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New York State Department of Environmental Conservation

PHASE III FEASIBILITY STUDY REPORT

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

Booth Oil Site
City of North Tonawanda
Niagara County, New York
(Site Registry No. 9-32-100)

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Consulting Engineers

FEBRUARY 1992

PHASE III FEASIBILITY STUDY
DETAILED ANALYSIS OF ALTERNATIVES
BOOTH OIL INACTIVE
HAZARDOUS WASTE SITE
CITY OF NORTH TONAWANDA, NEW YORK

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Summary

EXECUTIVE SUMMARY

The Booth Oil Inactive Hazardous Waste Site is a former waste oil collection, storage, and reclamation facility located in North Tonawanda, Niagara County, New York. As a New York State Superfund Site (NYSDEC Registry No. 9-32-100), the site was initially characterized during the Phase I Remedial Investigation (RI) to determine the nature and extent of contamination at the site. The Phase I RI involved analysis of existing information and environmental data, and collection and analysis of new data to establish initial site characterization. The Phase II RI provided additional field information necessary to refine and further characterize the site, and better determine the threat to public health and the environment, and the need for remediation. Together, the Phase I/Phase II RI has identified the operable units requiring remediation.

The Phase I/Phase II Feasibility Study (FS) Report (SCS Engineers and Dvirka and Bartilucci Consulting Engineers, 1991) identified and described remedial action alternatives which may be applicable to the operable units at the site, based on the Phase I RI. The Phase I/Phase II FS also recommended the performance of treatabilty studies to further evaluate the effectiveness of several potential treatment technologies. Based on this recommendation, laboratory-scale treatability studies were performed, using contaminated soil from the Booth Oil Site, on three promising treatment technologies.

The purpose of this Phase III FS is to incorporate the results of the Phase II RI and treatability studies to provide a detailed analysis of alternatives. This Phase III FS was prepared in conformance with the New York State Department of Environmental Conservation (NYSDEC) Division of Hazardous Waste Remediation Technical and Administrative Guidance Memorandum (TAGM) for the Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC document HWR-90-4030, 1990).

The Phase I/II RI and Preliminary Baseline Risk Assessment determined that the following areas at the Booth Oil Site require remediation.

- Surface Soil (1 foot thick layer).
- Subsurface Soil (5 feet thick layer, on average).
- Shallow groundwater beneath the site.
- The catch basin/storm sewer system adjacent to the site.
- Waste material in the underground piping network at the site.

For the purposes of the Phase III FS, the surface soil, subsurface soil, piping contents, and sediments removed from the catch basin/storm sewer system are considered a single operable unit. The shallow groundwater beneath the site is considered a second operable unit.

In this Phase III Feasibility Study, seven remedial alternatives are analyzed in general conformance with the selection criteria specified in the NYSDEC TAGM. Each alternative consists of a soil treatment technology, combined with extraction of on-site shallow groundwater, onsite pretreatment (via oil/water separation), and discharge of the pre-treated groundwater to the North Tonawanda wastewater treatment facility. The seven soil treatment technologies evaluated herein are:

- Off-site incineration;
- On-site incineration;
- On-site thermal separation;
- On-site solvent extraction;
- On-site containment;
- Off-site land disposal; and
- No Action.

The selection criteria, as specified in the NYSDEC TAGM, are:

- Compliance with New York State Standards, Criteria, and Guidelines (SCGs);
- Overall protection of human health and the environment;
- Short-term impacts and effectiveness;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility and volume;
- Implementability;
- Cost.

Using the weighting factors assigned by the TAGM for each of the selection criteria, total scores were assigned to each alternative by NYSDEC. In summary, the total scores, with and without cost, are as follows:

Alternative	Score (excluding cost)	Cost ($M)	Total Score (including cost)
On-site Incineration	71	17.5	82
On-site Thermal Separation	70	21.7	81
On-site Solvent Extraction	70	11.8	82
On-site Containment	54	4.2	69
Off-site Disposal	64	13.6	76
Off-site Incineration	78	74.6	78

Based on the detailed evaluation of alternatives presented herein, and the results of the laboratory-scale treatability studies, the NYSDEC preferred alternative consists of the following components:

- On-site treatment of contaminated soil and sewer sediments by thermal separation, solvent extraction, or incineration technologies;

- o Off-site or on-site treatment/destruction of the oily product recovered from the separation process (if separtion is performed);

- o Stabilization of the treated soils and sewer sediments, if necessary, to reduce mobility of inorganic contaminants;

- o Placement of the treated soils and sewer sediments back on site with a topsoil cover and vegetative layer; and

- o Extraction and on-site pre-treatment of shallow groundwater beneath the site for discharge to the North Tonawanda treatment facility. Residues, if any, from on-site groundwater treatment will either be treated/destroyed onsite, or treated, destroyed, and disposed off-site. The Town of North Tonawanda, in conversations with NYSDEC, has indicated that its publicly owned treatment works (POTW) may be able to accept the groundwater from the Booth Oil Site after oil/water separation to remove non aqueous phase liquids. Negotiations with the POTW are ongoing, and appear positive.

A final determination of which of the three on-site treatment technologies will be utilized will be made based on the following factors:

- o Results of on-site pilot-scale treatability studies;
- o Construction/treatment bids and technical data obtained from qualified remediation firms; and
- o Negotiation with the responsible parties.

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SECTION 1

INTRODUCTION

1.1 PURPOSE

The Booth Oil Inactive Hazardous Waste Site is a former waste oil collection, storage, and reclamation facility located in North Tonawada, Niagara County, New York. As a New York State Superfund Site (NYSDEC Registry No. 9-32-100), the site was initially characterized düring the Phase I Remedial Investigation (RI) to determine the nature and extent of the contamination at the site. The Phase I RI involved analysis of existing information and environmental data, and collection and analysis of new data to establish initial site characterization. The Phase II RI provided additional field information necessary to refine and further characterize the site, and better determine the threat to public health and the environment, and the need for remediation. Together, the Phase I/Phase II RI has identified the operable units requiring remediation.

The Phase I/Phase II Feasibility Study (FS) Report (SCS Engineers and Dvirka and Bartilucci Consulting Engineers, 1991) identified and described remedial action alternatives which may be applicable to the operable units at the site, based on the Phase I RI. The purpose of this Phase III FS is to incorporate the results of the Phase II RI and provide a detailed analysis of alternatives on the basis of short-term effectiveness, and long-term effectiveness and permanence, reduction of toxicity, mobility, or volume, implementability, compliance with standards, criteria and guidelines, cost, and protection of human health and the environment. This Phase III FS was prepared in conformance with the New York State Department of Environmental Conservation (NYSDEC) Division of Hazardous Waste Remediation Technical and Administrative Guidance Memorandum (TAGM) for the Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC document HWR-90-4030, 1990).

1.2 OVERVIEW OF EVALUATION CRITERIA

Each of the remedial action alternatives examined in this report will be evaluated on the basis of the following factors:

- o Compliance with New York State Standards, Criteria and Guidelines (SCGs).
- o Overall Protection of Human Health and the Environment.
- o Long-term effectiveness and permanence.
- o Short-term effectiveness.
- o Reduction of Toxicity, Mobility, and volume.
- o Implementability.
- o Cost.

The questions on the scoresheets in the TAGM are used as the basis for the evaluation of each factor. Although the scoresheets are not included in the FS, the questions on the scoresheets are answered in the discussion of each factor.

Applicable New York State standards, criteria and guidelines were initially presented in the Phase I/II RI report. The SCGs presented were chemical-specific standards for the site. Applicable SCGs for a Superfund site also include action-specific and location-specific SCGs. The applicable chemical-specific, location-specific, and action-specific SCGs for the Booth Oil Site are discussed in Section 1.5 of this report. Each of the remedial action alternatives will be evaluated for compliance with these SCGs.

The evaluation of the overall protection of human health and the environment provided by each alternative will discuss the effectiveness of an alternative in reducing human and environmental exposure to contaminants at the site. Also, residual risks existing after remediation will be addressed.

Examination of the long-term effectiveness and permanence of a remedial alternative evaluates whether or not the alternative is considered permanent in accordance with the NYSDEC TAGM. The TAGM considers destruction, separation and treatment, and solidification and chemical fixation of inorganic contaminants as permanent remedies. Containment and off-site land disposal are not considered permanent. The expected lifetime of the alternative and the quantity and nature of waste or residual remaining at the site after remediation are discussed.

Evaluation of the short-term effectiveness of an alternative considers any human health and environmental risks that would exist during implementation of the remedial action. The times to implement the remedial actions and any mitigative measures for the short-term risks are determined.

The evaluation of an alternative on the basis of reduction of toxicity, mobility, and volume discusses the quantity of waste treated or destroyed and the quantity of waste produced in the treatment process. It also examines whether a remedial alternative reduces the mobility of waste at the site by containment or an alternative treatment technology (e.g., stabilization/solidification). The irreversibility of destruction, treatment, or immobilization of the waste constituents is included in this evaluation.

The evaluation of implementability considers difficulties in the construction of the alternative and the reliability of the alternative in meeting applicable performance goals. The evaluation examines the possible need for future remedial actions. The level of coordination required with other agencies and the availability of the technologies in the remedial action are discussed.

The cost evaluation presents the capital and operation and maintenance (O&M) costs of each alternative. For each alternative, a total present worth cost is determined. The accuracy of the costs presented are expected to be within the range of 50 percent greater to 30 percent less than the actual cost of the alternative, in accordance with cost estimate guidance contained in EPA guidance on conducting remedial investigations and feasibility studies under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)(EPA, 1988). The present worth costs of the alternatives are compared.

1.3 IDENTIFICATION OF OPERABLE UNITS

The Phase I/II RI and Preliminary Baseline Risk Assessment determined that the following areas at the Booth Oil Site require remediation.

- Surface Soil (1 foot thick layer).
- Subsurface Soil (5 feet thick layer, on average).
- Shallow groundwater beneath the site.
- The catch basin/storm sewer system.
- Waste material in the underground piping network at the site.

These units are shown in Figure 1-1.

For the purposes of the Phase III FS, the surface soil, subsurface soil, piping contents, and sediments removed from the catch basin/storm sewer system are considered a single operable unit. The shallow groundwater beneath the site is considered a second operable unit.

1.3.1 Surface Soil

The contaminated surface soil at the Booth Oil Site covers an area of approximately 90,000 square feet to a depth of one foot. Approximately 3,300 cubic yards of surface soil require remediation. The soil contains volatile organic compounds (VOCs), semivolatile organic compounds, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and lead at levels exceeding the soil action levels established by the Phase I/II RI. Tables 1-1 and 1-2 present the concentrations of VOCs, semivolatiles (including PAHs), PCBs, and inorganic contaminants, respectively, detected in the surface soil during the Phase I/II RI.

Remediation guidelines were established for specific categories of organic compounds and total lead in the Phase I/II RI. The organic compounds in the specific categories are presented in Table 1-3. The total concentrations of the categories of compounds detected in the surface soil samples during the Phase I/II RI are presented in Tables 1-4 and 1-5.

The Phase I/II RI determined that the surface soils, as well as the subsurface soils, are contaminated near most of the on-site railroad tracks. The railroad would reportedly like to remove many of the existing on-site tracks, and replace them with a few new lines. This work has not been performed because of the ongoing investigation at the site. Track removal and replacement will need to be coordinated with remedial actions for the surface and subsurface soils.

1.3.2 Subsurface Soil

The contaminated subsurface soil at the Booth Oil Site is found over an area of approximately 130,000 square feet with an average depth of 5 feet. Including 1 foot of the underlying clay layer, approximately 26,000 cy of subsurface soil require remediation. This soil contains VOCs, semivolatiles, PAHs, PCBs, and lead at levels exceeding the soil action levels determined in the Phase I/II RI. A large portion of the subsurface soil samples collected in the Phase I/II RI had flash points less than 140°F. However, the soil is not considered a RCRA hazardous waste because RCRA defines liquids with flash points less than 140°F as ignitable hazardous waste. The portions of the soil containing PCBs in concentrations greater than 50 ppm are considered hazardous waste according to 6 New York Code of Rules and Regulations (NYCRR) Part 372. The concentrations of VOCs, semivolatiles (including PAHs), PCBs, and inorganics, respectively, detected in the subsurface soil of the Booth Oil Site during the Phase II of the RI are presented in Table 1-6. Total concentrations of the groups of compounds are exhibited in Tables 1-7 and 1-8.

1.3.3 Groundwater

The shallow groundwater beneath the Booth Oil Site contains VOCs, semivolatile organic compounds, PCBs, and metals at levels exceeding the NYSDEC Class GA groundwater standards/guidelines. Among the 16 VOCs detected at levels above the standards are trichloroethylene, vinyl chloride, and 1,2-dichloroethene. Semivolatiles present above the regulatory limits include phenol, 4-methylphenol, and 2,4-dimethylphenol. PCBs (PCB-1242, PCB-1254, PCB-1260) and metals (antimony, arsenic, chromium, lead, and zinc) also were found at levels exceeding the NYSDEC Class GA Standards/Guidance Values. Tables 1-9 and 1-10 present the concentration of VOCs, semivolatiles (including PAHs), PCBs, and inorganics detected in the monitoring wells at the Booth Oil Site during Phase I and Phase II of the RI, respectively. The total concentrations of the groups of contaminants are exhibited in Tables 1-11 and 1-12.

Non-aqueous phase liquid (NAPL) was detected floating on the water table in two of the monitoring wells at the Booth Oil Site during the Phase I RI, and one of the monitoring wells during the Phase II RI. Analysis of the NAPL detected elevated levels of PCBs and total petroleum hydrocarbons. The concentrations of contaminants in the NAPL are given in Tables 1-9 through 1-12. The NAPL will need to be removed during the remedial action.

The contaminated groundwater at the Booth Oil Site is perched on the clay layer beneath the overlying soil and fill material. It is located primarily in the southwestern part of the site. The Phase I/II RI estimates that a volume of 300,000 gallons of contaminated water is present at the site.

1.3.4 Catch Basin and Storm Sewer System

The catch basin and storm sewer system along Robinson Street south of the Booth Oil Site contains contaminated sediment. Tables 1-13 and 1-14 presents the concentrations of contaminants detected in sediment from the catch basins and manholes, respectively, during the Phase I/II RI. The total concentrations of the specific categories of contaminants in catch basin and manhole sediment samples collected during the Phase I/II RI are exhibited in Tables 1-15 and 1-16. These sediments require remediation. The Phase I/II RI estimates that the volume of sediment is not large.

1.3.5 Waste Material in the Underground Piping Network

NAPL was detected in the underground piping network during the Phase I/II RI. The NAPL contains high levels of PCBs, total petroleum hydrocarbons, and lead. Also, the NAPL exhibits the hazardous waste characteristic of ignitability. The concentrations of contaminants in the NAPL are presented in Table 1-17.

1.4 IDENTIFICATION OF REMEDIAL ACTION ALTERNATIVES FOR DETAILED ANALYSIS

The Phase I/II Feasibility Study Report screened remedial alternatives which may be applicable to the operable units. The alternatives which passed the initial screening, and were thus recommended for subsequent detailed analysis, are presented below.

- On-site containment and a groundwater pump and treat system.
- Soil Treatment by solvent extraction and a groundwater pump and treat system.
- Soil treatment by thermal separation and a groundwater pump and treat system.
- Soil treatment by on-site incineration and a groundwater pump and treat system.
- Soil treatment by off-site incineration and a groundwater pump and treat system.
- Soil treatment by on-site stabilization/solidification and a groundwater pump and treat system.

Each of these alternatives will be examined in detail in this report with the exception of soil treatment by on-site stabilization/solidification. After reviewing the Phase II Remedial Investigation results and the Phase I/II Feasibility Study report, NYSDEC has decided that this technology would not be suitable for the Booth Oil Site.
Stabilization/solidification technologies reduce the mobility of the contaminants. As contaminants are relatively immobile in the hydrogeologic setting of the site, stabilization/solidification would not provide any significant reduction in the potential risks posed by the site. With a final cover placed on the stabilized/solidified waste, the technology provides only minimal improvement over in-place containment. Thus, it will not be considered further in the detailed analysis.

The following alternatives also will be evaluated in detail:

- o Off-site disposal of contaminated soil and a groundwater pump and treat system.

- o No action alternative.

Off-site disposal will be evaluated because it is generally a less costly off-site option than off-site incineration. If contaminant hot spots are excavated prior to on-site containment, the off-site disposal option may be used for the removed soil. The no action alternative is evaluated in accordance with EPA FS guidance.

The Town of North Tonawanda, in conversations with NYSDEC, has indicated that its publicly owned treatment work (POTW) may be able to accept the groundwater from the Booth Oil Site after oil/water separation to remove NAPL. Negotiations with the POTW are ongoing, and appear positive. Thus, treatment technologies for the contaminated groundwater are not evaluated in detail herein. The groundwater pump and treat system evaluated in each of the remedial alternatives will consist only of groundwater extraction, oil/water separation, and discharge to the sanitary sewer.

1.5 NEW YORK STATE STANDARDS, CRITERIA, AND GUIDELINES (SCGs)

As described in the NYSDEC TAGM on Selection of Remedial Action Alternatives at Inactive Hazardous Waste Sites, applicable or relevant and appropriate New York State Standards, Criteria, and Guidelines (SCGs) for the Booth Oil Site can be classified as chemical-specific SCGs, location-specific SCGs, and action-specific SCGs. SCGs (formerly termed "ARARs" and clean-up guidelines) for the Booth Oil Site were previously identified in the Phase I/II RI Report. The following discussion re-introduces SCGs for the Booth Oil Site, and discusses their general applications.

The SCGs are summarized in Table 1-18. They were finalized after a review of CERCLA Compliance with Other Laws Manual: Draft Guidance (EPA, 1988b) and CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental Statutes and State Requirements (EPA, 1989). More specific discussions of SCGs, as they apply to each specific remedial action alternative, are presented in Section 3.

Chemical-specific SCGs for the contaminated soil and sediment at the Booth Oil Site were determined during the Phase I/II RI. The SCGs include limits for total VOCs, total PAHs, total supplemental semivolatile organic compounds (SSOCs), and total lead. These SCGs were established by considering the risk to human health and the environment from direct contact with the contamination or through migration of the contamination in the air, surface water, and groundwater. The established soil cleanup guidelines for the categories are as follows:

Total VOCs - 1 mg/kg
Total PAHs - 100 mg/kg
Total PCBs - 10 mg/kg
Total SSOCs - 10 mg/kg
Total Lead - 500 mg/kg

Chemical-specific groundwater standards/guidance values for the Booth Oil Site are the NYSDEC Class GA groundwater standards an guidance values found in the NYSDEC Technical and Operational Guidance Series (TOGS) dated September 25, 1990.

Applicable chemical-specific standards for air emissions from the Booth Oil Site are the Ambient Guideline Concentrations (AGCs) and National

Emission Standards for Hazardous Air Pollutants (NESHAPS) presented in the NYSDEC's Air Guide-1 (NYSDEC, 1989). The Air Cleanup Criteria established by the NYSDEC will be applicable during remedial operations, particularly if excavation of the contaminated soil is performed. Excavation of the contaminated soil is expected to release toxic vapors and dust. Also, any New York State nuisance odor or noise regulations would be applicable during the remedial action.

The Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act are not SCGs for the site. The perched groundwater is not a source of drinking water. Thus, it will not be necessary to reduce contaminants in the groundwater to the MCL levels.

Although the waste at the site is not a hazardous waste under the Federal Resource Conservation and Recovery Act (RCRA) program, some of the waste is listed as a hazardous waste under New York State's RCRA delegated program. As defined in 6 NYCRR 371, waste material at the site with total PCB concentrations in excess of 50 ppm is a listed hazardous waste. Because New York is authorized to implement the RCRA program, the state hazardous waste regulations are applicable.

The action-specific SCGs at the site depend on the remedial alternative. Alternatives requiring transportation of hazardous waste off-site must comply with the SCGs of the 6 NYCRR Part 372 and the U.S. Department of Transportation regulations regarding shipment of hazardous waste and hazardous materials. On-site incineration of waste material must comply with substantive requirements of 6 NYCRR Part 373, the Clean Air Act, 6 NYCRR Part 212, and Toxic Substances Control Act (TSCA) regulations (under New York State law, remedial actions at state Superfund sites must comply with the substantive requirements of environmental permits). Leaving the waste in place at the site would require capping of the waste area in accordance with 6 NYCRR Part 373 and a minimum of 30 years of post-closure maintenance and groundwater monitoring. Discharge of the perched groundwater to the sanitary sewer system must comply with the pretreatment requirements and concentration limits of the North Tonawanda POTW.

Alternatives involving the excavation and treatment of the contaminated soil and sediment at the Booth Oil Site do not need to comply with the RCRA land disposal restrictions. The waste at the Booth Oil Site is not considered a hazardous waste because it does not possess a hazardous waste characteristic (ignitability, corrosivity, reactivity, or EP Toxicity) for a solid. Half of the soil samples possessed a flash point less than 140 ^{o}F. However, a flash point less than 140 ^{o}F characterizes only liquids as ignitable hazardous waste. One of 25 soil samples collected at the site did fail the EP Toxicity test for lead. This one result cannot be used to characterize all of the contaminated soil at the site as EP Toxic hazardous waste.

FIGURE 1-1

AREAS OF BOOTH OIL SITE REQUIRING REMEDIAL ACTION

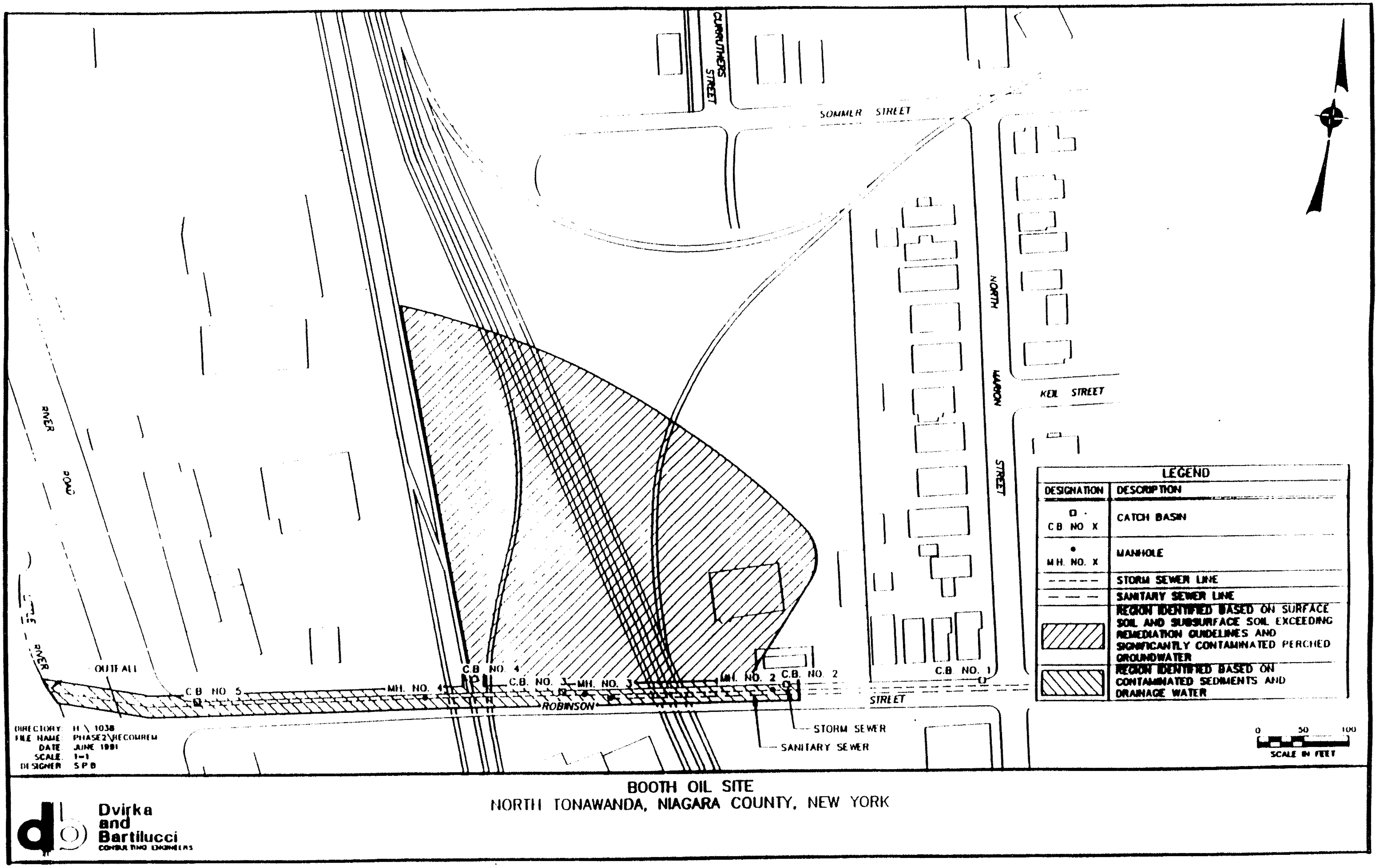


TABLE 1-1
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY*
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acenaphthene	1215	16000	U
Acenaphthylene	27	460	U
Anthracene	47	400	U
Benzo(a)anthracene	180	1500	U
Benzo(b)fluoranthene	346	2900	U
Benzo(k)fluoranthene	137	1800	U
Benzoic acid	25	260	U
Benzo(g,h,i)perylene	63	560	U
Benzo(a)pyrene	110	1000	U
Benzyl alcohol	1	18	U
4-Bromophenyl-phenylether	U	U	U
Butylbenzylphthalate	497	9900	U
4-Chloroaniline	U	U	U
bis(2-Chloroethoxy)methane	U	U	U
bis(2-Chloroethyl)ether	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U
4-Chloro-3-methylphenol	U	U	U
2-Chloronaphthalene	U	U	U
2-Chlorophenol	1	14	U
4-Chlorophenyl-phenylether	U	U	U
Chrysene	1006	8400	U
Dibenzo(a,h)anthracene	10	120	U
Dibenzofuran	30	440	U
Di-n-butylphthalate	767	6700	U
1,2-Dichlorobenzene	484	6500	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	39	890	U
3,3'-Dichlorobenzidine	U	U	U
2,4-Dichlorophenol	U	U	U
Diethylphthalate	17	150	U
2,4-Dimethylphenol	22170	270000	U
Dimethylphthalate	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
bis(2-Ethylhexyl)phthalate	10711	84000	280
Fluoranthene	1304	11000	U
Fluorene	359	4200	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachlorocyclopentadiene	U	U	U
Hexachloroethane	U	U	U
Indeno(1,2,3-cd)pyrene	84	900	U
Isophorone	107	2900	U
2-Methylnaphthalene	17333	190000	41
2-Methylphenol	7670	81000	U
4-Methylphenol	73787	1000000	U
Naphthalene	7762	89000	U
2-Nitroaniline	U	U	U
3-Nitroaniline	U	U	U
4-Nitroaniline	U	U	U
Nitrobenzene	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
N-Nitrosodiphenylamine (1)	411	3800	U
N-Nitroso-di-n-propylamine	U	U	U
Di-n-octylphthalate	199	3400	U
Pentachlorophenol	1	25	U
Phenanthrene	5709	54000	U
Phenol	41504	520000	U
Pyrene	3767	55000	U
1,2,4-Trichlorobenzene	76	1000	U
2,4,6-Trichlorophenol	U	U	U
2,4,5-Trichlorophenol	U	U	U

QUALIFIER	NOTE
U: Analyzed for but not detected	*: Surface and subsurface soil included

TABLE 1-1 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY*
VOLATILE ORGANICS

VOLATILE COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acetone	1381	12000	19
Benzene	154	3000	U
Bromodichloromethane	U	U	U
Bromoform	U	U	U
Bromomethane	U	U	U
2-Butanone	350	1600	U
Carbon Disulfide	5	90	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chloroethane	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dibromochloromethane	U	U	U
1,1-Dichloroethane	718	15000	U
1,1-Dichloroethene	11	230	U
1,2-Dichloroethane	U	U	U
1,2-Dichloroethene (total)	7884	160000	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	4168	75000	U
2-Hexanone	U	U	U
Methylene Chloride	465	6400	U
4-Methyl-2-pentanone	1	13	U
Styrene	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	10163	220000	U
Toluene	14185	300000	U
Trichloroethene	7846	170000	U
1,1,1-Trichloroethane	1058	22000	U
1,1,2-Trichloroethane	U	U	U
Vinyl Acetate	U	U	U
Vinyl Chloride	U	3	U
Xylene (total)	22266	390000	U

QUALIFIER

U: analyzed for but not detected

NOTE

*: Surface and subsurface soil included

TABLE 1-1 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY*
PESTICIDES/PCBs

PESTICIDE/PCB COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Aldrin	0.4	6.7	U
PCB - 1242	3970.6	25000	U
PCB - 1016	U	U	U
PCB - 1232	U	U	U
PCB - 1254	3747.1	39000	U
PCB - 1260	2232.9	13000	U
PCB - 1221	U	U	U
PCB - 1248	7388.2	83000	U
alpha-BHC	U	U	U
beta-BHC	U	U	U
delta-BHC	U	U	U
gamma-BHC	U	U	U
alpha-Chlordane	U	U	U
gamma-Chlordane	U	U	U
4,4'-DDD	2.9	50	U
4,4'-DDE	U	U	U
4,4'-DDT	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	U	U
Endrin-Ketone	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
Methoxychlor	U	U	U
Toxaphene	U	U	U

QUALIFIER

U: Analyzed for but not detected

NOTE

*: Surface and subsurface soil included

TABLE 1-1 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY*
INORGANIC CONSTITUENTS

PARAMETERS	AVERAGE SOIL CONCENTRATION (mg/kg)	MAXIMUM SOIL CONCENTRATION (mg/kg)	MINIMUM SOIL CONCENTRATION (mg/kg)
Aluminum	14692	31600	5690
Antimony	11	156	U
Arsenic	17	80.7	1.4
Barium	472	3170	95.7
Beryllium	1	5.6	0.35
Cadmium	3	19.3	0.29
Calcium	71684	187000	12300
Chromium	43	200	6.6
Cobalt	9	16.8	2.8
Copper	144	1160	23.4
Cyanide	2	8.9	U
Iron	28537	56500	13700
Lead	1912	27700	11.2
Magnesium	25728	57100	6480
Manganese	835	2550	389
Mercury	U	1.7	U
Nickel	29	182	4.8
Potassium	2253	5980	733
Selenium	1	1.9	U
Silver	U	2	U
Sodium	587	1540	214
Thallium	24	443	U
Vanadium	25	47.4	9.4
Zinc	449	3040	74.2

QUALIFIER	NOTE
U: Analyzed for but not detected	*: Surface and subsurface soil included

TABLE 1-1 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY
INORGANIC CONSTITUENTS

PARAMETERS	AVERAGE SOIL CONCENTRATION (mg/kg)	MAXIMUM SOIL CONCENTRATION (mg/kg)	MINIMUM SOIL CONCENTRATION (mg/kg)
Aluminum	14692	31600	5690
Antimony	11	156	U
Arsenic	17	80.7	1.4
Barium	472	3170	95.7
Beryllium	1	5.6	0.35
Cadmium	3	19.3	0.29
Calcium	71684	187000	12300
Chromium	43	200	6.6
Cobalt	9	16.8	2.8
Copper	144	1160	23.4
Cyanide	2	8.9	U
Iron	28537	56500	13700
Lead	1912	27700	11.2
Magnesium	25728	57100	6480
Manganese	835	2550	389
Mercury	U	1.7	U
Nickel	29	182	4.8
Potassium	2253	5980	733
Selenium	1	1.9	U
Silver	U	2	U
Sodium	587	1540	214
Thallium	24	443	U
Vanadium	25	47.4	9.4
Zinc	449	3040	74.2

