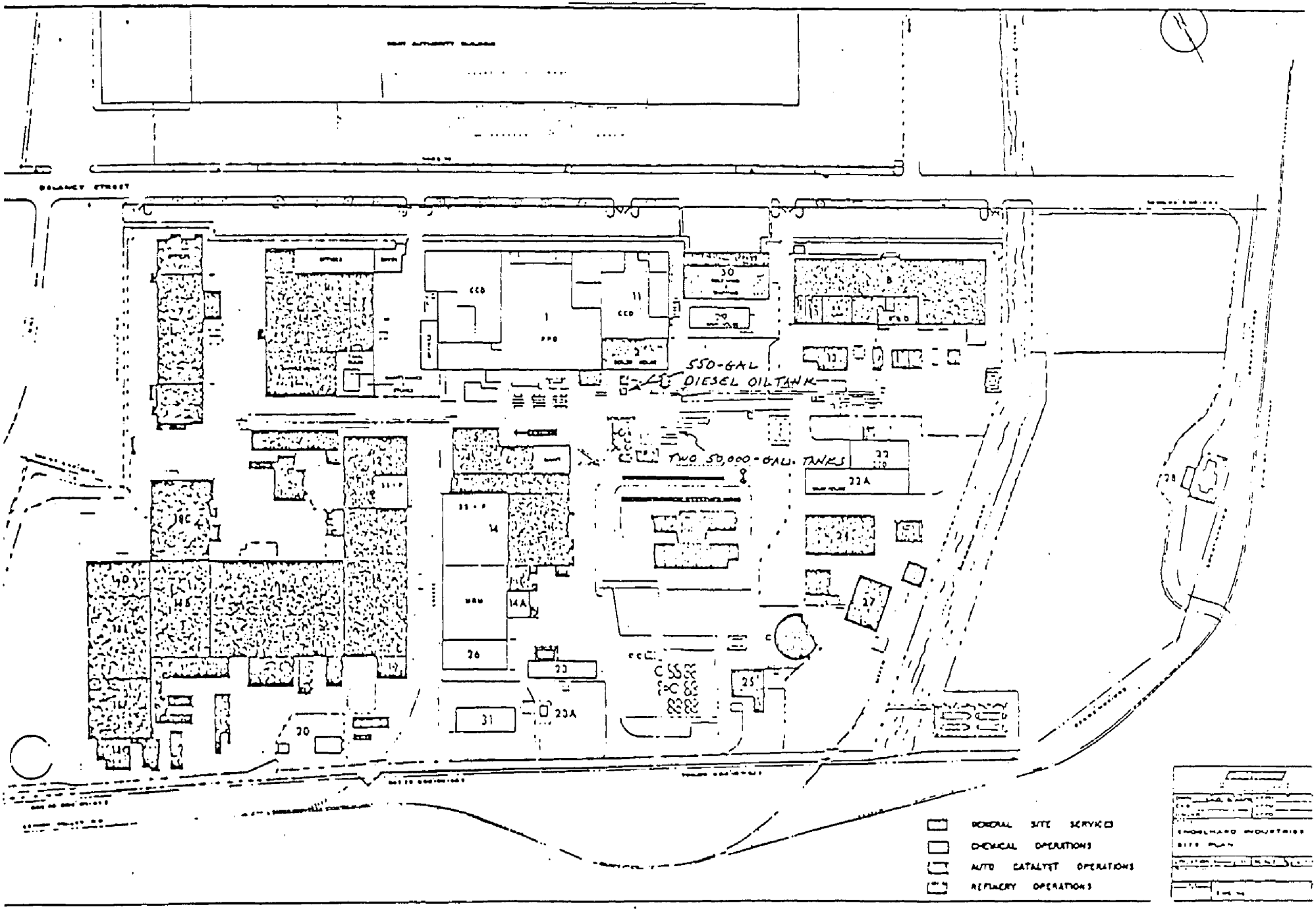
Russell E Oiler

Signature

April 19, 1985

Date

ENGELHARD CORPORATION
SPCC - DELANCY STREET FACILITY
EXHIBIT A-1



TIERRA-B-016532

ENGELHARD CORPORATION

SPCC DELANCY STREET FACILITY

EXHIBIT A-2

DIKE SIZING FOR DIESEL OIL CONTAINMENT

Diesel oil tank capacity:	550 gallons
Existing dike measurements:	W = 81 inches
	L = 80 inches
	H = 27.75 inches
	Volume = 778 gallons
Maximum 24-hour rainfall on Newark area during past twelve months	= 2.77 inches (on 12-22-83)
Equivalent volume on dike	= 78 gallons
Minimum volume requirement for dike	= 550 + 78
	= 628 gallons

Height of diking 628 gallons will occupy:

$$\frac{628 \times 144}{7.48 \times 80 \times 81} = 22.39 \text{ inches}$$

Freeboard: 27.75 - 22.39 = 5.37 inches

Conclusion:

Existing dike size is more than adequate to comply with the requirements.

ENGELHARD CORPORATION

SPCC - DELANCY STREET FACILITY

EXHIBIT B

(Specimen)

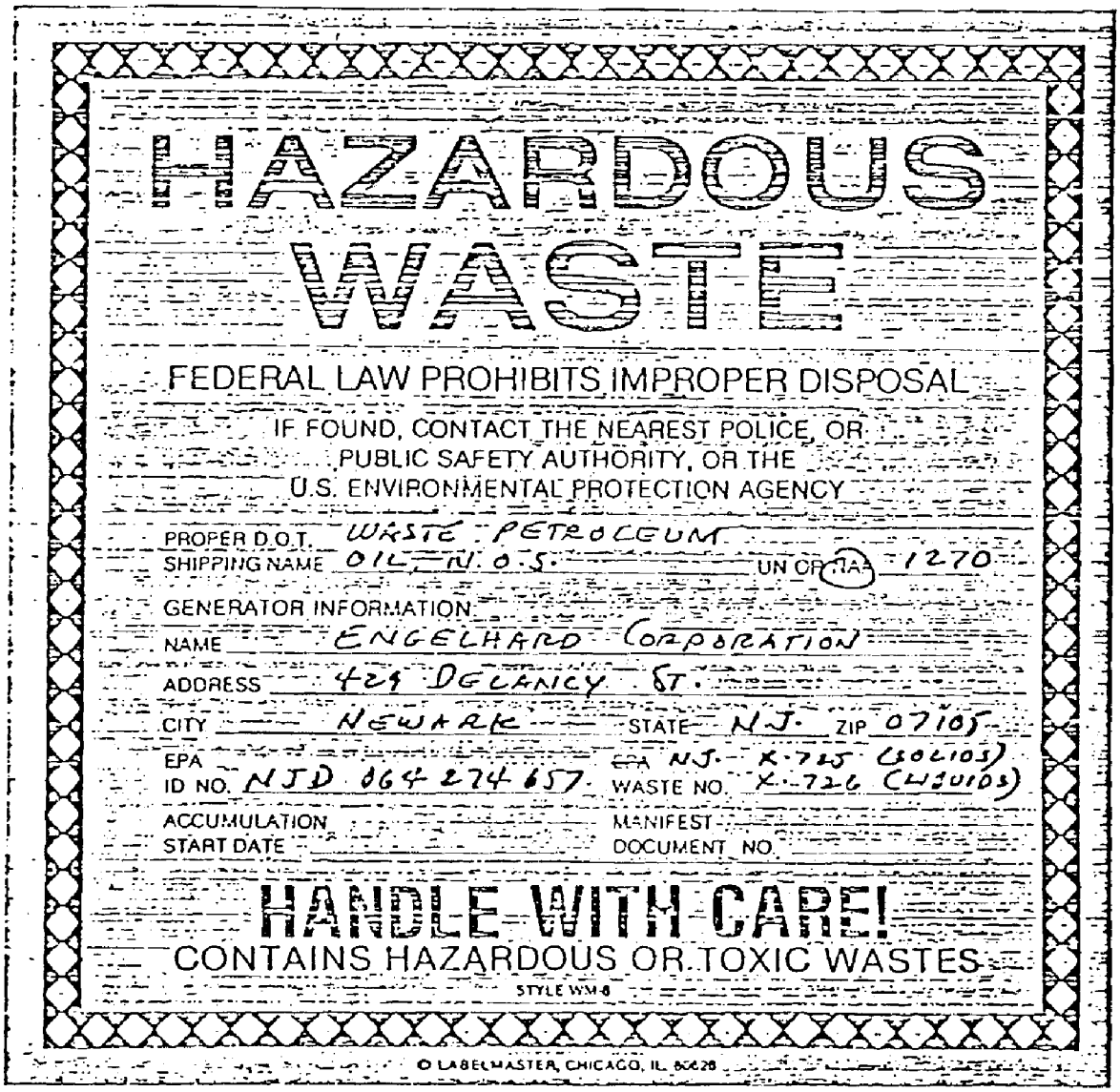


EXHIBIT C

EQUEST FOR WASTE DISPOSAL

WASTE PROFILE SHEET

(Send to: Environmental Engineering Department, Delancy Street)

cility: ☐ Carteret ☐ East Newark ☐ Union

☐ Delancy Street ☐ Menlo Park

Requestor's Name (Print) _____ (Sign) _____

Department No. _____

Telephone _____ Date _____

Waste Name _____

Process Generating Waste _____

Quantity _____ Packaging _____

Note: If wastes are lab chemicals, please provide a listing of each chemical's name, weight or volume, and its physical state, liquid or solid. The information below does not have to be provided.

Waste Properties:

At 70°F

☐ Liquid

☐ Solid

☐ Slurry

If Liquid:

☐ Bilayered

☐ Multilayered

☐ None

pH _____

Color _____

Flashpoint _____

Sp. Gr. _____

emical Constituents (provide weight or volume %, mg/liter; indicate with EST if estimated; attach copy of analysis if analyzed):

		Check the following if believed present:		
		Ag	Cr	Ni
		As	Cu	Al
		Ba	Hg	Zn
		Be	Mn	Pb
		Cd	Mg	

If this material was purchased for our use, attach a copy of the Material Safety Data Sheet.

If a sample is needed, how much lead time will you need? _____

ENVIRONMENTAL ENGINEERING DEPARTMENT USE

Facility EPA ID No. _____

Waste Stream No. _____

Received by: _____ Date _____

Is waste hazardous: ☐ Yes ☐ No

Disposer(s) contacted: _____ Sample? ___ Date ___

_____ Sample? ___ Date ___

roper DOT Shipping Name _____ UN/NA No. _____

DOT Hazard Class _____ EPA Hazard Code _____ EPA Waste Type _____

ENGELHARD CORPORATION

SPCC - DELANCY STREET FACILITY

EXHIBIT D

Weekly Inspection Log Sheet

Inspector _____

Date _____

Time _____

Oil Tanks	Problems Identified Yes	No	Remarks	Remedial Actions Taken
Bldg. 2 (south)				
Diesel oil tank	☐	☐		
Underground Tanks				
Tank 1 (north)	☐	☐		
Tank 2 (south)	☐	☐		

- Inspect for structural integrity, signs of leaks, leaks, potential problems on dikes, tank shells, piping, flanges and valves. If a problem or potential problem is cited, describe under "REMARKS" and note down what actions were taken regarding the problem.

THIS SHEET IS TO BE MADE PART OF THE SPCC RECORDS AND SHALL BE KEPT FOR MINIMUM OF THREE YEARS FROM ABOVE DATE.

Month-Yea[r] _____ Fuel Oil No. 4 [I]nventory Log
([50,000]-G[al] [T]anks)

Day	Storage Tanks				Boiler(s) in Operation					
	Gauge Readings		Dipstick Measurements*		Oil Flowmeter Readings**					
	Tank #1	Tank #2	Tank #1	Tank #2	Boiler No.			Boiler No.		
	In.	Gals.	In.	Gals.	Before	After	Consump.	Before	After	Consump.
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
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27										
28										
29										
30										
31										

Instructions:

1. Gauge Readings - daily, at start of day shift.
2. Dipstick Measurements - Monday & Thursday, at start of day shift.

* Temperature of oil is to be taken for the following corrections:
Volume correction = .0004 x Vol. Oil measured x temp. diff. °F between readings (subtract if colder)

** This section to be filled up whenever fuel oil is used. Flowmeters are those provided in each boiler's fuel line. Operator starting up the boiler will enter "BEFORE" readings before start, or at start of shift of day shift operator if boilers are already operating. Operator on duty when boiler is shut down will enter "AFTER" readings, or at end of shift of 3rd shift operators if boilers are still operating.

ENGELHARD CORPORATION

SPCC - DELANCY STREET FACILITY

EXHIBIT F

Emergency Call List

Emergency Telephone Numbers

Security

F. J. Rock	741-7414
Wells Fargo	622-1144

Plant Services

W. Griffin	840-0126
J. Hrevnak	851-0828
A. Mathews	436-7037
J. R. Newbrough	725-6042
W. P. Pinkasavage	364-7305 364-4225

Environmental Engineering

R. P. Angelillo	287-4473
V. G. Morando, Jr.	367-1329

Oil Supplier

Hess Oil Co.	636-3000

ENGELHARD CORPORATION

SPCC - DELANCY STREET FACILITY

EXHIBIT G

GOVERNMENTAL AGENCIES EMERGENCY CALL LIST

The Environment, Health & Safety Department maintains the following list of government agencies to be notified, as appropriate, should a spill incident occur.

(A "spill incident" is defined as the discharge of oil or hazardous substances into or upon the navigable waters of the United States violating applicable water quality standards or causing a film or sheen or discoloration of the surface of the water or adjoining shorelines.)

1. National Response Center
   Washington, D. C.
   (800) 424-8802 (Toll Free)
   If no answer, call 8 (202) 426-2675

2. U. S. Environmental Protection Agency, Region II
   Environmental Spill Hot Line
   (201) 548-8730

3. N. J. State Department of Environmental Protection
   Division of Water Resources
   Spill Prevention Program
   (609) 292-5560 Night (609) 292-7172

4. Chemtrec (800) 424-9300

In the event of a spill incident posing a serious hazard to property or public health or safety, the following agencies are also to be notified:

5. Newark Police Headquarters
   Emergency 911
   Non-Emergency 733-6000

6. Newark Fire Department
   Emergency 911
   Non-Emergency 733-7400

ENGELHARD CORPORATION

SPCC - DELANCY STREET FACILITY

EXHIBIT H

CONTAINMENT EQUIPMENT

Absorbents

The site is equipped with adequate supplies of spill absorbent materials which absorb approximately 100 times their weight in spilled fluids. Absorbents are stored in the central maintenance building and are easily accessible in the event of a liquid hazardous waste release. Additional absorbent materials consist of bagged sawdust for spill cleanup, available in Building 7A.

Leak Seal Bags

A product consisting of neoprene bags which can be inflated with air for the control of leaks is stored on site. The deflated bags are placed directly over the leaking area of a vessel or pipe and inflated to stop the leak. These products are also stored in the central maintenance building.

Storage Drums

DOT 17C and 17E steel drums are stored in the Hazardous Waste Storage Building. These drums are oil compatible and are used for containment and storage of oil and cleanup materials.

Emergency Portable Pumps

Portable air operated pumps are also available in various areas of the facility. These pumps can be quickly moved to any areas affected by a spill for prompt, effective containment and cleanup.

EXHIBIT I

AMERADA HESS CORPORATION

TELETYPE: 710-928-0373
CABLE ADDRESS: HESSOIL

1 HESS PLAZA
WOODBRIDGE, N J 07095
(201) 636-3000

January 31, 1984

Engelhard Corporation
Engelhard Industries Division
70 Wood Ave. So.
Iselin, NJ 08830

Attention: George Heinemeier

Dear George,

As per our conversation, this letter is in response to your inquiry concerning renting* tankers from Amerada Hess Corporation.

We are in a position and willing to provide empty tankers in case of an emergency developing in any of your storage tanks. Our tankers have a capacity of 7,000 gallons. We would like as much advance notice as possible in order to have the tankers available. The cost will be approximately $50.00 to $60.00 a day. If the storage tanks are being repaired or cleaned, the oil stored in the tankers will be returned to the storage tanks. Therefore, there will be no need for oil to be returned to us.

If you should have any questions regarding this or any other matter, please do not hesitate to contact me.

Very truly yours,

AMERADA HESS CORPORATION

Nikki

Nikki S. Leary
Sales Representative

NSL/maib

George, these are "tanker trucks"

HW File CC0008
07-14-94
Should have a File

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT

INCIDENT REPORT

D.W.M. ASSIGNED CASE NUMBER: 92-10-01-002	HOT LINE ☐	INDEXED ☐	
DATE: 10-01-92	TIME (Military): 1150	D.W.M. ID NO.: 0185 ECO 204	

INCIDENT REPORTED BY:

NAME: P.O. Legare	PHONE: 212-668-7920		
AFFILIATION: USCG CGTP N.Y.	CODE:		
STREET:			
CITY: Governors Island	STATE: N.J.	ZIP CODE:	

INCIDENT LOCATION: Rpt'd by worker - Mr. Welch 201-465-6349

NAME: Engelhardt Industries	PHONE:		
STREET: 429 Delancey St	UTM VERT:	UTM HORIZ:	
CITY: Newark	COUNTY: 07	STATE: NJ	ZIP CODE:

SOURCE OF SPILLED AND/OR DISCHARGED SUBSTANCE: Confirmed ☐ Alleged ☒ More Than 1 Source ☐

COMPANY NAME: Engelhardt Industries	PHONE:		
CONTACT:	TITLE:		
STREET: 429 Delancey St.	DEP COMPANY NO.:		
CITY: Newark	COUNTY: Essex	STATE: NJ	ZIP CODE:

SUSPECTED SPILLED AND/OR DISCHARGED SUBSTANCE: ☐ Confirmed ☒ Alleged ☐ More Than 2 Substances

1. pos. pcb's			SUBSTANCE NO.:
AMOUNT SPILLED: 1	UNITS: Drum	A/P/E: E	S/L/G/M: S
2.			SUBSTANCE NO.:
AMOUNT SPILLED:	UNITS:	A/P/E:	S/L/G/M:

DATE OF INCIDENT:	TIME (Military):	TEMP.:	WEATHER:	WIND (Dir. & Vel.):
SPILL ORIGIN: Drum				CODE:
CAUSE: Leaking drum				CODE:
WATER BODY AFFECTED: Storm Sewer				CODE:
ASSOCIATED FIRE AND/OR HAZARDS:				

INCIDENT REFERRED TO:

AGENCY:	PHONE:
CONTACT:	AGENCY CODE:

PRIMARY D.W.M. INVESTIGATOR:	FOLLOWUP:

BAA000031

TIERRA-B-016542

STREET		
CITY Governors Island	STATE N.J.	ZIP CODE

IDENT LOCATION: apt'd by worker - Mr. Welch 201-465-6349

NAME Englehardt Industries	PHONE	
STREET 429 Delancey St	UTM VERT	UTM HORIZ
CITY Newark — COUNTY 07	STATE N.J.	ZIP CODE

SOURCE OF SPILLED AND/OR DISCHARGED SUBSTANCE: Confirmed ☐ Alleged ☒ More Than 1 Source ☐

COMPANY NAME Englehardt Industries	PHONE	
CONTACT — TITLE		
STREET 429 Delancey St.	DEP COMPANY NO.	
CITY Newark — COUNTY Essex	STATE N.J.	ZIP CODE

SUSPECTED SPILLED AND/OR DISCHARGED SUBSTANCE: ☐ Confirmed ☒ Alleged ☐ More Than 2 Substances

1. pos. pcb's				SUBSTANCE NO.
AMOUNT SPILLED 1	UNITS Drum	A/P/E E		S/L/G/M L
2.				SUBSTANCE NO.
AMOUNT SPILLED	UNITS	A/P/E		S/L/G/M

DATE OF INCIDENT	TIME (Military)	TEMP.	WEATHER	WIND (Dir. & Vel.)
SPILL ORIGIN Drum				CODE
CAUSE Leaking				CODE
WATER BODY AFFECTED Storm sewer				CODE
ASSOCIATED FIRE AND/OR HAZARDS				

INCIDENT REFERRED TO:

AGENCY	PHONE
CONTACT	AGENCY CODE

PRIMARY D.W.M. INVESTIGATOR	FOLLOWUP
NO FURTHER ACTION NFA	DATE

COMMENTS:

USCG # 82-10-01/4/0530
see Follow up report

E Dn T175W RIO FO

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT

INCIDENT FOLLOWUP REPORT

D.W.M. CASE NUMBER 82-10-01-0028	D.W.M. ID NO.
PHONE INVESTIGATION DATE 10-01-82	FIRST ON-SCENE INVESTIGATION DATE

AGENCY CONTACTED: More Than 3 Agencies ☐

AGENCY Newark Health Dept	PHONE (201) 733 7590
CONTACT Dr FRATANTUNO	AGENCY CODE 5900
AGENCY DIV. WATER Resources	PHONE 292-0421
CONTACT TONY ALTIERI	AGENCY CODE 2185
AGENCY US COAST GUARD COTP N.Y.	PHONE 212-668-7920
CONTACT P. O. Scott	AGENCY CODE

PERSON OR COMPANY RESPONSIBLE FOR SPILL: (Revised) ☐ More Than One Source ☐

COMPANY NAME Englehardt Industries		PHONE	
CONTACT Mr Brown	TITLE Environmental Coordinator		
STREET 429 Delancey St		DEP COMPANY NO.	
CITY Newark	COUNTY Essex	STATE NJ	ZIP CODE

ACTUAL SPILL OR DISCHARGE LOCATION: (Revised) ☐

NAME SAME AS Above		PHONE	
STREET		UTM VERT	UTM HORIZ
CITY	COUNTY	STATE	ZIP CODE

OWNER OF SPILL OR DISCHARGE LOCATION

NAME SAME as Above		PHONE	
STREET			
CITY		STATE	ZIP CODE

SUBSTANCE SPILLED AND/OR DISCHARGED: (Revised) ☐ More Than 2 Substances ☐

1. Rain water possibly contaminated with PCB's				SUBSTANCE NO.
AMOUNT SPILLED 5 oz in 8 gallon	UNITS GALS	A/P/E A		S/L/G/M L
2.				SUBSTANCE NO.
AMOUNT SPILLED	UNITS	A/P/E		S/L/G/M

SPILL ORIGIN (Revised) ☐	From drum storage	CODE
CAUSE (Revised) ☐	leaky containers	CODE
WATERBODY AFFECTED (Revised) ☐	NONE AS Reported by Contractor	CODE

TIERRA-B-016544

AGENCY	
Div. WATER Resources	292-0427
CONTACT: Tony Alteri	AGENCY CODE: 285
AGENCY: US COAST GUARD COTP N.Y.	PHONE/WX: 212-668-7920
CONTACT: P. O. Scott	AGENCY CODE:

PERSON OR COMPANY RESPONSIBLE FOR SPILL: (Revised) ☐ More Then One Source ☐

COMPANY NAME: Englehardt Industries			PHONE:
CONTACT: Mr Brown	TITLE: Environmental Coordinator		
STREET: 429 Delancey St			DEP COMPANY NO.
CITY: Newark	COUNTY: Essex	STATE: NJ	ZIP CODE:

ACTUAL SPILL OR DISCHARGE LOCATION: (Revised) ☐

NAME: SAME AS ABove		PHONE:	
STREET:		UTM VERT	UTM HORIZ
CITY:	COUNTY:	STATE	ZIP CODE

OWNER OF SPILL OR DISCHARGE LOCATION

NAME: SAME as Above	PHONE:	
STREET:		
CITY:	STATE	ZIP CODE

SUBSTANCE SPILLED AND/OR DISCHARGED: (Revised) ☐ More Than 2 Substances ☐

1. Rain water possibly contaminated with PCBs			SUBSTANCE NO.
AMOUNT SPILLED: 15 oz 1/8 gallon	UNITS: gALS	A/P/E: A	S/L/G/M: L
2.			SUBSTANCE NO.
AMOUNT SPILLED	UNITS	A/P/E	S/L/G/M

SPILL ORIGIN (Revised) ☐: From drum storage	CODE
CAUSE (Revised) ☐: leaky container	CODE
WATERBODY AFFECTED (Revised) ☐: NONE AS Reported by Englehardt ENVIRON. COORDINATOR	CODE

NO FURTHER ACTION	DATE

CONCLUSIONS, RECOMMENDATIONS, COMMENTS

AT 12:10 I called Englehardt Industries and spoke with Mr Waskis (Safety Dept) regarding the leaky Drum.

Reply - will check it out I'm unaware of this problem. Will call you back.

NEW [redacted]SEY DEPARTMENT OF ENVIRONMENTA[redacted]OTECTION
DIVISION OF WASTE MANAGEMENT

D.W.M. ASSIGNED CASE NUMBER 82-10-01-002		Page 3 of 3
DATE 10-01-82	TIME 11:50	D.W.M. ID NO. ____

AT 12:25 I contacted Mike FANTANTINO Newark Health OFFICER and informed him of the problem at Englehardt Industries.

AT 12:30 I called Tony ALTIERI Div of Water Resources and informed him of the problem at Englehardt Industries.

AT 12:45 Tom Brown Environmental Coord. for Engelhardt Industries returned my call and informed me that one drum out of a total of 10 is leaking. It possibly contains PCB contaminated material from a clean up. He is going to place the leaking drum in an over pack and put down speedi dry to absorb the spilled liquid. Approximately 10 gallons from the drums leaked out, supposedly rainwater contaminated with PCB. The drums are stored on asphalt and the leakage has not reached a storm sewer or sewage line.

AT 13:10 hrs I contacted Water Resources Tony ALTIERI and informed him of the updated information. He would relay it to proper personnel

AT 13:15 hrs P.O. Scott U.S. Coast Guard called. I informed him of the updated information as reported by Engelhardt Industries. He informed

[illegible] and informed him of the problem at Engelhardt Industries.

AT 12:30 I called Tony Altieri Div of Water Resources and informed him of the problem at Engelhardt Industries.

AT 12:45 Tom Brown Environmental Coord. for Engelhardt Industries returned my call and informed me that one drum out of a total of 10 is leaking. It possibly contains PCB contaminated material from a clean up. He is going to place the leaking drum in an over pak and put down speedi dry to absorb the spilled liquid. Approximately 10 gallons from the drum leaked out, supposedly rain water contaminated with PCB. The drums are stored on asphalt and the leakage has not reached a storm sewer or sewage line.

AT 13:10 hrs I contacted Water Resources Tony Altieri and informed him of the updated information. He would relay it to proper personnel.

AT 13:15 hrs P.O. Scott U.S. Coast Guard called. I informed him of the updated information as reported by Engelhardt Industries. He informed me that a Coast Guard response team is on their way out to the site and if any new information should be found we will be notified.

AT 13:20 hrs I contacted Newark Health Dept and gave them an update on the problem Mr. Frattaruso indicated since they are cleaning up no one would respond from his office

Presentation of
Additional ECRA Sampling Results and
Second Revised Cleanup Plan for the
Engelhard Corporation Facility at
429 Delancy Street
Newark, Essex County, New Jersey

ECRA Case No. 85689
Volume I of III

Prepared for

Engelhard Corporation
Edison, New Jersey 08818

Prepared by

ENVIRON Corporation
Princeton, New Jersey 08540

May 1991

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CONTENTS
(continued)

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(continued)

TABLES
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(continued)

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(Volume II)

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(continued)

APPENDICES
(Volume III)

I. INTRODUCTION

A. Purpose and Scope

On October 28, 1985, Engelhard Corporation (Engelhard) submitted the General Information Submission for its facility at 429 Delancy Street in Newark, Essex County, New Jersey to the New Jersey Department of Environmental Protection (NJDEP). This action provided for Engelhard's compliance with the Environmental Cleanup Responsibility Act (ECRA) after Engelhard made the formal announcement of its intention to cease operations at this facility. Prior to this time, a pre-ECRA environmental investigation was conducted by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) at the Engelhard site, and included the collection of soil and ground water samples. The results of this on-site investigation led to the conclusion that elevated concentrations of several priority pollutant metals (PPMs) were present in soil throughout the site, and that the presence of these metals was largely attributable to the municipal fill material on which the site had been built. Samples collected from monitoring wells evidenced a limited presence of several PPMs and volatile organic compounds (VOCs) in ground water. The results of this study were submitted to NJDEP on November 25, 1985 as part of Engelhard's ECRA Site Evaluation Submission (SES).

Following Engelhard's submission of the SES, representatives of the NJDEP inspected the site and prepared both an inspection report and written comments on the O'Brien & Gere sampling program. In response to these documents, ENVIRON Corporation (ENVIRON) prepared and submitted a Revised Sampling Plan in November 1986, which included provisions for extensive sampling of soil, sediments and ground water. After NJDEP's review of the Revised Sampling Plan, Engelhard and NJDEP held a series of meetings in which mutually acceptable responses to NJDEP's new comments were incorporated into the plan, which was resubmitted in March 1987.

The Revised Sampling Plan was implemented in the spring of 1987, and included the collection and analysis of soil and ground water samples from known or suspected areas of environmental concern (AECs) and from background locations. Additional monitoring wells were installed to characterize more fully the shallow aquifer system and to obtain data from several downgradient property boundaries. Also, sediment samples were collected from Pierson's Creek, the drainage ditch along the southern property boundary and the roof of the Building 18 complex. An initial report of results was submitted to NJDEP on April 24, 1987. Following further evaluation and interpretation of the analytical results, additional data were collected as part of an Interim Investigation to enhance Engelhard's understanding of existing site characterization information.

Based upon the results of the Revised Sampling Plan and Interim Investigation, ENVIRON prepared and submitted to NJDEP in March 1989 a proposed Cleanup Plan for the Delancy Street site. Site-specific data and a discussion of all site characterization work completed to date were included in that plan. In general, the Cleanup Plan proposed to remove soils in portions of the site to achieve site-specific cleanup criteria derived from a health-based risk assessment. ENVIRON also proposed feasibility testing to examine a potential cleanup technology, and proposed additional delineation sampling of soils, ditch sediments and ground water, which ENVIRON believed was necessary for further development of effective site cleanup strategies and treatment system designs.

In its September 22, 1989 letter responding to the March 1989 Cleanup Plan, NJDEP concluded that the plan could not be approved at that time based upon an assessment of the approach used to develop background contamination values and because a specific cleanup technology had not been selected. In that letter, however, NJDEP conditionally approved the proposed feasibility testing and delineation sampling. In response to a number of comments and conditions contained in the agency's letter, some additional sampling was proposed, as outlined in Engelhard's October 10, 1989 letter to NJDEP. The field sampling and feasibility testing were implemented during November and December 1989. At the agency's request, Engelhard provided the data obtained during this phase of investigation to NJDEP prior to the development of a Revised Cleanup Plan.

Engelhard and NJDEP held several discussions regarding the results of the additional ECRA sampling and the conceptual approach to establishing appropriate cleanup criteria for remediating the Delancy Street site. Subsequently, ENVIRON prepared and submitted to NJDEP in November 1990 a Revised Cleanup Plan for the site. This document addressed comments NJDEP provided in May 8, 1990 and September 19, 1990 letters to Engelhard regarding the March 1989 Cleanup Plan, the October 1989 Underground Storage Tank Cleanup Plan and the January 1990 Cleanup Plan addendum. This document also provided a summary of the results of the Revised Sampling Plan and Interim Investigation and presented and evaluated the results of the additional ECRA sampling and feasibility testing. In general the Revised Cleanup Plan consisted of (1) a conceptual design for cleanup of soil and sediment contamination at the site to proposed cleanup objectives through excavation and off-site disposal, and (2) a discussion of several additional tasks to be completed prior to implementing cleanup. The additional tasks included a limited amount of pre-remediation sampling to delineate areas to be remediated and additional soil sorting testing to assess the potential for reduction in the volume of affected soil requiring off-site disposal.

NJDEP responded to the November 1990 Revised Cleanup Plan in a March 1, 1991 letter to Engelhard, and indicated that the plan could not be approved because the statistical approach used to determine the scope of cleanup necessary to return the site to background conditions underestimated the volume of soil requiring remediation. NJDEP also rejected the proposed pre-remediation sampling approach designed to determine the extent of excavation required. As a result, NJDEP requested that the November 1990 plan be amended to incorporate the comments and conditions set forth in the agency's March 1, 1991 letter and that the plan be resubmitted.

In response to NJDEP's letter, Engelhard held several discussions and attended a March 28, 1991 meeting with NJDEP to discuss the cleanup of the site. At that meeting, Engelhard and NJDEP agreed on an appropriate method to guide the scope of cleanup and discussed the nature and extent of pre-remediation sampling necessary to fully define the areas requiring cleanup. After this meeting, a letter outlining the points of agreement was prepared by Engelhard and sent to NJDEP on April 9, 1991. Based on the points of

agreement as specified in that letter, ENVIRON has prepared this Second Revised Cleanup Plan for the Delancy Street site. Engelhard and ENVIRON believe that this plan is fully responsive to NJDEP's concerns regarding this site, and that formal approval by the agency will be received. Although Engelhard is optimistic that the cleanup to background conditions set forth in this plan will result in a cleanup suitable to both Engelhard and NJDEP, Engelhard reserves its right to use a health-based approach for establishing cleanup goals if we are unable to achieve a satisfactory outcome based upon cleanup to background. All figures, tables and plates mentioned in the text are provided in Volume II.

B. Site Description and History

The Engelhard facility is located at 429 Delancy Street in Newark, Essex County, New Jersey (Figure I-1). The site is surrounded by heavy industrial operations and transportation routes. The heavy industrial area located north of the property extends for approximately one mile and includes industries such as a large trucking company, a truck warehousing operation; a manufacturer of industrial bactericides, fungicides and paint additives, who also processes dental amalgams; automobile junk yards; and an abandoned factory, which appears to have been used for manufacturing. Railroad tracks and the New Jersey Turnpike are located along the eastern property boundary. The area further east of the facility, along Doremus Avenue, includes a group of chemical refineries and the Passaic Valley Sewerage Commissioners (PVSC). Lehigh Valley Railroad Company tracks, the New Jersey Turnpike, and Newark International Airport are located south of the facility. An airplane approach pattern for Newark International Airport passes directly over the site, and the airport's main runway is less than 5,000 feet from the southern property boundary. U.S. Route 1 and 9 is located along the western property boundary. Several warehouses and an automobile salvage yard are located adjacent to U.S. Route 1 and 9. The nearest residential neighborhood begins approximately 0.25 mile west of the facility's northwestern property boundary.