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-1 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY
PESTICIDES/PCBs

PESTICIDE/PCB COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Aldrin	0.4	6.7	U
PCB - 1242	3970.6	25000	U
PCB - 1016	U	U	U
PCB - 1232	U	U	U
PCB - 1254	3747.1	39000	U
PCB - 1260	2232.9	13000	U
PCB - 1221	U	U	U
PCB - 1248	7388.2	83000	U
alpha-BHC	U	U	U
beta-BHC	U	U	U
delta-BHC	U	U	U
gamma-BHC	U	U	U
alpha-Chlordane	U	U	U
gamma-Chlordane	U	U	U
4,4'-DDD	2.9	50	U
4,4'-DDE	U	U	U
4,4'-DDT	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	U	U
Endrin-Ketone	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
Methoxychlor	U	U	U
Toxaphene	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-1
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acenaphthene	1215	16000	U
Acenaphthylene	27	460	U
Anthracene	47	400	U
Benzo(a)anthracene	180	1500	U
Benzo(b)fluoranthene	346	2900	U
Benzo(k)fluoranthene	137	1800	U
Benzoic acid	25	260	U
Benzo(g,h,i)perylene	63	560	U
Benzo(a)pyrene	110	1000	U
Benzyl alcohol	1	18	U
4-Bromophenyl-phenylether	U	U	U
Butylbenzylphthalate	497	9900	U
4-Chloroaniline	U	U	U
bis(2-Chloroethoxy)methane	U	U	U
bis(2-Chloroethyl)ether	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U
4-Chloro-3-methylphenol	U	U	U
2-Chloronaphthalene	U	U	U
2-Chlorophenol	1	14	U
4-Chlorophenyl-phenylether	U	U	U
Chrysene	1006	8400	U
Dibenzo(a,h)anthracene	10	120	U
Dibenzofuran	30	440	U
Di-n-butylphthalate	767	6700	U
1,2-Dichlorobenzene	484	6500	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	39	890	U
3,3'-Dichlorobenzidine	U	U	U
2,4-Dichlorophenol	U	U	U
Diethylphthalate	17	150	U
2,4-Dimethylphenol	22170	270000	U
Dimethylphthalate	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
bis(2-Ethylhexyl)phthalate	10711	84000	280
Fluoranthene	1304	11000	U
Fluorene	359	4200	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachlorocyclopentadiene	U	U	U
Hexachloroethane	U	U	U
Indeno(1,2,3-cd)pyrene	84	900	U
Isophorone	107	2900	U
2-Methylnaphthalene	17333	190000	41
2-Methylphenol	7670	81000	U
4-Methylphenol	73787	1000000	U
Naphthalene	7762	89000	U
2-Nitroaniline	U	U	U
3-Nitroaniline	U	U	U
4-Nitroaniline	U	U	U
Nitrobenzene	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
N-Nitrosodiphenylamine (1)	411	3800	U
N-Nitroso-di-n-propylamine	U	U	U
Di-n-octylphthalate	199	3400	U
Pentachlorophenol	1	25	U
Phenanthrene	5709	54000	U
Phenol	41504	520000	U
Pyrene	3767	55000	U
1,2,4-Trichlorobenzene	76	1000	U
2,4,6-Trichlorophenol	U	U	U
2,4,5-Trichlorophenol	U	U	U

QUALIFIER

U: Analyzed for but not detected

TABLE 1-1 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY
VOLATILE ORGANICS

VOLATILE COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acetone	1381	12000	19
Benzene	154	3000	U
Bromodichloromethane	U	U	U
Bromoform	U	U	U
Bromomethane	U	U	U
2-Butanone	350	1600	U
Carbon Disulfide	5	90	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chloroethane	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dibromochloromethane	U	U	U
1,1-Dichloroethane	718	15000	U
1,1-Dichloroethene	11	230	U
1,2-Dichloroethane	U	U	U
1,2-Dichloroethene (total)	7884	160000	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	4168	75000	U
2-Hexanone	U	U	U
Methylene Chloride	465	6400	U
4-Methyl-2-pentanone	1	13	U
Styrene	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	10163	220000	U
Toluene	14185	300000	U
Trichloroethene	7846	170000	U
1,1,1-Trichloroethane	1058	22000	U
1,1,2-Trichloroethane	U	U	U
Vinyl Acetate	U	U	U
Vinyl Chloride	U	3	U
Xylene (total)	22266	390000	U

QUALIFIERS

U: analyzed for but not detected

TABLE 1-1 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I CONTAMINATED SOIL SUMMARY
INORGANIC CONSTITUENTS

PARAMETERS	AVERAGE SOIL CONCENTRATION (mg/kg)	MAXIMUM SOIL CONCENTRATION (mg/kg)	MINIMUM SOIL CONCENTRATION (mg/kg)
Aluminum	14692	31600	5690
Antimony	11	156	U
Arsenic	17	80.7	1.4
Barium	472	3170	95.7
Beryllium	1	5.6	0.35
Cadmium	3	19.3	0.29
Calcium	71684	187000	12300
Chromium	43	200	6.6
Cobalt	9	16.8	2.8
Copper	144	1160	23.4
Cyanide	2	8.9	U
Iron	28537	56500	13700
Lead	1912	27700	11.2
Magnesium	25728	57100	6480
Manganese	835	2550	389
Mercury	U	1.7	U
Nickel	29	182	4.8
Potassium	2253	5980	733
Selenium	1	1.9	U
Silver	U	2	U
Sodium	587	1540	214
Thallium	24	443	U
Vanadium	25	47.4	9.4
Zinc	449	3040	74.2

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-2
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II SURFACE SOIL SUMMARY
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acenaphthene	50	120	U
Acenaphthylene	204	820	U
Anthracene	158	470	U
Benzo(a)anthracene	1672	5800	U
Benzo(b)fluoranthene	3342	13000	330
Benzo(k)fluoranthene	487	2700	U
Benzoic acid	58	210	U
Benzo(g,h,i)perylene	552	2800	U
Benzo(a)pyrene	1090	2800	U
Benzyl alcohol	U	U	U
4-Bromophenyl-phenylether	U	U	U
Butylbenzylphthalate	93	290	U
4-Chloroaniline	U	U	U
bis(2-Chloroethoxy)methane	U	U	U
bis(2-Chloroethyl)ether	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U
4-Chloro-3-methylphenol	U	U	U
2-Chloronaphthalene	U	U	U
2-Chlorophenol	U	U	U
4-Chlorophenyl-phenylether	U	U	U
Chrysene	1548	4700	160
Dibenzo(a,h)anthracene	U	U	U
Dibenzofuran	81	250	U
Di-n-butylphthalate	63	150	U
1,2-Dichlorobenzene	6	35	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorobenzidine	U	U	U
2,4-Dichlorophenol	U	U	U
Diethylphthalate	U	U	U
2,4-Dimethylphenol	483	1700	U
Dimethylphthalate	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
bis(2-Ethylhexyl)phthalate	2115	9400	U
Fluoranthene	1553	3800	U
Fluorene	63	140	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachlorocyclopentadiene	U	U	U
Hexachloroethane	U	U	U
Indeno(1,2,3-cd)pyrene	662	3300	U
Isophorone	U	U	U
2-Methylnaphthalene	1275	6900	U
2-Methylphenol	U	U	U
4-Methylphenol	1650	6600	U
Naphthalene	1213	6800	U
2-Nitroaniline	U	U	U
3-Nitroaniline	U	U	U
4-Nitroaniline	U	U	U
Nitrobenzene	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
N-Nitrosodiphenylamine (1)	U	U	U
N-Nitroso-di-n-propylamine	U	U	U
Di-n-octylphthalate	52	110	U
Pentachlorophenol	38	230	U
Phenanthrene	670	1600	U
Phenol	567	2400	U
Pyrene	4655	21000	180
1,2,4-Trichlorobenzene	U	U	U
2,4,6-Trichlorophenol	U	U	U
2,4,5-Trichlorophenol	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-2
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II SURFACE SOIL SAMPLING
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acenaphthene	50	120	U
Acenaphthylene	204	820	U
Anthracene	158	470	U
Benzo(a)anthracene	1672	5800	U
Benzo(b)fluoranthene	3342	13000	330
Benzo(k)fluoranthene	487	2700	U
Benzoic acid	58	210	U
Benzo(g,h,i)perylene	552	2800	U
Benzo(a)pyrene	1090	2800	U
Benzyl alcohol	U	U	U
4-Bromophenyl-phenylether	U	U	U
Butylbenzylphthalate	93	290	U
4-Chloroaniline	U	U	U
bis(2-Chloroethoxy)methane	U	U	U
bis(2-Chloroethyl)ether	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U
4-Chloro-3-methylphenol	U	U	U
2-Chloronaphthalene	U	U	U
2-Chlorophenol	U	U	U
4-Chlorophenyl-phenylether	U	U	U
Chrysene	1548	4700	160
Dibenzo(a,h)anthracene	U	U	U
Dibenzofuran	81	250	U
Di-n-butylphthalate	63	150	U
1,2-Dichlorobenzene	6	35	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorobenzidine	U	U	U
2,4-Dichlorophenol	U	U	U
Diethylphthalate	U	U	U
2,4-Dimethylphenol	483	1700	U
Dimethylphthalate	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
bis(2-Ethylhexyl)phthalate	2115	9400	U
Fluoranthene	1553	3800	U
Fluorene	63	140	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachlorocyclopentadiene	U	U	U
Hexachloroethane	U	U	U
Indeno(1,2,3-cd)pyrene	662	3300	U
Isophorone	U	U	U
2-Methylnaphthalene	1275	6900	U
2-Methylphenol	U	U	U
4-Methylphenol	1650	6600	U
Naphthalene	1213	6800	U
2-Nitroaniline	U	U	U
3-Nitroaniline	U	U	U
4-Nitroaniline	U	U	U
Nitrobenzene	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
N-Nitrosodiphenylamine (1)	U	U	U
N-Nitroso-di-n-propylamine	U	U	U
Di-n-octylphthalate	52	110	U
Pentachlorophenol	38	230	U
Phenanthrene	670	1600	U
Phenol	567	2400	U
Pyrene	4655	21000	180
1,2,4-Trichlorobenzene	U	U	U
2,4,6-Trichlorophenol	U	U	U
2,4,5-Trichlorophenol	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-2 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II SURFACE SOIL SAMPLING
INORGANIC CONSTITUENTS

CONSTITUENTS	AVERAGE SOIL CONCENTRATION (mg/kg)	MAXIMUM SOIL CONCENTRATION (mg/kg)	MINIMUM SOIL CONCENTRATION (mg/kg)
Aluminum	10143	18600	3250
Antimony	3	10.6	U
Arsenic	32	77.9	4
Barium	164	255	72.9
Beryllium	1	3	0.38
Cadmium	1	2.6	0.76
Calcium	50339	109000	7290
Chromium	59	381	16.4
Cobalt	6	8.7	3
Copper	87	254	34.7
Iron	27670	42700	19000
Lead	296	563	102
Magnesium	18909	31100	3610
Manganese	1223	7010	283
Mercury	U	0.74	0.28
Nickel	22	35.1	14.6
Potassium	1546	2130	682
Selenium	1	2.2	0.61
Silver	U	U	U
Sodium	410	795	284
Thallium	U	0.53	U
Vanadium	26	38.7	12.5
Zinc	344	821	217
Cyanide	U	U	U

QUALIFIERS

U: Analyzed for but not detected

Table 1-2
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II SURFACE SOIL SAMPLING
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acenaphthene	50	120	U
Acenaphthylene	204	820	U
Anthracene	158	470	U
Benzo(a)anthracene	1672	5800	U
Benzo(b)fluoranthene	3342	13000	330
Benzo(k)fluoranthene	487	2700	U
Benzoic acid	58	210	U
Benzo(g,h,i)perylene	552	2800	U
Benzo(a)pyrene	1090	2800	U
Benzyl alcohol	U	U	U
4-Bromophenyl-phenylether	U	U	U
Butylbenzylphthalate	93	290	U
4-Chloroaniline	U	U	U
bis(2-Chloroethoxy)methane	U	U	U
bis(2-Chloroethyl)ether	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U
4-Chloro-3-methylphenol	U	U	U
2-Chloronaphthalene	U	U	U
2-Chlorophenol	U	U	U
4-Chlorophenyl-phenylether	U	U	U
Chrysene	1548	4700	160
Dibenzo(a,h)anthracene	U	U	U
Dibenzofuran	81	250	U
Di-n-butylphthalate	63	150	U
1,2-Dichlorobenzene	6	35	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorobenzidine	U	U	U
2,4-Dichlorophenol	U	U	U
Diethylphthalate	U	U	U
2,4-Dimethylphenol	483	1700	U
Dimethylphthalate	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
bis(2-Ethylhexyl)phthalate	2115	9400	U
Fluoranthene	1553	3800	U
Fluorene	63	140	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachlorocyclopentadiene	U	U	U
Hexachloroethane	U	U	U
Indeno(1,2,3-cd)pyrene	662	3300	U
Isophorone	U	U	U
2-Methylnaphthalene	1275	6900	U
2-Methylphenol	U	U	U
4-Methylphenol	1650	6600	U
Naphthalene	1213	6800	U
2-Nitroaniline	U	U	U
3-Nitroaniline	U	U	U
4-Nitroaniline	U	U	U
Nitrobenzene	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
N-Nitrosodiphenylamine (1)	U	U	U
N-Nitroso-di-n-propylamine	U	U	U
Di-n-octylphthalate	52	110	U
Pentachlorophenol	38	230	U
Phenanthrene	670	1600	U
Phenol	567	2400	U
Pyrene	4655	21000	180
1,2,4-Trichlorobenzene	U	U	U
2,4,6-Trichlorophenol	U	U	U
2,4,5-Trichlorophenol	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-3

CATEGORIES OF ORGANIC COMPOUNDS DETECTED
AT THE BOOTH OIL SITE

Volatile Organic Compounds (VOCs)

Acetone
Benzene
Bromomethane
2-Carbon disulfide
Carbon Tetrachloride
Chloroethane
Chloroform
Chloromethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2-Dichloroethane
1,2-Dichloroethene (total)
1,2-Dichloropropane
cis-1,3-Dichloropropene
trans-1,3 Dichloropropene
Ethylbenzene
2-Hexanone
Methylene Chloride
4-Methyl-1-1,2-pentanone
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Tolene
Trichloroethene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Vinyl Acetate
Vinyl Chloride
Xylene (total)

Polycyclic Aromatic Hydrocarbons (PAHs)

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(a)pyrene
Chrysene
Dibenzo(a,h)anthracence
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Naphthalene
Phenanthrene
Pyrene

Polychlorinated Biphenols (PCBs)

PCB Arochlor-1242
PCB Arochlor-1248
PCB Arochlor-1254
PCB Arochlor-1260

Supplemental Semivolatile Organic Compounds (SSOCs)

2,4-Dimethylphenol
2-Methylnaphthalene
2-Methylphenol
4-Methylphenol

TOTAL 1-4
PHASE I SURFACE SOIL SUMMARY
TOTAL CONCENTRATIONS OF SPECIFIC CATEGORIES

SAMPLE LOCATION	TOTAL VOCS (mg/kg)	TOTAL PAHs (mg/kg)	TOTAL SSOCs (mg/kg)	TOTAL PCBs (mg/kg)	TOTAL LEAD (mg/kg)
SS-1	NP	NP	NP	8.2	NP
SS-2	NP	NP	NP	32.0+	NP
SS-3	NP	NP	NP	20.9+	NP
SS-4	NP	NP	NP	1.3	NP
SS-5	0.2	8.8	1.8	43.0+	744+
SS-6	9.4+	2.4	447.8+	51.0+	1390+
SS-7	0.03	11.7	2.6	18.9+	300
SS-8	15.8+	10.5	6.0	43.0+	801+
SS-9	NP	NP	NP	30.1+	NP
SS-10	0.09	4.4	21.1+	112.0+	2280+
SS-11	0.05	10.9	0.2	ND	133
SS-12	0.05	2.8	0.09	ND	103
SS-13	0.03	9.5	0.1	ND	469
SS-14	NP	NP	NP	ND	NP
Remediation Guidelines	1.0	100	10.0	10.0	500

Notes:

SS: Surface Soil
VOC: Volatile Organic Compound
PAH: Polycyclic Aromatic Hydrocarbon
SSOC: Supplemental Semivolatile Organic Compound
PCB: Polychlorinated Biphenyls
NP: Analysis not performed
ND: Analyzed for but not detected
+: Exceeds remediation guideline

TABLE 1-5
PHASE II SURFACE SOIL SUMMARY
TOTAL CONCENTRATIONS OF SPECIFIC CATEGORIES
OF ORGANIC COMPOUNDS AND LEAD

SAMPLE LOCATION	TOTAL VOCs (mg/kg)	TOTAL PAHs (MG/KG)	TOTAL SSOCs (MG/KG)	TOTAL PCBs (MG/KG)	TOTAL LEAD (mg/kg)
SS-15	NP	NP	NP	ND	NP
SS-16	NP	NP	NP	ND	NP
SS-17	0.02	22.2	0.04	ND	NP
SS-18	0.02	8.3	0.02	ND	102
SS-19	0.02	1.4	ND	1.3	427
SS-20	0.04	13.2	ND	0.8	563+
SS-21	164+	86.6	15.2+	143+	372
SS-22	0.02	64.2	0.3	ND	175
SS-23	0.03	8.5	0.2	ND	244
SS-24	0.02	4.3	ND	ND	248
SS-25	0.02	5.7	1.0	3.5	186
SS-26	NP	NP	NP	NP	442
Remediation Guidelines	1.0	100	10.0	10.0	500

Notes:

SS: Surface Soil
VOC: Volatile Organic Compound
PAH: Polycyclic Aromatic Hydrocarbon
SSOC: Supplemental Semivolatile Organic Compound
PCB: Polychlorinated Biphenyls
NP: Analysis not performed
ND: Analyzed for but not detected
+: Exceeds remediation guideline

TABLE 1-6(CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II SUBSURFACE SOIL SUMMARY
PESTICIDES/PCBS

PESTICIDE/PCB COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Aldrin	U	U	U
PCB - 1242	U	U	U
PCB - 1016	U	U	U
PCB - 1232	U	U	U
PCB - 1254	22	110	U
PCB - 1260	U	U	U
PCB - 1221	U	U	U
PCB - 1248	2200	11000	U
alpha-BHC	U	U	U
beta-BHC	3	13	U
delta-BHC	U	U	U
gamma-BHC	U	U	U
alpha-Chlordane	U	U	U
gamma-Chlordane	U	U	U
4,4'-DDD	U	U	U
4,4'-DDE	2	9.9	U
4,4'-DDT	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	U	U
Endrin-Ketone	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
Methoxychlor	U	U	U
Toxaphene	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-6(CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II SUBSURFACE SOIL SUMMARY
VOLATILE ORGANICS

VOLATILE COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acetone	507 B	2200 B	20 B
Benzene	4	22	U
Bromodichloromethane	U	U	U
Bromoform	U	U	U
Bromomethane	U	U	U
2-Butanone	7	28	U
Carbon Disulfide	1	3	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chloroethane	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dibromochloromethane	U	U	U
1,1-Dichloroethane	6	28	U
1,1-Dichloroethene	U	U	U
1,2-Dichloroethane	U	U	U
1,2-Dichloroethene (total)	U	U	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	77	380	U
2-Hexanone	U	U	U
Methylene Chloride	6 B	10 B	U
4-Methyl-2-pentanone	3	16	U
Styrene	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	1	6	U
Toluene	60	280	U
Trichloroethene	U	2	U
1,1,1-Trichloroethane	U	U	U
1,1,2-Trichloroethane	U	U	U
Vinyl Acetate	U	U	U
Vinyl Chloride	U	U	U
Xylene (total)	484	2400	U

QUALIFIERS

B: Compound found in method blank as well as sample
U: Analyzed for but not detected

TABLE 1-6
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II SUBSURFACE SOIL SUMMARY
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	AVERAGE SOIL CONCENTRATION (ug/kg)	MAXIMUM SOIL CONCENTRATION (ug/kg)	MINIMUM SOIL CONCENTRATION (ug/kg)
Acenaphthene	3	16	U
Acenaphthylene	3	16	U
Anthracene	70	220	U
Benzo(a)anthracene	278	710	U
Benzo(b)fluoranthene	613	1500	U
Benzo(k)fluoranthene	60	240	U
Benzoic acid	62	310	U
Benzo(g,h,i)perylene	72	360	U
Benzo(a)pyrene	226	650	U
Benzyl alcohol	U	U	U
4-Bromophenyl-phenylether	U	U	U
Butylbenzylphthalate	360	1800	U
4-Chloroaniline	U	U	U
bis(2-Chloroethoxy)methane	U	U	U
bis(2-Chloroethyl)ether	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U
4-Chloro-3-methylphenol	U	U	U
2-Chloronaphthalene	U	U	U
2-Chlorophenol	U	U	U
4-Chlorophenyl-phenylether	U	U	U
Chrysene	343	840	U
Dibenzo(a,h)anthracene	34	170	U
Dibenzofuran	13	63	U
Di-n-butylphthalate	1388	6900	U
1,2-Dichlorobenzene	U	U	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorobenzidine	U	U	U
2,4-Dichlorophenol	U	U	U
Diethylphthalate	U	U	U
2,4-Dimethylphenol	540	2700	U
Dimethylphthalate	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
bis(2-Ethylhexyl)phthalate	1430	4500	480
Fluoranthene	502	1300	U
Fluorene	7	37	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachlorocyclopentadiene	U	U	U
Hexachloroethane	U	U	U
Indeno(1,2,3-cd)pyrene	80	400	U
Isophorone	U	U	U
2-Methylnaphthalene	24	120	U
2-Methylphenol	U	U	U
4-Methylphenol	174	450	U
Naphthalene	31	80	U
2-Nitroaniline	U	U	U
3-Nitroaniline	U	U	U
4-Nitroaniline	U	U	U
Nitrobenzene	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
N-Nitrosodiphenylamine (1)	U	U	U
N-Nitroso-di-n-propylamine	U	U	U
Di-n-octylphthalate	99	400	U
Pentachlorophenol	U	U	U
Phenanthrene	330	870	U
Phenol	U	U	U
Pyrene	540	1600	U
1,2,4-Trichlorobenzene	U	U	U
2,4,6-Trichlorophenol	U	U	U
2,4,5-Trichlorophenol	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-6(CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II SUBSURFACE SOIL SUMMARY
INORGANIC CONSTITUENTS

CONSTITUENTS	BOSB5CAS 11/13/90 (mg/kg)	BOSB5CS 11/13/90 (mg/kg)
Aluminum	22500	20500
Antimony	U	U
Arsenic	4.3	5.4
Barium	214	126
Beryllium	0.95	1.4
Cadmium	U	U
Calcium	67400	64400
Chromium	33.2	30.4
Cobalt	13.2	12.4
Copper	30.9	28.1
Iron	30500	33300
Lead	26.7	16.8
Magnesium	14500	16800
Manganese	509	549
Mercury	U	U
Nickel	34.4	31.4
Potassium	4910	4880
Selenium	U	U
Silver	U	U
Sodium	1240	1550
Thallium	U	U
Vanadium	40.6	45.4
Zinc	76.4	73.9
Cyanide	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-7
PHASE I SUBSURFACE SOIL SUMMARY
TOTAL CONCENTRATIONS OF SPECIFIC CATEGORIES
OF ORGANIC COMPOUNDS AND LEAD

SAMPLE LOCATION	TOTAL VOCs (mg/kg)	TOTAL PAHs (mg/kg)	TOTAL SSOCs (mg/kg)	TOTAL PCBs (mg/kg)	TOTAL LEAD (mg/kg)
MW-1 (0-2 ft)	37.9	43.1	36.0+	13.0+	286
MW-4 (0-2 ft)	NP	NP	NP	34.2+	NP
MW-5 (4-6 ft)	67.6+	14.0	17.9+	2.5	107
MW-6 (1-4 ft)	7.6	7.6	4.7	67.0	1350+
MW-7 (5-7 ft)	0.05	5.1	0.8	2.3	90
MW-8 (2-4 ft)	NP	NP	NP	8.3	NP
MW-9 (0-2 ft)	NP	NP	NP	24.1+	NP
SB-1 (7-9 ft)	15.7+	9.3	1.8	9.0	157
SB-2 (6-8 ft)	NP	NP	NP	ND	NP
SB-4 (6-8 ft)	NP	NP	NP	3.7	NP
SB-4 (11-13 ft)	0.4	0.07	0.06	ND	11.5
SB-5 (3-7.5 ft)	13734+	213.8	1541.0+	122.0+	27,700+
SB-5 (8-10 ft)	0.4	ND	3.1	ND	16.8
SB-5 (10-12 ft)	0.07	nd	0.5	0.1	26.7
SB-7 (2-4 ft)	25.0+	7.6	11.0+	5.1	100
SB-8 (2-4 ft)	NP	NP	NP	1.4	NP
SB-9 (11-13 ft)	0.5	1.1	0.7	4.2	11.2
SB-10 (0-2 ft)	0.3	0.3	0.04	1.9	171
SB-11 (2-4 ft)	NP	NP	NP	NP	NP
SB-12 (2-4 ft)	0.05	2.5	0.4	ND	119
Remediation Guidelines	1.0	100	10.0	10.0	500

NOTES:

SS: Surface Soil
VOC: Volatile Organic Compound
PAH: Polycyclic Aromatic Hydrocarbon
SSOC: Supplemental Semivolatile Organic Compound
PCB: Polychlorinated Biphenyls
NP: Analysis not performed
ND: Analyzed for but not detected
MW: Monitoring Well
SB: Soil Boring
+: Exceeds remediation guideline

TABLE 1-8
PHASE II SUBSURFACE SOIL SUMMARY
TOTAL CONCENTRATIONS OF SPECIFIC CATEGORIES OF
ORGANIC COMPOUNDS AND LEAD

SAMPLE LOCATION	TOTAL VOCs (mg/kg)	TOTAL PAHs (mg/kg)	TOTAL SSOCs (mg/kg)	TOTAL PCBs (mg/kg)	TOTAL LEAD (mg/kg)
SB-15 (1-2 ft)	5.3+	8.1	0.1	ND	NP
SB-23 (1-2 ft)	0.05	8.8	5.4	11.0	NP
SB-24 (2-4 ft)	0.03	0.5	ND	ND	NP
Remediation Guidelines	1.0	100	10.0	10.0	500

NOTES:

SB: Soil Boring
VOC: Volatile Organic Compound
PAH: Polycyclic Aromatic Hydrocarbon
SSOC: Supplemental Semivolatile Organic Compound
PCB: Polychlorinated Biphenol
NP: Analysis not performed
ND: Analyzed for but detected
+: Exceeds remediation guideline

TABLE 1-9
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I GROUNDWATER SUMMARY
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	AVERAGE GROUNDWATER CONCENTRATION (ug/l)	MAXIMUM GROUNDWATER CONCENTRATION (ug/l)	MINIMUM GROUNDWATER CONCENTRATION (ug/l)
Acenaphthene	0.2	2	U
Acenaphthylene	U	U	U
Anthracene	U	U	U
Benzo(a)anthracene	U	U	U
Benzo(b)fluoranthene	U	U	U
Benzo(k)fluoranthene	U	U	U
Benzoic acid	0.5	5	U
Benzo(g,h,i)perylene	U	U	U
Benzo(a)pyrene	U	U	U
Benzyl alcohol	U	U	U
4-Bromophenyl-phenylether	U	U	U
Butylbenzylphthalate	U	U	U
4-Chloroaniline	U	U	U
bis(2-Chloroethoxy)methane	U	U	U
bis(2-Chloroethyl)ether	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U
4-Chloro-3-methylphenol	U	U	U
2-Chloronaphthalene	U	U	U
2-Chlorophenol	U	U	U
4-Chlorophenyl-phenylether	U	U	U
Chrysene	U	U	U
Dibenzo(a,h)anthracene	U	U	U
Dibenzofuran	0.2	2	U
Di-n-butylphthalate	320.09	3200	U
1,2-Dichlorobenzene	2.5	19	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	0.3	3	U
3,3'-Dichlorobenzidine	U	U	U
2,4-Dichlorophenol	U	U	U
Diethylphthalate	U	U	U
2,4-Dimethylphenol	531.6	3100	U
Dimethylphthalate	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
bis(2-Ethylhexyl)phthalate	38.1	130	U
Fluoranthene	4.2	22	U
Fluorene	0.2	2	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachlorocyclopentadiene	U	U	U
Hexachloroethane	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U
Isophorone	1.4	14	U
2-Methylnaphthalene	64.2	370	U
2-Methylphenol	324	2800	U
4-Methylphenol	1401	12000	U
Naphthalene	75.7	400	U
2-Nitroaniline	U	U	U
3-Nitroaniline	U	U	U
4-Nitroaniline	U	U	U
Nitrobenzene	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
N-Nitrosodiphenylamine (1)	U	U	U
N-Nitroso-di-n-propylamine	U	U	U
Di-n-octylphthalate	3.5	18	U
Pentachlorophenol	U	U	U
Phenanthrene	25.1	84	U
Phenol	391	3800	U
Pyrene	9.7	37	U
1,2,4-Trichlorobenzene	6.4	37	U
2,4,6-Trichlorophenol	U	U	U
2,4,5-Trichlorophenol	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-9 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I GROUNDWATER SUMMARY
VOLATILE ORGANICS

VOLATILE COMPOUNDS	AVERAGE GROUNDWATER CONCENTRATION (ug/l)	MAXIMUM GROUNDWATER CONCENTRATION (ug/l)	MINIMUM GROUNDWATER CONCENTRATION (ug/l)
Acetone	567.2	4500	U
Benzene	79.1	310	0.7
Bromodichloromethane	0.1	1	U
Bromoform	U	U	U
Bromomethane	U	U	U
2-Butanone	U	U	U
Carbon Disulfide	0.2	1	U
Carbon Tetrachloride	0.1	1	U
Chlorobenzene	U	U	U
Chloroethane	U	U	U
Chloroform	41.1	360	U
Chloromethane	U	U	U
Dibromochloromethane	U	U	U
1,1-Dichloroethane	407.7	1800	U
1,1-Dichloroethene	70	600	U
1,2-Dichloroethane	0.2	2	U
1,2-Dichloroethene (total)	14863.8	64000	49
1,2-Dichloropropane	0.1	0.9	U
cis-1,3-Dichloropropene	0.1	1	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	127.4	750	U
2-Hexanone	4.8	42	U
Methylene Chloride	115.8	630	U
4-Methyl-2-pentanone	20.1	180	U
Styrene	0.2	2	U
1,1,2,2-Tetrachloroethane	0.2	2	U
Tetrachloroethene	503.8	2000	U
Toluene	764.9	4100	U
Trichloroethene	381.9	2000	U
1,1,1-Trichloroethane	233.2	1400	U
1,1,2-Trichloroethane	0.1	1	U
Vinyl Acetate	U	U	U
Vinyl Chloride	14757.3	120000	36
Xylene (total)	723.6	4700	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-9 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I GROUNDWATER SUMMARY
PESTICIDES/PCBS