The site is located approximately 1.5 miles west of Newark Bay. Pierson's Creek, a small, man-made, tidally-influenced surface water body, originates in the industrialized area north of the facility and receives runoff from a variety of sources, including the storm sewer

underneath Delancy Street. The creek flows underneath the Lehigh Valley Railroad yard (via a buried culvert) prior to discharging to Newark Bay. Surface water runoff from the site drains into Pierson's Creek and an adjacent drainage ditch through both direct runoff and a network of storm sewers.

Before 1952, when Engelhard began to purchase and develop the property, the site was part of a larger area that had been used as a municipal dump by the City of Newark. As a consequence, prior to any industrial activity, this site, as any other similar dump site, would have contained significant levels of many heavy metals, petroleum hydrocarbons, and other inorganic/organic constituents. Review of aerial photographs from 1940 and 1951 indicates that the entire site was covered with waste for at least 11 years prior to Engelhard's occupancy. These photographs also show that the area surrounding the site has been subjected to similar fill activities. Discussions with longtime Engelhard employees and review of geologic logs from the drilling of test borings and the installation of monitoring wells indicate that the entire site is underlain by approximately 10-15 feet of fill material containing glass, cinders, construction debris, slag, and other debris commonly found in municipal waste deposited during this time period.

In the early 1950s, Cummins Diesel Company (Cummins) purchased a small parcel of land on the northwestern section of the site and built a truck repair garage. Cummins reportedly operated the garage until 1956, when Engelhard purchased both the Cummins property and the building. The Cummins garage was later used by Engelhard for precious metal refining operations and is referred to by Engelhard as Building 7/7A.

Engelhard began operations on the central portion of the site in 1953 and expanded until the entire property, with the exception of the area east of Pierson's Creek, was utilized for manufacturing operations by the late 1960s. Since the site was developed, Engelhard has refined precious metals, conducted research, and manufactured catalysts and other specialty chemicals. A detailed description of Engelhard's activities is included in the Revised Sampling Plan for the site, which was resubmitted to NJDEP in March 1987.

C. Summary of Previous Sampling Activities

1. General

As discussed above, O'Brien & Gere implemented a limited soil and ground water sampling program in 1985 as part of a pre-ECRA investigation. The results of this study provided data regarding general site conditions and potential industrial impacts. Based on the results of this preliminary sampling program, subsequent review of historical aerial photographs, discussions with Engelhard personnel and several site inspections, 76 AECs were identified. The rationale for selection of each AEC is provided in Table I-1, and the locations are illustrated on Plate 1. Sampling conducted during the Revised Sampling Plan and Interim Investigation was targeted to these AECs and to a number of background locations; Plate 1 illustrates the sampling locations from these investigations.

The results of both sampling programs indicated that several classes of constituents were present in soil, sediment and ground water samples collected at the site. Detailed discussions of all sampling activities, analytical results and proposed strategies for remediation or recommendations for additional sampling were provided to NJDEP in the March 1989 Cleanup Plan. Provided below is a brief summary of the findings of the Revised Sampling Plan and Interim Investigation and NJDEP's response, where appropriate, to the recommended actions as outlined in the agency's September 22, 1989, May 8, 1990, September 19, 1990, or March 1, 1991 letters to Engelhard. The results of the additional ECRA sampling proposed in the March 1989 Cleanup Plan are provided and discussed in Section IV.

2. Soils

The analytical results from the Revised Sampling Plan indicated that the informal ECRA action levels[1] were exceeded for several constituents, including total petroleum

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[1] The informal ECRA action levels for soil and ground water were used in the March 1989 Cleanup Plan to simplify the presentation of the analytical results. Neither ENVIRON nor Engelhard believes that these guidelines necessarily and without exception provide the appropriate basis for site cleanup.

hydrocarbons (TPHCs) and PPMs, across a significant portion of the site. The metal species most often detected included cadmium, chromium, copper, lead, mercury, silver and zinc. Other metals such as antimony, arsenic, beryllium, nickel, selenium and thallium were present at a limited number of locations. Other constituents -- such as VOCs, base/neutral compounds (BNs), polychlorinated biphenyls (PCBs) and pesticides -- were detected only in a few localized areas. It is noteworthy that a trend of decreasing constituent levels with depth, which might be expected if surface deposition were the primary mechanism for dispersal, has only been observed randomly across the site. The results of soil sampling conducted within the AECs are provided in Appendix A.

The apparently random distribution of elevated constituent concentrations was expected, because the entire site is underlain by a former municipal landfill and many of the constituents observed are often deposited with municipal waste. To measure the degree of elevated constituent levels in the fill material, the Revised Sampling Plan provided for the evaluation of background concentrations for selected constituents expected to have been present on-site prior to Engelhard's occupancy. A series of samples were collected from areas that were not affected by Engelhard's industrial activities, such as underneath the employees' parking lot and below the foundation of Building 7/7A, the oldest structure at the site, which was erected before Engelhard's operations began. The concern about background conditions was previously recognized by NJDEP, and both the number of samples and the parameters to be analyzed, as well as the actual sample locations, were discussed with and agreed to by NJDEP prior to commencement of background sampling.

Background samples were originally analyzed only for PPMs and TPHCs because initial analytical results from the 1985 sampling program suggested that these constituents might be present in the fill. After implementation of the Revised Sampling Plan, ENVIRON collected additional samples from the same background locations and analyzed them for BNs and aluminum. Background samples were not analyzed for

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Site-specific cleanup criteria which ENVIRON and Engelhard believe are more appropriate for remediation of this site are discussed in Section V.

VOCs, PCBs or pesticides because there was no evidence to suggest that these constituents would likely be present in the fill material over broad areas of the site. Rather, sampling for these constituents was targeted for a limited number of areas where their occurrence could be related to historical industrial activities. Summary tables of the background data are provided in Appendix B.

Results of the background sampling indicated that PPMs (with the exception of beryllium), TPHCs, BNs and aluminum are present at concentrations above the informal ECRA action levels in fill material that has not been affected by Engelhard's industrial activities. For these constituents, the reported levels can be attributed either to the waste placed in the landfill prior to Engelhard's occupancy of the site or to constituents naturally present in the soil of the landfill. Comparison of the sampling results for the AECs with the informal ECRA action levels for these constituents is therefore not a valid method for defining soil conditions potentially related to Engelhard's industrial activities. Engelhard's approach for determining the extent of remediation required based on an analysis of the background data is presented in Section V.

3. Pierson's Creek

Eleven surface sediment samples were collected from Pierson's Creek as part of the Revised Sampling Plan. Seven of these samples were collected from areas immediately adjacent to storm water or industrial outfalls that discharge to Pierson's Creek from the Engelhard site. The remaining four sediment samples were collected from upstream areas, north of Engelhard's property boundary, to establish background conditions. The analytical results for these 11 samples are summarized in Appendix C. Additionally, during the Interim Investigation, a tidal influence study was conducted in the creek to determine the effect of tidal flow conditions on sediment transport.

Analysis of the sampling results collected from Pierson's Creek indicates that PPMs and TPHCs are present in sediments along the sampled portions of the creek as a result of multiple sources of discharge. Tidal flow reversals could conceivably transport constituents from their point of discharge either upstream or downstream, making it

difficult to pinpoint the source of the original discharge. Considering the relatively slow and infrequent tidal flow reversals, and the predominantly faster downstream flow from normal discharges as well as rainfall events, it can be expected that most sediment transport occurs in the downstream direction. However, some patterns in the distribution of concentrations could be discerned, making it possible to attribute the presence of certain constituents to specific activities.

For example, chromium, lead, mercury and TPHCs are present in much higher concentrations in samples collected upstream of the site. The presence of these constituents in upstream sediments is consistent with information gathered about operations in the industrial area north of the Engelhard site. According to NJDEP records, at least one plant has a known history of discharges of PPMs into Pierson's Creek, and is known to have handled chemicals containing mercury, silver, lead and other constituents for 30 years. The TPHC concentrations correlate well with many observations of oil moving downstream in the creek. The presence of this oil can be attributable to upstream industrial sources, an auto salvage yard, and a network of city storm sewers serving not only the industrial section, but providing drainage for many streets and heavily travelled roadways in that area.

Other metals, including arsenic, copper, silver and zinc are at similar levels both in downstream and in upstream areas. The only PPMs in the downstream sediments that were higher than in upstream sediments were cadmium, copper and nickel. Though copper and nickel concentrations in some portions of the creek were at or slightly above the upstream levels, both constituents were present at levels less than those observed in on-site soils. No specific source of cadmium has been identified, although the higher levels in the creek occurred at the confluence of the City of Newark storm sewer underneath Delancy St., suggesting a source other than the Engelhard site. Cadmium is primarily used as an anticorrosive and in the electroplating industries, as well as in pigments, especially those used in plastics. Cadmium is also used in batteries and electric components. The city storm sewer collects drainage from areas that have historically contained auto salvage yards, paint and pigment manufacturing facilities, plastics formulating shops, and plating operations. The few AECs that contained

cadmium on the Engelhard site could not have influenced levels found in the area of the creek where the storm sewer discharged.

Remediation of contaminated sediments in Pierson's Creek was not proposed in the March 1989 Cleanup Plan because the pattern of constituent concentrations reflected multiple sources of discharge, and Engelhard maintained that no one party can effectively remediate the entire system. Remediating the segment of Pierson's Creek that passes through the site, without at the same time remediating other segments of the creek and ensuring the cessation of discharges to the creek that will affect it again, will not accomplish an effective cleanup. Given the complex nature of Pierson's Creek, Engelhard suggested in the March 1989 Cleanup Plan that any remedial activities might be more properly handled by the Division of Water Resources at NJDEP under the context of a broader investigation.

In its September 22, 1989 letter to Engelhard, NJDEP acknowledged the complexities associated with developing effective remedial strategies for Pierson's Creek, but requested that a remediation plan be prepared for that portion of the Creek passing through the Engelhard site. To respond to the agency's concerns, Engelhard proposed in the November 1990 Revised Cleanup Plan to remediate sediments 50 feet upstream and 50 feet downstream of each industrial discharge point to a depth of 1 foot. In its March 1, 1991 letter, NJDEP rejected this remediation proposal and requested that additional sediment sampling for precious metals (PMs) be conducted along Pierson's Creek. A proposal for this sampling is included as part of the Revised Cleanup Plan in Section V.

4. Drainage Ditch

As part of the Revised Sampling Plan, surface sediment samples were collected from six locations adjacent to storm water outfalls that discharge to the drainage ditch along Engelhard's southern property boundary. Analytical results for this sampling are presented in Appendix D.

Constituent concentrations in the ditch were generally less than, or equivalent to, concentrations observed in sections of Pierson's Creek. Concentrations of cadmium,

lead, mercury and zinc were in all cases lower than those observed in Pierson's Creek. Concentrations of antimony, arsenic, beryllium, chromium, copper, selenium, silver, thallium and TPHCs were approximately equal to those observed in Pierson's Creek. Nickel was the only constituent in the ditch present at higher concentrations than those observed in Pierson's Creek. Several potential sources that may explain the observed constituent pattern have been identified and are described briefly below:

- TPHCs and some PPMs may have been discharged to the ditch through runoff from the railroad yard located south of the ditch. Assorted refuse has been observed in the railroad yard, along with visible signs of the presence of TPHCs and, possibly, other constituents in the soil under the tracks.

- Runoff from U.S. Route 1 and 9 and the area west of the highway may have discharged to the ditch; highways are frequently sources of TPHCs and PPMs such as lead (from leaded gasoline).

- Nickel sulfate and copper sulfate may have been discharged to the ditch through chemical processing and storage activities associated with six aboveground storage tanks formerly located south of the Building 18 complex (AEC 69).

- A former drainage swale (AEC 16) located near Building 4/4A may have carried runoff to the ditch; TPHC and PPM concentrations near the AEC 16 discharge point are higher than in some other sections of the ditch.

These potential sources most likely account for some of the observed concentrations of PPMs and TPHCs. For most of the drainage ditch, however, a single source could not be identified as the primary contributor to the constituent pattern observed, nor could Engelhard's contribution be quantified based upon available data.

The results of the limited number of surface samples do suggest, however, that at least a portion of these levels may be attributable to former Engelhard activities. As a result, further vertical and horizontal delineation of constituent patterns -- designed to provide some of the data necessary to quantify Engelhard's potential contribution -- was proposed in the March 1989 Cleanup Plan. The results of this sampling are presented and discussed in Section IV.

5. Ground Water

As part of the 1985 pre-ECRA investigation, O'Brien & Gere installed 14 2-inch diameter monitoring wells at the site. Sampling results from these wells indicated the presence of several PPMs and low levels of VOCs in ground water. As part of the Revised Sampling Plan, 14 additional wells (4 inches in diameter) were installed and sampled in March and April 1987. The 2-inch wells were not sampled as part of the Revised Sampling Plan since, at that time, NJDEP was not accepting data from 2-inch monitoring wells for ECRA compliance. These wells were, however, used as piezometers. As part of the Interim Investigation, ENVIRON sampled the 14 4-inch wells in September 1987 and three times in 1988 (January, May and October) to confirm the previous results and to determine whether contaminant levels were changing as a result of the cessation of manufacturing operations at the site. Summarized results of the 1987 and 1988 ground water sampling episodes are provided in Appendix E.

In ground water samples collected during the Revised Sampling Plan and Interim Investigation, PPMs were present in the shallow ground water beneath the site at concentrations in excess of the informal ECRA action levels. In general, levels of PPMs in ground water across the site increased in September 1987 after the initial sampling rounds in March and April 1987. The levels of metals typically remained high before decreasing in May 1988, often to concentrations below informal ECRA action levels. This trend of decreasing metal concentrations was also observed during the October 1988 sampling round.

The most significant concentrations of PPMs found above the informal ECRA action levels have been detected in MW13. The metals reported at elevated levels included cadmium, chromium, lead and zinc. The trend of increased PPM levels observed in the September 1987 and January 1988 sampling rounds in other site wells was generally not observed in MW13. Rather, PPM concentrations decreased consistently with time. This can be attributed to the cessation of acid handling operations in adjacent portions of the facility. Chromium and lead were also consistently identified at concentrations above the informal ECRA action levels in MW14 during this period of monitoring, possibly due to the presence of free-phase petroleum product observed in this well.

TPHCs, BNs, and VOCs were detected only in a few localized areas of the site. Concentrations of TPHCs in MW14 were consistently detected above the informal ECRA action level. In addition, approximately 20 inches of free-phase product were measured in MW14 in September 1987. This petroleum product was removed during the September 1987 sampling round, and limited reaccumulation (less than 1 inch) has occurred since then. BNs at concentrations above the method detection limits have also been detected in MW14 and MW16. The occurrence of these compounds in MW14 is not unexpected, due to the presence of free-phase product. Levels of TPHCs just slightly above the informal ECRA action level were also detected sporadically in MWs 16, 17, and 21.

Three wells evidenced VOC concentrations above method detection limits. Benzene, trace levels of trans-1,2-dichloroethene and ethylbenzene were detected at MW14. The occurrence of VOCs in MW14 also is not unexpected, given the presence of free-phase product. Benzene and chlorobenzene were detected in MW16 only during one sampling round in 1987. Two 1988 sampling rounds identified chlorinated hydrocarbons in this well, although levels decreased between the January and May sampling rounds. Finally, chlorobenzene was detected in MW18 during the March 1987 and January 1988 sampling rounds.

As previously described, the analytical results of the Revised Sampling Plan and Interim Investigation indicated the presence of elevated constituent concentrations in

shallow ground water in certain areas beneath the site; however, neither the full areal extent of detected constituents nor the ground water quality of the deeper aquifer was investigated during these sampling programs. This information was considered essential for understanding the extent of affected ground water, determining whether sources are related to industrial activities or preexisting landfilled materials, and developing appropriate goals for potential cleanup actions. A proposal to install additional monitoring wells and to conduct aquifer testing was set forth in the March 1989 Cleanup Plan. The results of this work are provided in Section IV of this report.

D. Summary of Previous Remedial Actions

During the decommissioning of this facility, Engelhard performed a number of remedial actions that addressed contamination present in certain areas. Some of these actions were implemented as part of the Updated Decontamination Plan provided as Appendix I of the March 1989 Cleanup Plan. This plan has been revised to incorporate all decommissioning activities completed to date. The updated plan is included as Appendix F of this report. Other remedial actions were undertaken to comply with ECRA requirements. This section briefly discusses the cleanup activities performed to date.