PESTICIDE/PCB COMPOUNDS	AVERAGE GROUNDWATER CONCENTRATION (ug/l)	MAXIMUM GROUNDWATER CONCENTRATION (ug/l)	MINIMUM GROUNDWATER CONCENTRATION (ug/l)
Aldrin	U	U	U
PCB - 1242	423	3300	U
PCB - 1016	U	U	U
PCB - 1232	U	U	U
PCB - 1254	171	1500	U
PCB - 1260	135	870	U
PCB - 1221	U	U	U
PCB - 1248	U	U	U
alpha-BHC	U	U	U
beta-BHC	U	U	U
delta-BHC	U	U	U
gamma-BHC	U	U	U
alpha-Chlordane	U	U	U
gamma-Chlordane	U	U	U
4,4'-DDD	U	U	U
4,4'-DDE	U	U	U
4,4'-DDT	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	0.19	U
Endrin-Ketone	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
Methoxychlor	U	U	U
Toxaphene	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-9 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I GROUNDWATER SUMMARY
INORGANIC CONSTITUENTS

PARAMETER	AVERAGE GROUNDWATER CONCENTRATION (ug/l)	MAXIMUM GROUNDWATER CONCENTRATION (ug/l)	MINIMUM GROUNDWATER CONCENTRATION (ug/l)
Aluminum	18605	41700	5760
Antimony	8	27.6	U
Arsenic	21	45.7	5.2
Barium	457	912	196
Beryllium	1	2	0
Cadmium	2	4.8	1.1
Calcium	303500	591000	163000
Chromium	32	58.8	7.7
Cobalt	17	32.7	5.4
Copper	78	177	17.1
Iron	37875	78700	11300
Lead	143	375	32.6
Magnesium	101525	169000	51700
Manganese	1618	3210	667
Mercury	U	0.24	U
Nickel	51	83.1	21.4
Potassium	17900	30600	13000
Selenium	U	2.4	U
Silver	U	U	U
Sodium	169488	475000	26500
Thallium	U	U	U
Vanadium	39	77.5	9.8
Zinc	238	559	85.7
Cyanide	U	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-9 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I GROUNDWATER SUMMARY
NAPL SAMPLING
VOLATILE ORGANICS

VOLATILE COMPOUNDS	BOMW8GWO 8/7/90 (ug/l)
Acetone	540000 B
Benzene	U
Bromodichloromethane	U
Bromoform	U
Bromomethane	U
2-Butanone	U
Carbon Disulfide	U
Carbon Tetrachloride	U
Chlorobenzene	U
Chloroethane	U
Chloroform	U
Chloromethane	U
Dibromochloromethane	U
1,1-Dichloroethane	U
1,1-Dichloroethene	U
1,2-Dichloroethane	U
1,2-Dichloroethene (total)	U
1,2-Dichloropropane	U
cis-1,3-Dichloropropene	U
trans-1,3-Dichloropropene	U
Ethylbenzene	75000
2-Hexanone	U
Methylene Chloride	U
4-Methyl-2-pentanone	U
Styrene	U
1,1,2,2-Tetrachloroethane	U
Tetrachloroethene	U
Toluene	38000
Trichloroethene	U
1,1,1-Trichloroethane	U
1,1,2-Trichloroethane	U
Vinyl Acetate	34000
Vinyl Chloride	U
Xylene (total)	500000

TENTATIVELY IDENTIFIED COMPOUNDS	AVERAGE QUANTITY (ug/l)
Unknown trimethyl benzene	860000
Unknown ethyl-dimethyl benzene	720000
Unknown methyl benzene	690000
Unknown indene	390000
Unknown	380000
Unknown alkyl benzenes	480000
Unknown cycloalkane	385000

QUALIFIERS

U: Analyzed for but not detected
B: Detected in blank

TABLE 1-9 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I GROUNDWATER SUMMARY
NAPL SAMPLING
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	BOMW8GWO 8/7/90 (mg/kg)
Acenaphthene	U
Acenaphthylene	U
Anthracene	U
Benzo(a)anthracene	U
Benzo(b)fluoranthene	U
Benzo(k)fluoranthene	U
Benzoic acid	U
Benzo(g,h,i)perylene	U
Benzo(a)pyrene	U
Benzyl alcohol	U
4-Bromophenyl-phenylether	U
Butylbenzylphthalate	U
4-Chloroaniline	U
bis(2-Chloroethoxy)methane	U
bis(2-Chloroethyl)ether	U
bis(2-Chloroisopropyl)ether	U
4-Chloro-3-methylphenol	U
2-Chloronaphthalene	U
2-Chlorophenol	U
4-Chlorophenyl-phenylether	U
Chrysene	U
Dibenzo(a,h)anthracene	U
Dibenzofuran	U
Di-n-butylphthalate	U
1,2-Dichlorobenzene	U
1,3-Dichlorobenzene	U
1,4-Dichlorobenzene	U
3,3'-Dichlorobenzidine	U
2,4-Dichlorophenol	U
Diethylphthalate	U
2,4-Dimethylphenol	U
Dimethylphthalate	U
4,6-Dinitro-2-methylphenol	U
2,4-Dinitrophenol	U
2,4-Dinitrotoluene	U
2,6-Dinitrotoluene	U
bis(2-Ethylhexyl)phthalate	130
Fluoranthene	30
Fluorene	75
Hexachlorobenzene	U
Hexachlorobutadiene	U
Hexachlorocyclopentadiene	U
Hexachloroethane	U
Indeno(1,2,3-cd)pyrene	U
Isophorone	U
2-Methylnaphthalene	620
2-Methylphenol	U
4-Methylphenol	U
Naphthalene	290
2-Nitroaniline	U
3-Nitroaniline	U
4-Nitroaniline	U
Nitrobenzene	U
2-Nitrophenol	U
4-Nitrophenol	U
N-Nitrosodiphenylamine (1)	42
N-Nitroso-di-n-propylamine	U
Di-n-octylphthalate	U
Pentachlorophenol	U
Phenanthrene	U
Phenol	U
Pyrene	29
1,2,4-Trichlorobenzene	U
2,4,6-Trichlorophenol	U
2,4,5-Trichlorophenol	U

TENTATIVELY IDENTIFIED COMPOUNDS	AVERAGE QUANTITY (ug/l)
Benzene,1-methyl-3-propyl	1200000
Naphthalene, 1,4,6-trimethyl	690000
Unknown	900000
Total unknown alkanes	1157500
Total unknown benzenes	1120000
Unknown cycloalkane	850000
Unknown cyclohexane	660000
Unknown naphthalene	1200000

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-9 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I GROUNDWATER SUMMARY
NAPL SAMPLING
PESTICIDES/PCBS

PESTICIDE/PCB COMPOUNDS	BOMW8GWO 8/7/90 (mg/kg)
Aldrin	U
PCB - 1242	820
PCB - 1016	U
PCB - 1232	U
PCB - 1254	190
PCB - 1260	U
PCB - 1221	U
PCB - 1248	U
alpha-BHC	U
beta-BHC	U
delta-BHC	U
gamma-BHC	U
alpha-Chlordane	U
gamma-Chlordane	U
4,4'-DDD	U
4,4'-DDE	U
4,4'-DDT	U
Dieldrin	U
Endosulfan I	U
Endosulfan II	U
Endosulfan Sulfate	U
Endrin	U
Endrin-Ketone	U
Heptachlor	U
Heptachlor Epoxide	U
Methoxychlor	U
Toxaphene	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-10
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II GROUNDWATER SUMMARY
SEMIVOLATILE ORGANICS

SEMIVOLATILE COMPOUNDS	BOMW11GW 12/12/90 (ug/l)	BOMW12GW 12/12/90 (ug/l)	BOMW14GW 12/12/90 (ug/l)	BOMW18GW 12/11/90 (ug/l)	AVERAGE GROUNDWATER CONCENTRATION (ug/l)
Acenaphthene	1 J	U	U	U	U
Acenaphthylene	U	U	U	U	U
Anthracene	U	U	U	U	U
Benzo(a)anthracene	U	U	U	U	U
Benzo(b)fluoranthene	U	U	U	U	U
Benzo(k)fluoranthene	U	U	U	U	U
Benzoic acid	U	U	U	U	U
Benzo(g,h,i)perylene	U	U	U	U	U
Benzo(a)pyrene	U	U	U	U	U
Benzyl alcohol	U	U	U	U	U
4-Bromophenyl-phenylether	U	U	U	U	U
Butylbenzylphthalate	U	U	U	U	U
4-Chloroaniline	U	U	U	U	U
bis(2-Chloroethoxy)methane	U	U	U	U	U
bis(2-Chloroethyl)ether	U	U	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U	U	U
4-Chloro-3-methylphenol	U	U	U	U	U
2-Chloronaphthalene	U	U	U	U	U
2-Chlorophenol	U	U	U	U	U
4-Chlorophenyl-phenylether	U	U	U	U	U
Chrysene	U	U	U	U	U
Dibenzo(a,h)anthracene	U	U	U	U	U
Dibenzofuran	U	U	U	U	U
Di-n-butylphthalate	2 J	1 J	U	U	1
1,2-Dichlorobenzene	U	U	U	U	U
1,3-Dichlorobenzene	U	U	U	U	U
1,4-Dichlorobenzene	U	U	U	U	U
3,3'-Dichlorobenzidine	U	U	U	U	U
2,4-Dichlorophenol	U	U	U	U	U
Diethylphthalate	U	U	U	U	U
2,4-Dimethylphenol	U	U	U	110	28
Dimethylphthalate	U	U	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U	U	U
2,4-Dinitrophenol	U	U	U	U	U
2,4-Dinitrotoluene	U	U	U	U	U
2,6-Dinitrotoluene	U	U	U	U	U
bis(2-Ethylhexyl)phthalate	12 B	6 JB	7 JB	11 B	9
Fluoranthene	0.9 J	U	U	U	U
Fluorene	3 J	U	U	6 J	2
Hexachlorobenzene	U	U	U	U	U
Hexachlorobutadiene	U	U	U	U	U
Hexachlorocyclopentadiene	U	U	U	U	U
Hexachloroethane	U	U	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U	U	U
Isophorone	U	U	U	U	U
2-Methylnaphthalene	U	U	U	72	18
2-Methylphenol	U	U	U	22	6
4-Methylphenol	U	U	U	U	U
Naphthalene	2 J	U	U	74 +	19
2-Nitroaniline	U	U	U	U	U
3-Nitroaniline	U	U	U	U	U
4-Nitroaniline	U	U	U	U	U
Nitrobenzene	U	U	U	U	U
2-Nitrophenol	U	U	U	U	U
4-Nitrophenol	U	U	U	U	U
N-Nitrosodiphenylamine (1)	U	U	U	U	U
N-Nitroso-di-n-propylamine	U	U	U	U	U
Di-n-octylphthalate	2 J	U	U	3 J	1
Pentachlorophenol	U	U	U	U	U
Phenanthrene	1 J	U	U	13	4
Phenol	U	U	U	U	U
Pyrene	1 J	U	U	U	U
1,2,4-Trichlorobenzene	U	U	U	U	U
2,4,6-Trichlorophenol	U	U	U	U	U
2,4,5-Trichlorophenol	U	U	U	U	U

QUALIFIERS

B: Compound found in the method blank as well as the sample
J: Compound found below the detection limit
U: Analyzed for but not detected

NOTES

*: Value pertains to each isomer individually
**: Value pertains to total phenols
+: Value exceeds Groundwater Standards/Guidelines

TABLE 1-1 0 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II GROUNDWATER SUMMARY
VOLATILE ORGANICS

VOLATILE COMPOUNDS	AVERAGE GROUNDWATER CONCENTRATION (ug/l)	MAXIMUM GROUNDWATER CONCENTRATION (ug/l)	MINIMUM GROUNDWATER CONCENTRATION (ug/l)
Acetone	1641 B	9500 B	10 B
Benzene	12	52	U
Bromodichloromethane	U	U	U
Bromoform	U	U	U
Bromomethane	U	U	U
2-Butanone	3	26	U
Carbon Disulfide	2	9	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chloroethane	U	U	U
Chloroform	U	U	U
Chloromethane	1	12	U
Dibromochloromethane	U	U	U
1,1-Dichloroethane	310	1200	U
1,1-Dichloroethene	U	U	U
1,2-Dichloroethane	U	U	U
1,2-Dichloroethene (total)	10323	64000	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	U	100	U
2-Hexanone	U	U	U
Methylene Chloride	426	3400	U
4-Methyl-2-pentanone	U	U	U
Styrene	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	U	U	U
Toluene	549	3700	U
Trichloroethene	U	U	U
1,1,1-Trichloroethane	5	62	U
1,1,2-Trichloroethane	U	U	U
Vinyl Acetate	U	U	U
Vinyl Chloride	6013	67000	U
Xylene (total)	212	1200	U

QUALIFIERS

B: Compound found in method blank as well as sample
U: Analyzed for but not detected

TABLE 1-10(CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II GROUNDWATER SUMMARY
PESTICIDES/PCBS

PESTICIDE/PCB COMPOUNDS	BOMW11GW 12/12/90 (ug/l)	BOMW12GW 12/12/90 (ug/l)	BOMW14GW 12/12/90 (ug/l)	BOMW18GW 12/11/90 (ug/l)	AVERAGE GROUNDWATER CONCENTRATION (ug/l)
Aldrin	U	U	U	U	U
PCB - 1242	18	U	U	10	32 *
PCB - 1016	U	U	U	U	U *
PCB - 1232	U	U	U	U	U *
PCB - 1254	6.2	U	U	4	7 *
PCB - 1260	U	U	U	U	U *
PCB - 1221	U	U	U	U	U *
PCB - 1248	U	U	U	U	1 *
alpha-BHC	U	U	U	U	U
beta-BHC	U	U	U	U	U
delta-BHC	U	U	U	U	U
gamma-BHC	U	U	U	U	U
alpha-Chlordane	U	U	U	U	U
gamma-Chlordane	U	U	U	U	U
4,4'-DDD	U	U	U	U	U
4,4'-DDE	U	U	U	U	U
4,4'-DDT	U	U	U	U	U
Dieldrin	U	U	U	U	U
Endosulfan I	U	U	U	U	U
Endosulfan II	U	U	U	U	U
Endosulfan Sulfate	U	U	U	U	U
Endrin	U	U	U	U	U
Endrin-Ketone	U	U	U	U	U
Heptachlor	U	0.04 J	U	U	0.01
Heptachlor Epoxide	U	U	U	U	U
Methoxychlor	U	U	U	U	U
Toxaphene	U	U	U	U	U

QUALIFIERS

J: Compound found below detection limit
U: Analyzed for but not detected
*: Average includes results from MW1 through MW 9.

TABLE 1-10(CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II GROUNDWATER SUMMARY
INORGANIC CONSTITUENTS

CONSTITUENTS	BOMW11GW 12/12/90 (ug/l)	BOMW12GW 12/12/90 (ug/l)	BOMW14GW 12/12/90 (ug/l)	BOMW18GW 12/11/90 (ug/l)	AVERAGE GROUNDWATER CONCENTRATION (ug/l)
Aluminum	52500	50100	25100	57100	46200
Antimony	U	U	U	U	U
Arsenic	29.7 +	26.4 +	18.4	32.5 +	27 +
Barium	508	403	248	630	447
Beryllium	4.7 B+	2.7 B	1.6 B	3.4 B+	3
Cadmium	U	U	U	2.1 B	1
Calcium	220000	325000	196000	436000	294250
Chromium	87.5 +	77.3 +	43.9	90.7 +	75 +
Cobalt	40.8 B	32 B	16.3 B	38.4 B	32
Copper	163	135	108	133	135
Iron	101000 +	81700 +	43200 +	105000 +	82725 +
Lead	759 +	113 +	77.1 +	91.2 +	260 +
Magnesium	60100 +	111000 +	55900 +	134000 +	90250 +
Manganese	1840 +	3120 +	1460 +	2720 +	2285 +
Mercury	0.32	0.28	0.24	0.24	U
Nickel	111	87.6	43.9	98.9	85
Potassium	12000	13300	10100	18200	13400
Selenium	U	U	U	U	U
Silver	U	U	U	U	U
Sodium	18900	60400 +	47400 +	163000 +	72425 +
Thallium	U	U	U	U	U
Vanadium	112	97.9	55.8	112	94
Zinc	654 +	370 +	281	419 +	431 +
Cyanide	U	U	U	U	U

QUALIFIERS

B: Value is between the Instrument Detection Limit (IDL) and the Contract Required Detection Limit (CRDL)
U: Analyzed for but not detected

NOTES

+: Value exceeds Groundwater Standards/Guidelines

TABLE 1-10 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II GROUNDWATER SUMMARY
NAPL SAMPLING
VOLATILE ORGANICS

VOLATILE COMPOUNDS	BOMW8GWO 12/11/90 (ug/kg)
Acetone	19000 B
Benzene	210 J
Bromodichloromethane	U
Bromoform	U
Bromomethane	U
2-Butanone	U
Carbon Disulfide	U
Carbon Tetrachloride	U
Chlorobenzene	U
Chloroethane	U
Chloroform	U
Chloromethane	U
Dibromochloromethane	U
1,1-Dichloroethane	U
1,1-Dichloroethene	U
1,2-Dichloroethane	U
1,2-Dichloroethene (total)	U
1,2-Dichloropropane	U
cis-1,3-Dichloropropene	U
trans-1,3-Dichloropropene	U
Ethylbenzene	37000
2-Hexanone	U
Methylene Chloride	U
4-Methyl-2-pentanone	U
Styrene	U
1,1,2,2-Tetrachloroethane	U
Tetrachloroethene	U
Toluene	5900 JB
Trichloroethene	U
1,1,1-Trichloroethane	U
1,1,2-Trichloroethane	U
Vinyl Acetate	U
Vinyl Chloride	U
Xylene (total)	230000

QUALIFIERS

B: Compound found in method blank as well as sample
J: Compound found below detection limit
U: Analyzed for but not detected

TABLE 1-10 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II GROUNDWATER SUMMARY
NAPL SAMPLING
PCBs

PCB COMPOUNDS	BOMW8GWO 12/11/90 (ug/kg)
PCB - 1016	U
PCB - 1221	U
PCB - 1232	U
PCB - 1242	120000
PCB - 1248	U
PCB - 1254	24000 J
PCB - 1260	U

QUALIFIERS

J: Compound found below detection limit
U: Analyzed for but not detected

TABLE 1-10 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II GROUINDWATER SUMMARY
NAPL SAMPLING
INORGANIC CONSTITUENTS

CONSTITUENTS	BOMW8GWO 12/11/90 (mg/kg)
Aluminum	49.1
Antimony	U
Arsenic	4.8
Barium	50.7
Beryllium	U
Cadmium	U
Calcium	180 BE
Chromium	3.9
Cobalt	U
Copper	3.2 B
Iron	97.9
Lead	46.7
Magnesium	6 B
Manganese	2.3 B
Mercury	U
Nickel	1.9 B
Potassium	U
Selenium	0.56 B
Silver	U
Sodium	106 B
Thallium	U
Vanadium	U
Zinc	6.1
Cyanide	NR

QUALIFIERS

B: Value is between the Instrument Detection Limit (IDL) and the Contract Required Detection Limit (CRDL)
E: Value is estimated due to interference
U: Analyzed for but not detected

NOTES

NR: Not Required

TABLE 1-11
PHASE I GROUNDWATER SUMMARY
TOTAL CONCENTRATIONS FOR SPECIFIC CATEGORIES OF
ORGANIC COMPOUNDS AND LEAD

SAMPLE LOCATION	TOTAL VOCs (ug/l)	TOTAL PAHs (ug/l)	TOTAL SSOCs (ug/l)	TOTAL PCBs (ug/l)	TOTAL LEAD (ug/l)
MW-1	4180	10	13	ND	168
MW-2	529	ND	ND	ND	58
MW-4	194,840	61	3260	ND	33
MW-5	89,580	489	18270	690	147
MW-6	4645	11	1230	2	375
MW-7	236	ND	ND	3	47
MW-8	483	77	59	194	75
MW-8 (NAPL)	1,187,000	424,000	620,000	1,010,000	50,150
MW-9	6155	13	ND	ND	238
SB-9	2318	253	280	5670	NP

NOTES:

MW: Monitoring Well
SB: Soil Boring
VOC: Volatile Organic Compound
PAH: Polycyclic Aromatic Hydrocarbon
SSOC: Supplemental Semivolatile Organic Compound
PCB: Polychlorinated Biphenol
NAPL: Non-Aqueous Phase Liquid
NP: Analysis not performed
ND: Analyzed for but not detected

TABLE 1-12
PHASE II GROUNDWATER SUMMARY
TOTAL CONCENTRATIONS FOR SPECIFIC CATEGORIES OF
ORGANIC COMPOUNDS AND LEAD

SAMPLE LOCATION	TOTAL VOCs (ug/l)	TOTAL PAHs (ug/l)	TOTAL SSOCs (ug/l)	TOTAL PCBs (ug/l)	TOTAL LEAD (ug/l)
MW-1	156	NP	NP	ND	NP
MW-2	828	NP	NP	ND	NP
MW-4	131,030	NP	NP	ND	NP
MW-5	79,500	NP	NP	ND	NP
MW-6	3645	NP	NP	ND	NP
MW-7	106	NP	NP	ND	NP
MW-8	177	NP	NP	429	NP
MW-9	15,340	NP	NP	ND	NP
MW-11	27	9	ND	24	759
MW-12	83	ND	ND	ND	113
MW-14	14	ND	ND	ND	77
MW-18	3264	93	22	14	91
MW-8 (NAPL)					

NOTES:

MW: Monitoring Well
VOC: Volatile Organic Compound
PAH: Polycyclic Aromatic Hydrocarbon
SSOC: Supplemental Semivolatile Organic Compound
PCB: Polychlorinated Biphenols
NAPL: Non-Aqueous Phase Liquid
NP: Analysis not performed
ND: Analyzed for but not detected

TABLE 1-13
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I STORM WATER SEWER SUMMARY
CATCH BASIN SEDIMENT SAMPLING
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	BOCB3SD 6/27/90 (ug/kg)	BOCB3SDRE 6/27/90 (ug/kg)	SOIL CLEANUP CRITERIA (ug/kg)	AVERAGE CB SEDIMENT CONCENTRATIONS [a] (ug/kg)
Acenaphthene	U	U	2220	U
Acenaphthylene	U	U	5140	U
Anthracene	U	U	65000	U
Benzo(a)anthracene	2000	1600	5	1800
Benzo(b)fluoranthene	3700	1500	55	2600
Benzo(k)fluoranthene	U	1200	55	600
Benzoic acid	U	U	167	U
Benzo(g,h,i)perylene	830	U	593110	415
Benzo(a)pyrene	U	U	---	U
Benzyl alcohol	U	U	32	U
4-Bromophenyl-phenylether	U	U	---	U
Butylbenzylphthalate	U	U	---	U
4-Chloroaniline	U	U	---	U
bis(2-Chloroethoxy)methane	U	U	---	U
bis(2-Chloroethyl)ether	U	U	68	U
bis(2-Chloroisopropyl)ether	U	U	---	U
4-Chloro-3-methylphenol	U	U	115	U
2-Chloronaphthalene	U	U	---	U
2-Chlorophenol	U	U	38	U
4-Chlorophenyl-phenylether	U	U	---	U
Chrysene	2300	2100	20	2200
Dibenzo(a,h)anthracene	U	U	713680	U
Dibenzofuran	U	U	---	U
Di-n-butylphthalate	U	U	41000	U
1,2-Dichlorobenzene	U	U	66	U
1,3-Dichlorobenzene	U	U	73	U
1,4-Dichlorobenzene	U	U	92	U
3,3'-Dichlorobenzidine	U	U	---	U
2,4-Dichlorophenol	U	U	0.65	U
Diethylphthalate	U	U	260	U
2,4-Dimethylphenol	U	U	50	U
Dimethylphthalate	U	U	---	U
4,6-Dinitro-2-methylphenol	U	U	---	U
2,4-Dinitrophenol	U	U	---	U
2,4-Dinitrotoluene	U	U	---	U
2,6-Dinitrotoluene	U	U	---	U
bis(2-Ethylhexyl)phthalate	9800	11000	1517325	10400
Fluoranthene	4300	2500	22892	3400
Fluorene	U	U	8180	U
Hexachlorobenzene	U	U	68	U
Hexachlorobutadiene	U	U	74	U
Hexachlorocyclopentadiene	U	U	---	U
Hexachloroethane	U	U	1270	U
Indeno(1,2,3-cd)pyrene	U	U	28	U
Isophorone	U	U	---	U
2-Methylnaphthalene	5200	5100	21250	5150
2-Methylphenol	U	U	---	U
4-Methylphenol	U	U	---	U
Naphthalene	U	U	650	U
2-Nitroaniline	U	U	---	U
3-Nitroaniline	U	U	232	U
4-Nitroaniline	U	U	275	U
Nitrobenzene	U	U	104	U
2-Nitrophenol	U	U	162	U
4-Nitrophenol	U	U	162	U
N-Nitrosodiphenylamine (1)	U	U	---	U
N-Nitroso-di-n-propylamine	U	U	---	U
Di-n-octylphthalate	1600	U	5965	800
Pentachlorophenol	U	U	2555	U
Phenanthrene	6100	4900	57300	5500
Phenol	U	U	0.4	U
Pyrene	1500	2000	210000	1750
1,2,4-Trichlorobenzene	U	U	336	U
2,4,6-Trichlorophenol	U	U	---	U
2,4,5-Trichlorophenol	U	U	62	U

QUALIFIERS

U: Analyzed for but not detected

NOTES

---: Not established

TABLE 1-13 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I STORMWATER SEWER SUMMARY
CATCH BASIN SEDIMENT SAMPLING
VOLATILE ORGANICS

VOLATILE COMPOUNDS	BOCB3SD* 6/27/90 (ug/kg)	BOCB3SDRE* 6/27/90 (ug/kg)	AVERAGE CB SEDIMENT CONCENTRATION (ug/kg)
Acetone	2300	6600	4450
Benzene	U	U	U
Bromodichloromethane	U	U	U
Bromoform	U	U	U
Bromomethane	U	U	U
2-Butanone	1100	2800	1950
Carbon Disulfide	U	U	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chloroethane	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dibromochloromethane	U	U	U
1,1-Dichloroethane	140	230	185
1,1-Dichloroethene	U	U	U
1,2-Dichloroethane	U	190	95
1,2-Dichloroethene (total)	1400	2000	1700
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	210	105
Ethylbenzene	1200	1700	1450
2-Hexanone	U	230	115
Methylene Chloride	590	1400	995
4-Methyl-2-pentanone	U	U	U
Styrene	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	U	680	340
Toluene	1500	1600	1550
Trichloroethene	U	U	U
1,1,1-Trichloroethane	U	U	U
1,1,2-Trichloroethane	U	U	U
Vinyl Acetate	U	U	U
Vinyl Chloride	850	2400	1625
Xylene (total)	3300	5500	4400

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-13 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I STORMWATER SEWER SUMMARY
CATCH BASIN SEDIMENT SAMPLING
INORGANIC CONSTITUENTS

COMPOUNDS	BOCB3SD 6/27/90 (mg/kg)
Aluminum	8760
Antimony	5.6 U
Arsenic	7.1
Barium	141
Beryllium	1 B
Cadmium	2.7
Calcium	126000
Chromium	64.5
Cobalt	3.8 B
Copper	76.9 E
Cyanide	1.5
Iron	18100
Lead	611
Magnesium	33300
Manganese	701
Mercury	0.14 U
Nickel	16.8
Potassium	1300 B
Selenium	0.91 B
Silver	1.2 U
Sodium	1350 B
Thallium	0.63 U
Vanadium	16.8 E
Zinc	388

QUALIFIERS

B : Compound found at a concentration less than contract required detection limit (CRDL) but greater than instrument detection limit (IDL)
E : Value is estimated due to interference
U: Analyzed for but not detected

TABLE 1-13 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I STORMWATER SEWER SUMMARY
CATCH BASIN SEDIMENT SAMPLING
PESTICIDES/PCBS

PESTICIDES/PCB COMPOUNDS	BOCB1SD 6/27/90 (ug/kg)	BOCB2SD 6/27/90 (ug/kg)	BOCB3SD 6/27/90 (ug/kg)	BOCB5SD 6/27/90 (ug/kg)	PRELIMINARY SOIL CLEANUP CRITERIA (ug/kg)	AVERAGE CB SEDIMENT CONCENTRATION (ug/kg)
Aldrin	NA	NA	U	NA	---	U
PCB - 1242	U	13000	13000	1900	85	6975
PCB - 1016	U	U	U	U	85	U
PCB - 1232	U	U	U	U	---	U
PCB - 1254	U	31000	4600	1200	275	9200
PCB - 1260	4500	140000	6800	2200	---	38375
PCB - 1221	U	U	U	U	---	U
PCB - 1248	U	U	U	U	205	U
alpha-BHC	NA	NA	U	NA	---	U
beta-BHC	NA	NA	U	NA	---	U
delta-BHC	NA	NA	U	NA	---	U
gamma-BHC	NA	NA	U	NA	---	U
alpha-Chlordane	NA	NA	U	NA	22	U
gamma-Chlordane	NA	NA	U	NA	22	U
4,4'-DDD	NA	NA	U	NA	---	U
4,4'-DDE	NA	NA	U	NA	---	U
4,4'-DDT	NA	NA	U	NA	---	U
Dieldrin	NA	NA	U	NA	---	U
Endosulfan I	NA	NA	U	NA	---	U
Endosulfan II	NA	NA	U	NA	---	U
Endosulfan Sulfate	NA	NA	U	NA	---	U
Endrin	NA	NA	U	NA	---	U
Endrin-Ketone	NA	NA	U	NA	---	U
Heptachlor	NA	NA	U	NA	---	U
Heptachlor Epoxide	NA	NA	U	NA	---	U
Methoxychlor	NA	NA	U	NA	---	U
Toxaphene	NA	NA	U	NA	---	U