1. Underground Storage Tank Removal

As part of decommissioning activities, five underground storage tanks were removed from the site in 1987, including the two 50,000-gallon fuel oil tanks in AEC 11 and the three gasoline tanks in AECs 26 and 27. Following removal of each of the five tanks, post-excavation samples were collected and analyzed for target parameters recommended by NJDEP. Results of these analyses, submitted to NJDEP in November 1987 as part of the Cleanup Plan for the Underground Tank Excavations, indicated that all TPHC- and VOC-contaminated soils had been removed from AECs 26 and 27. Accordingly, ENVIRON proposed to backfill the excavations in these areas. Post-excavation sampling performed in AEC 11 identified TPHC contamination exceeding the proposed site-specific background level of 3,200 parts per million (ppm). As a result, ENVIRON proposed to remove additional soils from AEC 11, along with any

other soils that appeared stained. Post-excavation samples would be collected every 10 linear feet from the excavation walls and, if ground water were not encountered, one for each 100 square feet of the excavation floor. Following the proposed soil removal, this excavation would be backfilled. Finally, ENVIRON proposed to excavate the underground tank in AEC 35 following removal of the overlying scrubber unit. Post-excavation sampling also would be conducted at this location.

The Cleanup Plan for the Underground Tank Excavations was resubmitted to NJDEP on October 23, 1989 at the request of the NJDEP Case Manager. No revisions were made prior to the resubmittal. In its May 8, 1990 letter providing comments on the March 1989 Cleanup Plan and the October 1989 Cleanup Plan for the Underground Tank Excavations, NJDEP indicated that the proposed activities related to AECs 11, 26 and 27 were acceptable. No other conditions were imposed.

2. Roof of Building 18 Complex

ENVIRON collected four sediment samples from AEC 76, the stained portion of the roof of the Building 18 complex, as part of the Revised Sampling Plan. Results of this sampling, presented in Table III-6 of the March 1989 Cleanup Plan, showed elevated levels of PPMs. Additional sampling was conducted in both stained and unstained areas, and elevated PPM concentrations again were detected. These data also suggested that PPM levels in unstained areas were generally lower than in stained areas. Subsequently, Engelhard collected additional samples for precious metal (PM) analysis. Data from these analyses indicated that economically recoverable concentrations of certain PMs were present in the roof sediments. Therefore, Engelhard removed all of the sediments from the roof of the Building 18 complex and sent these materials off-site for PM recovery. In addition, Engelhard repaired and retarred sections of the roof. The methods used to remove the gravel and sediments from the roof of Building 18 and to clean and repair the roof surface before retarring are detailed in Appendix F of this report. Because these activities fully addressed PPM contamination in the investigated areas of the roof, Engelhard and ENVIRON do not

believe that further discussion of the roof is warranted. This conclusion was previously set forth in the March 1989 Cleanup Plan.

3. AEC 31

During execution of the Revised Sampling Plan, ENVIRON installed a soil boring in AEC 31, an area of eroded concrete in an alley between Buildings 6 and 14. Sampling results identified elevated PPM levels. Subsequently, Engelhard collected soil samples from this location for PM analyses. These results indicated that economically recoverable concentrations of certain PMs were present in this AEC. Accordingly, Engelhard excavated soils from this area for off-site PM recovery. Soils were excavated to the southern wall of Building 6 and to the water table.

ENVIRON collected post-excavation samples from this area to document residual PPM concentrations. Results of sampling in this alley are included in Appendix F. ENVIRON compared these results to the health-based, site-specific cleanup guidelines that had been developed for the site. Copper, lead and silver were identified at concentrations exceeding the corresponding site-specific cleanup guidelines at a number of sampling points. Accordingly, Engelhard excavated soil from three sidewall sampling locations in these areas. Confirmatory post-excavation sampling demonstrated that the additional excavation resulted in residual PPM levels below site-specific guidelines. Soils around the locations of a number of floor samples with elevated PPM levels were left in place because these samples were obtained from soils directly above the water table. Subsequent to this sampling, this excavation was backfilled and the area repaved.

4. Area East of Pierson's Creek

Three drums were discovered east of Pierson's Creek. The area around these drums was designated AEC 22, and was investigated between March and June 1988. This investigation included the collection of soil samples around the drums. These samples evidenced concentrations of several PPMs above the informal ECRA action levels. The drums were removed, and the contents analyzed for waste classification

purposes. That analysis indicated that lead exceeded the EP Toxicity threshold value by a factor of 100. Accordingly, the drums were disposed of as hazardous waste.

Subsequently, the area around one of the drums was excavated by digging test pits to determine whether other drums might be present. In a pile of construction debris, a hot water heater tank and a decayed drum were unearthed. After these items were removed, two post-excavation samples were collected and analyzed for priority pollutants plus a forward library search (PP+40). Concentrations of 1.18 ppm of DDT and 0.4 ppm of DDE were detected in one of these samples. In its investigation of potential sources for these pesticides, ENVIRON spoke with the Essex County Mosquito Control Commission regarding historical mosquito control practices in this area. The Commission informed ENVIRON that from 1942 to 1962, this area was sprayed with a 5% DDT solution diluted with 100 parts of fuel oil. Since Engelhard did not use, store or manufacture DDT at this site, it is likely that regional historical mosquito control operations resulted in the DDT level identified in AEC 22. DDE, a breakdown product of DDT, is also present for this reason. Engelhard concluded in its October 10, 1989 response letter to NJDEP that these levels do not warrant remediation under ECRA because they are not considered excessive and are not attributable to industrial operations.

II. METHODOLOGY FOR ADDITIONAL ECRA SAMPLING

A. General

ENVIRON completed the additional ECRA sampling investigation at the Delancy Street facility in general conformance with the scope of work set forth in ENVIRON's March 1989 Cleanup Plan and approved by NJDEP in its September 22, 1989 letter. In response to several conditions contained in NJDEP's letter, some additional sampling was conducted as outlined in Engelhard's October 10, 1989 response letter to NJDEP. All procedures and sampling techniques were consistent with the protocols outlined in NJDEP's Sampling Plan Guide and ENVIRON's Manual of Field Procedures. Some minor modifications to the sampling program were necessary due to certain conditions and restrictions encountered during field work. Where applicable, these modifications are discussed in the following sections.

B. Delineation Borings Around MW14

To delineate the extent of free-phase petroleum product identified in MW14, ENVIRON completed 11 hollow-stem auger borings adjacent to and downgradient of this monitoring well. Each of these borings was drilled to the water table. At some locations, a split-spoon sampler was used to collect a soil sample across the soil/water interface. This sample was then inspected for evidence of free-phase petroleum product. At other locations, the loose nature of the fill material prevented recovery of a soil sample with the split-spoon sampler. In these instances, the auger flight was examined for petroleum product. Figure II-1 indicates the locations of these borings. Each boring was sealed with a cement-bentonite grout mixture.

C. Drainage Ditch Sampling

As proposed in the March 1989 Cleanup Plan, ENVIRON completed eight hand auger borings in the drainage ditch along the southern property boundary. The locations of these borings are provided on Figure II-2. Six of these were completed adjacent to former boring locations sampled in 1987 as part of the Revised Sampling Plan; these additional samples were collected to characterize the vertical pattern of TPHC and PPM contamination previously identified at those locations. The other two borings were completed between previous sampling locations to characterize more fully the distribution of these contaminants in the drainage ditch. Six of the eight borings were sampled at three depths, generally from 0.0 to 0.5 foot, 1.5 to 2.0 feet and 2.5 to 3.0 feet. At the other two locations, the loose nature of the fill prevented collection of either the intermediate or deep sample. Each sample was analyzed for TPHCs, PPMs, gold, platinum and palladium. Appendix G includes soil boring logs for these sampling locations.

D. Monitoring Wells and Ground Water Sampling

1. Monitoring Well Installation and Construction

In the March 1989 Cleanup Plan, ENVIRON proposed to install three shallow and six deep wells to augment the existing on-site ground water monitoring network. As part of that proposal, ENVIRON also recommended using the existing 2-inch wells, installed by O'Brien & Gere in 1985, to reduce the number of new 4-inch wells potentially required for monitoring. In its September 22, 1989 letter, NJDEP approved the use of these 2-inch wells and requested that an additional deep well be installed adjacent to existing shallow well MW14. As a result, ENVIRON installed three shallow and seven deep wells at the site as part of the additional ECRA investigation. The locations of all new and existing wells are shown on Figure II-3. Geologic logs and construction specifications for these 10 new wells are provided in Appendix H.

Each of the shallow monitoring wells was completed according to NJDEP specifications for wells monitoring unconsolidated formations. A 10-foot screen, generally set 2 feet above and 8 feet below the water table, was placed in each of these

wells. During drilling, split-spoon samples were collected to determine the depth of the potentially confining peat and clay layers that underlie the fill unit throughout most of the site.

The deep monitoring wells were also constructed per NJDEP specifications for unconsolidated formations, with the addition of a telescoped steel outer casing. This 8-inch outer casing was set approximately 2 feet into the peat and clay layer by filling the annular space with a cement-bentonite grout mixture. This grout was emplaced with a tremie pipe and was allowed to cure for a minimum of 24 hours. Subsequently, the well was completed by drilling through the peat and clay layer with a tricone bit; the water present in the casing combined with the formation material to create a drilling fluid similar to the consistency of drilling mud. During the drilling, split-spoon samples were collected to determine the thickness of the peat and clay layers into which the steel outer casing was set. The deep wells were completed with 10 feet of screen set in a predominantly silt layer encountered beneath the peat and clay.

2. Monitoring Well Development

Each newly installed well was developed by air surging for at least one hour or until the water appeared free of fine sediment. In addition, all existing wells were redeveloped to remove accumulated sediment and improve yield. The existing wells were developed for one hour or until the water clarity ceased to improve, whichever occurred first. In the majority of these wells, water clarity improved to the point where no sand and little silt were present in the development water.

3. Ground Water Sampling

After allowing the new wells to stabilize for at least two weeks, ENVIRON sampled all on-site monitoring wells during December 1989. Prior to sampling, depth to water and total well depth were measured at each well to calculate the standing water volume. A minimum of three well volumes were subsequently purged from each well, unless a well purged dry before three well volumes were removed. Each well was

allowed to recover so that a sufficient volume of water was present for sample collection.

All wells were sampled for TPHCs, PPMs and aluminum, total dissolved solids (TDS), specific conductance and pH. All ground water samples for metals analyses were filtered on-site shortly after sample collection. In addition to these parameters, newly installed shallow wells 25 and 26S and existing wells 4A, 5A, 7, 14, 16, 17, 18, 20 and 21 were analyzed for BN+15 and VOC+15 (BNs and VOCs with library searches). The BN and VOC analyses were conducted to confirm previous detections of organic constituents and to examine the potential horizontal migration of these compounds. ENVIRON also analyzed MW14D for BN+15 and VOC+15 to determine whether the petroleum constituents present in MW14 had migrated vertically.

To verify the presence of TPHCs, BNs and/or VOCs in MWs 4A, 5A, 7, 20 and 25, these wells were resampled in April 1990 for TPHCs, BN+15 and VOC+15. Because the constituent concentrations present in these samples were considerably less than those observed in the December 1989 samples, an additional round of sampling was performed in August 1990 at these five wells. All samples were again analyzed for TPHCs, BN+15 and VOC+15. The sampling and analytical methodologies used during both of these later sampling rounds were similar to those used during the earlier December 1989 sampling.

4. Aquifer Testing

Following ground water sampling, ENVIRON conducted falling head and recovery slug tests on five of the shallow monitoring wells: MWs 5A, 13, 21, 24 and 25. These wells were selected to provide areal coverage of most of the developed portion of the property.

The falling head slug tests were performed by introducing a 5-foot slug of PVC pipe that was filled with water. This was lowered into the well until the top of the slug was below the water level. At that point, a Hermit Environmental Data Logger (Hermit) was activated to begin recording the change in water elevation. Once the water level had stabilized, this test was terminated. The slug was then withdrawn to

begin the recovery slug test. The Hermit was reactivated once the bottom of the slug was just at the water surface. As described above, the test was stopped once the water level had stabilized near the original static water level.

The data collected by the Hermit was then downloaded into a computer to be analyzed by AQTESOLV®. This program was used to determine hydraulic conductivity at each tested monitoring well.

5. Waste Containment and Disposal

Soil cuttings generated during the drilling of all but one of the new monitoring wells were drummed and staged near the wells. Cuttings from MW14D were noticeably contaminated with free-phase petroleum product and thus were drummed. MWs 2D, 26S, 26D, 27S and 27D were installed through pavement near property boundaries. Although obvious contamination was not observed in the field, cuttings from these locations were contained to prevent storm water from transporting these soils to off-site areas. Because MWs 7D, 24D and 25 were also installed through pavement, cuttings from these wells were drummed and staged near the wells. Only the cuttings from MW23D, which was completed in an unpaved area, were left on the surface; these cuttings did not appear to be contaminated.

Drilling fluids were contained only if obvious contamination was noted. Only the drilling fluid from MW14D met this criterion and was consequently drummed. All other drilling fluids were left on pavement to dry.

Samples were collected by Engelhard personnel from the drummed materials for waste classification analyses. All materials have subsequently been disposed of properly.

E. Quality Assurance/Quality Control

1. Decontamination Procedures

During the drilling program, all downhole equipment (i.e., auger flights, split spoons and drilling rods) was decontaminated using high-pressure steam. This process was conducted on a bermed pad constructed of 6-mil plastic sheeting and 4-inch by 4-inch beams. After the drilling was completed, the plastic sheeting and accumulated sediments and water were placed in a drum for disposal.

The hand auger used to complete the drainage ditch borings was decontaminated using the NJDEP-recommended seven-step process: alconox wash, tap water rinse, acetone rinse, air dry, deionized water rinse, nitric acid rinse and final deionized water rinse. All ground water sampling equipment was laboratory-prepared per NJDEP requirements.

2. Wash Blanks, Trip Blanks and Duplicate Samples

To monitor the effectiveness of laboratory decontamination procedures, an equipment wash blank was collected on each day of ground water sampling and analyzed for all parameters for which samples were collected that day. A total of four wash blanks were collected and analyzed for TPHCs, PPMs and TDS. In addition, two of these samples were analyzed for VOC+15 and BN+15.

One wash blank was collected during the drainage ditch sampling to verify the effectiveness of in-field decontamination procedures. This sample was analyzed for TPHCs and PPMs.

On days when ground water samples were collected for VOC+15 analysis, a trip blank accompanied the field team during the sampling activity. A total of two such trip blanks were collected and analyzed for VOC+15.

To monitor the consistency of laboratory analytical procedures, two duplicate ground water samples were collected. Both samples were analyzed for TPHCs, PPMs and aluminum, TDS, specific conductance and pH. In addition, one of these duplicate samples was analyzed for VOC+15 and BN+15.

F. Laboratory Methodologies

NET Mid-Atlantic, Inc. (NET) of Thorofare, New Jersey performed all ground water analyses in accordance with the March 1989 Cleanup Plan. The analyses for VOCs and BNs included 15-compound library searches to identify non-target organic compounds possibly present in the samples. NET also performed the TPHC and PPM analyses of the drainage ditch samples. Accredited Laboratories, Inc. of Carteret, New Jersey performed the precious metals analyses of drainage ditch samples. Table II-1 lists the USEPA methodologies used in the analysis for each parameter.

G. Data Reporting

Tier II data packages, including the original data sheets and full laboratory documentation, were submitted previously to NJDEP with the November 1990 Revised Cleanup Plan. Several adjustments necessary to interpret the data effectively are described below.

- The collection of duplicate samples generates two sets of results for a given sampling location and depth. Assuming both samples were collected and analyzed correctly, both sets of results are considered valid. For this report, results of duplicate samples are presented individually rather than averaged.

- The unabridged data tables provided with the November 1990 Revised Cleanup Plan also present tentatively identified compounds (TICs), which are obtained from the forward library search associated with the BN and VOC priority pollutant scans. Reported with these chemicals are the estimated concentrations and retention times used by the laboratory for identification of compounds. The estimated concentrations are based on assumed response factors, and may vary from actual concentrations by as much as 500%. Because of the substantial uncertainty in the quantification of TIC concentrations, it is unreasonable to include these chemicals in any BN and VOC total. Thus, the TICs are not included in the summary tables.

Their presence, however, is considered in attempting to understand qualitatively the nature and source(s) of contamination.

- If the letter "J" follows a reported concentration, that compound was not present above the minimum detection limit (which is based on the dilution of the extract). However, mass spectral data suggested its presence, and the reported concentration is an estimate. These values have been added to the tables provided by NET in the Tier II data packages. ENVIRON has also provided these values in the summary tables of analytical results.

- The data qualifier "B" following a value indicates that the compound was also detected in the method blank analyzed with that sample. The purpose of this qualifier is to warn that the quantification of a chemical has been affected by contamination in the analytical laboratory, as measured by the method blank.

III. GEOLOGIC AND HYDROGEOLOGIC FINDINGS

A. Regional Geology and Hydrogeology

In Essex County and surrounding areas, the surficial soils consist of Pleistocene deposits. Typical of these deposits is unstratified drift, characterized by a heterogeneous layer of sediments with grain sizes ranging from clay to boulders. Unstratified drift was deposited as end and ground moraines during periods of glaciation. The other type of unconsolidated, surficial deposit is stratified drift, comprised of sand or sand and gravel, interbedded with clays and silts. These deposits originated from sediments borne in glacial meltwaters. Recent age sediments are found proximate to active drainage pathways, and are composed of clay, silt and/or sand with varying amounts of gravel. These deposits are not laterally extensive.

Underlying these unconsolidated deposits is the Brunswick Formation, the predominantly shale and sandstone upper member of the Newark Group. In the southern portion of Essex County, where the Engelhard site is located, the Brunswick Formation is a soft red shale, and becomes coarse to the north where conglomerate layers are present. The beds of the Brunswick Formation generally strike to the northeast, and dip to the northwest at a shallow angle of 10 to 15 degrees.

The fractured Brunswick Formation is the main source of ground water in the Newark area and in Essex County. In general, ground water in upland portions of Essex County is present under unconfined conditions, whereas confined or semi-confined conditions are often encountered in the lowland areas of Newark and in those areas near the Passaic River. Quaternary clay deposits overlying the Brunswick in these areas are the reason for the confined conditions.

Ground water is primarily contained in and moves through the highly developed sets of joints and fractures in the Brunswick Formation. These joints and fractures are interconnected to the extent that ground water moves vertically through them as well as

horizontally. Thus, wells completed in the Brunswick Formation commonly withdraw ground water from more than one zone.

The predominant uses of ground water in the Newark area are related to industrial cooling and processing. Although ground water has been used for domestic purposes in the past, there are no current, significant withdrawals of ground water for this purpose. This is demonstrated by the results of a 5-mile well search ENVIRON requested in 1990. The search, conducted by NJDEP, included sites listed in the NJGS Case Index of contaminated industrial properties and water withdrawal points for surface water and ground water as provided by the Bureau of Water Allocation. Appendix I provides the radius printout of this well search, and Figure III-1 shows the locations of wells within 1/2 mile of the Engelhard site for which well records were provided; the locations of these wells are tabulated on Table III-1.

As the well search information indicates, ground water in the vicinity of the Engelhard site is not used for domestic purposes. Six facilities located within 1/2 mile of the Engelhard site have wells. Of these, three have shallow or deep monitoring wells. Each of the remaining three facilities has one bedrock well completed in the Brunswick Formation to depths between 300 and 500 feet. According to the well records, these wells are used only for industrial or cooling water.

B. Site Geology and Hydrogeology

Examination of soil boring logs and monitoring well information derived from the 1985 O'Brien and Gere field investigation, the Revised Sampling Plan and Interim Investigation, and the additional ECRA sampling program, indicates that six distinct geologic zones underlie the Engelhard site to a depth of approximately 80 feet below ground surface. Appendix H provides monitoring well logs for the 10 recently installed wells. Monitoring well and soil boring logs for all previous sampling locations were provided to NJDEP in the March 1989 Cleanup Plan and other prior documents. Figure III-2 shows the locations of three geologic cross sections presented in Figures III-2A through III-2C. The site-specific stratigraphy is described briefly below.

Zone 1 consists of approximately 10 to 15 feet of fill material characterized by sandy soils, ash, brick fragments, construction debris, glass, wood, metal fragments and other miscellaneous substances typical of landfill debris. This fill material is continuous across the site, but is not homogeneous. Zones 2 and 3 consist of a discontinuous peat layer and an organic-rich clay layer, respectively, both of which average 3 to 5 feet in thickness. These peat and clay layers were not encountered during the installation of MWs 27S and 27D, suggesting that the fill material likely rests on the underlying silt aquifer in this area. Zone 4 consists of a layer of 20 to 40 feet of clayey silt and fine sand, and is the unit in which the deep wells are screened. This layer is continuous across the site and occasionally contains fine to medium sand lenses, particularly in the eastern portion of the site adjacent to Pierson's Creek. Zone 5, a glacial till layer approximately 10 to 20 feet thick, lies directly beneath the clayey silt and fine sand and is underlain by the Brunswick Formation (Zone 6). The bedrock surface was encountered at depths between 45 and 80 feet below ground surface.

Ground water levels and flow beneath this site have been determined from monitoring wells completed in the surficial fill aquifer (Zone 1) and in the underlying partially-confined silt aquifer (Zone 4). A total of 27 shallow wells and 11 deep wells have been installed in the fill and silt aquifers, respectively. Depths to ground water collected from the wells monitoring the fill unit range from 3 to 7 feet below the ground surface, while ground water in wells monitoring the deeper transmissive zone is typically encountered at depths of 5 to 6 feet. Ground water elevation data from some of the well clusters suggest a downward gradient from the upper zone to the lower transmissive unit. Water level measurements obtained during earlier phases of investigation are provided in Appendix J.

A number of ground water contour maps for the shallow fill aquifer were previously developed from existing water level data and presented in the March 1989 Cleanup Plan. In general, flow in the developed portion of the site is to the northeast and east toward Delancy Street and Pierson's Creek, respectively. The flow characteristics in the undeveloped area east of Pierson's Creek were generally observed to be variable. Ground water contour maps for the deep silt aquifer were not prepared at that time due to the lack of a sufficient number of monitoring points.

One additional round of depth to water measurements was collected at the site after the installation of the new wells in November/December 1989. Representative ground water contours of the shallow aquifer are provided in Figure III-3. These data confirm that shallow ground water in the developed portion of the site generally flows to the northeast or southeast, with minor variations. One localized variation exists at MW22, where ground water flow appears to be locally radial. Given that MW22 is completed on a small hill and the area is unpaved, it is probable that a small ground water mound exists in this area. In addition, ground water flow in the undeveloped portion of the site east of Pierson's Creek appears to be influenced by nearby surface water bodies. For example, ground water flow appears to be toward Pierson's Creek in the western portion of this area, while flow in the eastern portion of this undeveloped parcel is consistently toward MW9 and MW10A, adjacent to an off-site portion of the drainage ditch.

The ground water flow direction in the deep, partially-confined silt aquifer was also examined from the December 1989 measurement. Figure III-4 presents the ground water contour map for the deep aquifer. As depicted on this figure, deep ground water flow in the developed portion of the property is generally to the east and northeast, similar to that observed in the shallow fill aquifer. In the undeveloped area east of Pierson's Creek, deep ground water appears to flow to the southeast. However, the partially-confining peat and clay layers were not encountered at MW27D, and the water level in this deep well was similar to that measured in adjacent shallow well MW27S. These data indicate that ground water in the deeper aquifer is present under unconfined conditions in this area.

As indicated in Section II, ENVIRON conducted slug and bail tests on five shallow monitoring wells. The data generated in the field are provided in Appendix K. Table III-2 presents the hydraulic conductivities determined from these tests. ENVIRON calculated ground water flow velocities using these values for hydraulic conductivity. The flow velocity, or "seepage velocity" (V), was estimated by the following equation, generally referred to as Darcy's Law:

$$V = K \bullet i/N_e$$

where:

K = hydraulic conductivity in length per unit time (e.g., cm/sec)

i = hydraulic gradient (ft/ft)

N_e = effective porosity (dimensionless)

The calculated velocities, also provided on Table III-2, range from 3.3×10^{-7} cm/sec at MW5A to 4.8×10^{-5} cm/sec at MW22. The velocities were calculated with a hydraulic gradient of 0.003 and an effective porosity of 0.1.

IV. RESULTS AND DISCUSSION OF ADDITIONAL ECRA SAMPLING

A. General

This section of the report presents and discusses the results of the additional ECRA sampling program proposed in the March 1989 Cleanup Plan. The primary objectives of this work were to: (1) delineate the extent of free-phase petroleum product around MW14; (2) provide data regarding the lateral and vertical distribution of contaminants in the drainage ditch; and (3) expand the ground water monitoring network to include additional shallow and deep wells at upgradient and downgradient property boundaries. In addition, a laboratory-scale soil sorting feasibility study was performed to evaluate that technology's potential to separate material requiring off-site disposal from material that can be properly replaced on-site. The results of this sampling and analysis as they relate to each of these objectives are discussed below. Where appropriate, results from previous investigations are included in the discussions.

B. Delineation Borings Around MW14

MW14 was installed during implementation of the Revised Sampling Plan in an area adjacent to two former 20,000-gallon underground fuel oil tanks. Free-phase petroleum product was detected in this well at the time it was installed. Monitoring of the product thickness over time has indicated that less than 1/2 inch of free-phase hydrocarbons has reaccumulated on the water table. In addition, ground water sampling has confirmed elevated TPHC, BN and PPM levels in MW14. The source of the free-phase hydrocarbons observed in MW14 was initially thought to be the underground fuel oil tanks that were reportedly removed in 1964.

To determine whether other potential sources of free-phase product existed, hydrostatic pressure tests were conducted on several underground pipelines extending through this area. The pipelines had been used to supply fuel to the boiler located in Building 2 from

two former, 50,000-gallon, partially-underground storage tanks (AEC 11) and/or to recirculate oil from the boiler to the tanks. One 3-inch return line failed the hydrostatic pressure test. Former leakage from this pipeline is the presumed source for the free-phase petroleum product and dissolved constituents identified in MW14.

As indicated in Section II, borings were completed in the vicinity of MW14 to delineate the extent of free-phase petroleum product. Droplets of fuel oil were observed either in the split-spoon samples or on the lead auger flight at boring locations B1, B2, B3, B4, B6 and B10. Figure IV-1 illustrates the observed incidence of free-phase petroleum product, covering an area of about 9,000 square feet between Building 2 and the former location of the two 50,000-gallon, partially-underground fuel oil tanks in AEC 11. Observations made during completion of the delineation borings suggest that the vertical soil interval contaminated with free-phase oil is minimal (approximately 1 to 2 feet in thickness). The underground product line that failed the hydrostatic pressure test is present near the upgradient edge of this area.

Consistent with the March 1989 Cleanup Plan, the results of this investigation have been used to develop an appropriate remediation scheme for the active source of ground water contamination in the vicinity of MW14. Because the results of the delineation sampling program indicate that the free-phase product on the water table and in the soil interval just above the water table is limited in areal extent, and because ground water quality data confirm that free-phase product and dissolved constituents have not migrated to downgradient wells, Engelhard and ENVIRON believe that removing the free-phase product and excavating the soil interval contaminated with free-phase material will effectively remediate the source of the ground water contamination detected in MW14 and minimize the potential for future impacts. Based on these data and the proposed cleanup actions, ground water recovery and treatment in this area of the site are not proposed. NJDEP previously indicated that source control remedies would preclude the need for ground water cleanup. Ground water quality data from MW14 and other wells in the vicinity of this area are presented and discussed in Section IV.D. A specific proposal for cleanup of free-phase product and contaminated soil is provided in Section V.

C. Drainage Ditch Sediments

Initial sampling of the drainage ditch during implementation of the Revised Sampling Plan was targeted to surface sediments adjacent to storm water outfalls that discharge to the ditch from the Engelhard site. Results of this sampling indicated elevated TPHC and PPM concentrations in most tested areas. Potential on-site sources included discharge from former chemical processing and storage activities associated with aboveground storage tanks formerly located south of the Building 18 complex and a former drainage swale from the Building 4/4A area. Potential off-site sources included runoff from Route 1 and 9 and the adjacent railroad yard. For most of the ditch, however, a single source for PPMs and TPHCs could not be identified. Therefore, ENVIRON proposed additional sampling in the March 1989 Cleanup Plan to characterize more fully the lateral and vertical distribution of contaminants. Analytical results for TPHCs, PPMs and three precious metals (PMs) in the drainage ditch sediment samples are provided in Table IV-1.

Results of this additional sampling confirm the presence of elevated PPM and/or TPHC concentrations in ditch sediments. Constituent concentrations in the ditch were generally less than those observed in sections of Pierson's creek. The data also demonstrate that TPHCs and PPMs generally are not distributed in a consistent pattern in either the lateral or vertical directions over the length of the drainage ditch. The absence of well-defined contaminant distribution trends suggests contributions from both point and non-point source areas. The uneven physical configuration of the drainage ditch and episodic periods of flow may also be responsible for the contaminant distributions observed. In addition, PMs were detected in a limited number of samples, although there was no correlation between samples containing precious metals and those reporting the highest levels of PPMs. In fact, the samples with the highest levels of PPMs contained no precious metals.

Consistent with previous data, however, these results also suggest that certain areas along the ditch may have been affected by Engelhard's industrial activities. For example, elevated levels of both copper and nickel were detected in the shallow and mid-depth sediment samples from boring location DD03 (see Figure II-2). This condition could have been related to the use and handling of copper sulfate and nickel sulfate in the area of the

former aboveground tanks behind the Building 18 complex. The ditch received direct storm water runoff from this area. Further, the vertical distribution of TPHCs, PPMs, and PMs at this boring location suggests a surficial source. These constituents were present at elevated levels in the shallow and mid-depth sediment samples, but either were not present or were detected at significantly lower concentrations in the deepest sample obtained from this location. This is the expected pattern of contamination from a surficial source. The other sample location exhibiting PPM level likely associated with former Englehard industrial activities is near outfall 001 (sample DD05). This outfall was a sewer line from areas of Building 14, one of the few buildings on-site that contained floor drains.

Although the data obtained to date indicate that certain areas appear to have been impacted by former Engelhard industrial activities, discrete sources affecting other areas of the ditch cannot be ascertained. As indicated in the March 1989 Cleanup Plan, the scope of remediation of drainage ditch sediments would ultimately depend upon the lateral and vertical extent of TPHCs and/or PPMs. Unlike Pierson's Creek, the drainage ditch is not a dynamic system subject to tidal influence and multiple discharges from active, industrial sources. In fact, the recent sampling did not identify contaminant distribution trends suggestive of off-site source areas. The ditch is an isolated area that is not likely to become recontaminated once remediation is complete. Therefore, as discussed in Section V, Engelhard has developed a cleanup proposal to address the length of the drainage ditch.

D. Shallow Ground Water

1. General

As part of the additional ECRA sampling, all shallow monitoring wells were analyzed for dissolved PPMs and aluminum. In addition, analyses for TPHCs, BN+15 and VOC+15 were performed on samples from MWs 4A, 5A, 7, 14, 16, 17, 18, 20, 21, 25, 26S and 27S. In general, the results of this sampling indicate that concentrations of PPMs in shallow ground water have decreased significantly since the initial ground water sampling rounds in 1987, and confirm that TPHCs and other organic constituents

are present only in localized areas of the site. Table IV-2 presents the results of this sampling, and the findings are summarized briefly below.

2. PPMs

Except for cadmium, lead and isolated occurrences of a few other metals, PPMs generally were not present above informal ECRA action levels in the November/December 1989 shallow ground water samples. Figure IV-2 presents those metals that were identified in ground water at concentrations exceeding the informal guidelines. Cadmium and lead were detected at or above ECRA action levels in only nine and six shallow wells, respectively. Arsenic and chromium were identified in two shallow wells each above informal ECRA action levels. Finally, mercury and selenium were detected in MW14 at concentrations above the informal ECRA action levels. In most of these instances, PPM concentrations did not exceed the informal action levels by more than a factor of two to three.

The 1989 results are consistent with the trends observed during the 1988 sampling rounds associated with the Interim Investigation. For most metals, concentrations have remained below informal ECRA action levels and relatively constant over time. At other locations, PPMs have now decreased to concentrations below the informal ECRA action levels or below method detection limits. For example, significant decreases in cadmium, chromium, copper, lead and zinc levels were observed in MW13, most likely due to the cessation of acid handling and storage in this portion of the site. Similarly, substantial decreases in copper, lead, and zinc concentrations have occurred in MW21. Except for lead, levels of these metals in MW21 are currently below the informal ECRA action levels. Decreases in other metal concentrations, particularly lead and zinc, were observed in MWs 16 through 20, 22 and 23; at all of these locations, levels of these metals are below the informal ECRA action levels.

Three shallow monitoring wells did exhibit metal concentrations elevated to a greater degree than discussed above. In MW27S, installed in a former parking lot at the northeastern property boundary, 300 ppb of arsenic were detected. Engelhard did not conduct industrial operations in this portion of the site. Thus, information

regarding former site activities does not suggest a source for the arsenic identified in this well. Similarly, 1,340 ppb of lead were detected in MW21, completed in an area of the site where a septic system had been located. This system accepted wastewater from Building 24, where Engelhard manufactured catalysts. Although discharges to this system have ceased, this lead concentration is still within the range of historical data. If industrial activity was the source of this lead, then concentrations should have decreased following cessation of industrial operations. Since this is not the case, a likely industrial source for the elevated lead concentrations in MW21 has not been identified.

The remaining location with significantly elevated PPMs is MW14. Chromium and lead were detected in both duplicate samples at concentrations greater than one order of magnitude above informal ECRA action levels. Mercury was identified only slightly above the informal ECRA action level in both samples from this well. Selenium also was detected minimally above the informal ECRA action level in one duplicate sample, but was present at an anomalously elevated level in the other. The probable source for the PPMs in MW14 is the free-phase hydrocarbons present on the water table in this well. Information regarding former industrial activities in this portion of the site does not suggest another potential source.

Other than the elevated PPM concentrations in MW14, the 1989 data do not suggest specific industrial sources for the metal concentrations currently observed at the site. The most frequently identified PPMs present above informal ECRA action levels, cadmium and lead, are present at relatively consistent levels across the site, suggesting that the source is unrelated to former Engelhard operations. Further, the presence of elevated cadmium and lead levels in several of the deep monitoring wells but not in the adjacent shallow wells supports this conclusion. Based on these data, ground water remediation for PPMs is not proposed. Furthermore, NJDEP has indicated to Engelhard that ground water remediation in the area of MW14 would not be necessary should source control remedies be implemented. The metal contamination at MW14 will be addressed by removing the free-phase product and excavating the affected soil. The specific cleanup approach for soils in the area is described in Section V.