QUALIFIERS

U: Analyzed for but not detected

NOTES

NA: Not Applicable
---: Not established

TABLE 1-14
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II MANHOLE SEDIMENT SAMPLING
SEMIVOLATILE ORGANICS

SEMIVOLATILE COMPOUNDS	BOMH2SD 11/14/90 (ug/kg)	BOMH2SDRE 11/14/90 (ug/kg)	BOMH3SD 11/14/90 (ug/kg)	BOMH3SDDL 11/14/90 (ug/kg)	BOMH4SD 11/14/90 (ug/kg)	AVERAGE SEDIMENT CONCENTRATION (ug/kg)
Acenaphthene	71 J	68 J	1200	1200 JD	390 J	554
Acenaphthylene	U	32 J	U	180 JD	270 J	90
Anthracene	180 J	140 J	1600	1600 JD	860 J	880
Benzo(a)anthracene	620 J+	U	3800 +	4000 D+	3400 +	2607 +
Benzo(b)fluoranthene	1700 +	1500 +	11000 +	8700 D+	13000 +	8567 +
Benzo(k)fluoranthene	U	U	U	U	U	U
Benzoic acid	330 J+	69 J	U	U	U	110
Benzo(g,h,i)perylene	U	U	U	U	U	U
Benzo(a)pyrene	650 J	620 J	3400	3800 D	3800	2617
Benzyl alcohol	U	U	U	U	U	U
4-Bromophenyl-phenylether	U	U	U	U	U	U
Butylbenzylphthalate	590 J	980	3300	4000 D	U	1297
4-Chloroaniline	U	U	U	U	U	U
bis(2-Chloroethoxy)methane	U	U	U	U	U	U
bis(2-Chloroethyl)ether	U	U	U	U	U	U
bis(2-Chloroisopropyl)ether	U	U	U	U	U	U
4-Chloro-3-methylphenol	U	U	U	U	U	U
2-Chloronaphthalene	U	U	U	U	U	U
2-Chlorophenol	U	U	U	U	U	U
4-Chlorophenyl-phenylether	U	U	U	U	U	U
Chrysene	850 +	830 +	5100 +	5000 D+	5700 +	3883 +
Dibenzo(a,h)anthracene	U	U	U	U	U	U
Dibenzofuran	U	57 J	1100	970 JD	410 J	503
Di-n-butylphthalate	150 J	94 J	U	U	U	50
1,2-Dichlorobenzene	U	U	300 J+	290 JD+	U	100 +
1,3-Dichlorobenzene	U	U	U	U	U	U
1,4-Dichlorobenzene	U	U	U	U	100 J	U
3,3'-Dichlorobenzidine	U	U	U	U	U	U
2,4-Dichlorophenol	U	U	U	U	U	U
Diethylphthalate	U	35 J	U	U	U	12
2,4-Dimethylphenol	U	U	450 J+	440 JD+	270 J+	240 +
Dimethylphthalate	U	U	U	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U	U	U	U
2,4-Dinitrophenol	U	U	U	U	U	U
2,4-Dinitrotoluene	U	U	U	U	U	U
2,6-Dinitrotoluene	U	U	U	U	U	U
bis(2-Ethylhexyl)phthalate	1300 B	2100 B	15000 B	14000 BD	14000 B	10100
Fluoranthene	1400	1500	4900	7600 D	4600	3633
Fluorene	U	120 J	1200	1500 JD	420 J	540
Hexachlorobenzene	U	U	U	U	U	U
Hexachlorobutadiene	U	U	U	U	U	U
Hexachlorocyclopentadiene	U	U	U	U	U	U
Hexachloroethane	U	U	U	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U	U	U	U
Isophorone	U	U	U	U	U	U
2-Methylnaphthalene	69 J	52 J	1200	1300 JD	500 J	590
2-Methylphenol	U	U	U	U	U	U
4-Methylphenol	U	22 J	450 J	410 JD	220 J	223
Naphthalene	U	29 J	2000 +	2000 D+	400 J	800
2-Nitroaniline	U	U	U	U	U	U
3-Nitroaniline	U	U	U	U	U	U
4-Nitroaniline	U	U	U	U	U	U
Nitrobenzene	U	U	U	U	U	U
2-Nitrophenol	U	U	U	U	U	U
4-Nitrophenol	U	U	U	U	U	U
N-Nitrosodiphenylamine (1)	U	U	U	U	U	U
N-Nitroso-di-n-propylamine	U	U	U	U	U	U
Di-n-octylphthalate	300 J	790 J	1700	4500 D	1700	1233
Pentachlorophenol	U	U	U	U	U	U
Phenanthrene	840	870	6700	7100 D	3500	3680
Phenol	U	U	U	U	U	U
Pyrene	1500	2100	U	10000 D	U	500
1,2,4-Trichlorobenzene	U	U	580 J+	U	620 J+	400
2,4,6-Trichlorophenol	U	U	U	U	U	U
2,4,5-Trichlorophenol	U	U	U	U	U	U

QUALIFIERS

B: Compound found in method blank as well as sample
D: Value from the diluted run
J: Compound found below the detection limit
U: Analyzed for but not detected

NOTES

---: not established
DL: Diluted run
RE: Reanalysis
+: Value exceeds Soil Cleanup Criteria Guidelines

TABLE 1-14 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II MANHOLE SEDIMENT SAMPLING
VOLATILE ORGANICS

VOLATILE COMPOUNDS	BOMH2SD 11/14/90 (ug/kg)	BOMH3SD 11/14/90 (ug/kg)	BOMH4SD 11/14/90 (ug/kg)	AVERAGE SEDIMENT CONCENTRATION (ug/kg)
Acetone	28 B	1900 JB	3900 B	1943
Benzene	U	U	U	U
Bromodichloromethane	U	U	U	U
Bromoform	U	U	U	U
Bromomethane	U	U	U	U
2-Butanone	U	U	U	U
Carbon Disulfide	U	U	U	U
Carbon Tetrachloride	U	U	U	U
Chlorobenzene	U	U	U	U
Chloroethane	U	U	U	U
Chloroform	U	U	U	U
Chloromethane	U	U	U	U
Dibromochloromethane	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,1-Dichloroethene	U	U	U	U
1,2-Dichloroethane	U	U	U	U
1,2-Dichloroethene (total)	U	U	U	U
1,2-Dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trans-1,3-Dichloropropene	U	U	U	U
Ethylbenzene	U	1300 +	U	433
2-Hexanone	U	U	U	U
Methylene Chloride	4 JB	U	U	1
4-Methyl-2-pentanone	U	U	U	U
Styrene	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U
Tetrachloroethene	U	U	U	U
Toluene	U	1200 +	U	400
Trichloroethene	U	1600 +	U	533
1,1,1-Trichloroethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
Vinyl Acetate	U	U	U	U
Vinyl Chloride	U	U	U	U
Xylene (total)	U	3600 +	U	1200

QUALIFIERS

B: Compound found in method blank as well as sample
J: Compound found below detection limit
U: Analyzed for but not detected

NOTES

---: not established
+: Value exceeds Soil Cleanup Criteria Guidelines

TABLE 1-14 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE II MANHOLE SEDIMENT SAMPLING
PESTICIDE/PCB COMPOUNDS

PESTICIDE/PCB COMPOUNDS	BOMH2SD 11/14/90 (ug/kg)	BOMH3SD 11/14/90 (ug/kg)	BOMH4SD 11/14/90 (ug/kg)	AVERAGE SEDIMENT CONCENTRATION (ug/kg)
Aldrin	U	U	U	U
PCB - 1242	U	U	U	U
PCB - 1016	U	U	U	U
PCB - 1232	U	U	U	U
PCB - 1254	U	U	U	U
PCB - 1260	1500 C	4200 C	8600 C	4767
PCB - 1221	U	U	U	U
PCB - 1248	U	5300 C+	10000 C+	5100
alpha-BHC	U	U	U	U
beta-BHC	U	U	U	U
delta-BHC	U	U	U	U
gamma-BHC	U	U	U	U
alpha-Chlordane	U	U	U	U
gamma-Chlordane	U	U	U	U
4,4'-DDD	U	U	U	U
4,4'-DDE	U	U	U	U
4,4'-DDT	U	U	U	U
Dieldrin	U	U	U	U
Endosulfan I	U	U	U	U
Endosulfan II	U	U	U	U
Endosulfan Sulfate	U	U	U	U
Endrin	U	U	U	U
Endrin-Ketone	U	U	U	U
Heptachlor	U	U	U	U
Heptachlor Epoxide	U	U	U	U
Methoxychlor	U	U	U	U
Toxaphene	U	U	U	U

QUALIFIERS

C: Compound confirmed by GC/MS
U: Analyzed for but not detected

NOTES

---: not established
+: Value exceeds Soil Cleanup Criteria Guidelines

TABLE 1-15
PHASE I STORM SEWER SUMMARY
CATCH BASIN SEDIMENT SAMPLING
TOTAL CONCENTRATIONS OF SPECIFIED CATEGORIES
OF ORGANIC COMPOUNDS AND LEAD

SAMPLE LOCATION	TOTAL VOCs (mg/kg)	TOTAL PAHs (mg/kg)	TOTAL SSOCs (mg/kg)	TOTAL PCBs (mg/kg)	TOTAL LEAD (mg/kg)
Catch Basin No. 1	NP	NP	NP	4.5	NP
Catch Basin No. 2	NP	NP	NP	184.0+	NP
Catch Basin No. 3	27.6+	20.7	5.2	24.4+	611+
Catch Basin No. 5	NP	NP	NP	5.3	NP
Remediation Guidelines	1.0	100	10.0	10.0	500

NOTES:

VOC: Volatile Organic Compound
PAH: Polycyclic Aromatic Hydrocarbon
SSOC: Supplemental Semivolatile Organic Compound
PCB: Polychlorinated Biphenyl
NP: Analysis not performed
+: Exceeds remediation guideline

TABLE 1-16
PHASE II STORM SEWER SUMMARY
MANHOLE SEDIMENT SAMPLING
TOTAL CONCENTRATIONS OF SPECIFIED CATEGORIES
OF ORGANIC COMPOUNDS AND LEAD

SAMPLING LOCATION	TOTAL VOCs (mg/kg)	TOTAL PAHs (mg/kg)	TOTAL SSOCs (mg/kg)	TOTAL PCBs (mg/kg)	TOTAL LEAD (mg/kg)
Manhole No. 2	0.03	7.8	0.07	1.5	NP
Manhole No. 3	465	35	1	18	NP
Manhole No. 4	3.9+	49.5	1.0	18.6+	NP
Manhole No. 6	0.05	NP	NP	NP	NP
Remediation Guidelines	1.0	100	10.0	10.0	500

NOTES:

VOC: Volatile Organic Compound
PAH: Pollycyclic Aromatic Hydrocarbon
SSOC: Supplemental Semivolatile Organic Compound
PCB: Polychlorinated Biphenyl
NP: Analysis not performed
+: Exceeds remediation guideline

TABLE 1-17
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I UNDERGROUND PIPE SAMPLING
SEMIVOLATILE ORGANICS

SEMIVOLATILE ORGANIC COMPOUNDS	BOUST2 6/28/90 (mg/kg)	BOUST3 6/28/90 (mg/kg)
Acenaphthene	U	U
Acenaphthylene	U	U
Anthracene	U	U
Benzo(a)anthracene	130	U
Benzo(b)fluoranthene	92	U
Benzo(k)fluoranthene		U
Benzoic acid	U	U
Benzo(g,h,i)perylene	U	U
Benzo(a)pyrene	U	U
Benzyl alcohol	U	U
4-Bromophenyl-phenylether	U	U
Butylbenzylphthalate	110	U
4-Chloroaniline	U	U
bis(2-Chloroethoxy)methane	U	U
bis(2-Chloroethyl)ether	U	U
bis(2-Chloroisopropyl)ether	U	U
4-Chloro-3-methylphenol	U	U
2-Chloronaphthalene	U	U
2-Chlorophenol	U	U
4-Chlorophenyl-phenylether	U	U
Chrysene	88	U
Dibenzo(a,h)anthracene	U	U
Dibenzofuran	U	U
Di-n-butylphthalate	91	49
1,2-Dichlorobenzene	U	U
1,3-Dichlorobenzene	U	U
1,4-Dichlorobenzene	U	U
3,3'-Dichlorobenzidine	U	U
2,4-Dichlorophenol	U	U
Diethylphthalate	U	U
2,4-Dimethylphenol	U	U
Dimethylphthalate	U	U
4,6-Dinitro-2-methylphenol	U	U
2,4-Dinitrophenol	U	U
2,4-Dinitrotoluene	U	U
2,6-Dinitrotoluene	U	U
bis(2-Ethylhexyl)phthalate	300	260
Fluoranthene	91	50
Fluorene	45	U
Hexachlorobenzene	U	U
Hexachlorobutadiene	U	U
Hexachlorocyclopentadiene	U	U
Hexachloroethane	U	U
Indeno(1,2,3-cd)pyrene	U	U
Isophorone	U	U
2-Methylnaphthalene	590	U
2-Methylphenol	U	U
4-Methylphenol	U	U
Naphthalene	140	U
2-Nitroaniline	U	U
3-Nitroaniline	U	U
4-Nitroaniline	U	U
Nitrobenzene	U	U
2-Nitrophenol	U	U
4-Nitrophenol	4700	U
N-Nitrosodiphenylamine (1)	U	U
N-Nitroso-di-n-propylamine	U	U
Di-n-octylphthalate	93	U
Pentachlorophenol	U	U
Phenanthrene	150	U
Phenol	U	U
Pyrene	130	48
1,2,4-Trichlorobenzene	U	U
2,4,6-Trichlorophenol	U	U
2,4,5-Trichlorophenol	U	U

QUALIFIERS

B: Compound found in method blank as well as in sample
J: Value found below the detection limit
U: Analyzed for but not detected

TABLE 1-17 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I UNDERGROUND PIPE SAMPLING
VOLATILE ORGANICS

VOLATILE COMPOUNDS	BOUST2* 6/28/90 (ug/kg)	BOUST3* 6/28/90 (ug/kg)	BOUST3RE* 6/28/90 (ug/kg)
Acetone	16000	2400	1900
Benzene	650	U	U
Bromodichloromethane	U	U	U
Bromoform	U	U	U
Bromomethane	U	U	U
2-Butanone	3600	330	860
Carbon Disulfide	U	U	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chloroethane	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dibromochloromethane	U	U	U
1,1-Dichloroethane	U	U	U
1,1-Dichloroethene	U	U	U
1,2-Dichloroethane	U	U	U
1,2-Dichloroethene (total)	U	U	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	7000	U	U
2-Hexanone	2300	U	U
Methylene Chloride	3100	U	310
4-Methyl-2-pentanone	3700	U	U
Styrene	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	10000	U	U
Toluene	11000	U	150
Trichloroethene	5100	U	U
1,1,1-Trichloroethane	4400	U	U
1,1,2-Trichloroethane	U	U	U
Vinyl Acetate	U	U	U
Vinyl Chloride	U	U	U
Xylene (total)	47000	100	U

QUALIFIERS

B: Compound found in method blank as well as in sample
J: Compound present but below the detection limit
U: Analyzed for but not detected

NOTES

RE: Re-analysis
*: Samples analyzed at medium level

TABLE 1-17 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I UNDERGROUND PIPE SAMPLING
INORGANIC CONSTITUENTS

PARAMETER	BOUST2 6/28/90 (mg/kg)	BOUST3 6/28/90 (mg/kg)
Aluminum	114	44.1
Antimony	U	U
Arsenic	1.1	1.9
Barium	9.6	106
Beryllium	U	U
Cadmium	0.18	U
Calcium	136	197
Chromium	5.9	3.7
Cobalt	0.22	U
Copper	10.8	1.7
Iron	785	346
Lead	51.9	67.3
Magnesium	6.8	15.9
Manganese	4.7	3.7
Mercury	U	U
Nickel	4.5	1.2
Potassium	U	40.7
Selenium	U	0.31
Silver	U	U
Sodium	61.4	62.1
Thallium	U	U
Vanadium	2.1	3.7
Zinc	58.1	14.7
Cyanide	U	U

QUALIFERS

B: Compound found at a concentration less than contract required detection limit (CRDL) but greater than instrument detection limit (IDL)
E: Value is estimated due to interference
U: Analyzed for but not detected

TABLE 1-17 (CONTINUED)
BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
PHASE I UNDERGROUND PIPE SAMPLING
PESTICIDES/PCBS

PESTICIDE/PCB COMPOUNDS	BOUST2 6/28/90 (ug/kg)	BOUST3 6/28/90 (ug/kg)
Aldrin	U	U
PCB - 1242	U	280000
PCB - 1016	U	U
PCB - 1232	U	U
PCB - 1254	U	U
PCB - 1260	U	180000
PCB - 1221	U	U
PCB - 1248	U	U
alpha-BHC	U	U
beta-BHC	U	U
delta-BHC	U	U
gamma-BHC	U	U
alpha-Chlordane	U	U
gamma-Chlordane	U	U
4,4'-DDD	U	U
4,4'-DDE	U	U
4,4'-DDT	U	U
Dieldrin	U	U
Endosulfan I	U	U
Endosulfan II	U	U
Endosulfan Sulfate	U	U
Endrin	U	U
Endrin-Ketone	U	U
Heptachlor	U	U
Heptachlor Epoxide	U	U
Methoxychlor	U	U
Toxaphene	U	U

QUALIFIERS

U: Analyzed for but not detected

TABLE 1-18
APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK
STATE STANDARDS, CRITERIA, AND GUIDELINES (SCGs)
FOR THE BOOTH OIL SITE

SCG	APPLICATION
NYSDEC Soil Cleanup Criteria Guidelines	Cleanup of contaminated soil
NYSDEC Standards and Guidelines for Class GA Groundwater	Cleanup of perched groundwater
New York State Guidelines for the Control of Toxic Ambient Air Contaminants	Air emissions from on-site incineration and on-site thermal separation
Air Cleanup Criteria of NYSDEC Division of Air Resources	Air emissions from on-site incineration or on-site thermal separation, remedial operations
AIR/SUPERFUND NATIONAL TECHNICAL GUIDANCE STUDY SERIES	Air emissions from on-site incineration or on-site thermal separation, remedial operations
ACGIH Threshold Limiting Values	Air emissions from remedial operations, including excavation
National Ambient Air Quality Standards (NAAQS)	Air emissions from on-site incineration, on-site thermal separation
Target Concentrations for the High-risk Chemicals identified in the Health Risk Assessment	Cleanup of contaminated soil and perched groundwater

TABLE 1-18 (CONTINUED)

SCG	APPLICATION
6 NYCRR 372-373	Transportation and disposal of PCB contaminated (>50 ppm) soil
U.S. Department of Transportation Hazardous Materials Transportation Regulations	Transportation of PCB contaminated (>50 ppm) soil to an off-site landfill or incinerator
40 CFR 264 Part O Standards for incinerators	On-site and off-site incineration of the contaminated soil
40 CFR 264 Part N Standards for landfills	On-site containment/capping
North Tonawanda POTW Pretreatment Guidelines	Discharge of perched groundwater to the POTW
Occupational Safety and Health Administration (OSHA) Regulations of 40 CFR 1910	Worker training, work practices, and worker protection for remedial operations
NYS Uniform Procedures Act	Dicharge of perched groundwater to the POTW

Section 2

SECTION 2

DESCRIPTION OF REMEDIAL ALTERNATIVES

In this section, the alternatives for remediation of the contaminated shallow groundwater and surface and subsurface soil are outlined. In subsequent sections, each alternative will be evaluated on the basis of compliance with New York State SCGs, overall protection of human health and the environment, short-term impacts and effectiveness, long-term effectiveness and permanence, reduction of toxicity, mobility, and volume, implementability, and cost.

2.1 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES FOR GROUNDWATER

The remedial action at the Booth Oil Site will consist of remediation of the contaminated shallow groundwater and surface and subsurface soil. The remedial alternative described below for the groundwater will be performed in combination with a remedial alternative for the soils, unless the no action alternative is implemented.

The Town of North Tonawanda POTW has stated that they may be willing to accept pretreated groundwater from the Booth Oil Site. The only remedial action alternative that will be evaluated for treatment of the groundwater is groundwater extraction, followed by oil/water separation and discharge to the sanitary sewer. In this alternative, groundwater at the site will be extracted with a series of extraction wells or trench drains. The groundwater in the extraction wells (Figure 2-1) or trench drains (Figure 2-2) will be pumped to an oil/water separator (Figure 2-3) where the NAPL particles coalesce and float to the surface of the aqueous phase. The NAPL phase is skimmed off for destruction by off-site incineration. Because the NAPL exhibits the RCRA characteristic of ignitability and also contains PCBs, incineration at a unit having both RCRA and TSCA permits will be required. Water from the oil/water separator will be discharged directly to the sanitary sewer at one of the manholes along Robinson Street.

2.1 REMEDIAL ACTION ALTERNATIVES FOR CONTAMINATED SURFACE AND SUBSURFACE SOILS

The following alternatives will be evaluated in detail for remediation of the contaminated surface and subsurface soil at the Booth Oil Site.

- o On-site Containment.
- o On-site Treatment by Incineration.
- o Off-site Treatment by Incineration.
- o On-site Treatment by Thermal Separation.
- o On-site Treatment by Solvent Extraction.
- o Off-site Disposal.
- o No Action Alternative.

Each of these alternatives is described below.

2.2.1 Alternative A: On-site Containment

In this alternative, a slurry wall and cover system would be constructed at the Booth Oil Site. A slurry wall three feet in thickness and to a depth sufficient to key into the underlying clay layer would be placed around the area of contamination at the site. The depth of the slurry wall is estimated at ten feet. A cover would be constructed over the surface and subsurface soil requiring remediation. The cover would consist of an impermeable layer of compacted clay or other material which prevents infiltration of precipitation to the waste material. The impermeable layer may be overlain by a drainage layer and topsoil with vegetative cover.

A typical RCRA cover ranges in thickness from about five to seven feet, depending on the specific materials and thicknesses specified in the multi-layer design. The presence of on-site railroad tracks makes such a cover non-desirable for the Booth Oil Site. The use of alternate materials (e.g. a layer of asphalt or a thin layer of bentonite rather than several feet of standard low permeability clay) will be evaluated for use at the site.

Construction of the slurry wall and cover would be performed in coordination with the railroad. The railroad plans to remove many of the existing tracks which run through the site, including the arced track running through the northeast portion of the area of contamination and three of the four tracks running straight through the middle of the site.

These four tracks will not be replaced. The fourth track through the middle of the site will be removed for the remedial action and then reestablished. The arced track bisecting the western part of the site will be re-routed north of the site to join together with the tracks on the western border.

The railroad's plans present a couple of possibilities for the construction of the slurry wall.

- One slurry wall could encircle the entire area of contamination. The wall would key into the clay layer beneath the site to a depth of ten feet.

- Two slurry walls could be placed around two portions of the area of contamination after all of the contaminated soil is consolidated in these two areas. One wall could be constructed around the area of contamination west of the tracks running through the center of the site. The other wall could surround the part of the area of contamination east of the tracks. In order to construct the two walls, contaminated soil beneath the central tracks, within twenty feet of both sides of the central tracks, and within twenty feet of Robinson Street (if necessary) and the tracks bordering the site to the west would be excavated and placed in the area of contamination. Clean soil would be backfilled. The walls would then be constructed. Each wall would extend down both sides of the new central track corridor.

These two options are presented in Figure 2-4. Depending on the slurry wall option, there are a few possibilities for construction of the cover.

If one slurry wall is placed around the site, the railroad would remove the tracks prior to placement of the cover. The layer of contaminated soil beneath the tracks then could be excavated and placed elsewhere on the area of contamination. After backfilling with clean soil and grading, the cover would be constructed over the entire area. The new tracks would be constructed on the impermeable layer. An impermeable layer of asphalt or similar low permeability material then would be placed between the new tracks and on both sides of the tracks. The drainage layer, topsoil, and vegetative cover would be placed over the parcels of land created by the new tracks. In this option, the railroad would be out of service during the entire cover construction period. This may not be acceptable to the railroad.

In another option with one slurry wall, the railroad would remove the tracks and replace them immediately after excavation of the contaminated soil beneath the tracks and backfilling. A layer of asphalt or other low permeability material then would be placed between the new tracks and to each side of the tracks to prevent infiltration of precipitation. The impermeable layer, drainage layer, topsoil, and vegetative cover then would be placed over the parcels of land requiring remediation.

In a third option, the existing tracks and underlying contamination could be removed and clean soil backfilled prior to placing the new tracks. Contaminated soil within twenty feet of both sides of the new-track corridor, the tracks bordering the site to the west, and Robinson Street (if necessary) would be excavated and placed on the area of contamination. The slurry walls would be constructed, extending down both sides of the clean track corridor. The cover system would be keyed into the slurry walls, leaving a clean track corridor between contained areas of the site. In this option, the impermeable cover barrier and slurry wall would not need to be established and maintained beneath the tracks, resulting in reduced down time for the railroad and minimized long-term threats to the impermeable containment structures.

Construction of one slurry wall around the site may involve construction beneath railroad tracks that are in place. This construction is difficult, but can be accomplished. Also, it may be necessary to construct the southern portion of the slurry wall in Robinson Street so that the slurry wall is not in contact with the waste it is designed to contain. This construction can be performed, but would require the closing of a segment of Robinson Street for several days. The presence of soil contaminants at or near the property boundaries may also require other portions of the slurry wall to be constructed off-site, thereby creating an additional implementation problem.

2.2.2 Alternative B: On-site Treatment by Incineration

This alternative involves the excavation and on-site incineration of approximately 29,300 cubic yards of contaminated soil. Incineration of the soil would be performed by a mobile incinerator at the site. Excavation of the soil would be performed beneath a temporary, portable structure so that toxic vapors and nuisance odors can be prevented from reaching the surrounding community. As previously mentioned, excavation of the soil, particulary in the vicinity of the railroad tracks, would be performed in coordination with the railroad. Excavated material would be stockpiled prior to incineration. To control dust, the stockpile would be wetted. The air beneath the hood would be treated for removal of the toxic vapors and nuisance odors prior to discharge to the atmosphere. Treated soil would be stabilized and backfilled at the site and vegetative cover would be established.

A potential structure which may be used for the excavation is a Sprung Structure. A Sprung Structure was used to cover the area being excavated during remediation of the McColl Superfund Site in California. Sprung Structures are available in custom sizes, and can be moved around the site using a crane. The structure is amenable to collection of off-gas for vapor phase treatment. At the McColl Site, air beneath the structure was processed through a vapor treatment system consisting of a HEPA filter, wet scrubber, and carbon filter. Workers were required to perform the excavation in Level A personal protective equipment (PPE) because of the levels of volatiles generated during the excavation. At the Booth Oil

Site, workers may also be required to excavate the site in higher levels of PPE than level D (i.e., Level C or Level B) when the operation is performed under a structure. Air monitoring under the structure will determine the necessary level of PPE.

Potential incineration systems for use at the Booth Oil Site include the circulating bed combustor from Ogden Environmental Services (OES) (Figure 2.5), infrared incineration systems from O. H. Materials Corporation or ECOVA Corporation (Figure 2-6), and a portable rotary kiln incinerator from Weston Services (Figure 2-7).

The circulating bed combustor from OES consists of a combustion chamber, cyclone, fluegas cooler, baghouse, scrubber (if necessary), and ash conveyor system. Contaminated soil is fed into the solids return leg and combines with return solids from the cyclone to enter the combustion chamber. A fan fluidizes the soil particles. The high velocity of the air maintains a uniform temperature (e.g., 1600 ^{o}F) around the combustion loop formed by the combustion chamber and the cyclone. Limestone added with the contaminated soil effectively neutralizes acid gases generated by the combustion process and controls sulfur dioxide emissions.

Fluegas exits the loop above the cyclone while the cyclone returns solid particles to the combustion chamber. Fluegas enters a cooling chamber and then passes through a baghouse for particulate removal before leaving through the exhaust stack. If acid gases would pose a problem, a scrubber system could be placed in front of the baghouse. Ash is drawn from the bottom of the combustion chamber for disposal or treatment and disposal. According to OES, the circulating bed combustor requires an area of approximately 6,000 square feet (60 ft X 100 ft) for set-up. It can process four tons per hour of contaminated soil.

The OES circulating bed combustor was tested successfully on waste from the McColl Superfund Site in California and PCB-laden soil at Alaska's Swanson River Oil Field. The system achieved a DRE exceeding 99.99% on such contaminants as benzene, toluene, xylene, ethylbenzene, naphthalene, 2-methylnaphthalene, and 1,1,1-trichloroethane at the McColl Site (EPA Region IX, 1989). The DRE for the system burning the PCB-contaminated soil at Swanson River exceeded 99.9999% (Warner - Waste Alternatives, 1989). The Swanson River data was submitted to EPA as part of OES' application for a TSCA permit to burn PCBs. Subsequently, EPA issued a TSCA permit to OES for the burning of PCBs in the circulating bed combustor. The permit is applicable in all 10 EPA regions. Currently, OES has four operable circulating bed combustors.

The O.H. Materials Corporation and ECOVA Corporation infrared incineration systems use infrared heating elements in the primary combustion chamber to provide the heat necessary for the desorption and combustion of organics in the contaminated soil. The systems have a primary combustion chamber (PCC) and secondary combustion chamber (SCC). In the PCC, the contaminated soil is heated to temperatures between 1200 ^{o}F and 1600 ^{o}F with the infrared heating elements to desorb the organics from the soil. Some desorbed organics are combusted at the surface of the soil in the presence of combustion air. The gas stream enters the SCC where it is exposed to a temperature of 2200 ^{0}F and combustion air for the complete destruction of the remaining organic compounds.

Exhaust from the SCC passes through a packed-tower scrubber for treatment of acid gas emissions and particulate removal. The infrared incineration systems occupy an area of approximately 20,000 square feet (100 ft X 200 ft). The systems can process five tons per hour of contaminated soil.

The ECOVA Corporation infrared incineration system was tested under the Superfund Innovative Technology Evaluation (SITE) Program at the Peak Oil Site in Florida and the Rose Township Demode Road Site in Michigan. It also was tested at the Florida Steel Corporation mill site and the Twin Cities Army Ammunition Plant in Minnesota. All of these tests were performed on soils containing PCBs and other organic compounds. The system was capable of achieving RCRA-mandated DREs of 99.99% for hazardous organics and the TSCA-mandated DRE of 99.9999% for PCBs (EPA, 1989b). TSCA trial burns at the Florida Steel Corporation mill site achieved the necessary DRE for PCBs (99.9999%), resulting in a TSCA permit for the ECOVA infrared incineration system, applicable in all 10 EPA regions.

The transportable rotary kiln incinerator from Weston Services also has a TSCA permit applicable in all 10 EPA regions. The system consists of a primary combustion chamber operating between temperatures of 1200 ^{0}F and 2200 ^{0}F. The afterburner is designed for a gas residence time of two seconds at greater than 2200 ^{0}F. A fabric filter baghouse controls particulate emissions and a packed tower scrubber treats acid gas emissions. The system requires approximately 62,500 square feet (250 ft X 250 ft) of space for operation and can process approximately six tons per hour of contaminated soil.

2.2.3 Alternative C: Off-site Treatment by Incineration

In this alternative, approximately 29,300 cubic yards of contaminated soil would be excavated and transported to an off-site incinerator for destruction of the organic compounds in the soil. Again, excavation in the vicinity of the railroad tracks would be coordinated with the railroad. The soil would be transported by a certified EPA hazardous waste transporter and burned in an incinerator with both RCRA and TSCA permits (because of the PCB content of the soil). Potential incinerators with TSCA permits include the Rollins Environmental Services facility in Deer Park, Texas, the General Electric incinerator in Pittsfield, Massachusetts, and the ENSCO incinerator in El Dorado, Arkansas.

Excavation of the soil would be performed beneath a hood so that toxic vapors and nuisance odors can be prevented from reaching the surrounding community. The air beneath the hood would be treated for removal of the toxic vapors and nuisance odors. Section 2.2.2 provides a more complete description of this operation.

After excavation of the soil and transportation off-site, the Booth Oil Site would be backfilled with clean soil from off-site. The site would be brought up to grade with the surrounding area. Vegetative cover would be established at the site.

2.2.4 Alternative D: On-Site Treatment by Thermal Separation

In this alternative, approximately 29,300 cubic yards of contaminated soil would be excavated and thermally treated on-site to volatilize the PCBs, volatiles, and semivolatiles from the soil. The volatilized organics from the thermal separation process would be condensed, collected, and sent to a liquid injection incinerator off-site for destruction. The treated soil from the process may require additional treatment depending on the concentration of lead. Thermal treatment does not destroy inorganic contaminants and the clean-up level for lead might be exceeded in the soil residue. In this instance, the soil would be stabilized prior to backfilling on site. The excavation of soil near the railroad tracks would be coordinated with the railroad.