3. TPHCs, BNs and VOCs

Analyses for organic constituents at the 12 selected shallow wells confirm that (1) TPHCs and BNs are present in MW14, (2) the soil in the vicinity of MW14 is the only active source of ground water contamination, and (3) slightly elevated TPHC levels are present in MW16 and in other wells near Pierson's Creek and the drainage ditch. Figure IV-3 presents the concentrations of TPHCs and all detected target organic compounds in the shallow wells.

Although the 1989 data for MW14 are consistent with previous results, concentrations of TPHCs and BNs have decreased since the initial sampling rounds associated with the Revised Sampling Plan. The September 1987 analysis of ground water from this well identified significantly elevated TPHCs, as well as levels of fluorene, naphthalene and phenanthrene between 160 and 320 ppb for each BN compound. Benzene and ethylbenzene also were detected in two of the previous ground water sampling events. Although TPHC levels in this well have remained consistently high, the most recent data indicate that BN concentrations have decreased and VOCs are no longer present. The absence of VOCs and the declining BN concentrations in MW14 demonstrate that the free-phase petroleum product present on the water table at this location is not significantly impacting ground water quality. Further, neither free-phase product nor dissolved organic constituents are present in nearby downgradient monitoring wells (MW17, MW18, and MW21). As previously indicated in Section IV.B, ENVIRON and Engelhard believe that excavation of the petroleum-contaminated soil and removal of free-phase petroleum product will provide adequate source control and minimize the potential for future impacts to ground water. Based on these proposed actions and the fairly limited areal extent of free-phase product and dissolved constituents, ENVIRON has not proposed ground water remediation in this area of the site. Based on previous discussions with NJDEP, it is Engelhard's and ENVIRON's understanding that this approach will be acceptable to the agency.

TPHC concentrations above the informal ECRA action level were also identified at MWs 4A, 5A, 7, 16, 20 and 25. Total BNs and/or VOCs were detected at these

locations, but at low or trace concentrations. Two confirmatory rounds of ground water samples were subsequently collected in April and August 1990 from these wells for TPHC, BN+15 and VOC+15 analyses. Confirmatory samples were not collected from MW14 and MW16 because the 1989 results were consistent with previous data obtained from these locations.

The confirmatory sampling data indicate that although TPHCs were identified above the informal ECRA action level in MWs 4A, 5A, 7 and 20 during the April and August 1990 sampling rounds, these levels were, in general, below those detected in December 1989. Further, these concentrations are not materially different from the informal ECRA action level of 1000 ppb. In MW25, the concentration of TPHCs decreased from 25,200 ppb in December 1989 to only 270 ppb in April 1990. However, 13,700 ppb of TPHCs were detected in August 1990. Since the two confirmatory sampling rounds indicated that BNs are not present in MW25, it is likely that the elevated concentrations of TPHCs in this well are not the result of a petroleum product, but rather may be related to organic material from the soil horizon in which the well was completed. BNs and/or VOCs, identified at low levels in these wells during the December 1989 sampling, were generally absent or were detected at even lower concentrations in the two confirmatory sampling rounds. Based upon these data, Engelhard and ENVIRON believe that BNs and VOCs are not of concern at these locations.

The TPHCs at MWs 4A, 5A, 7, 20 and 25 are clearly unrelated to the fuel oil contamination in MW14. First, the delineation borings completed around MW14 indicated that free-phase hydrocarbons have not migrated beyond the eastern edge of Building 2. Second, elevated TPHCs have not been consistently identified in MWs 17, 18, 21, and 26S, all of which are downgradient of MW14 but closer to MW14 than those wells along the creek. Thus, the levels of TPHCs present at MWs 4A, 5A, 20 and 25 likely originate from other sources.

The presence of TPHCs in shallow wells adjacent to Pierson's Creek and the drainage ditch suggests that these surface water bodies may also be a source of the TPHCs. This is consistent with visual observations made since 1985 regarding the

water quality in Pierson's Creek. Floating petroleum product or sheen, often clearly migrating on-site from upstream, off-site locations, has been frequently noted in Pierson's Creek. It is possible that this floating petroleum product could affect local ground water quality. Nonetheless, given the low and generally decreasing levels of TPHCs at these locations, and the absence of BN and VOC contamination, Engelhard and ENVIRON believe that further investigation and/or cleanup is unwarranted. However, limited monitoring in and around the MW14 area is proposed in Section V to verify the adequacy of cleanup.

E. Deep Ground Water

Pre-ECRA sampling of the original four deep monitoring wells in 1985 identified slightly elevated concentrations of cadmium, lead and xylenes. Analyses were not conducted for TPHCs or BNs, nor were samples again collected from these wells until 1989. As proposed in the March 1989 Cleanup Plan, seven additional deep monitoring wells were installed in the silt aquifer which underlies the surficial fill unit. As part of the 1989 sampling program, all deep wells were analyzed for dissolved PPMs and aluminum, specific conductance, TDS and pH. In addition, Engelhard chose to analyze MW14D for TPHCs, BN+15 and VOC+15 due to the elevated constituent levels previously identified in MW14. Table IV-2 includes the 1989 ground water quality data for the deep aquifer. Concentrations of all parameters detected at or above informal ECRA action levels are presented on Figures IV-2 and IV-3.

TPHCs, BNs and VOCs were not detected in MW14D, demonstrating that the fuel oil contamination present in MW14 has not migrated to the deeper, silt aquifer. This further supports the previous conclusion that ground water withdrawal and treatment at MW14 are unnecessary.

Several PPMs were detected in the deep aquifer at concentrations above informal ECRA action levels. Cadmium was identified above the informal guideline in seven of the deep wells at levels between 12 and 52 ppb. Lead was also detected at these locations at concentrations ranging from 110 to 240 ppb. Other PPMs were detected above informal action levels at scattered locations. Chromium was detected at MW7D, but only slightly

above the informal action level. Mercury was identified at MW5B minimally above the ECRA action level, whereas selenium was detected in MWs 4B and 5B nearly an order of magnitude above the informal ECRA action level.

In general, the PPM data for the deep aquifer suggest that the source of the elevated metal concentrations is regional, off-site and unrelated to former Engelhard activities. First, there is no correlation between PPM concentrations in the surface and deep aquifers, indicating that PPMs in the surficial aquifer do not represent a significant source. Cadmium and lead levels were above informal ECRA action levels in MWs 2D, 23D, 26D, and 27D, yet below the informal guidelines in the corresponding shallow wells. Similarly, although lead, mercury and selenium were found in MWs 4B and 5B, these metals were not detected above informal ECRA action levels in adjacent shallow wells 4A and 5A. Only cadmium was detected in MWs 4A and 5A at concentrations exceeding the informal ECRA action level. Second, cadmium and lead concentrations are generally higher at the upgradient property boundary and decline in the downgradient direction, being lowest at MWs 26D and 27D. These data suggest that the cadmium and lead contamination is from an upgradient source. Based upon these data, Engelhard and ENVIRON do not believe that further investigation or remediation of deep ground water is warranted.

During a May 2, 1991 telephone conversation with Mr. Scott MacDonald of ENVIRON, Messrs. Richard Dewan and Rob Lux of NJDEP confirmed that the current data sufficiently characterize ground water quality in the deeper aquifer and that further monitoring in the deeper aquifer will not be required.

F. Large Material Separation Feasibility Study

1. General

Published literature indicates that metal contaminants found in the soil matrix generally tend to concentrate on smaller particles due to adsorption/desorption characteristics and the increase in the ratio of surface area to volume that occurs with decreasing grain size. Based upon the nature of contaminants and fill material at the Engelhard site, a soil sorting feasibility study was designed and conducted to examine

the distribution of metals adsorbed to soils less than 1/2 inch in size. The goal of this study was to perform a laboratory-scale soil sorting test to identify a range of smaller grain-sized soils that might contain a high percentage of the total mass of contaminants present on-site. The identification of such a range might indicate that soil sorting could be used as a remedial component to isolate and extract the soil fraction containing the majority of metal contaminants. This would result in a decrease in the volume of soil requiring treatment or disposal.

As described in the November 1990 report, Engelhard and ENVIRON concluded that although soil sorting identified a general trend of increasing metal concentrations with decreasing grain size, soil separation of materials less than 1/2 inch does not appear to be an effective method of isolating a significant portion of the mass of chemical constituents found within the soil matrix. However, the demonstrated inverse correlation between metals concentrations and particle size indicates that it might be possible to use this technology to sort materials greater than 1/2 inch in diameter. As discussed below further investigation was conducted to determine the physical characteristics of the portion of the soil matrix greater than 1/2 inch. The results and full discussion of the previous work with materials less than 1/2 inch in size is provided in Appendix N.

2. Large Material Separation Testing

A large material separation test was conducted to determine the percentage of fill material considered to be large debris, the processing and handling requirements for debris separation, and the efficiency of a vibrating screen in separating large debris from fine-grained soils at the site. Separation was accomplished using a Read Screen All® of double-stacked vibrating screens with 1/2-inch and 2-inch openings. Examination of the debris included determining the percentage by weight and by volume of each of the following fractions: (1) material greater than 2 inches; (2) material less than 2 inches but greater than 1/2 inch; and (3) material less than 1/2 inch. Visual inspection of the material was also used to evaluate the process.

The large material separation test was conducted in Building 14 on the Engelhard site. Approximately 3 cubic yards of representative fill material were excavated for the test from Building 4 hill. The fill material was temporarily stockpiled inside Building 14 and allowed to dry. Subsequently, the dried soil was placed into 12 pre-weighed, 55-gallon drums. Each of these drums was then reweighed to calculate the total weight of the material to be screened. A total of 7,147 pounds of material were placed into these drums.

The soil from each drum was placed onto a Read Screen All® and screened, with the screen running backwards to allow for longer retention time. Large material, that fraction not passing through the 2-inch screen, and the fine fraction, that which passed through the 1/2 inch screen, were placed into pre-weighed drums. Each of these drums was then re-weighed, to determine the weight of each fraction. The intermediate fraction (between 1/2 inch and 2 inches) was left on the floor for later inspection. The first screening resulted in a distribution of 1577 pounds (22%) in the large fraction, 1951 pounds (27%) in the intermediate fraction, and 3619 (51%) in the fine fraction.

The large material generally was comprised of construction debris such as concrete and brick fragments, elongated white ceramic blocks, and rocks. There appeared not to be a substantial amount of the types of residential fill material that had been observed at other areas of the site, such as bottles, tiles, or other household items. The intermediate fraction was comprised of smaller pieces of the same construction debris, as well as a minor amount of household debris. The fine fraction largely consisted of sand-sized material to very fine clay and silt. Some gravel and small pieces of household debris less than 1/2-inch were also observed.

The intermediate fraction appeared to contain an appreciable amount of fine material as well as some debris with at least one dimension greater than 2 inches, such as the elongated ceramic blocks (which generally were about 1/2 inch x 1 inch x 8 inches). Accordingly, this fraction (1951 pounds) was screened a second time, and the resulting three fractions were weighed and staged with the previously separated material. The results of this second screening of the intermediate fraction are as follows:

Secondary Large Fraction (>2 inch):	38 pounds
Secondary Fine Fraction (<1/2-inch):	292 pounds
Remaining Intermediate Fraction (1/2-2 inch):	1620 pounds

These results demonstrate that 15% (292 pounds) of the original 1951 pounds of the intermediate fraction was removed as fine material with a second screening. This portion of the fine fraction was comprised mainly of relatively large material, close to 1/2 inch; it appeared that the original screening removed the majority of the very fine clay and silt-sized material. This additional fine material was staged in a separate drum with the other seven drums of fine material. This second screening resulted in a modified total distribution of 1615 pounds (22.5%) in the large fraction, 1620 pounds (22.5%) in the intermediate fraction, and 3911 pounds (55%) in the fine fraction.

An inspection of the separated fractions indicated that a small but noticeable amount of fines was present on material in the intermediate fraction and to a lesser extent in the large fraction. These fines likely remained adhered to larger material due to moisture at the time of the initial screening. Representative portions of the intermediate and large fractions were subsequently washed to determine what additional fines, if any, could be removed from this fraction of the material. The washing apparatus consisted of an inverted hood with a piece of 1/2 inch screen covering the vent opening. This hood was placed over a 55-gallon drum. Water was staged in drums and pumped with a sump pump through a hose fitted with a low-pressure spray nozzle.

About 22 pieces from the large fraction were placed in the hood and washed several times while being turned to allow even washing. ENVIRON inspected this material and concluded that this method was not removing enough of the fines. Accordingly, the pieces were washed manually; 195 pounds of the large material were washed in this manner. Each piece was rinsed and lightly brushed into a drum of standing water. The washed pieces were placed on plastic sheeting to dry. The wash water was allowed to settle; the water was decanted and reused to wash the intermediate fraction. The fines were placed in front of an electric heater to dry.

Four batches of the intermediate fraction, totaling 322 pounds, were washed in the hood. A steel rake was used to agitate the pieces during washing. The washed pieces were placed on plastic sheeting to dry. The wash water was allowed to settle for approximately one day. Engelhard personnel subsequently pumped off the water and placed the fines in front of a heater for drying. The fines and large and intermediate washed fractions were weighed once these fractions had dried. The weights are provided below.

Large Fraction:
188 pounds fill material, or 95%
10 pounds fines, or 5%
198 pounds total

Intermediate Fraction:
291 pounds fill material, or 93%
23 pounds fines, or 7%
314 pounds total

ENVIRON believes that the above percentages of fine material washed off of the intermediate and large fractions are representative of the mass of residual fines on the screened fractions that were not washed. The total residual weights of fines on each fraction were estimated by applying these percentages to the full net weights of the intermediate and large fractions. ENVIRON calculated that 113 and 81 pounds of fines remained on the intermediate and large fractions, respectively. The mass of these residual fines, 194 pounds, represents 2.7% of the total excavated mass. The adjusted total weight and distribution of each fraction following screening and washing are:

Fine Fraction:	4105 pounds, or 57.4%
Intermediate Fraction:	1507 pounds, or 21.1%
Large Fraction:	1534 pounds, or 21.5%

An examination of the data generated during the mechanical screening and washing studies indicates that screening of the excavated material into the three fractions discussed--that is less than 1/2 inch, greater than 1/2 inch but less than 2 inches, and greater than 2 inches--results in an effective separation of fines from large inert material. It is also apparent from the data that the second screening of the intermediate fraction results in significant additional removal of fines amounting to about 15% of the original intermediate fraction. Conversely, there is only a slight gain in the large fraction from the first to second screening of the intermediate fraction. Furthermore, there were only slight losses due to the removal of fines accomplished by the washing of the intermediate and large material. The table below summarizes the percentage of material in each of the three fractions after the first and second screenings as well as the washing of the material that has been screened twice.

Summary of Size Distribution of Excavated Soil (By Weight in Pounds)

	Large Fraction (>2")	Intermediate Fraction (>1/2"-<2")	Fine Fraction Go Off-site (<1/2")
Total Distribution After First Screening of Excavated Soil	1577 22%	1951 27%	3619 51%
Total Distribution After Second Screening of Intermediate Fraction	1615 22.5%	1620 22.5%	3911 55%
Total Distribution After Washing of Large & Intermediate Fractions after Second Screening	1534 21.5%	1507 21.1%	4105 57.4%

Based on the results of this testing, Engelhard believes that the separation of fine-grained soils from materials greater than 1/2 inch will be effective in significantly reducing the volume of material requiring remediation. Since washing of the larger material appeared to have little effect on the total amount of fines removed from the

large debris, Engelhard and ENVIRON believe that the separation of the fill material into the three fractions described above and the rescreening of the intermediate-sized fraction (>1/2" but <2") represents the most effective and practical method for removing fine sediments containing metals from larger landfill debris. A proposal for this sorting methodology is outlined in Section V.

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V. CLEANUP PLAN

A. Introduction

This section describes the proposed Cleanup Plan for the Engelhard site. This is a cleanup plan for contaminated soils and sediments, and includes a discussion of additional tasks that must be completed prior to implementing cleanup. Engelhard plans to initiate the proposed additional field sampling and the preparation of a detailed work plan following approval of this Cleanup Plan by NJDEP. The Cleanup Plan consists of the following elements:

- The cleanup objectives;
- The method for soil and sediment remediation;
- A pre-remediation sampling program;
- A schedule to implement the Cleanup Plan; and
- A cost estimate for the proposed cleanup activities.

B. Cleanup Objectives

As discussed in this report and in the March 1989 Cleanup Plan, elevated levels of PPMs and TPHCs were found in samples taken within many AECs. However, the results of background sampling indicate that a significant portion of the PPMs and TPHCs are attributable to prior municipal landfill activities. The primary objective, therefore, of the remediation is to return the site to "background" conditions (i.e., conditions that existed prior to site development for industrial operations). To accomplish this, four remedial tasks have been identified and provide the basis of the Cleanup Plan, as outlined below:

(1) Remediate AECs, or portions of AECs, for PPMs and BNs to return the site to background conditions.

(2) Remediate drainage ditch sediments containing PPMs and TPHCs.

(3) Remediate the source area of free-phase petroleum product observed in and around MW14.

(4) Remediate two underground tank locations (one current and one former) pursuant to the NJDEP-approved November 1987 Cleanup Plan for Underground Tank Excavations.

Details regarding the specific cleanup goals and method of remediation in each of these areas are provided in the following sections. A proposal for additional investigation of Pierson's Creek is provided in Section V.D. as part of a pre-remediation sampling program.

C. Scope of Cleanup

The scope of cleanup in each area is based on the results of sampling activities conducted to date. Specific cleanup objectives have been developed for each proposed action. The scope of cleanup and basis for the cleanup goals for each area are provided below.

1. Areas of Environmental Concern with Elevated PPM Levels

The scope of soil remediation for PPMs in on-site soils will be determined using one of two criteria. For As, Cu, Cr, Hg, Pb, Ni, Tl and Zn, remediation will be undertaken to establish a distribution of metal concentrations in on-site soils (excluding background areas) equivalent to that obtained from background areas. To accomplish this, soil excavation will take place within AECs such that the distribution of metal concentrations in remaining on-site soils will be essentially the same as that in background samples. More specifically, the following criteria discussed and agreed to during the March 28, 1991 meeting between Engelhard and NJDEP will be achieved following remediation: (1) no PPM value at any sampling location will exceed the log-normal mean plus three standard deviation units for that PPM in the background

population; (2) at least 98% of the PPM levels in on-site soils after remediation will have concentrations that are less than two standard deviation units above the log-normal mean of the same constituents in the background population; and (3) at least 84% of the PPM levels in on-site soils after remediation will have concentrations that are less than one standard deviation unit above the log-normal mean of the same constituents in the background population. Since these quantile distributions are estimates, variances from these values will be considered acceptable if the data vary no more than 4% at the mean plus one standard deviation and 2% at the mean plus two standard deviations of the background distribution. NJDEP approved these variances during the March 28, 1991 meeting with Engelhard. The sample distribution of on-site soils after remediation and the background sample distribution will be compared in tabular form in the final work plan. In addition, that work plan will include summary tables and figures necessary for NJDEP to evaluate the effectiveness of the proposed cleanup program.

The above basis of remediation was deemed acceptable by NJDEP at the March 28, 1991 meeting, provided that ENVIRON can supply evidence that no lateral and vertical trends in PPM concentrations exist. ENVIRON has analyzed the data, and has found no definable horizontal or vertical trends in PPM data. If trends exist, then PPM concentrations from adjacent sampling locations should correlate. The greatest correlation would be expected between those samples that are collected from different depths at the same location, since these samples are the most closely spaced. Thus, high values of a constituent in the surface would be expected to be coincident with similar high values in the underlying samples.

Figures 1 through 12 provided in Appendix N show pairs of constituent concentrations from the same sampling location. The X axis in each figure is the surface constituent value and the Y axis is the constituent value of the sample taken immediately below the surface sample. Similarly, Figures 13 through 24 in Appendix N show the constituent concentration from the middle interval paired with the sample collected from the deeper interval. These figures demonstrate that there is no consistent tendency for high values of any constituent to coincide with similar high

values in the underlying samples. Furthermore, high concentrations in the middle interval do not correlate with high concentrations in the deepest sampling interval.

Further evidence for the lack of spatial correlation can be found by examining the number of locations exhibiting a distinct vertical trend in concentration for a given constituent. For the purpose of this discussion, a distinct downward trend is defined to be present when the surface concentration is greater than the middle interval concentration and the middle interval concentration is greater than the deepest interval concentration. A distinct upward trend is present when concentrations decrease consistently from the deepest interval to the surface interval.

The 45 AEC sampling locations that were sampled at three depths were examined for the presence of distinct vertical trends. There were 708 analyses of PPMs at these locations. If PPM concentrations were distributed randomly with respect to depth, then one would expect, by chance alone, 118 of these analyses (or one analysis in six) to exhibit a distinct upward trend. Similarly, 118 analyses would be expected to exhibit a distinct downward trend. The results show 98 downward trends and 129 upward trends. These apparently random results are consistent with the heterogeneous nature of the fill material being sampled and the absence of vertical trends.

For Sb, Cd, Se and Ag, site-specific action levels will be used to determine the extent of remediation necessary. For Sb, the action level will be 47 ppm; for Se, 12 ppm; for Ag, 41 ppm and for Cd, 44 ppm. These action levels were agreed to by NJDEP during the March 28, 1991 meeting and are based on maximum constituent concentrations detected in background soil samples.

The initial scope of remediation for PPMs using existing site data and applying the above-described cleanup criteria is illustrated on Plate 1. The areal extent of remediation was determined by consideration of several criteria, including the results from AEC sampling, historical aerial photographs, and physical boundaries. Where remediation will not extend to the water table or where all sampling intervals are not addressed, the vertical extent of remediation was determined by calculating the midpoint between intervals targeted for remediation and overlying or underlying intervals. As proposed in Section V.D., pre-remediation sampling will be conducted to

confirm the bounds of excavation. As agreed to by NJDEP during the March 28, 1991 meeting, any data from previous sampling within two feet of a proposed pre-remediation sample can be used in lieu of collecting a new sample. Shallow monitoring wells are located in several of the areas targeted for remediation, including AECs 24, 25, 73 and 74. Since the proposed remediation will require the removal of these wells, these wells will be abandoned during the cleanup program. ENVIRON has not proposed additional ground water monitoring at these locations and, therefore, these wells will not be replaced.

2. Areas of Environmental Concern Analyzed for TPHCs

During the March 28, 1991 meeting, NJDEP indicated that the need for remediation of soils with elevated TPHC concentrations should be evaluated based on concentrations of carcinogenic polycyclic aromatic hydrocarbons (CaPAHs) and total BNs. Accordingly, sampling will be conducted to determine the levels of total BNs and CaPAHs in those areas previously sampled only for TPHCs. This sampling is presented below in Section V.D.

3. Areas of Environmental Concern with Elevated BN Levels

Samples from AECs 5, 11, 12, 19, 22, 24, 25 and 44 were analyzed for TPHCs and PAHs or BNs during the initial 1987 sampling program. These areas include underground fuel oil storage tanks, drum storage locations, surface stains, and the photographic sludge fill area west of the Building 18 complex. Information regarding former site operations suggested that these were areas where PAHs or BNs potentially would be present. ENVIRON calculated the levels of CaPAHs and total BNs in these samples (Table V-1). As the data in this table indicate, only 7 of the 38 sampling intervals had concentrations of CaPAHs above 10 ppm, and only one had total BNs above 100 ppm. Remediation will be undertaken at AECs 12, 19 and 44 and in a portion of AEC 5, as shown on Plate 1, to address CaPAH and/or BN levels. It should be noted that only in AECs 19 and 44 is remediation driven solely by CaPAH and/or BN concentrations. PPM remediation is also necessary at the other locations.

4. Areas of Environmental Concern with VOCs

As part of the 1987 sampling program, soil samples from AECs 5, 22, 30 and 44 were analyzed for VOC+15. These areas were sampled for VOCs because information about previous site operations suggested that VOC-containing materials potentially were handled in these areas. VOCs were not detected at any of these locations above 1 ppm. Therefore, Engelhard does not believe that VOCs need to be considered further in these or other on-site AECs not associated with underground storage tanks or soils in the vicinity of MW14.

5. Drainage Ditch Sediments

As discussed in Section IV, sediments in the drainage ditch that runs along the facility's southern boundary evidence elevated levels of PPMs and TPHCs. While the sources of these constituents have not been fully defined, Engelhard proposes to remediate the sediments along the length of the drainage ditch bordering the site; the average depth of sediments in the ditch is 3 feet. The resulting volume to be excavated is 890 cubic yards. Because the eastern portion of the drainage ditch is not located on Engelhard property, cleanup of this area is subject to acquiring access to the property.

6. Soils in the Vicinity of MW14

As discussed previously in Section IV, free-phase fuel oil is present in MW14. The extent to which free-phase hydrocarbons are present is limited to an area of approximately 9,000 square feet. Previous sampling confirmed that contamination has not migrated to downgradient wells. Therefore, Engelhard believes that remediating the layer of soil contaminated with fuel oil and removing free-phase product will result in an effective cleanup of the area around MW14. Previous observations suggest that the thickness of the oil-contaminated soil layer is minimal, comprising the 2-foot interval from 4 to 6 feet. This layer of thickness across 9,000 square feet results in a volume of about 670 cubic yards requiring remediation. This volume of soil will be excavated and disposed of at an off-site landfill. The volume of overlying, uncontaminated material that must be excavated is 1,330 cubic yards. Recovered

product will either be reclaimed or properly disposed of off-site. Oil-contaminated water will also be removed and disposed of off-site. Following removal of the layer of soil contaminated with fuel oil, post-excavation samples will be collected and analyzed for TPHCs. In those samples in which TPHCs exceed 1,000 ppm, 25% will also be analyzed for BN+15 and VOC+15. Where applicable, levels of BNs and VOCs identified will be compared to current informal ECRA action levels for these constituents. Remediation will be conducted until BN and VOC concentrations above these action levels have been addressed fully. Further remediation in areas characterized only by TPHCs less than 1,000 ppm is not proposed.

7. Underground Storage Tanks

As proposed in the NJDEP-approved November 1987 Cleanup Plan for Underground Tank Excavations, two underground tank locations (one current and one former) will be remediated as part of the Revised Cleanup Plan. The first location is in AEC 11, where two 50,000-gallon, partially-underground storage tanks and surrounding soil were removed in 1987. Engelhard will excavate the stained soil from the northwestern edge of the excavation, which was inaccessible during the 1987 remediation, and additional soil from the southeastern edge where previous post-excavation sampling indicated the presence of elevated TPHCs. It is estimated that approximately 30 cubic yards of soil will be removed during this additional excavation. As described above, in those post-excavation samples with TPHC levels above 1,000 ppm, 25% will also be analysed for BN+15 and VOC+15. These BN and VOC data will be used to determine whether remediation is complete. The second area is the location of an inactive, 2,000-gallon underground gasoline storage tank (AEC 35). This tank was formerly beneath a scrubber pad, preventing access to the tank. Engelhard removed the scrubber as part of its decommissioning program, thereby enabling excavation of the tank. Approximately 17 cubic yards of soil are estimated to require removal from this area. This volume is based on the assumption that the tank is 12 feet long, 6 feet wide and 5 feet deep, and that approximately 2 feet of soil on each side of the tank will be removed. As recommended by NJDEP, field screening

Engelhard Corporation, Newark, New Jersey

ECRA Case No. 85689

UPDATED DECONTAMINATION PLAN

Procedures for areas to be decommissioned at the Engelhard Delancy Street site were initially described in the Delancy Street Decontamination Plan submitted to NJDEP on March 20, 1987. Several modifications to this plan were subsequently made in August, 1987, and the revised plan is provided as Attachment 1. As of October 1, 1988, several phases of this plan, as well as several additional activities, have been implemented or are being initiated in the following areas:

- Equipment relocation or removal
- Drum removal
- Roof cleanup
- Precious metal (PM) recovery from floors/soils/walls
- Asbestos abatement
- PCB Capacitors
- RCRA Closure
- UGST lines cleaning and capping
- Buildings 4 and 4A demolition
- Effluent holding tank dismantling and planned dismantling
- General site demolition

Activities occurring to date in each of the above areas are described below.

Engelhard Corporation, Newark, New Jersey

ECRA Case No. 85689

I. Equipment Relocation or Removal

Engelhard maintained an inventory until production ceased, which they developed prior to decommissioning, of all equipment used in the production process at the Delancy Street facility. All equipment was decomissioned prior to removal or disposal as detailed in the Revised Decontamination Plan (Attachment 1). Decommissioned equipment is sent either to Engelhard's plant in Seneca, South Carolina, or to other Engelhard locations for reuse; removed from the site by a demolition contractor for salvage or scrap; or maintained on-site. At present no equipment remains on site.

II. Drum Removal

Engelhard contracted ENSI Environmental Services to coordinate the removal of drums and other containers of waste or surplus chemicals. ENSI inventoried all drums, sampling as necessary to identify the contents. Drums were then separated into the following compatibility groups for chemical waste classification streams:

- Acid-generating compounds; inorganic acids; no gas generators
- Inorganics; heavy metals; acid sensitive; gas generators
- Organic compounds; organic acids
- Combustible organics; organic bases
- Inorganic oxidizing agents
- Highly toxic organics

- Alkaline sensitive compounds
- Exceptions and materials requiring very special handling
- Unknowns

After segregation, materials were consolidated, analyzed, waste characterized, repackaged (if necessary) into approved shipping containers, and staged, pending removal from the site. All drums and other containers of waste/surplus chemicals were transported in accordance with applicable regulations to appropriate disposal locations.

Approximately 120 drum-equivalents, including soil cuttings from well installations and soil borings, remain on-site awaiting waste classification prior to final disposition by ENSI.

III. Roof Cleanup

In March 1988, Engelhard began to clean, repair and retar the roofs of Buildings 14 and 26. The gravel and sediment from these two roofs (including the white alumina powder on the roof of Building 26) were vacuumed by long hoses attached to a vacuum truck. When the majority of material was removed by vacuum, a power sweeper was used to push the remaining material (mostly sediments) into piles. The sediment was then contained for appropriate disposal. When the surfaces of the roofs were cleaned and the necessary repairs completed, the roofs were retarred. Regravelling, which is not necessary for roof integrity, was not undertaken.

In June 1988, Engelhard collected sediment samples from the roofs of Buildings 7 and 18 for PM analysis. Analytical results indicated that PM concentrations in the sediments on these roofs are sufficiently high to make recovery economically feasible. Procedures similar to those used for gravel and sediment collection on Buildings 14 and 26 were employed on Buildings 7 and 18, with particular emphasis on dust control to minimize PM loss. The gravel and sediments vacuumed and swept off the roof are contained on-site awaiting to shipment for PM recovery.

Samples were collected from the roof of Building 12 prior to cleaning. The majority of gravel and sediment were hand swept and placed in containers in preparation for PM recovery. On September 21, 1988, several weeks after roof cleaning was completed, a fire broke out in Building 12, destroying a large portion of the roof. Engelhard is making plans to repair the damaged sections of the building and the roof immediately.

IV. Precious Metal Recovery from Floors, Soils and Walls

Precious metal recovery activities have begun in several areas where Engelhard believes PM concentrations are sufficient to make recovery economically feasible. The areas under consideration include portions of the floors of Building 1, portions of the floors in the Building 18 complex, portions of the floors of Greek Alley north of Building 14, portions of the floors of Building 14, the soils from Building 4/4A hill and certain bricks from furnaces in Building 7.

Soil samples have been collected from borings drilled through the floors of Buildings 1, 18, 14 and Greek Alley and from borings completed in Building 4/4A hill to delineate where PM concentrations are sufficiently high to merit recovery. In areas where metal recovery is feasible, the floors have been scarified to a depth at which recoverable PMs are no longer found. In areas where PMs exist in the soils beneath the floors, soils were excavated to a depth at which PMs were no longer found at recoverable concentrations.

The steel platforms in parts of the Building 18 complex were scarified using walnut shell fragments. The resulting material, including the walnut shells onto which the metals are bound, was collected in containers for shipment to the Seneca facility where PMs will be recovered.

Bricks from furnaces in the refinery areas (Buildings 7A and 18) were sent to Seneca for PM recovery. Other bricks from furnace areas were ground or pulverized, sampled, and are presently awaiting shipment for PM recovery.

Soils sampled from the Building 4/4A hill were found to contain recoverable concentrations of PMs. Soils were contained and a portion shipped for PM recovery.

V. Asbestos Abatement

In July 1985, Clayton Environmental Consultants, Inc., performed an asbestos bulk sampling survey at the site for the purpose of identifying asbestos-containing materials in pipe insulation, vessels,

machinery, and equipment. Clayton analyzed all samples for asbestos fiber identification using polarized-light microscopy (PLM) and provided Engelhard with an inventory of asbestos-containing materials at the site. Each location where asbestos was identified was appropriately marked.

In the fall of 1985, Duall Incorporated was retained to remove the friable or damaged asbestos found at the facility. Intact asbestos was left in place at that time. In addition, all equipment designated for use at the Engelhard plant in Seneca, S.C., and other Engelhard sites, was stripped of asbestos insulation prior to shipment. Duall observed all proper procedures for worker safety, air monitoring, government agency notification, and waste manifesting.

During the final phase of decommissioning in the Summer of 1988, Duall Incorporated was retained again to remove all the remaining intact asbestos from the site. Only small quantities of intact asbestos located in inaccessible areas remain on-site.

VI. PCB Capacitors

Approximately 200 PCB-containing capacitors once used at the Engelhard facility have been manifested and shipped by ENSCO for legal disposal at a certified disposal site. Ten capacitors are still in use and will remain on-site until they are no longer needed.

VII. RCRA Closure

On March 23, 1987 Engelhard submitted to NJDEP a partial closure plan for two 1,000-gallon RCRA hazardous waste storage tanks. The tanks, located east of Building 11, are surrounded by a diked area. A Revised Closure Plan was submitted to NJDEP on September 3, 1987, and conditional approval was granted by NJDEP in a letter dated June 8, 1988. Procedures for decontaminating and post-cleaning sampling are outlined in the Revised Closure Plan, with additional conditions stipulated in the June 8, 1988 letter.