Excavation of the soil would be performed beneath a hooded structure so that toxic vapors and nuisance odors can be prevented from migrating to the surrounding community. Section 2.2.2 provides a more complete description of this operation. Excavated material would be stockpiled prior to treatment in the thermal separator. To control dust, the stockpile would be wetted. Odors from the stockpile would be controlled with a spray foam or cover. The air beneath the hood would be treated for removal of the toxic vapors and nuisance odors. After backfilling of the stabilized soil, vegetative cover would be established at the site.

Three thermal separation systems that may effectively treat the contaminated soil at the Booth Oil Site are closed-loop thermal separation, anaerobic thermal separation, and fluidized bed thermal separation. These systems are described below.

2.2.4.1. Closed-loop Thermal Separation--

One on-site thermal separation process tested in the USEPA SITE Program is a closed loop process. The process, diagrammed in Figure 2-8, involves feeding contaminated soil to a slowly rotating kiln (very similar to a rotary kiln incinerator) and heating it to a temperature between 500 ^{o}F and 800 ^{o}F with an external heat source (e.g., propane burners). Water, PCBs, and other organics are volatilized or steam stripped. The vapors are carried out of the dryer in a nitrogen gas stream.

The exiting gas stream from the kiln passes through a scrubber and two heat exchangers for particulate removal and condensation of the water vapor and organics. Condensed organics and recirculating water from the scrubber enter a phase separator where the floating organics are removed for off-site incineration. A bottom sludge is removed for dewatering and return to the kiln. Condensate from the heat exchangers are combined and allowed to gravity separate. Floating and sinking organics are removed for off-site incineration.

The nitrogen gas leaving the second heat exchanger is heated in an electric induction heater and passes through a blower. Five to ten percent of the carrier nitrogen gas is passed through a particulate filter and carbon adsorption unit before being vented to the atmosphere. The remainder of the carrier gas is reheated to between 400 ^{o}F and 700 ^{o}F and recirculated to the dryer.

The SITE demonstration showed that the process can reduce PCB concentrations in sandy soils from 2000 ppm to less than 25 ppm. The 25 ppm level was the cleanup level promulgated in the Re-Solve Superfund Site Record of Decision (ROD). Test results indicated that reduction to 10 ppm or less could be achieved consistently (SCS, 1990).

The closed-loop separation process has been lab-scale and pilot-scale tested on soils containing PCBs, volatiles, and semivolatiles. Results of these tests indicate that the process can achieve a destruction and removal efficiency (DRE) of 99.99% for hazardous organic constituents. In one lab-scale test, the system reduced the PCB concentration of a clay soil from 36,935 ppm to less than 2 ppm (CWM, 1989).

The commercial-scale closed-loop separation system is capable of treating 125 tons of contaminated soil with a 20 percent moisture content. It requires an area of 40,000 square feet (200 ft X 200 ft) for operation. The system is not designed to treat heavy metals present in soils. The heavy metals would either remain in the soil or be volatilized and collected in the gas treatment system.

2.2.4.2. Anaerobic Thermal Separation--

Another on-site thermal separation process is a hot-sand recycle process that operates under anaerobic conditions. In this process (Figure 2-9), contaminated soil charged to the processor passes through three zones. In the preheat zone, low-temperature hydrocarbons and water are volatilized at temperatures up to 500 ^{o}F. Oils and heavy hydrocarbons are volatilized in the reaction zone at temperatures between 700 ^{o}F and 1,150 ^{o}F under anaerobic conditions. Sand seals between the preheat zone and reaction zone, and reaction zone and combustion zone, maintain anaerobic conditions in the reaction zone. The water and oil removed from the processor are condensed and collected in separate vapor train equipment.

Some thermal cracking usually occurs in the reaction zone, creating light hydrocarbons and coke (char). This cracking is a result of pyrolysis. The coke may be burned in the combustion zone between 1,100 ^{o}F and 1500 ^{o}F to generate all or part of the heat requirements for the process. Hot sand from the combustion zone is recycled back to the reaction zone to provide the necessary heat for pyrolysis. Part of the sand is cooled for discharge, heating incoming solids in the preheat zone by thermal conduction through an annulus wall. Treated soil can be backfilled on-site.

The anaerobic thermal separation process has been evaluated on petroleum refinery waste and PCB-contaminated soil. It exceeds the best demonstrated available technologies criteria defined in the August 1988

Land Disposal Restrictions for First Third Scheduled Wastes (American Petroleum Institute, 1988). The process has been selected for use to remediate 60,000 cubic yards of PCB-contaminated soil at the OMC Superfund Site in Waukegan, Illinois, beginning in early 1991 (SCS, 1990).

The anaerobic thermal treatment process require 40,000 square feet of space for operation. The commercial unit can treat between 10 and 15 tons of contaminated soil per hour. Hazardous volatiles, semivolatiles, and PCBs would be removed from the soil in the preheat or reaction stage. Air emissions from the process would be minimal. The process would not treat metals present in the soil.

2.2.4.3 Fluidized Bed Thermal Separation--

Another on-site thermal separation process volatilizes PCBs and other organics in a co-current fluidized bed. This process is shown in Figure 2-10. In the bed, contaminated soil is contacted with heated air (1000 ^{o}F to 1500 ^{o}F), forcing the water, organics, and entrained solids into the air stream. Gas exits the fluidized bed and passes through a cyclone and baghouse for solids removal. From the baghouse, the gas enters a venturi scrubber and plate washer for cooling by a recirculated water stream. The gas then passes through a chiller unit. The water vapor and organics condense in the scrubber, plate washer, and chiller. Contaminated water is pumped to a contaminated water storage tank.

Cooled gases pass through two carbon filters for removal of residual organic contaminants. As the beds become exhausted, the system is shut down and the beds replaced. Carbon filters in parallel could be used to avoid the need for a shutdown.

The contaminated water is pumped to a centrifuge, where the organic compounds are spun out into a sludge ready for disposal. Liquid from the centrifuge enters a water filtration system that includes a sand filter, a clarifier, and two activated carbon beds. Clean water is pumped to a clean water storage tank for testing prior to discharge in an approved manner.

According to Recycling Sciences International, the fluidized bed system requires approximately 24,000 square feet of space for operation. It can treat a maximum of 15 tons of contaminated soil per hour.

2.2.5 Alternative E: On-site Treatment by Solvent Extraction--

In this alternative, the 29,300 cubic yards of contaminated surface and subsurface soil at the Booth Oil Site would be excavated and treated on-site with a solvent extraction system. The organic compounds adsorbed to the soil particles would be solubilized with a solvent, separated from the solvent, and collected. Then, they would be transported to an off-site liquid injection incinerator for destruction. The cleaned soil from the extraction process may require additional treatment depending on the concentration of lead. Solvent extraction does not remove inorganic contaminants and the clean-up level for lead might be exceeded in the soil residue. In this instance, the soil would be stabilized prior to backfilling on site. Vegetative cover would be established at the site.

Excavation of the soil would be performed beneath a hooded structure so that toxic vapors and nuisance odors can be prevented from migrating to the surrounding community. Section 2.2.2 provides a mor complete description of this operation. Excavated material would be stockpiled prior to treatment in the extraction unit. To control dust, the stockpile would be wetted. Odors from the stockpile would be controlled with a spray foam or cover. The air beneath the hood would be treated for removal of the toxic vapors and nuisance odors.

Solvent extraction works most effectively on soils which have low organic contents, such as sands and gravel. With these types of soil, a smaller quantity of solvent and lower contact time in the reaction vessel would be required to extract the organic compounds. At the Booth Oil Site, a large quantity of the contaminated soil is silty sand and gravel fill material which may be amenable to solvent extraction.

Two solvent extraction systems may effectively treat the contaminated soil at the Booth Oil Site. They are the triethylamine extraction and the acetone/kerosene-inorganic acid extraction. Each is discussed below.

2.2.5.1 Triethylamine Extraction--

The on-site triethylamine (TEA) extraction process is designed to remove organic compounds (PCBs, volatiles, and semivolatiles) from soil or sludge to produce a decontaminated soil. Figure 2-11 presents a flow diagram for the process. In the process, the soil is washed in the first extraction stage with TEA at 40 ^{O}F to remove organics. The TEA/organics/water mixture is decanted from the washer and heated to 130 ^{O}F to separate the TEA/organics and water phases. The TEA is steam stripped from the TEA/organics mixture and the water and recycled to the washer for re-use in further extraction stages. The organics are generally incinerated off-site in a liquid injection incinerator. The water is discharged to a surface water body or a wastewater treatment plant. Washed soil, before discharge, is dried in the soil contactor (a combination washer/dryer) to remove residual TEA. The TEA removed is condensed and recycled to the washer.

The triethylamine extraction process was tested by the USEPA at the General Refining Superfund Site near Savannah, GA. Like Booth Oil, the General Refining Site functioned as a waste oil refining facility. The waste consisted of a mixture of sludge and soil containing variable quantities of waste oil (0 to 40%), water (60 to 100%), and solids (2 to 30%). The waste contained relatively low levels of PCBs (5-15 ppm). After processing the 3700 cubic yards of sludges, the residual solids contained less than 0.1 ppm PCBs (Weimer, 1989).

The TEA process can be used to treat soils containing the PCBs, volatiles, and semivolatiles found at the Booth Oil Site. Treatability studies would be required to determine specific treatment parameters, including solvent/soil ratios, residence time, temperature, and the number of extraction stages needed to achieve the desired soil clean-up level. The process would not treat the metals in the soil. If the soil residue contains lead concentratrions exceeding the clean-up level, the residue will be stabilized prior to backfilling on-site.

2.2.5.2 Acetone/Kerosene Extraction + Inorganic Acid Extraction--

This on-site process uses organic solvents (acetone and kerosene) to extract organic compounds and an inorganic solvent to extract metals from soils. Figure 2-12 shows a diagram of the process. The process involves several steps:

- Contaminated soil is separated into solid and liquid fractions by centrifugation or filtration.
- The solid fraction is washed with acetone to extract organics. The acetone/organics/water mixture is decanted and goes to a liquid-liquid extractor. Acetone is steam stripped from the soil and recycled to the washer.
- In the liquid-liquid extractor, the organics transfer to the kerosene (stripping solvent), a hydrophobic solvent amenable to

destruction. The kerosene/organics mixture from the extractor is incinerated off-site in a liquid injection incinerator. The acetone/water mixture is distilled with the acetone returning to the washer and the water going to an adsorption unit.

- Water from the filter or centrifuge is processed in an adsorption unit which utilizes clean solids or other solid medium. The solid, after exhaustion, is sent to the washer. Clean water can be discharged to surface water or a sanitary sewer.

- Solids stripped of acetone are washed with an inorganic acid to remove heavy metals. After leaching of the metals, the acid/metal solution is placed in a liquid-liquid extractor where the metals are transferred to another acid so that the leaching acid can be recycled. The metals may be recovered by electrolytic precipitation or chemically precipitated and stabilized prior to land disposal.

The acetone/kerosene extraction plus inorganic acid extraction has successfully treated PCBs, volatiles, semivolatiles, and heavy metals in bench-scale and pilot-scale tests (Blank, 1990). Because the solvent extraction of metals has yet to be performed on a commercial scale, metals removal by solvents will not be considered in this FS. According to ART International, a commercial scale system will be available for on-site use sometime during 1993.

2.2.6 Alternative F: Off-site Disposal

In this alternative, approximately 29,300 cubic yards of contaminated soil at the Booth Oil Site would be excavated and transported off-site for disposal in an off-site landfill. The soil with PCB concentrations greater than 50 ppm is a hazardous waste in New York State, and disposal in New York State must be at a hazardous waste landfill permitted under 6 NYCRR Part 373. Also, the soil with PCB concentrations greater than 50 ppm must be disposed in a TSCA approved landfill. Most likely, all contaminated soil will be disposed in a hazardous waste landfill with both Part 373 (or RCRA) and TSCA permits.

Excavation of the soil would be performed beneath a hooded structure so that toxic vapors and nuisance odors can be prevented from migrating to the surrounding community. Section 2.2.2 provides a more complete description of this operation. The air beneath the hood would be treated for removal of the toxic vapors and nuisance odors.

After excavation and removal of the contaminated soil from the Booth Oil Site, clean soil would be backfilled at the site. The clean soil would be brought up to grade. Vegetative cover would be established at the site.

2.2.7 Alternative G: No Action Alternative

In this alternative, the Booth Oil Site would remain in its present condition. No remedial activities would be performed; however, periodic monitoring would be initiated. The contaminated shallow groundwater and surface and subsurface soil would not be removed and/or treated. Monitoring wells would be placed around the perimeter to the site to monitor migration of contaminants away from the site. The wells would be sampled periodically.