The tanks were emptied and all contents were disposed of appropriately. The insides of the tanks were rinsed with pressurized water, scrubbed to loosen any settled solids, and rinsed again with water (or dilute acid if necessary to reduce alkalinity), until the pH of the rinse water was below 12.5.

Because the tanks were used to store metal-containing sludge prior to being used for caustic solution storage, one sample collected from the rinse water was analyzed for priority pollutant metals (PPMs). As conditioned in the June 8, 1988 letter, Engelhard continued cleaning the tanks until metal concentrations in the rinse water collected from the tanks and the containment area attained non-detectable levels.

Soil sampling and testing will be performed around the cement containment dike as soon as the tanks and tank supports are removed.

A New Jersey registered professional engineer will provide written certification that all closure procedures were carried out in accordance with the closure plan.

VIII. Underground Storage Tank Lines Testing Cleaning and Capping

Four underground lines leading from two former 50,000-gallon underground fuel oil tanks to the boiler room in Building 2 and one line to an alternate fill line extending to the incoming transport station on Delancy Street were thought to be possible sources of elevated TPHC levels found in MW14. To explore further the potential source(s) of TPHC concentrations, Equipment and Meter Services performed hydrostatic pressure tests on these underground pipelines between October 21, 1987, and December 21, 1987. The procedures were performed in accordance with the National Fire Protection Association Methods 329 and 329A. A summary of the results from the hydrostatic pressure tests are included in Section V.C.5 of this report. All lines were drained and capped after testing and are no longer in use.

IX. Building 4/4A Demolition

Building 4/4A, which formerly housed PM refining and leaching operations, was demolished in March and April 1988. A portion of the resulting rubble and debris were removed and transported off-site for PM reclamation. Soils remaining on the hill where Building 4/4A formerly stood are being analyzed for potential PM recovery as described above.

X. Dismantling of Effluent Holding Tanks

In the early spring of 1986, Engelhard dismantled and removed the frame and the inner plastic liner of the easternmost effluent holding tank located in the southwest corner of the site. The outer liner was left in place covered with sand.

After notifying NJDEP, Engelhard dismantled the westernmost effluent holding tank in early September 1988. The remaining sections of the frame, as well as the double liner of the westernmost tank and the outer liner of the easternmost tank, were removed in late September 1988.

XI. General Site Demolition, Aboveground Tank Dismantling

In the fall of 1987, Engelhard hired a demolition contractor to assist with dismantling and decommissioning the Delancy Street facility. All excess equipment (i.e., the equipment which Engelhard did not salvage) is in the process of being cleaned, dismantled, and sold or disposed of by the contractor. The equipment and structures removed include aboveground storage tanks; structures such as stairways, lofts, and ladders located inside buildings; piping used to transport process materials; utility piping and duct work; the trestles supporting the pipes and duct work; process equipment, such as furnaces; air pollution control equipment, including scrubbers and filters; cooling towers; roof vents; and several small buildings and storage sheds. The contractor is scheduled to complete all demolition work by early March 1989.

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Engelhard Corporation, Newark, New Jersey

ECRA Case No. 85689

PROPOSED AND ONGOING REMEDIATION OF SELECTED AREAS

A. Introduction

This appendix provides a summary of a number of site remediation activities that are proposed, have been completed or are currently underway within several areas of the Engelhard Delancy Street facility including:

- -- removal of underground storage tanks and remediation of the open pits in AECs 11, 26, and 27;
- -- proposed tank removal and cleanup activities in AEC 35.
- -- removal of the drums found east of Pierson's Creek (AEC 22) and further investigation and remediation of this area.

Figure II-1 (map pocket) illustrates the tank sites in AECs 11, 26, 27 and 35 and the locations of the drums in AEC 22.

B. Completed Sampling and Proposed Cleanup Activities for AECs 11, 26, and 27

Details of the sampling and remediation activities for AECs 11, 26, and 27 are outlined in the Cleanup Plan for the Underground Tank Excavations (ENVIRON, 1987a), submitted to NJDEP in November 1987. The sampling and remediation protocol set forth in this document was discussed with NJDEP in a meeting on December 1, 1987. At this meeting it was agreed that NJDEP would complete its review of the Cleanup Plan, including the statistical analysis of the derivation of background TPHC

levels at the Delancy Street site. To date, no written comments have been received from NJDEP. The three excavations remain open pending NJDEP's approval of ENVIRON's recommendation for further soil excavation and final backfilling of the pits with clean fill.

C. AEC 35 Tank Removal and Sampling Proposal

The area around a 2,000-gallon gasoline tank which lies partially beneath a concrete pad comprises AEC 35. This pad formerly supported a large scrubber apparatus. The tank was emptied and left in place in the late 1970s. As explained in the Revised Sampling Plan (ENVIRON 1987), sampling protocol and cleanup activities for this tank were not addressed with the other underground storage tanks, because until recently the scrubber was still in place, rendering the tank inaccessible. The specific protocol for tank removal and post-excavation sampling is described in a letter dated March 20, 1987 from ENVIRON to the NJDEP Case Manager, Michael Metlitz. A summary of the sampling protocol and analytical methodology is provided below.

1. Sampling Protocol

All or part of the concrete pad will be removed prior to removal of the underground storage tank. Any visibly stained soil encountered during the tank excavation will be removed, provided that such removal does not threaten the integrity of the nearby transformer substation. All material removed from the excavation will be waste classified and sent for off-site disposal.

The underground storage tank will be removed after exposing the top of the tank and excavating as much soil around the tank as possible. When the tank has been removed, post-excavation samples will be collected at 10-foot intervals around the perimeter of the tank excavation at the vertical mid-point of the pit wall for TPHC and BTX analysis. Additional samples will be collected for TPHC and BTX analysis from the center line of the excavation bottom at five-foot intervals, consistent with the guidance set forth in the ECRA Draft Sampling Plan Guide.

If excavation indicates that the bottom of the tank is below the water table, no sampling will be performed below the water table. Perimeter samples, as described above, will be collected and analyzed at an interval approximately six inches above the water table.

The excavation of the tank from AEC 35 most likely will be scheduled in conjunction with the backfilling of AECs 11, 26 and 27. Total cost for tank excavation, removal and disposal; analysis of post-excavation samples; and backfilling the excavation is approximately $10,000.

2. Sampling Methodologies

An ENVIRON field geologist will collect the post-excavation samples. Each sample will be labelled, and the method of collection and sampling location will be recorded in a field notebook. The

samples will be placed in containers prepared and supplied by the laboratory. Strict chain-of-custody procedures will be followed.

To provide quality control, duplicates of approximately five percent of the samples will be collected and analyzed. The effectiveness of field decontamination procedures will be evaluated through the collection of wash blanks (field blanks) for each day of sampling, which will be analyzed for the parameters measured in samples collected on that day.

3. Analytical Methodologies

National Environmental Testing Mid-Atlantic of Thorofare, New Jersey, a state-certified laboratory (NJDEP Certification Number 08153), will analyze all soil and water samples. Total petroleum hydrocarbon analysis will be performed using EPA method 418.1 for aqueous wash blank samples. Soil samples will be analyzed in the same manner following Soxhlet extraction. EPA method 8240 will be used to analyze for BTX in soil samples; and EPA method 624 will be used to analyze for BTX in aqueous wash blank samples.

4. Coordination with NJDEP

NJDEP will be notified in writing if any changes in the methods outlined in this proposal are necessary or if any delays are encountered.

Summarized analytical results will be prepared in tabular form. All documents associated with the sampling and testing (including

laboratory sheets, chain of custody, results of blank analyses, lab chronicles, summary of analytical tuning, and analytical methods used) will be submitted to NJDEP with the analytical data.

D. Investigation of Drums East of Pierson's Creek

Portions of the area east of Pierson's Creek (designated AEC 22) were investigated between March and June 1988 as a result of reports that a drum containing a white caked substance had been found lying on the ground surface in the northern section of AEC 22. Two additional drums were found approximately 100 feet south of the first drum. One of these two drums was found lying on the ground surface and the other was partially buried in a pile of construction debris consisting primarily of concrete blocks, asphalt, steel rods, rubber hose, ceramic, and glass. A small pocket of catalyst beads was also found.

During implementation of the Revised Sampling Plan, IT Corporation sampled and analyzed soils adjacent to these drums (soil samples 2201 and 2202) for PP+40. Arsenic and silver exceeded the site-specific background levels in sample 2201; chromium and silver exceeded these levels in sample 2202.

ENSI Inc. removed the drums and will dispose of the contents in a licensed landfill following waste classification. (Waste classification analyses showed that lead values (504.5 ppm) exceeded the EP Toxicity threshold value by a factor of one hundred. No other parameters were found to exceed allowable levels.) The pocket of beads and the

surrounding soils will be manually removed, waste classified, and disposed of in an appropriate landfill.

After drum removal, ENSI investigated additional areas east of the Creek by manually digging test pits up to 2.5 feet deep in the area near the former drum locations. Digging was focused primarily in what appeared to be several piles of construction debris in the vicinity of AEC 22 (Plate 1). (Large pieces of concrete, asphalt and tangled metal prohibited digging more than several inches below the surface in several locations.) A small, empty hot water heater tank was discovered in a pile of debris near the location where the two drums had been found. A partially exposed, decayed, empty drum was discovered in a pile of soil at the east end of the field. Because the tank and drum were found in piles of debris, it appears as if they were arbitrarily disposed of with the other debris. Post-excavation samples were collected from beneath both the tank and drum for PP+40 analysis. The tank and drum will be removed pending receipt of laboratory results.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

JUL 13 2007

GENERAL NOTICE LETTER
URGENT LEGAL MATTER
PROMPT REPLY NECESSARY
CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Mr. Barry W. Perry, Chairman & CEO
BASF Catalysts LLC
101 Wood Avenue
Iselin, New Jersey 08830

Re: Diamond Alkali Superfund Site, Newark Bay Study Area
Notice of Potential Liability

Dear Mr. Perry:

The United States Environmental Protection Agency ("EPA") is charged with responding to the release and/or threatened release of hazardous substances, pollutants, and contaminants into the environment and with enforcement responsibilities under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. §9601 et seq. Based on the results of previous CERCLA remedial investigation activities and other environmental studies performed at the Diamond Alkali Superfund Site ("Site"), which includes the Lower Passaic River Study Area, EPA has decided to further expand the area of study to include Newark Bay and portions of the Hackensack River, the Arthur Kill, and the Kill Van Kull. This expanded area of the study is known as the Newark Bay Study Area. EPA has documented the release or threatened release of hazardous substances, pollutants and contaminants into the Newark Bay Study Area.

By this letter, EPA is notifying BASF Catalysts ("BASF") of its potential liability relating to the Newark Bay Study Area of the Site pursuant to Section 107(a) of CERCLA, 42 U.S.C. §9607(a). Under CERCLA, potentially responsible parties ("PRPs") include current and past owners and operators, as well as persons who arranged for the disposal or treatment of hazardous substances, or the transport of hazardous substances. Based on information that EPA evaluated during the

course of its investigation, EPA believes that hazardous substances were released from the former Engelhard Corporation facility located at 429 Delancy Street in Newark, New Jersey into the Newark Bay Study Area. Hazardous substances, pollutants and contaminants released from the facility into the Newark Bay Study Area present a risk to the environment and the humans who may ingest contaminated fish and shellfish. Therefore, BASF may be potentially liable for response costs which the government may incur relating to the Newark Bay Study Area. In addition, responsible parties may be required to pay damages for injury to, destruction of, or loss of natural resources, including the cost of assessing such damages.

For the first phase of the Newark Bay Study, the EPA is proceeding with a multi-year study to determine an appropriate remediation plan for the Newark Bay Study Area. The study involves investigation of environmental impacts and pollution sources, as well as an evaluation of alternative actions, leading to recommendations of environmental remediation activities.

You are requested to preserve and retain any documents now in your Company's or its agents' possession or control, that relate in any manner to your facility or the Site or to the liability of any person under CERCLA for response actions or response costs at or in connection with the facility or the Site, regardless of any corporate document retention policy to the contrary.

Enclosed is a list of the other PRPs who have received Notice letters. This list represents EPA's findings on the identities of PRPs to date. We are continuing efforts to locate additional PRPs who have released hazardous substances, directly or indirectly, into the Newark Bay Study Area. Exclusion from the list does not constitute a final determination by EPA concerning the liability of any party for the release or threat of release of hazardous substances into the Newark Bay Study Area. Be advised that notice of your potential liability at the Site may be forwarded to all parties on this list as well as to the Natural Resource Trustees.

We request that you participate in the EPA-approved activities underway as part of the Newark Bay Study. You, along with other such parties, will be expected to both participate in and fund this CERCLA study. For those who choose not to cooperate, EPA may apply the CERCLA enforcement process, pursuant to Sections 106(a) and 107(a) of CERCLA, 42 U.S.C. §9606(a) and §9607(a) and other laws.

In February 2004, EPA signed an Administrative Order on Consent ("AOC") with Occidental Chemical Corporation ("OCC") to conduct a multi-year remedial investigation/feasibility study in Newark Bay pursuant to CERCLA. This study is being conducted by Tierra Solutions, Inc. with EPA oversight. Tierra Solutions, Inc. is an affiliate of the company from which OCC purchased Diamond Shamrock Chemicals (a former owner of a chemical plant at 80 Lister Avenue in Newark, New Jersey), and is performing the work pursuant to that company's indemnity obligation to OCC. Be advised that notice of your potential liability is being forwarded to OCC by EPA.

We strongly encourage you to contact OCC to discuss your participation. You may do so by

contacting:

Carol E. Dinkins, Esq.
Vinson & Elkins LLP
First City Tower
1001 Fannin Street, Suite 2300
Houston, TX 77002-6760
Tel. (713) 758-2528
Fax (713) 615-5311
cdinkins@velaw.com

Written notification should be provided to EPA documenting your intention to participate with OCC and settle with EPA no later than 30 calendar days from your receipt of this letter. The result of any agreement between EPA and your company will need to be memorialized in an AOC. Your written notification should be mailed to:

Amelia M. Wagner, Esq.
Assistant Regional Counsel
U.S. Environmental Protection Agency
290 Broadway, 17th Floor
New York, NY 10007-1866

Pursuant to CERCLA Section 113(k), EPA has established an administrative record that contains documents that will form the basis of EPA's decision on the selection of a response action for the Site. The administrative record files along with the Site file are located at EPA's Region 2 office located at 290 Broadway, New York, NY on the 18th floor. You may call the Records Center at (212) 637-4308 to make an appointment to view the administrative record and/or the Site file for the Diamond Alkali Site, Newark Bay.

Inquiries by counsel or inquiries of a legal nature should be directed to Ms. Wagner at (212) 637-3141. Questions of a technical nature should be directed to Elizabeth Butler, Remedial Project Manager, at (212) 637-4396.

Sincerely yours,

Ray Basso, Strategic Integration Manager
Emergency and Remedial Response Division

Enclosure

COMPANIES ISSUED GENERAL NOTICE LETTERS BY EPA FOR THE NEWARK BAY STUDY AREA OF THE DIAMOND ALKALI SUPERFUND SITE

Mr. Steven Fiverson, President
Amcol Realty Co.
Colt Corporation
Columbia Terminals, Inc.
49 Central Avenue
South Kearny, NJ 07032

Mr. Steven Fiverson, President
Amcol Realty Co.
Colt Corporation
Columbia Terminals, Inc.
P.O. Box 2726
Palm Beach, FL 33480

Mr. Barry W. Perry, Chairman & CEO
BASF Catalysts LLC
101 Wood Avenue
Iselin, New Jersey 08830

Dr. Attila Molnar, President & CEO
Bayer Corporation
100 Bayer Road
Pittsburgh, PA 15205-9741

Chevron Texaco Corporation
Law Department
1111 Bagby Street, Suite 4012
Houston, TX 77002

Bernard Reilly, Esq.
Legal Department
E.I. duPont de Nemours & Company
1007 Market Street
Wilmington, DE 19898

Mr. Gregory B. Kenny, President & CEO
General Cable Industries, Inc.
4 Tesseneer Drive
Highland Heights, KY 41076

David M. Cote, Chief Executive Officer
Honeywell International, Inc.
101 Columbia Road
Morristown, New Jersey 07962

COMPANIES ISSUED GENERAL NOTICE LETTERS BY EPA FOR THE
NEWARK BAY STUDY AREA OF THE DIAMOND ALKALI SUPERFUND SITE

Chief Executive Officer
ISP Environmental Services, Inc.
1361 Alps Road, Bldg. 8
Wayne, NJ 07470-3700

OENJ Cherokee Corporation
c/o Cherokee Investment Partners, LLC
702 Oberlin Road
Suite 150
Raleigh, NC 27605

President
Prentiss, Inc.
C.B. 2000
Floral Park, New York 11001

Mr. Ralph Izzo, President
Public Service Electric & Gas
80 Park Plaza
Newark, New Jersey 07102

Daryl D. Smith, President
Troy Chemical Corporation
8 Vreeland Road
P.O. Box 955
Florham Park, New Jersey 07932