FIGURE 2-1

TYPICAL GROUNDWATER EXTRACTION WELL

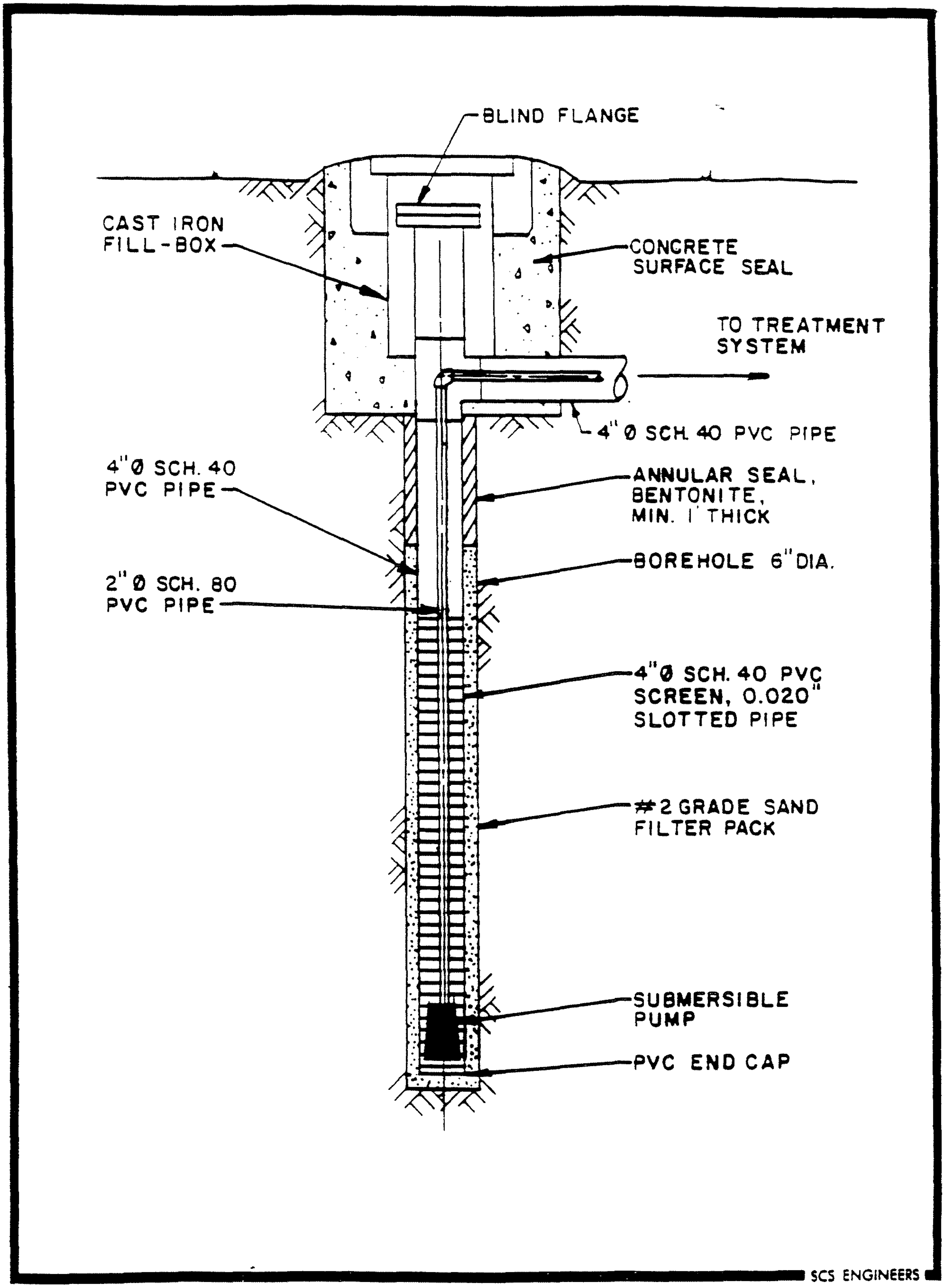


FIGURE 2-2

TRENCH DRAIN COMPONETS

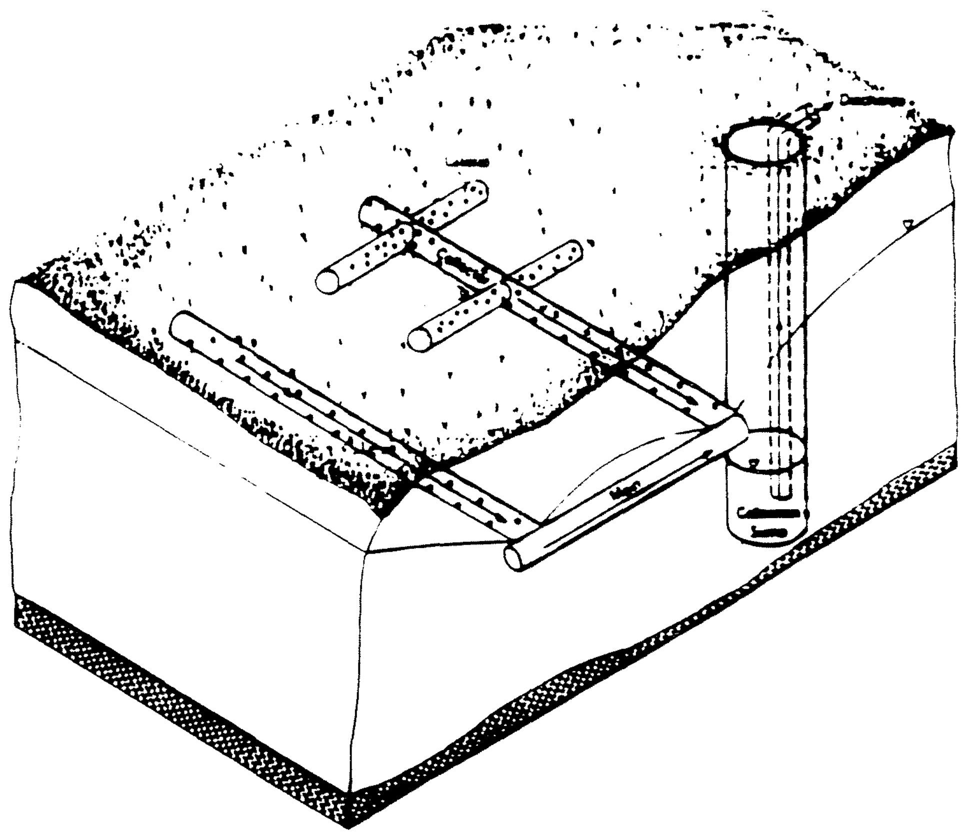


FIGURE 2-3

OIL/WATER SEPARATOR

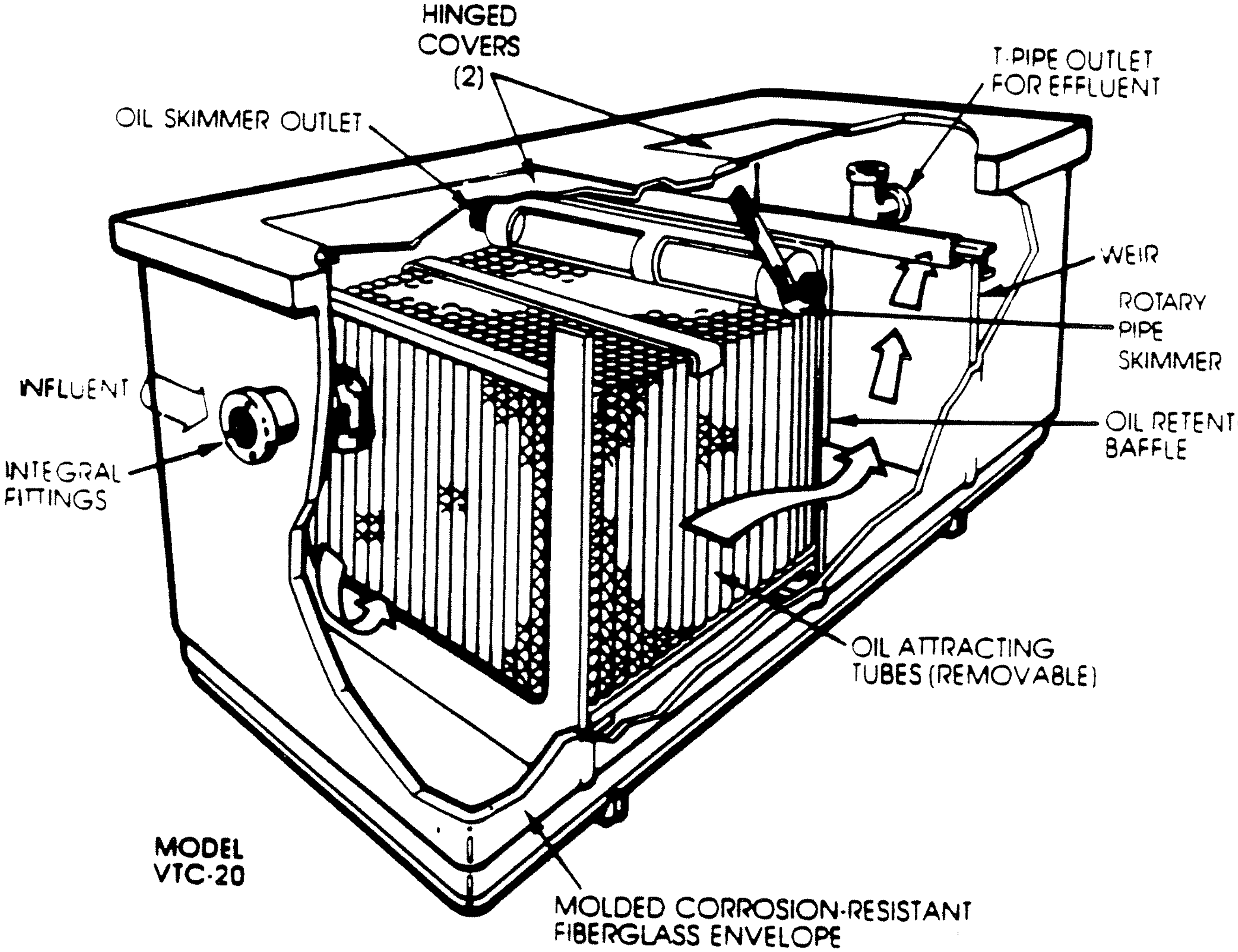


FIGURE 2-4

SLURRY WALL ATERNATIVES FOR BOOTH OIL SITE

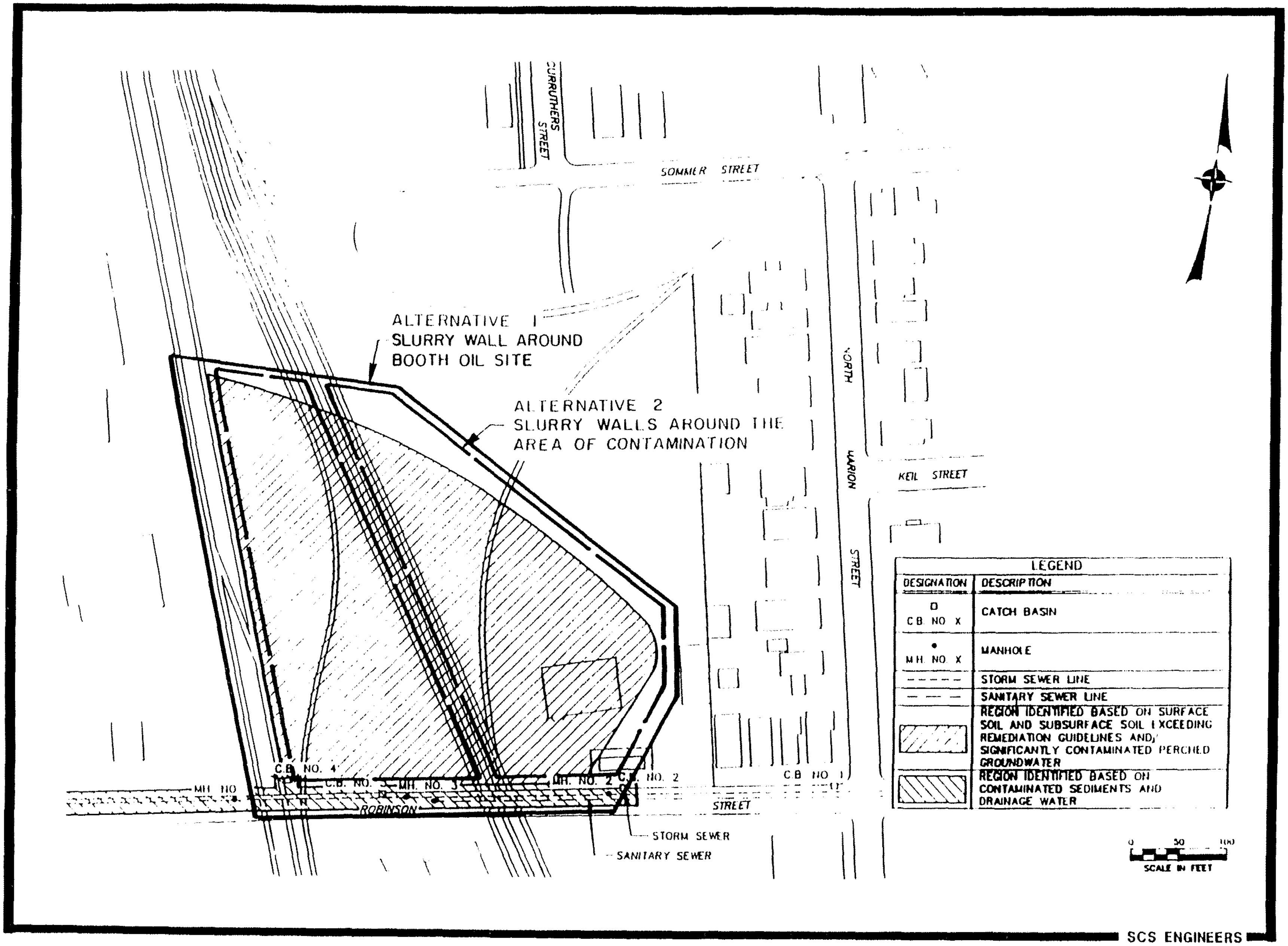


FIGURE 2-5

CIRCULATING BED COMBUSTOR PROCESS FLOW SCHEMATIC

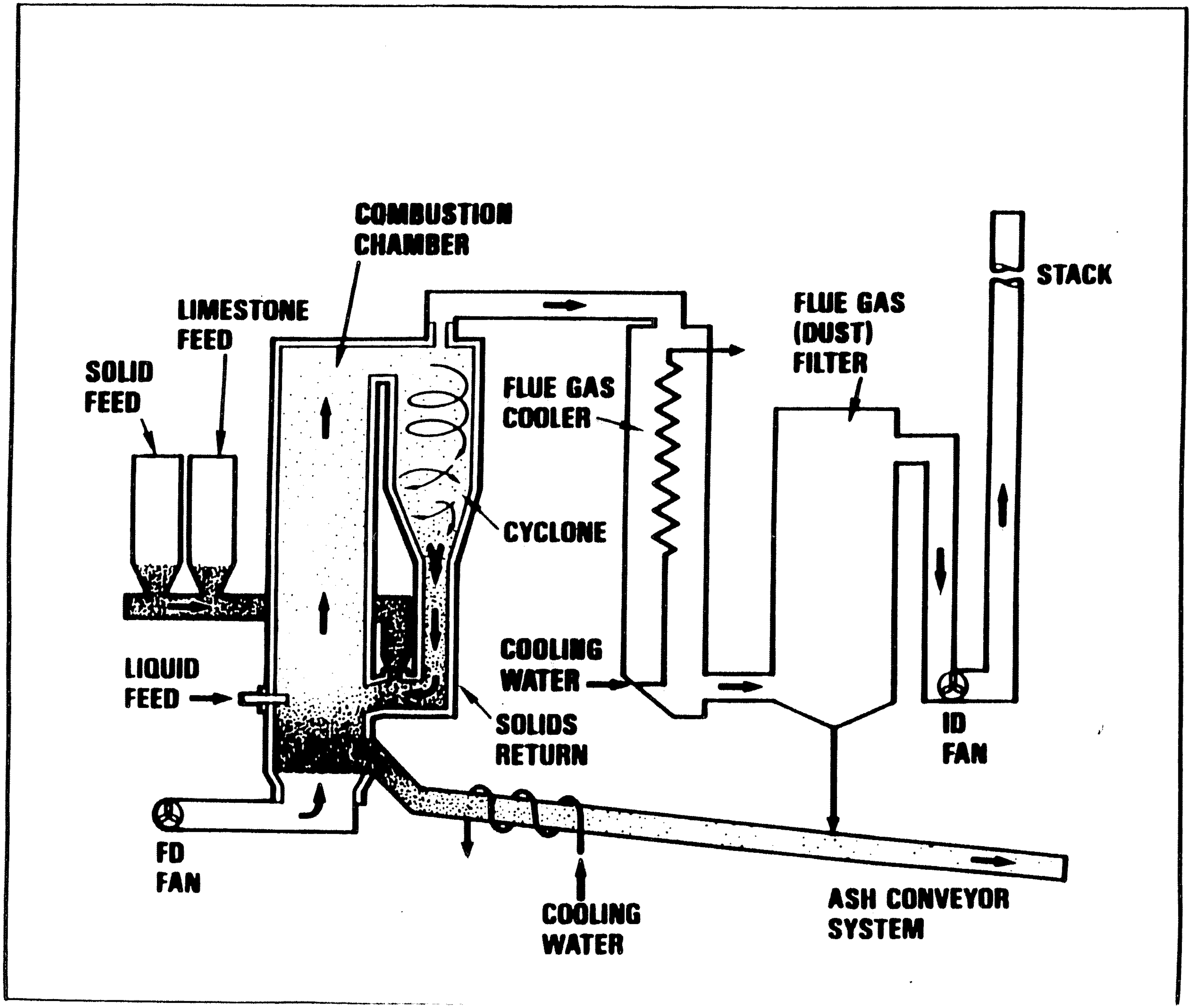


FIGURE 2-6

SHIRCO INFRARED INCINERATION SYSTEM

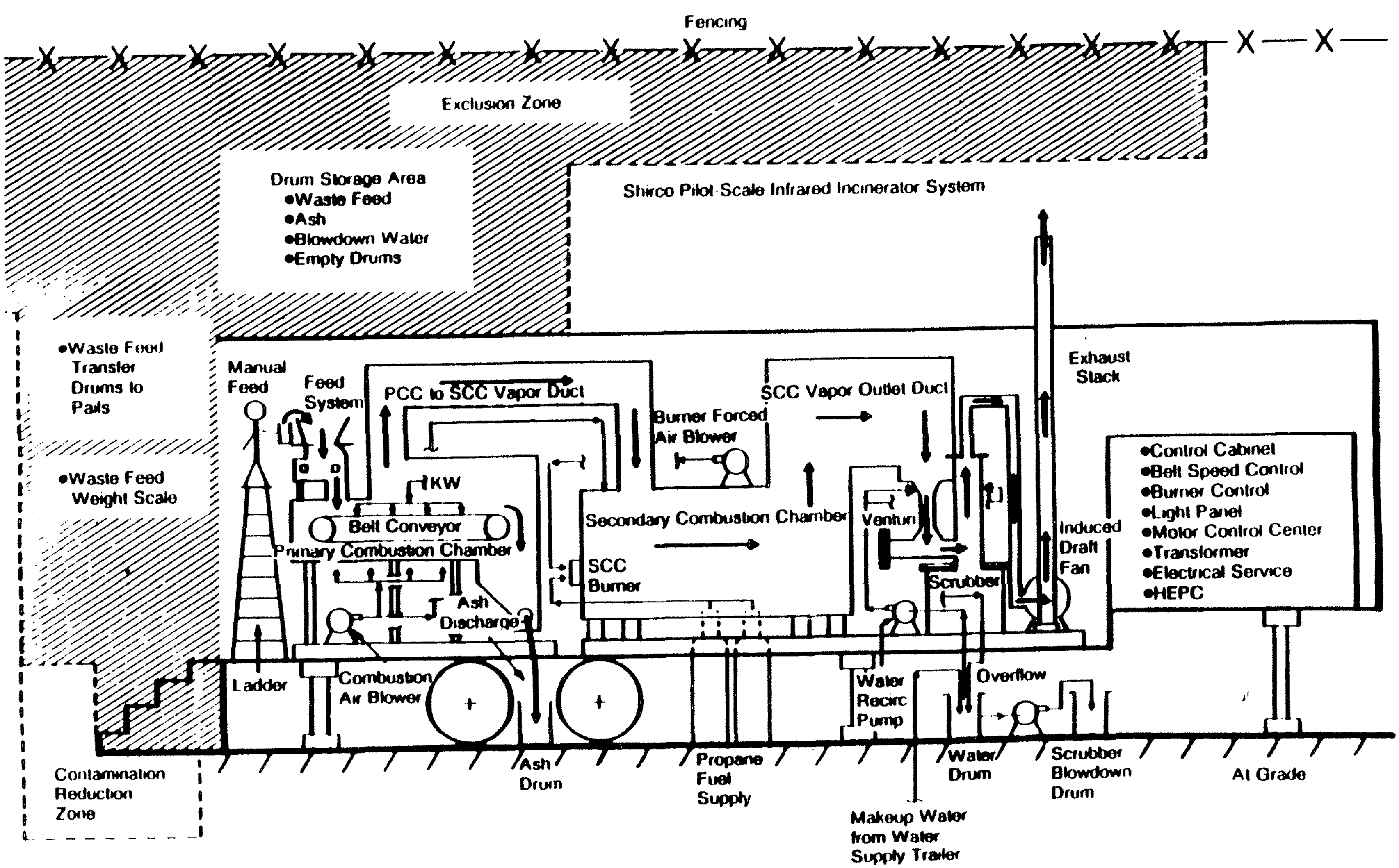
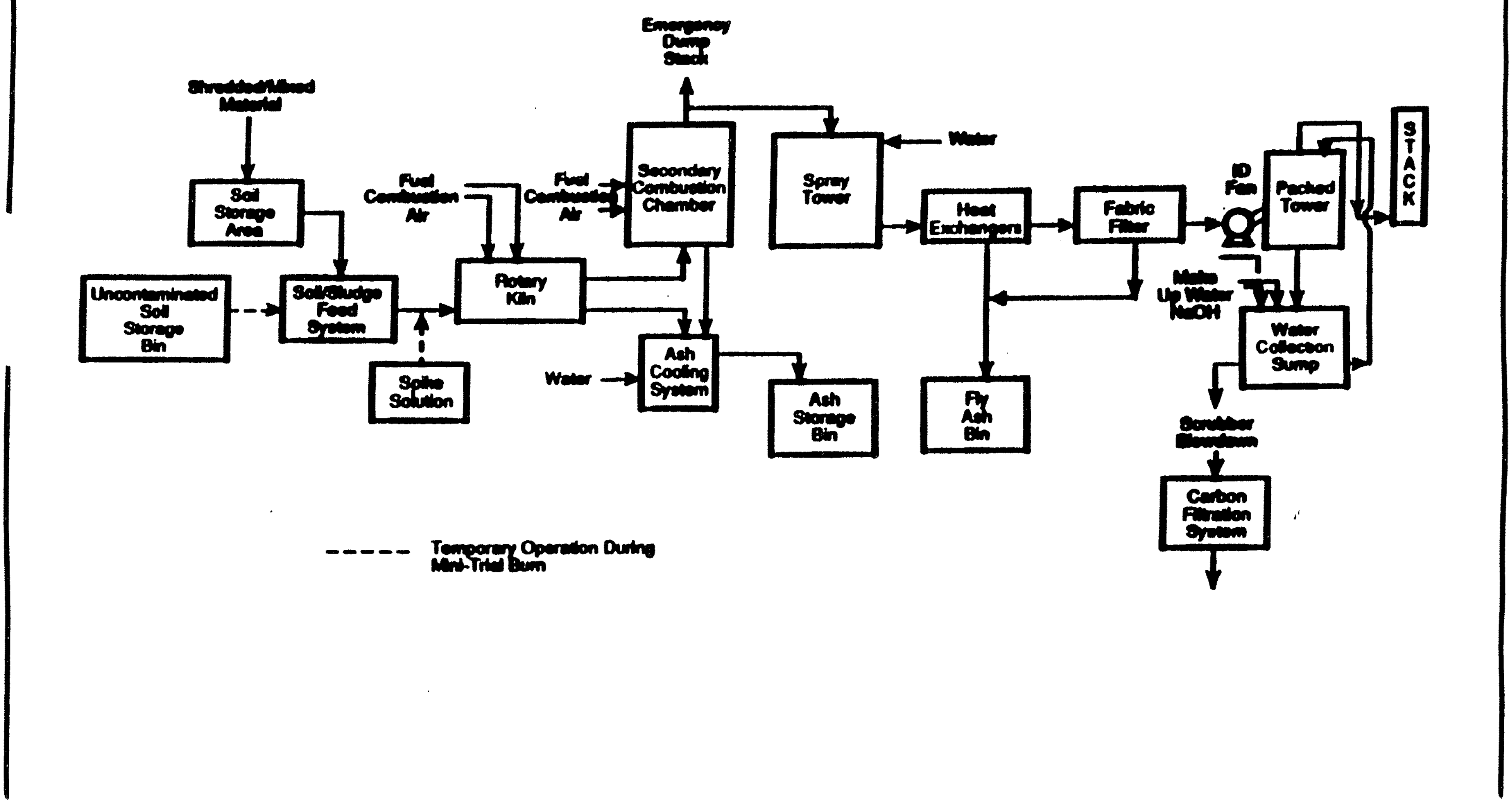


FIGURE 2-7

TIS PROCESS FLOW SCHEMATIC



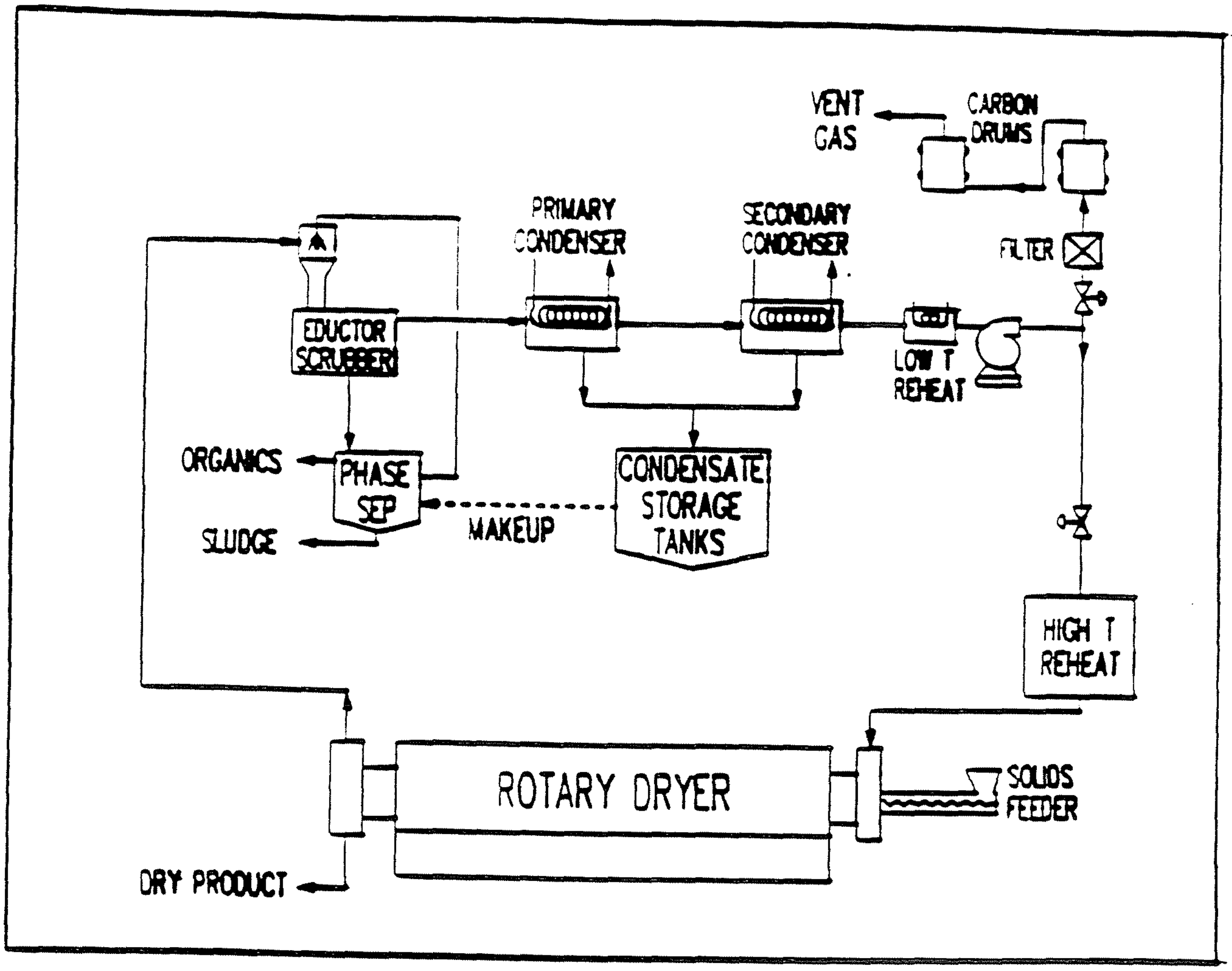


FIGURE 2-8 Closed-loop Therman Separation Process.
Source: Chemical Waste Management, 1989.

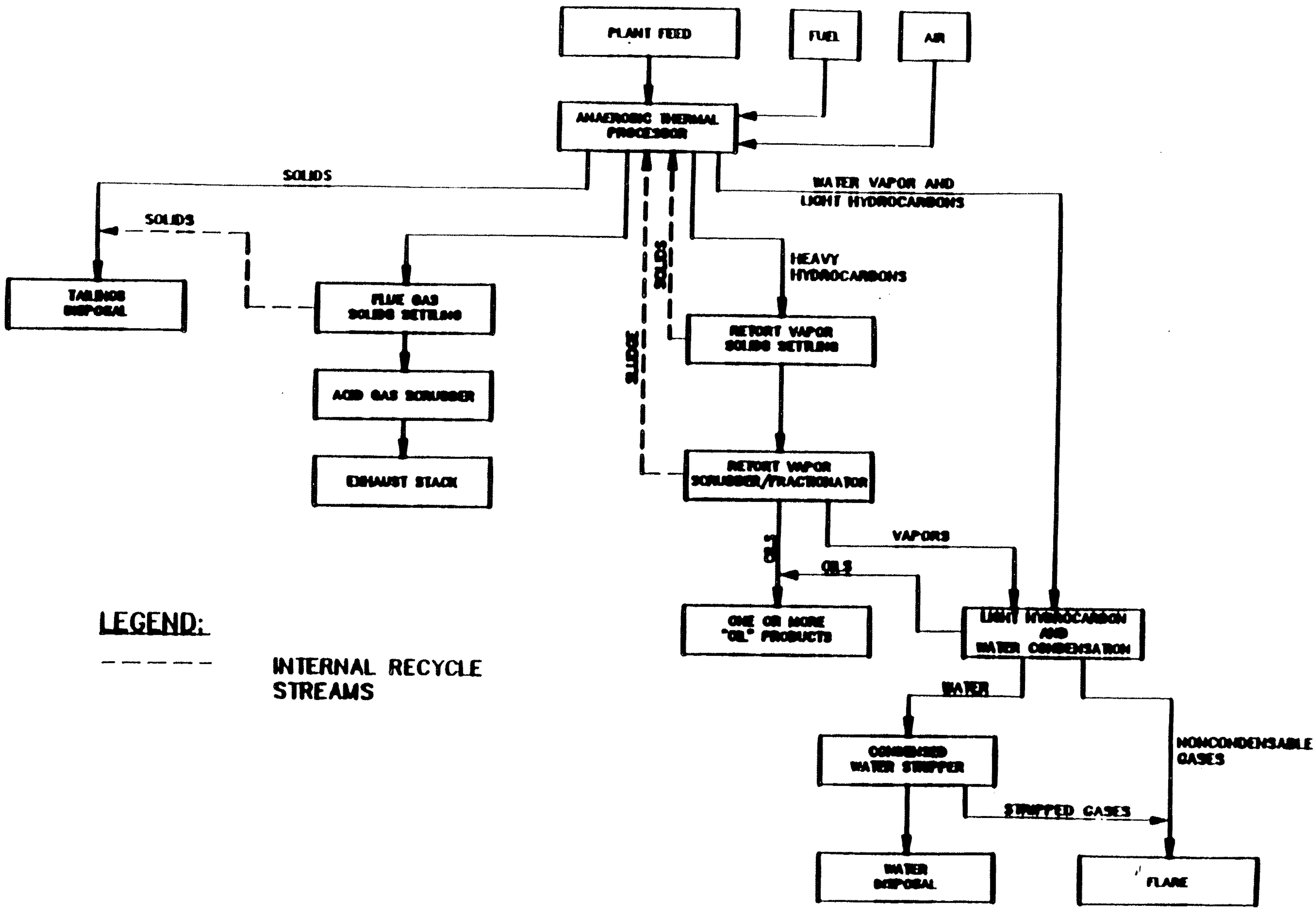


FIGURE 2-9 Anaerobic Thermal Separation Process Schematic.

FIGURE 2-10 FLUIDIZED BED THERMAL SEPARATION

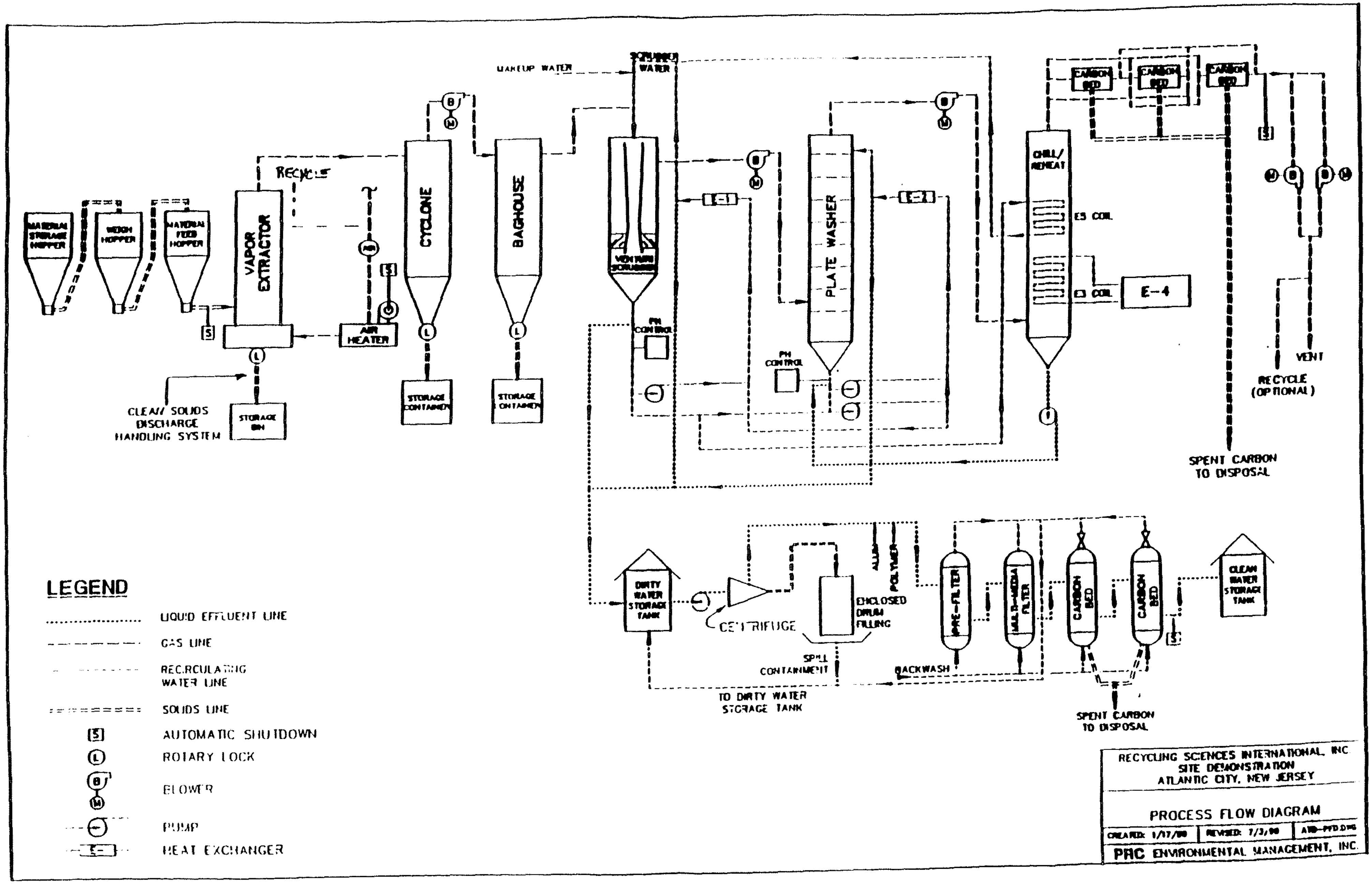


FIGURE 2-11

RCC Resources Conservation Company

B.E.S.T.• SOIL CLEANUP UNIT SCHEMATIC

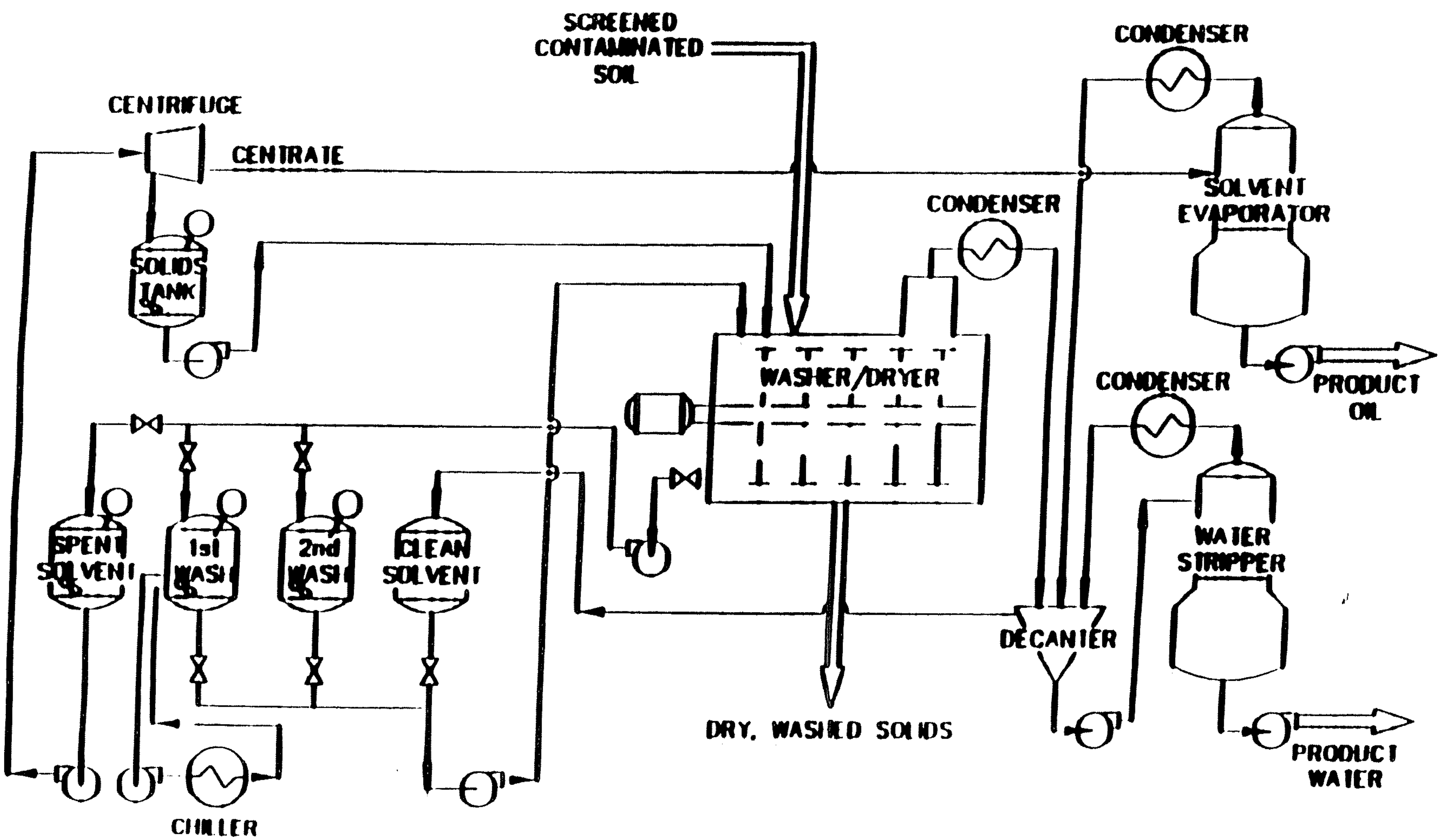
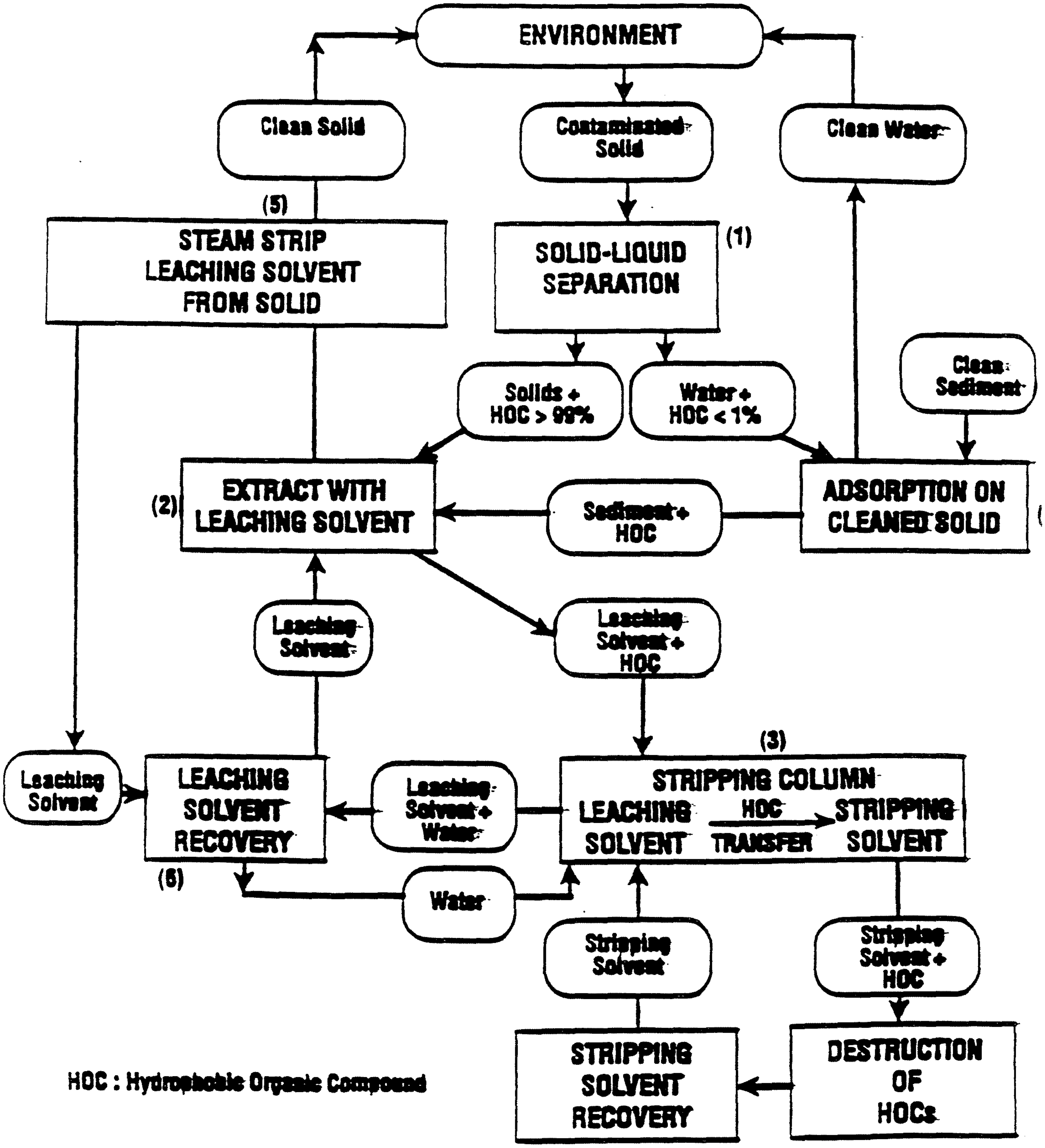


FIGURE 2- 12

Leep Technology Process Flow



HOC : Hydrophobic Organic Compound

Section 3

SECTION 3

COMPARATIVE ANALYSES OF ALTERNATIVES

3.1 INTRODUCTION

The following seven alternatives are being considered for remediation of the Booth Oil Site:

- On-site Containment with Groundwater Extraction and Treatment
- Soil Treatment by On-site Incineration with Groundwater Extraction and Treatment
- Soil Treatment by Off-site Incineration with Groundwater Extraction and Treatment
- Soil Treatment by On-site Thermal Separation with Groundwater Extraction and Treatment
- Soil Treatment by On-site Solvent Extraction with Groundwater Extraction and Treatment
- Soil Treatment by Off-site Land Disposal with Groundwater Extraction and Treatment
- No Action Alternative

In this section, the technologies comprising each alternative will be compared for the seven factors outlined in the NYSDEC TAGM: compliance with NYS SCGs; protection of human health and the environment; short-term impact and effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, and volume; implementability; and cost.

The guidelines for the comparisons are the questions presented on the scoresheets in the NYSDEC TAGM.

Because it is anticipated that the groundwater at the Booth Oil Site will be extracted, treated in an oil/water separator, and discharged to the North Tonawanda POTW, the groundwater technologies discussed in the Phase I/II FS will not be evaluated in detail herein. The focus of the comparisons in this section will be the technologies for remediation of the contaminated soil at the site. The remedial alternative which will be implemented at the site will consist of one of the soil treatment alternatives and the groundwater treatment alternative (unless the no action alternative is selected).

3.1 Compliance with New York State Standards, Criteria, and Guidelines

As discussed in Section 1.5, chemical-, action-, and location-spacific SCGs have been identified for the Booth Oil Site. Compliance of each of the remedial alternatives with the SCGs is evaluated below.

3.1.1 Chemical-specific SCGs

The remedial action alternatives for the Booth Oil Site would comply with the chemical-specific SCGs to varying degrees.

- o Off-site incineration and off-site land disposal would meet the chemical-specific SCGs as all soil exceeding the soil clean-up guidelines would be removed for off-site treatment/disposal.

- On-site incineration and the on-site separation processes (solvent extraction and thermal separation) would meet the chemical-specific SCGs for the organic contaminants. These processes remove and/or destroy organic compounds. The processes most likely would not comply with the clean-up levels for inorganic compounds such as lead because they are not currently capable of removing inorganics from soil. The lead levels detected in the soil during the RI indicate that the residue from the processes may exceed the clean-up guideline for lead.

- On-site containment and the no action alternative would not meet any of the chemical-specific SCGs for the site as the wastes exceeding the remediation guidelines would remain in place.

In addition to the soil clean-up guidelines, Section 1.5 identifies important chemical-specific SCGs regarding air emissions. These SCGs are intended to ensure that no remedial alternative results in an unacceptable degradation of ambient air quality.

- All alternatives, with the exception of the no action alternative and on-site containment, involve significant excavation and handling of contaminated soil. These activities are likely to release vapors and dust in sufficient quantities to require substantial engineering controls to avoid violation of the air quality SCGs. These engineering controls (i.e. hooded structure with a gas collection and treatment system), which are more fully described in Section 2, would be adequate to meet the SCGs. However, short-term excursions would be possible.

- On-site containment would require excavation and handling of a smaller quantity of contaminated soil than the treatment alternatives. These activities are likely to release vapors and dust in quantities necessitating the implementation of engineering controls to avoid violation of the air quality SCGs. The controls discussed in Section 2 would be adequate for compliance with the SCGs.

- The no action alternative would not violate the air SCGs because none of the contaminated soil would be disturbed.

In summary, all alternatives for the site, except on-site containment and the no action alternative, would comply with the chemical-specific SCGs. Those involving excavation and backfilling of residuals are ranked slightly lower because of the potential for non-compliance with the air quality and lead clean-up level SCGs. The on-site treatment alternatives would substantively comply with the organic contaminant clean-up SCGs. The off-site alternatives would provide a higher degree of assurance that the clean-up level for total lead would be met. On-site containment and the no action alternative are the least effective in meeting the chemical-specific SCGs because the soil clean-up guidelines would not be met.

3.1.2 Action-specific SCGs

All remedial alternatives would be designed and implemented to comply with the action-specific SCGs discussed in Section 1.5.

- Alternatives in which the contaminated soil is transported off-site (off-site incineration and off-site land disposal) would comply with the applicable regulations for transportation of hazardous materials, hazardous waste, and PCB waste, as appropriate. The soil would be shipped by a licensed hauler. It would be manifested, covered, and placarded as required by the regulations.

- Off-site incineration and off-site land disposal would occur at permitted facilities.

- On-site destruction and separation processes would be performed under the requirements of Federal and State regulations for the treatment of hazardous/PCB wastes.

- All point source air and water discharges would be performed in compliance with the applicable regulatory program.

- The cover system for on-site containment would be designed, constructed, and maintained in accordance with performance requirements for a hazardous waste landfill.

3.1.3 Location-Specific SCGs

No location-specific SCGs were identifed for the Booth Oil Site.

3.2 Overall Protection of Human Health and the Environment

After remediation of the Booth Oil Site with any of the remedial alternatives except the no action alternative, human and environmental exposure to contaminants via ingestion of groundwater/surface water or soil/sediment and dermal contact with soil/sediment and surface water, would be reduced to acceptable levels.

- The groundwater would be extracted and treated until it is completely removed or meets the New York State Class GA groundwater standards.

- With off-site incineration and off-site land disposal, all contaminated soil with contaminant concentrations above the remediation guidelines would be removed, thereby eliminating any exposure routes.

- With on-site incineration, on-site solvent extraction, and on-site thermal separation, all of the organic compounds exceeding the clean-up guidelines would be removed. As the backfilled residuals would have the potential to exceed the remediation guideline for lead, a potential risk to human health and the environment may remain. To eliminate this potential risk, the backfilled soils would be stabilized prior to backfilling to reduce the mobility of lead in the environment. A cover of clean soil would be placed over the backfilled residues to protect human health by reducing direct exposure to the lead.

- On-site containment with a slurry wall and cover would prevent direct exposure to the contaminants in the soil. Precipitation infiltration and groundwater flow would be sufficiently reduced to eliminate the migration of contaminants to off-site human and environmental receptors.

Off-site incineration and off-site land disposal provide the highest level of overall protection of human health and the environment because all of the contaminated soil would be removed from the site. The on-site treatment alternatives (on-site incineration, on-site solvent extraction, and on-site thermal separation) would be slightly less protective as the residuals with elevated lead levels would be disposed on-site. With the exception of the no action alternative, on-site containment is least protective of human health and the environment.

3.3 **Short-Term Impacts and Effectiveness**

Several of the remedial alternatives for the contaminated soil at the Booth Oil Site present potential short-term exposure risks to the community and the environment. In particular, those remedial actions that require excavation and soil handling (on-site incineration, off-site incineration, on-site thermal separation, on-site solvent extraction, on-site containment, and off-site land disposal) would generate vapors, nuisance odors, and dust particles which may travel to the surrounding community. If not controlled adequately, the dust and toxic vapors would pose an inhalation risk and the nuisance odors would be irritating. Workers excavating the site would be required to wear appropriate levels of PPE. The dust would be controlled by wetting the particles. Toxic vapors and nuisance odors would be controlled by covering the area being excavated and filtering the air beneath the hood through a carbon filter. Odors from stockpiled material would be controlled with an appropriate spray foam or cover.

Severity of the potential short-term impacts from excavation and soil handling activities would depend on the duration of the remadial alternative. The duration of each alternative is as follows:

- On-site incineration - Depending upon the technology option, 1.8 - 3.0 years working 8 hours/day, 5 days/week, assuming 80 percent online incinerator availability.

- Off-site incineration - 0.5 years with 20 22-ton truckloads being transported to the incinerator each day (1998 truckloads total).

- On-site thermal separation - Depending upon the technology option, 1.7 - 2.6 years working 8 hours/day, 5 days/week with the thermal separator (80% online availability).

- On-site solvent extraction (TEA) - 2.0 years working 8 hours/day, 5 days/week with 80% online system availability.
- Off-site land disposal - 0.5 years with 20 22-ton trucks being transported to the land disposal facility each day (1998 trucks total).

These duration estimates have been made after "normalization" of the various vendor technical proposals, e.g., some estimates were made using treatment rates in tons while others were used treatment rates expressed in cubic yards. The following constant assumptions were made for each option:

- One cubic yard of contaminated soil weighs 1.5 tons;
- There are 260 working days in each year;
- Normalization of 7-day week/24-hour day treatment rates was achieved by multiplying the calculated total duration by 2, i.e., 1 day of work at 24 hours/day equals 2 days at 8 hours/day; and
- One treatment unit was utilized for each alternative.

Transportation of contaminated soil for off-site incineration and off-site land disposal may pose additional potential risks by the release of contaminants from the trucks as a result of an accident or loose sealing of the waste material. To minimize the potential risk, the waste material would be contained securely in the leak-proof, lined trucks beneath a sealed cover.

Point source air emissions from some of the alternatives could pose additional short-term risks. During on-site incineration and on-site thermal separation, air emissions from the incinerator or thermal separator, such as acid gases, volatilized lead, VOCs, and particulates, would be controlled by appropriate air pollution control equipment. Potential air pollution control devices include wet scrubbers, baghouses, electrostatic precipitators, and carbon adsorption beds. The emissions would comply with the RCRA and TSCA emission requirements and the NYSDEC regulations and air clean-up criteria. With optimized control, they would not pose a risk to the environment or the surrounding community.

On-site containment requires minimal soil excavation and handling resultig in reduced risks from released dusts, vapors, and odors. Some soil in the area of contamination would be excavated to install the slurry wall, remediate the tracks, and rough grade the site. The control measures for reducing emissions which were discussed in the alternatives involving large-scale excavation would be effective in controlling releases from this smaller-scale activity.

Remediation of the groundwater at the site would not pose any significant short-term risks. The groundwater extraction and treatment system would operate automatically with minimal operator attention. The groundwater treatment system may generate volatile emissions. Depending on their levels, control may be necessary.

In summary, the potential short-term impacts associated with the excavation activities are determined to be the most severe. Therefore, the on-site treatment alternatives (incineration, thermal separation, and solvent extraction) would result in the greatest potential short-term impacts because these alternatives take longer to implement than the off-site options (incineration and land disposal). The additional potential impacts for the off-site alternatives associated with transportation of the waste are not large enough to offset the longer implementation times of the on-site alternatives. Additionally, two of the on-site options (incineration and thermal separation) produce point source air emissions. The short-term impacts from the excavation and soil handling activities of the on-site containment alternative are less than the other on-site alternatives and the off-site alternatives. The no action alternative would have the least short-term impacts.

3.4 Long Term Effectiveness and Permanence

3.4.1 Permanence

The various technologies being considered for use at the Booth Oil Site may or may not be permanent remedies for the site. According to NYSDEC TAGM 4030, destruction technologies and separation/treatment technologies are considered permanent remedies for organic contaminants. Stabilization/solidification of treated residuals to immobilize inorganic contaminants such as lead is considered permanent. On-site containment and off-site land disposal are not considered permanent remedies. The classification of each of the remedial alternatives at the Booth Oil Site is discussed below.

Based on the definitions above, on-site and off-site incineration (destruction technologies) are permanent remedies for the Booth Oil Site. The organic contaminants would be permanently destroyed and, if necessary, the inorganic contaimants in the residue would be stabilized. Likewise, on-site thermal separation and on-site solvent extraction (separation/treatment technologies), are permanent remedies. The organic contaminants are removed from the contaminated soil and destroyed; inorganic contaminants remaining in the soil are stabilized (if necessary). On-site containment and off-site land disposal are not permanent because the physical containment structures used have a limited lifetime. The structures would require repair and/or replacement.

Treatment proposed for the groundwater at the site would be a permanent remedy for the contaminants in the water. Oil/water separation, discharge, and treatment by the North Tonawanda POTW would remove the organic contaminants from the groundwater to acceptable levels prior to final discharge to the Niagara River. The metals concentrations of the water discharged to the POTW would meet the POTW's pretreatment requirements. Some of the metals in the discharge from the site would transfer into the sludge generated during the primary and secondary treatment processes at the POTW.

The lifetimes of the remedial actions that are not permanent remedies (on-site containment and off-site land disposal) are difficult to estimate because of the lack of reliable data on the long-term performance of the alternatives. Proper maintenance of the cover may result in extending its life to 20 years or more. Off-site landfills may have an effective lifetime of 30 years or more.

3.4.2. Waste Remaining at the Site

The remedial alternatives for the Booth Oil Site which are destruction technologies (on-site incineration and off-site incineration) and separation/treatment technologies (on-site thermal separation and on-site solvent extraction) would treat all of the contaminated soil at the site. The organic contaminants would be removed and/or destroyed. No untreated waste would remain at the site.

Backfilled soil from the treatment processes would remain at the site. Soil from all of the processes except solvent extraction with metals removal would contain lead. Soils containing lead concentrations above the clean-up guidelines would be stabilized with cement to reduce the mobility of the lead.

With the off-site land disposal alternative, all wastes would be removed from the site and replaced with clean fill. No waste or treated residual would remain at the site.

On-site containment with a slurry wall and cover would not treat any of the waste at the Booth Oil Site. Because infiltration of precipitation and lateral migration of groundwater would be inhibited, the mobility of the contaminants at the site would decrease.

3.4.3. Environmental Controls

Remedial alternatives requiring post-closure monitoring and maintenance are on-site containment, the no action alternative, in-situ stabilization/solidification, and ex-situ on-site stabilization/solidification with on-site placement of the solid material. With each of these alternatives, a minimum of 30 years monitoring and maintenance would be conducted. Groundwater monitoring wells would be placed at the perimeter of the site to detect any migration of contaminants away from the site. If contaminants are found in the monitoring wells at unacceptable levels, corrective actions will be taken. The cover at the site would be inspected regularly and maintained as needed. If no fence is placed at the site, more frequent monitoring would be required.

If residuals from the on-site treatment alternatives (incineration, thermal separation, and solvent extraction) contain elevated concentrations of lead and are backfilled on-site after stabilization, post-closure monitoring and maintenance would be required similar to that for the containment alternative. Groundwater monitoring wells would be sampled periodically to detect migration of contaminants, primarily lead, away from the site.

In conclusion, off-site incineration is judged to be the most long-term effective and permanent alternative. All waste is removed from the site, with the organic contaminants being destroyed by the incineration process and the inorganics in the residue being stabilized prior to landfilling. Those alternatives which dispose of treated residuals on-site (on-site incineration, on-site thermal separation, and on-site solvent extraction) are slightly less long-term effective and permanent because residuals exceeding the lead clean-up goal might be disposed on-site requiring minimal long-term monitoring and maintenance. Off-site land disposal is long-term effective, requires no long-term monitoring/maintenance, but is not permanent; contaminants remain in the soil at the off-site landfill. On-site containment is the least long-term effective and permanent alternative, with the exception of the no action alternative. Contaminated soil remains at the site without treatment, requiring 30 years of groundwater monitoring and maintenance.

3.5 Reduction of Toxicity, Mobility, and Volume

3.5.1. Reduction of Toxicity

All of the remedial alternatives for the Booth Oil Site, with the exception of on-site containment, off-site land disposal, and no action, would significantly reduce the toxicity of the waste attributable to the organic contaminants. In the destruction processes (on-site incineration and off-site incineration), the organic contaminants would be destroyed. In the separation/treatment alternatives (on-site thermal separation and on-site solvent extraction), organic contaminants would be removed from the soil and destroyed off-site. Neither the destuction nor the separation/treatment technologies would reduce the toxicity of the waste due to lead. On-site containment, off-site land disposal, and no action would not reduce the toxicity of the hazardous wastes attributable to either the organics or lead.

3.5.2 Reduction of Mobility and Volume

Those alternatives involving the on-site backfilling of treated residuals (on-site incineration, on-site thermal separation, and on-site solvent extraction) may need to be capable of reducing the mobility of the lead in the residuals. Stabilization of the soil prior to backfilling would lower the mobility of the lead, but would not affect its toxicity. Stabilization would result in a volume increase for the soil between 10 and 50 percent, depending on the quantities of additives used.

On-site containment and off-site land disposal would reduce the mobility of the contaminants through isolation with physical structures. The toxicity and volume of the contaminants would be unchanged. The no action alternative would not affect the mobility or volume of the contaminants.

3.5.3 Reversibility

All of the remedial alternatives, with the exception of off-site land disposal, on-site containment, and no action, would irreversibly reduce the toxicity, mobility, and volume of the organic waste components. In each, the organic contaminants would be destroyed. Stabilization of the residues of each alternative would reduce the mobility of the lead in the soil. The lead would be strongly bound in a solidified mass resistant to leaching. The reduction in mobility provided by off-site land disposal and on-site containment is reversible because the physical containment structures have a limited lifetime and would require repair and/or replacement.

Off-site incineration, on-site incineration, on-site thermal separation, and on-site solvent extraction would provide the highest reduction in the toxicity and mobility of the wastes at the site. Organic contaminants would be destroyed and lead in the residue would be stabilized prior to land disposal. Stabilization would result in a volume increase for the waste. Off-site disposal would provide a lesser degree of reduction of toxicity and mobility. The alternative would not reduce the toxicity of the waste at all but would reduce mobility by containing the waste in a landfill. The waste would not experience a volume increase. Likewise, on-site containment would not reduce toxicity. It would provide less reduction in mobility of contaminants than off-site land disposal because a slurry wall and cover system is not as secure as a hazardous waste landfill. The no action alternative does not affect the toxicity, mobility, or volume of the waste.

Extraction and treatment of the contaminated groundwater from the Booth Oil Site will be irreversible. The organic contaminants will be either removed by an oil/water separator and destroyed or mineralized by treatment at the North Tonawanda POTW. The only future remedial action that may be neccessary is the extraction of recharged groundwater if the layer of water at the site is not perched.

3.6 Implementability

3.6.1. Ease of Implementation

At the Booth Oil Site, there are two general implementation problems: air emissions and the railroad tracks. These problems are discussed below.

In order to implement any of the remedial action alternatives (except the no action alternative) at the Booth Oil Site, the railroad tracks within the area requiring remediation must be removed. The soil beneath the tracks cannot be capped, excavated, or treated until the tracks have been removed. The rail company that owns the tracks will be responsible for taking up the tracks and placing new ones after completion of the remedial action. Because the railroad will be responsible for removing the tracks, any remedial action will be coordinated with the rail company. This most likely will result in some delay in implementation of an alternative.

The remedial alternatives requiring excavation of the contaminated soil for treatment or disposal (on-site incineration, off-site incineration, on-site thermal separation, on-site solvent extraction, and off-site land disposal) will be somewhat difficult to implement because of the vapors, odors, and dust that are anticipated during excavation and soil handling. The control systems for the air emissions are discussed in more detail in Section 2. Workers excavating the site may be required to wear higher levels of PPE than level D (most likely level C and possibly level B).

The on-site treatment technologies could be easily set-up and operated at the Booth Oil Site. Adequate space exists in the area of the site not requiring remediation for the set-up and operation of the technologies being evaluated. However, the railroad tracks dividing the area not marked for remediation may present difficulties for the location of technologies. Space requirements of each technology are as follows:

- On-site incineration
  - Circulating Bed Combustor - 18,000 ft^2
  - Infrared Incineration System - 32,000 ft^2
  - Transportable Incineration System - 74,500 ft^2

- On-site Thermal Separation
  - Closed-Loop Thermal Separation - 52,000 ft^2
  - Anaerobic Thermal Separation - 52,000 ft^2
  - Fluidized Bed Thermal Separation - 34,000 ft^2

- On-site Solvent Extraction
  - Triethylamine Extraction - 27,000 ft^2

These space estimates were provided by vendors of the technologies. They include space for equipment set-up, stockpiling of soil before and after treatment, pre-processing equipment, and decontamination area.

On-site containment of the waste with a slurry wall and cover may be somewhat difficult to implement. If a slurry wall is placed around the entire site, a cover of low permeability material may be placed over the entire area. If two slurry walls are constructed, covers would be placed over the two areas surrounded by the walls. Because of the railroad tracks, there would be complications in the implementation of either alternative.

Difficulties may arise in the construction of the slurry wall. In the alternative involving the construction of one slurry wall around the entire area of contamination, the slurry wall around the site would be constructed beneath railroad tracks that may not be removed. Construction of the wall beneath the tracks would not permit operation of the tracks during the construction operation. Also, the southern portion of the slurry wall, if constructed on the site, would run through the area requiring remediation. Generally, it is desirable to construct the slurry wall outside the area of contamination so that contaminants do not contact the wall. If soil borings in the area of contamination adjacent to Robinson Street indicate that the soil is too contaminated for construction of a slurry wall, that portion of the wall may need to be constructed in Robinson Street. This could be achieved but with some difficulty.

Construction of two slurry walls at the site may present difficulties for the groundwater extraction system. More dewatering wells may be necessary. Additionally, the piping from the well(s) on one side of the tracks would need to be routed beneath or over the tracks to the treatment system.

3.6.2. <u>Delays in Implementation</u>

Each of the on-site treatment technologies may experience technical delays. The treatment equipment may experience mechanical difficulties and delay the remedial action. Each of the soil treatment technologies utilizes a significant amount of mechanical equipment. As is typical of such equipment, malfunctions are not uncommon. Mixing equipment, conveying systems, heating systems, blowers, and other mechanical components of the remedial technologies can experience breakdown.

On-site containment, off-site land disposal, and off-site incineration may likely be delayed in their implementation. The slurry wall and cover at the site would be constructed in coordination with the railroad. The railroad's plans may delay construction of the slurry wall and cover system. Excavation of the waste for off-site land disposal or off-site incineration also could be delayed by the railroad's schedule.

3.6.3. Coordination of the Remedial Alternatives

None of the remedial alternatives requires coordination with offices of agencies outside NYSDEC to the extent that project implementation would be delayed significantly. The major coordination problem involves the railroad company. Because each remedial alternative except no action requires removal of the railroad tracks in the area of contamination, coordination with the railroad will be equvalent for all of these alternatives. Remedial alternatives with shorter implementation periods will be more easily coordinated with the railroad as they will involve less downtime for the tracks.

The groundwater extraction, treatment, and discharge that will be a part of any remedial alternative selected must be coordinated with the North Tonawanda POTW. The discharge would need to comply with the pretreatment requirements of the POTW.

3.6.4. Availability of Technologies

Each of the remedial technologies being considered for the Booth Oil Site is commercially available. The availability of the technologies is not considered to effect the implementability of any of the alternatives. However, as the number of vendors currently offering solvent extraction is limited, a strict competitive bidding process for this technology may not be possible.

Off-site incineration, off-site land disposal, on-site incineration, on-site thermal separation, and on-site solvent extraction have the most significant implementability problems because of the measures necessary for controlling air emissions during excavation. These problems are less severe for off-site land disposal and off-site incineration because they take the least time to implement. In addition, the on-site destruction and separation/treatment options have implementability problems associated with siting and operating complicated process equipment. Although the on-site containment alternative may be somewhat difficult to implement to accomodate the railroad tracks, these problems are less in comparison. The no action alternative has no implementability problems.

3.7 COST

The capital and operation and maintenance costs of each of the remedial alternatives being considered for the Booth Oil Site are summarized below. A complete breakdown of each estimate is presented in Table 3.1. A summary table comparing total capital and annual O&M costs, together with implementation period and net present worth (30 years) for each alternative is presented in Table 3.2.

When referencing these tables and the following cost summaries, it should be noted that individual vendor's cost estimates had to be normalized for any meaningful comparison to take place. The need for these adjustments were due to:

- o Incomplete estimates from certain vendors;
- o Inconsistent units and unit costs;
- o Inconsistent estimates for contaminated soil volumes; and
- o Inconsistent conversion of volume to tonnage by certain vendors.

Therefore, the following assumptions and normalization adjustments were performed to each cost estimate as necessary:

- o With the exception of the no action alternative, each alternative will coordinate with the railroad for remedial actions in the vicinity of the railroad tracks. This is particularly true for those alternatives which require soil excavation. For these alternatives, removal and replacement of tracks will be required. Track removal and replacement may also be required for the containment option (slurry wall and cap). Although there will be costs associated with the railroad tracks, it is assumed that all such costs will be borne by the railroad. No costs for such activities are included herein.

- An enclosure and vapor phase treatment system will be required for each alternative which incorporates soil excavation. Test pits performed at the site during the RI encountered significant odors. Ambient air sampling indicated that ambient air limits for several VOCs at the site may be exceeded during excavation operations. Details concerning the vapor phase treatment system are not be provided at this time. It is anticipated that the vapor phase treatment system will consist of a prefilter for particulate removal, followed by a system for removal of vapor phase organics (either carbon adsorption or catalytic combustion). For purposes of the cost estimate, $500,000 has been included to cover the capital and operating costs of the vapor phase treatment system.

- Except where noted otherwise, costs for mobilization, treatment, and demobilization are based on recent quotes or telephone conversations with companies which provide such services. Backup cost data from such companies is provided in the Appendices.

- No fence is included in any of the cost estimates. The need for a fence will be re-evaluated upon coordination with the railroad during final design.

- Costs are generally rounded to the nearest thousand dollars.

- Costs for services which are common to several alternatives (e.g., excavation of contaminated soil, backfill of treated soil or clean soil, etc.) have been standardized, as applicable. Units have also been standardized, as applicable.

- Groundwater treatment system costs were estimated by SCS Engineers;

- All site work costs (e.g., excavation, backfilling, heavy equipment rental) were estimated using Means Site Work Cost Data for 1991;

- Off-site incineration, and off-site land disposal costs were estimated using anecdotal information gathered by SCS Engineers;

- A 75 percent surcharge was levied against excavation costs for work in Level B personal protection;

- Disposal of extraction products (with 1% organics in the soil, approximately 1100 55-gallon drums), when not included in treatment costs, were estimated at $400,000 ($300/drum + transportation; cost provided by Chemical Waste Management);

- Monitoring and site inspection costs were estimated by SCS Engineers;

- O&M costs for maintaining on-site facilities (e.g., trailers, telephone, utilities) were estiamted by SCS Engineers;

- One cubic yard of contaminated soil weighs 1.5 tons;
- Present worth calculations based on 5 percent over 30 years (a factor of 15.3725);

- Treatment costs based on 7 days/week and 24 hour/day operation were multiplied by 2 to normalize for a 5 day/week, 8 hours/day operation (as specified in the SCS RFP sent to each vendor); and

- There are 2000 line miles between the job site and Arizona.

3.7.1. On-site Containment

The capital and operation and maintenance costs for a slurry wall and cap system at the Booth Oil Site are summarized below. Three options are considered: one slurry wall around the area of contamination with a synthetic geomembrane with a sandy soil drainage layer and vegetative cover, a slurry wall with an asphalt cover, and two slurry walls with synthetic geomembrane covers, sandy soil drainage layers, and vegetative cover.

3.7.1.1. Slurry Wall and Synthetic Membrane Cover

CAPITAL COST	$1,979,000
ANNUAL OPERATION AND MAINTENANCE	$105,000
30-YEAR PRESENT WORTH (5% interest)	$1,610,000
TOTAL COST	$3,589,000

3.7.1.2 Slurry Wall with Asphalt Cover

CAPITAL COST	$1,943,000
ANNUAL OPERATION AND MAINTENANCE	55,000
30-YEAR PRESENT WORTH (5% interest)	$841,000
TOTAL COST	$2,784,000

3.7.1.3 Slurry Walls with Synthetic Membrane Covers

CAPITAL COST	$2,604,000
ANNUAL OPERATION AND MAINTENANCE	$105,000
30-YEAR PRESENT WORTH (5% interest)	$1,610,000

TOTAL COST	$4,214,000

3.7.2. On-site Incineration

The capital costs and O & M costs for treatment of 29,300 cubic yards (44,000 tons) of contaminated soil at the Booth Oil Site in a mobile incinerator are summarized below. Remediation costs for three incinerators (circulating bed combustor, infrared incineration system, and transportable incineration system) are included.

3.7.2.1. Circulating Bed Combustor--

CAPITAL COSTS	$11,540,000
ANNUAL OPERATION AND MAINTENANCE	$77,000
30-YEAR PRESENT WORTH (5% interest)	$1,185,000
TOTAL COST	$12,725,000

3.7.2.2. Infrared Incineration System--

CAPITAL COSTS	$19,768,000
ANNUAL OPERATION AND MAINTENANCE	$77,000
30-YEAR PRESENT WORTH (5% interest)	$1,185,000
TOTAL COST	$20,953,000

3.7.2.3. Transportable Incineration System--

CAPITAL COSTS	$13,271,000
ANNUAL OPERATION AND MAINTENANCE	$77,000
30-YEAR PRESENT WORTH (5% interest)	$1,185,000
TOTAL COST	$14,457,000

3.7.3 Off-site Incineration

The capital and O & M costs for the excavation and treatment of 29,300 cubic yards of contaminated soil at the Booth Oil Site by off-site incineration are summarized below.

CAPITAL COSTS	$65,214,000
TOTAL COST	$65,214,000

3.7.4 On-site Thermal Separation

The capital and operating costs for excavation and treatment of 29,300 cubic yards of contaminated soil at the Booth Oil Site with three thermal separation systems are summarized below.

3.7.5.1. Closed-Loop Thermal Separation--

CAPITAL COSTS	$14,088,000
ANNUAL OPERATION AND MAINTENANCE	$77,000
30-YEAR PRESENT WORTH (5% interest)	$1,185,000
TOTAL COST	$15,273,000

3.7.5.2. Anaerobic Thermal Separation--

CAPITAL COSTS	$19,818,000
ANNUAL OPERATION AND MAINTENANCE	$77,000
30-YEAR PRESENT WORTH (5% interest)	$1,185,000
TOTAL COST	$21,003,000

3.7.5.3. Fluidized Bed Thermal Separation--

CAPITAL COSTS	$20,154,000
ANNUAL OPERATION AND MAINTENANCE	$77,000
30-YEAR PRESENT WORTH (5% interest)	$1,185,000
TOTAL COST	$21,339,000

3.7.6. On-site Solvent Extraction

The capital and operating costs for the excavation and treatment of 29,300 cubic yards of contaminated soil at the Booth Oil Site with the triethylamine and acetone/kerosene plus inorganic acid solvent extraction systems are summarized below.

3.7.6.1. Triethylamine extraction--

CAPITAL COSTS	$10,505,000
ANNUAL OPERATION AND MAINTENANCE	$77,000
30-YEAR PRESENT WORTH (5% interest)	$1,185,000
TOTAL COST	$11,790,000

3.7.6.2. Acetone/Kerosene Extraction + Inorganic Acid Extraction--

CAPITAL COSTS	$12,932,000
TOTAL COST	$12,932,000

3.7.7 Off-site Land Disposal

CAPITAL COSTS	$11,964,000
TOTAL COST	$11,964,000

3.7.8 Groundwater Extraction, Treatment, and Discharge

The capital and operating costs for the extraction, treatment, and discharge of 300,000 gallons of shallow groundwater at the Booth Oil Site are summarized below. These costs were added to the cost of the soil treatment alternatives presented above to determine the total cost of each remedial action alternative.

CAPITAL COSTS	$110,000
ANNUAL OPERATION AND MAINTENANCE	$4,500
30-YEAR PRESENT WORTH (5% interest)	$69,000
TOTAL COST	$179,000

3.8 COMPARATIVE ANALYSIS SUMMARY

Table 3.3 provides a summary, in tabular format, of the major evaluation factors for each of the remedial action alternatives. Table 3.2 provides a summary of the capital, operating, and present worth costs for each remedial action alternative. Table 3.2 also shows implementation times and O&M periods for each alternative. Table 3.1 provides an itemization of the costs for each alternative.

Incineration (on-site and off-site) and thermal separation are the only two treatment alternatives which are fully developed and proven to the extent that they could be recommended for the Booth Oil Site without the performance of detailed treatability studies. Each of these alternatives will be effective at destruction of the organic contaminants present in the soil. Heavy metals present in the soil will not be remediated by incineration or thermal separation. Metals which remain in the soil after thermal treatment could be stabilized using a pozzolanic-based additive (e.g., concrete or fly ash). Although the heavy metals concentrations are elevated (particularly lead with an average concentration of about 1,900 mg/kg), they are not so high as to justify the use of one of the more complicated and expensive systems.

Treatability testing was conducted with the X*TRAX (closed-loop) thermal separation system of Chemical Waste Management. The laboratory-scale study on a soil sample from the Booth Oil Site showed that X*TRAX could reduce the levels of organic contaminants to concentrations below the remediation guidelines. The total lead concentration was not reduced. The X*TRAX process did not cause the lead in the soil to become more leachable. The treated soil did not fail TCLP. Thus, the solid residue would not be classified as a hazardous waste. Additional details concerning the treatability study can be found in Section 4.

The remaining treatment alternative (on-site solvent extraction with or without metals removal) appears promising for the Booth Oil Site. Laboratory-scale treatability testing conducted with the Resource Conservation Company (RCC) BEST process (triethylamine extraction without metals removal) indicated that the BEST system can effectively remove organic contaminants from the soil at the Booth Oil Site to levels less than the remediation guidelines. In the treatability study, the total lead concentration was not reduced. Also, the BEST process made the lead in the soil more leachable, causing the treated soil to fail TCLP for lead. Without stabilization, the residual solid would be characterized as a hazardous waste. A representative of RCC indicated that a stabilizing agent could be added to the soil at the end of the treatment process to produce a treated solid that is not a hazardous waste. Results of the treatability study are detailed in Section 4.

The non-treatment technologies (on-site containment and off-site land disposal) can each be implemented successfully at the Booth Oil site.

Summary discussions for each alternative are provided below. These discussions assume that treatability studies would indicate that the treatment technologies can be effective for remediation of the Booth Oil Site.

3.8.1. On-Site Containment

The major advantages of on-site containment are that it is the least difficult of the alternatives to implement and has the lowest cost. Although on-site containment does not reduce the toxicity or volume of the wastes, the mobility would be sufficiently reduced to protect human health and the environment. The major disadvantages of the alternative are that it is not permanent, wastes would remain in place, long-term monitoring and maintenance would be required, and future land-use would be restricted.

3.8.2. On-Site Treatment Alternatives

The major advantages of the on-site treatment alternatives (incineration, thermal separation, and solvent extraction) are that they are permanent remedies and would require minimal long-term monitoring and maintenance. The soils would be treated to levels which would allow less control over future land use. However, there may be significant implementation problems associated with the excavation and handling of the soil on-site. If vapors and dust from these activities are not effectively controlled, there could be a temporary degradation of air quality in the local neighborhoods. It is anticipated that the control measure would mitigate the short-term risks, but they would be costly and may not be entirely effective.

3.8.3 Off-Site Alternatives

The off-site alternatives (incineration and land disposal) have one slight advantage over the on-site alternatives. This advantage is the shorter implementation time which reduces the short-term risks from excavation and soil handling. This advantage is more than off-set by the increased risks and impacts of transporting the contaminated soils, the non-permanent nature of off-site disposal, and the excessive costs of off-site incineration. Also, the off-site alternatives would not meet the NYSDEC preference for on-site actions.

3.8.4 No Action Alternative

The no action alternative is unacceptable, primarily because it does not protect human health and the environment. Waste remains in place at the site without treatment. The risks from current exposure routes would not be reduced to acceptable levels.

TABLE 3.1 ITEMIZED COST ESTIMATES

CAPITAL AND O&M COSTS				OPTION A-1 Slurry 1/Synth. Cover		OPTION A-2 Slurry 1/Asph. Cover		OPTION A-3 Slurry 2/Synth. Cover		OPTION B-1 OGDEN ENV. On-site Incin.(circ.bed)		OPTION B-2 OHM CORPORATION On-site Incin.(infrared)		OPTION B-3 WESTON On-site Incin.(mobile)	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost
CAPITAL COSTS															
GW EXTRACTION WELLS															
Mobilization	ea	$1,000	SCS	1	$1,000	1	$1,000	1	$1,000	1	$1,000	1	$1,000	1	$1,000
Install 3 wells	ea	$4,500	SCS	1	$4,500	1	$4,500	1	$4,500	1	$4,500	1	$4,500	1	$4,500
Install 3 pumps/controls	ea	$7,500	SCS	1	$7,500	1	$7,500	1	$7,500	1	$7,500	1	$7,500	1	$7,500
EXTRACTION WELLS SUBTOTAL					$13,000		$13,000		$13,000		$13,000		$13,000		$13,000
OIL/WATER SEPARATOR															
Seperation Unit	ea	$12,500	SCS	1	$12,500	1	$12,500	1	$12,500	1	$12,500	1	$12,500	1	$12,500
Shelter/fencing	ea	$25,000	SCS	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
Installation	ea	$2,000	SCS	1	$2,000	1	$2,000	1	$2,000	1	$2,000	1	$2,000	1	$2,000
Oil Disposal	ea	$50,000	SCS	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000
OIL/WATER SEPARATOR SUBTOTAL					$89,500		$89,500		$89,500		$89,500		$89,500		$89,500
PIPING															
Piping from system to sewer	ft	$14	MEANS	500	$7,000	500	$7,000	500	$7,000	500	$7,000	500	$7,000	500	$7,000
PIPING SUBTOTAL					$7,000		$7,000		$7,000		$7,000		$7,000		$7,000
SOIL TREATMENT MOBILIZATION	ea	variable	VENDOR	1	$15,000	1	$15,000	1	$15,000	Incl. in treatment costs		1	$400,000	1	$3,803,000
MOBILIZATION SUBTOTAL					$15,000		$15,000		$15,000				$400,000		$3,803,000
COVER															
Grading of site	sq. yd.	$0.12	MEANS	14,500	$1,740			14,500	$1,740						
Grading for base course	sq. yd.	$0.72	MEANS			14,500	$10,440								
60 mil HDPE liner	sq. ft.	$0.80	SCS	130,000	$104,000			130,000	$104,000						
6" Base Course	sq. yd.	$5.35	MEANS			14,500	$77,575								
4" Asphalt Binder course	ton	$31.99	MEANS			1,600	$51,184								
4" Asphalt surface course	ton	$32.00	MEANS			1,600	$51,200								
1' Sandy soil (incl. delivery)	ton	$8.00	MEANS	7,200	$57,600			7,200	$57,800						
Sandy Soil Install/compact 1'	cu. yd.	$3.91	MEANS	4,800	$18,768			4,800	$18,768						
Topsoil (incl. delivery)	cu. yd.	$10.00	MEANS	2,800	$28,000			2,800	$28,000	4,800	$48,000	4,800	$48,000	4,800	$48,000
Topsoil Install/compact	cu. yd.	$3.91	MEANS	2,800	$10,948			2,800	$10,948	4,800	$18,768	4,800	$18,768	4,800	$18,768
Establish vegetation	acre	$1,900	SCS	3	$5,700			3	$5,700	3	$5,700	3	$5,700	3	$5,700
COVER SUBTOTAL					$226,756		$190,399		$226,756		$72,468		$72,468		$72,468
SLURRY WALL															
Soil-Bentonite Slurry Wall	sq. ft.	$16.00	SCS	17,500	$280,000	17,500	$280,000	25,500	$408,000						
SLURRY WALL SUBTOTAL					$280,000		$280,000		$408,000						

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION A-1 Slurry 1/Synth. Cover		OPTION A-2 Slurry 1/Asph. Cover		OPTION A-3 Slurry 2/Synth. Cover		OPTION B-1 OGDEN ENV. On-site Incin.(circ.bed)		OPTION B-2 OHM CORPORATION On-site Incin.(infrared)		OPTION B-3 WESTON On-site Incin.(mobile)	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost
MOBILE HOOD															
Mobile Hood Structure	sq. ft	$12.00	SCS	7,200	$86,400	7,200	$86,400	7,200	$86,400	10,800	$129,600	10,800	$129,600	10,800	$129,600
Rental Crane to move hood	move	$2,500	MEANS	5	$12,500	5	$12,500	10	$25,000	15	$37,500	15	$37,500	15	$37,500
MOBILE HOOD SUBTOTAL					$98,900		$98,900		$111,400		$167,100		$167,100		$167,100
VAPOR PHASE TREATMENT SYSTEM															
GAC Adsorption Unit (inl O&M)	ea	$500,000	SCS	1	$500,000	1	$500,000	1	$500,000	1	$500,000	1	$500,000	1	$500,000
VAPOR PHASE SYSTEM SUBTOTAL					$500,000		$500,000		$500,000		$500,000		$500,000		$500,000
EXCAVATION															
Excavation	ton	$40.00	SCS	9,000	$360,000	9,000	$360,000	15,000	$600,000	44,000	$1,760,000	44,000	$1,760,000	Incl. in Treatment costs	
75% Surcharge for Level B	ton	$30.00	SCS	9,000	$270,000	9,000	$270,000	15,000	$450,000		$1,320,000		$1,320,000		
EXCAVATION SUBTOTAL					$630,000		$630,000		$1,050,000		$3,080,000		$3,080,000		
TRANSPORTATION															
Trade Waste Inciner	ton	$182	VENDOR												
Chem. Waste Landfill	ton	$21.59	VENDOR												
TRANSPORTATION SUBTOTAL															
SOIL TREATMENT															
Treatment 1 (incl. mob./demob.)	ton	$151.18	VENDOR							44,000	$6,651,744				
Treatment 2 (incl. mob./demob.)	cu. yd.	$180	VENDOR												
Treatment (incl. exc./backfill)			VENDOR											1	$6,740,750
Treatment 3	ton	$320	VENDOR									44,000	$14,080,000		
Treatment 4	ton	$1,200	VENDOR												
Treatment 5	cu. yd.	$300	VENDOR												
Treatment 6	ton	$340	VENDOR												
Treatment 7 (all incl.)	cu. yd	$274.41	VENDOR												
Stabilization w/ cement	cu. yd.	$10.00	VENDOR							29,000	$290,000	29,000	$290,000	29,000	$290,000
Disposal of extraction products	ea	$1,000,000	SCS												
Land Disposal	ton	$150	SCS												
SOIL TREATMENT SUBTOTAL											$6,941,744		$14,370,000		$7,030,750

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION A-1		OPTION A-2		OPTION A-3		OPTION B-1 OGDEN ENV.		OPTION B-2 OHM CORPORATION		OPTION B-3 WESTON	
				Slurry 1/Synth. Cover		Slurry 1/Asph. Cover		Slurry 2/Synth. Cover		On-site Incin.(circ.bed)		On-site Incin.(infrared)		On-site Incin.(mobile)	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty.	Total Cost	Est. Qty	Total Cost	Est. Qty.	Total Cost	Est. Qty	Total Cost
BACKFILLING															
Treated Soil	ton	$15.00	SCS							44,000	$660,000	44,000	$660,000	44,000	$660,000
Clean soil (delivery)	ton	$8.00	SCS	9,000	$72,000	9,000	$72,000	15,000	$120,000						
Clean soil (install/compact)	cu yd	$3.91	MEANS	6,000	$23,460	6,000	$23,460	10,000	$39,100						
BACKFILLING SUBTOTAL					$95,460		$95,460		$159,100		$660,000		$660,000		$660,000
DEMOBILIZATION	ea.	variable	VENDOR	1	$15,000	1	$15,000	1	$15,000	Incl. in treatment costs		1	$400,000	1	$920,000
DEMOBILIZATION SUBTOTAL					$15,000		$15,000		$15,000				$400,000		$920,000
MONITORING WELLS															
Installation	ea.	$1,500	SCS	6	$9,000	6	$9,000	6	$9,000	6	$9,000	6	$9,000	6	$9,000
MONITORING WELLS SUBTOTAL					$9,000		$9,000		$9,000		$9,000		$9,000		$9,000
TOTAL CAPITAL COST					$1,979,618		$1,943,259		$2,603,758		$11,539,812		$19,768,068		$13,271,818

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION A-1 Slurry 1/Synth. Cover		OPTION A-2 Slurry 1/Asph. Cover		OPTION A-3 Slurry 2/Synth. Cover		OPTION B-1 OGDEN ENV. On-site Incin (circ.bed)		OPTION B-2 OHM CORPORATION On-site Incin (infrared)		OPTION B-3 WESTON On-site Incin (mobile)	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost
ANNUAL OPERATIONS AND MAINTENANCE COSTS															
GW TREATMENT SYSTEM															
Extraction Wells (14% of capital)	ea	$1,800	SCS	1	$1,800	1	$1,800	1	$1,800	1	$1,800	1	$1,800	1	$1,800
Oil/Water Seperator (7% of capital)	ea.	$2,700	SCS	1	$2,700	1	$2,700	1	$2,700	1	$2,700	1	$2,700	1	$2,700
GW SYSTEM SUBTOTAL					$4,500		$4,500		$4,500		$4,500		$4,500		$4,500
SITE INSPECTIONS	ea	$1,000	SCS	4	$4,000	4	$4,000	4	$4,000	4	$4,000	4	$4,000	4	$4,000
SITE INSPECTIONS SUBTOTAL					$4,000		$4,000		$4,000		$4,000		$4,000		$4,000
MAINTENANCE OF VEGETATIVE COVER															
Mowing of cover	ea	$3,200	MEANS	14	$44,800			14	$44,800	14	$44,800	14	$44,800	14	$44,800
Fertilization	ea	$1,000	SCS	1	$1,000			1	$1,000	1	$1,000	1	$1,000	1	$1,000
Replace Topsoil	cu. yd	$14	SCS	300	$4,200			300	$4,200	300	$4,200	300	$4,200	300	$4,200
MAINTENANCE OF COVER SUBTOTAL					$50,000				$50,000		$50,000		$50,000		$50,000
GROUNDWATER MONITORING															
6 samps/qurtr (incl. analysis)	sample	$1,800	SCS	24	$43,200	24	$43,200	24	$43,200						
6 samps/qurtr (metals only)	sample	$650	SCS							24	$15,600	24	$15,600	24	$15,600
GW MONITORING SUBTOTAL					$43,200		$43,200		$43,200		$15,600		$15,600		$15,600
ON-SITE FACILITIES O&M															
On-site facilities O&M	ea.	$3,000	SCS	1	$3,000	1	$3,000	1	$3,000	1	$3,000	1	$3,000	1	$3,000
ON-SITE FACILITIES O&M SUBTOTAL					$3,000		$3,000		$3,000		$3,000		$3,000		$3,000
TOTAL ANNUAL O&M COSTS					$104,700		$54,700		$104,700		$77,100		$77,100		$77,100
30-YEAR PRESENT WORTH (5% ANNUAL INTEREST)					$1,609,501		$840,878		$1,609,501		$1,185,220		$1,185,220		$1,185,220
TOTAL OF CAPITAL COST + 30 YEARS OF O&M COSTS					$3,589,117		$2,784,135		$4,213,257		$12,725,032		$20,953,288		$14,457,038

ASSUMPTIONS

1 cu. yd. of soil weighs 1.5 tons
Present Worth calculation base on a factor of 15.3725 (based on 5% over 30 years)
No site maintenance required by option C
Excavation and backfilling costs have been standardized for all options
Soil treatment unit costs normalized for 5-day week/8-hour day (after subtracting fixed costs)
2000 line miles from Arizona to site

LEGEND

Slurry 1/Synth. Cover = One Slurry Wall and Synthetic Membrane Cover
Slurry 1/Asph. Cover = One Slurry Wall and Asphalt Cover
Slurry 2/Synth. Cover = Two Slurry Walls and Synthetic Membrane Covers
On-site Incin (circ. bed) = On-site incineration using a circulating bed incinerator
On-site Incin (infrared) = On-site incineration using an Infrared Incinerator

On-site Th. Sep. (C) = On-site Thermal adsorption (closed-loop)
On-site Th. Sep. (C) = On-site Thermal adsorption (Anaerobic)
On-site Th. Sep. (C) = On-site Thermal adsorption (Fluid)
On-site Sol. Ex. (A/K) = On-site solvent extraction (Acetone/Kerosene)
On-site Sol. Ex. (TEA) = On-site solvent extraction (Triethylamine)

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION C Off-site Incineration		OPTION D-1 CHEM-WASTE On-site Th. Sep.(C)		OPTION D-2 SOIL TECH On-site Th. Sep (A)		OPTION D-3 RECYCLING SCIENCES On-site Th. Sep.(F)	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est Qty	Total Cost	Est Qty	Total Cost	Est Qty	Total Cost	Est Qty	Total Cost
CAPITAL COSTS											
GW EXTRACTION WELLS											
Mobilization	ea	$1,000	SCS	1	$1,000	1	$1,000	1	$1,000	1	$1,000
Install 3 wells	ea	$4,500	SCS	1	$4,500	1	$4,500	1	$4,500	1	$4,500
Install 3 pumps/controls	ea.	$7,500	SCS	1	$7,500	1	$7,500	1	$7,500	1	$7,500
EXTRACTION WELLS SUBTOTAL					$13,000		$13,000		$13,000		$13,000
OIL/WATER SEPARATOR											
Seperation Unit	ea	$12,500	SCS	1	$12,500	1	$12,500	1	$12,500	1	$12,500
Shelter/fencing	ea	$25,000	SCS	1	$25,000	1	$25,000	1	$25,000	1	$25,000
Installation	ea	$2,000	SCS	1	$2,000	1	$2,000	1	$2,000	1	$2,000
Oil Disposal	ea	$50,000	SCS	1	$50,000	1	$50,000	1	$50,000	1	$50,000
OIL/WATER SEPARATOR SUBTOTAL					$89,500		$89,500		$89,500		$89,500
PIPING											
Piping from system to sewer	ft.	$14	MEANS	500	$7,000	500	$7,000	500	$7,000	500	$7,000
PIPING SUBTOTAL					$7,000		$7,000		$7,000		$7,000
SOIL TREATMENT MOBILIZATION	ea	variable	VENDOR	1	$10,000	1	$250,000	1	$425,000	1	$178,000
MOBILIZATION SUBTOTAL					$10,000		$250,000		$425,000		$178,000
COVER											
Grading of site	sq yd.	$0.12	MEANS								
Grading for base course	sq yd.	$0.72	MEANS								
60 mil HDPE liner	sq ft.	$0.80	SCS								
6" Base Course	sq yd	$5.35	MEANS								
4" Asphalt Binder course	ton	$31.89	MEANS								
4" Asphalt surface course	ton	$32.00	MEANS								
1' Sandy soil (incl. delivery)	ton	$8.00	MEANS								
Sandy Soil Install/compact 1'	cu. yd.	$3.91	MEANS								
Topsoil (incl. delivery)	cu yd.	$10.00	MEANS	4,800	$48,000	4,800	$48,000	4,800	$48,000	4,800	$48,000
Topsoil Install/compact	cu. yd.	$3.91	MEANS	4,800	$18,768	4,800	$18,768	4,800	$18,768	4,800	$18,768
Establish vegetation	acre	$1,900	SCS	3	$5,700	3	$5,700	3	$5,700	3	$5,700
COVER SUBTOTAL					$72,468		$72,468		$72,468		$72,468
SLURRY WALL											
Soil-Bentonite Slurry Wall	sq ft	$16.00	SCS								
SLURRY WALL SUBTOTAL											

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION C Off-site Incineration		OPTION D-1 CHEM-WASTE On-site Th. Sep.(C)		OPTION D-2 SOIL TECH On-site Th. Sep (A)		OPTION D-3 RECYCLING SCIENCES On-site Th. Sep.(F)	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est Qty	Total Cost	Est Qty	Total Cost	Est Qty	Total Cost	Est Qty	Total Cost
MOBILE HOOD											
Mobile Hood Structure	sq. ft.	$12.00	SCS	10,800	$129,600	10,800	$129,600	10,800	$129,600	10,800	$129,600
Rental Crane to move hood	move	$2,500	MEANS	15	$37,500	15	$37,500	15	$37,500	15	$37,500
MOBILE HOOD SUBTOTAL					$167,100		$167,100		$167,100		$167,100
VAPOR PHASE TREATMENT SYSTEM											
GAC Adsorption Unit (Inl. O&M)	ea.	$500,000	SCS	1	$500,000	1	$500,000	1	$500,000	1	$500,000
VAPOR PHASE SYSTEM SUBTOTAL					$500,000		$500,000		$500,000		$500,000
EXCAVATION											
Excavation	ton	$40.00	SCS	44,000	$1,760,000	44,000	$1,760,000	44,000	$1,760,000	44,000	$1,760,000
75% Surcharge for Level B	ton	$30.00	SCS		$1,320,000		$1,320,000		$1,320,000		$1,320,000
EXCAVATION SUBTOTAL					$3,080,000		$3,080,000		$3,080,000		$3,080,000
TRANSPORTATION											
Trade Waste Inciner.	ton	$182	VENDOR	44,000	$8,000,000						
Chem Waste Landfill	ton	$21.59	VENDOR								
TRANSPORTATION SUBTOTAL					$8,000,000						
SOIL TREATMENT											
Treatment 1 (incl. mob./demob.)	ton	$151.18	VENDOR								
Treatment 2 (incl. mob./demob.)	cu. yd.	$180	VENDOR								
Treatment (incl exc./backfill)			VENDOR								
Treatment 3	ton	$320	VENDOR					44,000	$14,080,000		
Treatment 4	ton	$1,200	VENDOR	44,000	$52,800,000						
Treatment 5	cu. yd.	$300	VENDOR			29,000	$8,700,000				
Treatment 6	ton	$340	VENDOR							44,000	$14,960,000
Treatment 7 (all incl.)	cu. yd.	$274.41	VENDOR								
Stabilization w/ cement	cu. yd.	$10.00	VENDOR			29,000	$290,000	29,000	$290,000	29,000	$290,000
Disposal of extraction products	ea.	$1,000,000	SCS			Incl. in treatment costs		Incl. in treatment costs		Incl. in treatment costs	
Land Disposal	ton	$150	SCS								
SOIL TREATMENT SUBTOTAL					$52,800,000		$8,990,000		$14,370,000		$15,250,000

$ 4,820,000

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION C Off-site Incineration		OPTION D-1 CHEM-WASTE On-site Th. Sep.(C)		OPTION D-2 SOIL TECH On-site Th. Sep (A)		OPTION D-3 RECYCLING SCIENCES On-site Th. Sep.(F)	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty.	Total Cost	Est. Qty.	Total Cost	Est. Qty.	Total Cost	Est. Qty.	Total Cost
BACKFILLING											
Treated Soil	ton	$15.00	SCS			44,000	$660,000	44,000	$660,000	44,000	$660,000
Clean soil (delivery)	ton	$8.00	SCS	44,000	$352,000						
Clean soil (install/compact)	cu yd	$3.91	MEANS	29,000	$113,390						
BACKFILLING SUBTOTAL					$465,390		$660,000		$660,000		$660,000
DEMOBILIZATION	ea	variable	VENDOR	1	$10,000	1	$250,000	1	$425,000	1	$130,000
DEMOBILIZATION SUBTOTAL					$10,000		$250,000		$425,000		$130,000
MONITORING WELLS											
Installation	ea	$1,500	SCS			6	$9,000	6	$9,000	6	$9,000
MONITORING WELLS SUBTOTAL							$9,000		$9,000		$9,000
TOTAL CAPITAL COST					$65,214,458		$14,088,068		$19,818,068		$20,154,068

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION C Off-site Incineration		OPTION D-1 CHEM-WASTE On-site Th. Sep.(C)		OPTION D-2 SOIL TECH On-site Th. Sep.(A)		OPTION D-3 RECYCLING SCIENCES On-site Th. Sep.(F)	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty.	Total Cost	Est. Qty.	Total Cost	Est. Qty.	Total Cost	Est. Qty.	Total Cost
ANNUAL OPERATIONS AND MAINTENANCE COSTS											
GW TREATMENT SYSTEM											
Extraction Wells (14% of capital)	ea.	$1,800	SCS			1	$1,800	1	$1,800	1	$1,800
Oil/Water Seperator (7% of capital)	ea.	$2,700	SCS			1	$2,700	1	$2,700	1	$2,700
GW SYSTEM SUBTOTAL							$4,500		$4,500		$4,500
SITE INSPECTIONS	ea.	$1,000	SCS			4	$4,000	4	$4,000	4	$4,000
SITE INSPECTIONS SUBTOTAL							$4,000		$4,000		$4,000
MAINTENANCE OF VEGETATIVE COVER											
Mowing of cover	ea.	$3,200	MEANS			14	$44,800	14	$44,800	14	$44,800
Fertilization	ea.	$1,000	SCS			1	$1,000	1	$1,000	1	$1,000
Replace Topsoil	cu. yd	$14	SCS			300	$4,200	300	$4,200	300	$4,200
MAINTENANCE OF COVER SUBTOTAL							$50,000		$50,000		$50,000
GROUNDWATER MONITORING											
8 samps/qurtr (incl. analysis)	sample	$1,800	SCS								
8 samps/qurtr (metals only)	sample	$650	SCS			24	$15,600	24	$15,600	24	$15,600
GW MONITORING SUBTOTAL							$15,600		$15,600		$15,600
ON-SITE FACILITIES O&M											
On-site facilities O&M	ea.	$3,000	SCS			1	$3,000	1	$3,000	1	$3,000
ON-SITE FACILITIES O&M SUBTOTAL							$3,000		$3,000		$3,000
TOTAL ANNUAL O&M COSTS							$77,100		$77,100		$77,100
30-YEAR PRESENT WORTH (5% ANNUAL INTEREST)							$1,185,220		$1,185,220		$1,185,220
TOTAL OF CAPITAL COST + 30 YEARS OF O&M COSTS					$65,214,458		$15,273,288		$21,003,288		$21,339,288

ASSUMPTIONS

1 cu. yd. of soil weighs 1.5 tons
Present Worth calculation base on a factor of 15.3725 (based on 5% o
No site maintenance required by option C
Excavation and backfilling costs have been standardized for all option:
Soil treatment unit costs normalized for 5-day week/8-hour day (afte
2000 line miles from Arizona to site

LEGEND

Slurry 1/Synth. Cover = One Slurry Wall and Synthetic Membrane Cov
Slurry 1/Asph. Cover = One Slurry Wall and Asphalt Cover
Slurry 2/Synth. Cover = Two Slurry Walls and Synthetic Membrane Cc
On-site Incin.(circ. bed) = On-site incineration using a circulating be
On-site Incin.(infrared) = On-site incineration using an infrared incin
On-site Incin.(mobile) = On-site incineration using a mobile incinera

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION E-1 RCC On-site Sol. Ex. (TEA)		OPTION E-2 ART INTERNATIONAL On-site Sol. Ex.(A/K)		OPTION F Off-site Land Disposal	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty	Total Cost	Est. Qty.	Total Cost	Est. Qty.	Total Cost
CAPITAL COSTS									
GW EXTRACTION WELLS									
Mobilization	ea.	$1,000	SCS	1	$1,000	1	$1,000	1	$1,000
Install 3 wells	ea.	$4,500	SCS	1	$4,500	1	$4,500	1	$4,500
Install 3 pumps/controls	ea.	$7,500	SCS	1	$7,500	1	$7,500	1	$7,500
EXTRACTION WELLS SUBTOTAL					$13,000		$13,000		$13,000
OIL/WATER SEPARATOR									
Seperation Unit	ea.	$12,500	SCS	1	$12,500	1	$12,500	1	$12,500
Shelter/fencing	ea.	$25,000	SCS	1	$25,000	1	$25,000	1	$25,000
Installation	ea.	$2,000	SCS	1	$2,000	1	$2,000	1	$2,000
Oil Disposal	ea	$50,000	SCS	1	$50,000	1	$50,000	1	$50,000
OIL/WATER SEPARATOR SUBTOTAL					$89,500		$89,500		$89,500
PIPING									
Piping from system to sewer	ft	$14	MEANS	500	$7,000	500	$7,000	500	$7,000
PIPING SUBTOTAL					$7,000		$7,000		$7,000
SOIL TREATMENT MOBILIZATION	ea.	variable	VENDOR	Included in treatment costs		Included in treatment costs		1	$10,000
MOBILIZATION SUBTOTAL									$10,000
COVER									
Grading of site	sq. yd.	$0.12	MEANS						
Grading for base course	sq. yd.	$0.72	MEANS						
60 mil HDPE liner	sq. ft.	$0.80	SCS						
6" Base Course	sq. yd.	$5.35	MEANS						
4" Asphalt Binder course	ton	$31.89	MEANS						
4" Asphalt surface course	ton	$32.00	MEANS						
1' Sandy soil (incl. delivery)	ton	$8.00	MEANS						
Sandy Soil Install/compact 1'	cu. yd.	$3.91	MEANS						
Topsoil (incl. delivery)	cu. yd.	$10.00	MEANS	4,800	$48,000	4,800	$48,000	4,800	$48,000
Topsoil Install/compact	cu. yd.	$3.91	MEANS	4,800	$18,768	4,800	$18,768	4,800	$18,768
Establish vegetation	acre	$1,900	SCS	3	$5,700	3	$5,700	3	$5,700
COVER SUBTOTAL					$72,468		$72,468		$72,468
SLURRY WALL									
Soil-Bentonite Slurry Wall	sq. ft.	$18.00	SCS						
SLURRY WALL SUBTOTAL									

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION E-1 RCC On-site Sol. Ex. (TEA)		OPTION E-2 ART INTERNATIONAL On-site Sol. Ex.(A/K)		OPTION F Off-site Land Disposal	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty.	Total Cost	Est. Qty.	Total Cost	Est. Qty.	Total Cost
MOBILE HOOD									
Mobile Hood Structure	sq. ft.	$12.00	SCS	10,800	$129,600	10,800	$129,600	10,800	$129,600
Rental Crane to move hood	move	$2,500	MEANS	15	$37,500	15	$37,500	15	$37,500
MOBILE HOOD SUBTOTAL					$167,100		$187,100		$167,100
VAPOR PHASE TREATMENT SYSTEM									
GAC Adsorption Unit (inl O&M)	ea	$500,000	SCS	1	$500,000	1	$500,000	1	$500,000
VAPOR PHASE SYSTEM SUBTOTAL					$500,000		$500,000		$500,000
EXCAVATION									
Excavation	ton	$40.00	SCS	43,950	$1,758,000	Incl. in treatment costs		44,000	$1,760,000
75% Surcharge for Level B	ton	$30.00	SCS		$1,318,500				$1,320,000
EXCAVATION SUBTOTAL					$3,076,500				$3,080,000
TRANSPORTATION									
Trade Waste Inciner.	ton	$182	VENDOR						
Chem. Waste Landfill	ton	$21.59	VENDOR					44,000	$950,000
TRANSPORTATION SUBTOTAL									$950,000
SOIL TREATMENT									
Treatment 1 (incl. mob./demob.)	ton	$151.18	VENDOR						
Treatment 2 (incl. mob./demob.)	cu. yd.	$180	VENDOR	29,000	$5,220,000				
Treatment (incl. exc./backfill)			VENDOR						
Treatment 3	ton	$320	VENDOR						
Treatment 4	ton	$1,200	VENDOR						
Treatment 5	cu. yd.	$300	VENDOR						
Treatment 6	ton	$340	VENDOR						
Treatment 7 (all incl.)	cu. yd.	$274.41	VENDOR			44,000	$12,074,040		
Stabilization w/ cement	cu. yd.	$10.00	VENDOR	29,000	$290,000				
Disposal of extraction products	ea.	$500,000	SCS	1	$500,000				
Land Disposal	ton	$150	SCS					44,000	$6,600,000
SOIL TREATMENT SUBTOTAL					$6,010,000		$12,074,040		$6,600,000

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION E-1 RCC On-site Sol. Ex. (TEA)		OPTION E-2 ART INTERNATIONAL On-site Sol. Ex.(A/K)		OPTION F Off-site Land Disposal	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty	Total Cost	Est. Qty	Total Cost	Est. Qty	Total Cost
BACKFILLING									
Treated Soil	ton	$15.00	SCS	44,000	$660,000	Incl. in treatment costs			
Clean soil (delivery)	ton	$8.00	SCS					44,000	$352,000
Clean soil (install/compact)	cu yd	$3.91	MEANS					29,000	$113,390
BACKFILLING SUBTOTAL					$660,000				$465,390
DEMOBILIZATION	ea.	variable	VENDOR	Incl. in treatment costs		Incl. in treatment costs		1	$10,000
DEMOBILIZATION SUBTOTAL									$10,000
MONITORING WELLS									
Installation	ea.	$1,500	SCS	6	$9,000	6	$9,000		
MONITORING WELLS SUBTOTAL					$9,000		$9,000		
TOTAL CAPITAL COST					$10,604,568		$12,932,108		$11,984,458

TABLE 3.1 (continued)

CAPITAL AND O&M COSTS				OPTION E-1 RCC On-site Sol. Ex (TEA)		OPTION E-2 ART INTERNATIONAL On-site Sol. Ex.(A/K)		OPTION F Off-site Land Disposal	
ITEM DESCRIPTION	UNIT	COST/UNIT	PRICING SOURCE	Est. Qty	Total Cost	Est. Qty.	Total Cost	Est. Qty.	Total Cost
ANNUAL OPERATIONS AND MAINTENANCE COSTS									
GW TREATMENT SYSTEM									
Extraction Wells (14% of capital)	ea.	$1,800	SCS	1	$1,800				
Oil/Water Seperator (7% of capital)	ea.	$2,700	SCS	1	$2,700				
GW SYSTEM SUBTOTAL					$4,500				
SITE INSPECTIONS	ea	$1,000	SCS	4	$4,000				
SITE INSPECTIONS SUBTOTAL					$4,000				
MAINTENANCE OF VEGETATIVE COVER									
Mowing of cover	ea	$3,200	MEANS	14	$44,800				
Fertilization	ea	$1,000	SCS	1	$1,000				
Replace Topsoil	cu yd	$14	SCS	300	$4,200				
MAINTENANCE OF COVER SUBTOTAL					$50,000				
GROUNDWATER MONITORING									
8 samps/qurtr (incl analysis)	sample	$1,800	SCS						
8 samps/qurtr (metals only)	sample	$650	SCS	24	$15,600				
GW MONITORING SUBTOTAL					$15,600				
ON-SITE FACILITIES O&M									
On-site facilities O&M	ea	$3,000	SCS	1	$3,000				
ON-SITE FACILITIES O&M SUBTOTAL					$3,000				
TOTAL ANNUAL O&M COSTS					$77,100				
30-YEAR PRESENT WORTH (5% ANNUAL INTEREST)					$1,185,220				
TOTAL OF CAPITAL COST + 30 YEARS OF O&M COSTS					$11,789,788		$12,832,108		$11,864,458

ASSUMPTIONS

1 cu. yd. of soil weighs 1.5 tons
Present Worth calculation base on a factor of 15.3725 (based on 5% o
No site maintenance required by option C
Excavation and backfilling costs have been standardized for all option:
Soil treatment unit costs normalized for 5-day week/8-hour day (afte
2000 line miles from Arizona to site

LEGEND

Slurry 1/Synth. Cover = One Slurry Wall and Synthetic Membrane Cov
Slurry 1/Asph. Cover = One Slurry Wall and Asphalt Cover
Slurry 2/Synth. Cover = Two Slurry Walls and Synthetic Membrane Co
On-site Incin.(circ. bed) = On-site incineration using a circulating be
On-site Incin.(infrared) = On-site incineration using an infrared incin
On-site Incin.(mobile) = On-site incineration using a mobile incinera

TABLE 3-2. ECONOMIC AND IMPLEMENTATION SUMMARY

ALTERNATIVE	CAPITAL COST ($K)	IMPLEMENTATION PERIOD (YR)	ANNUAL O&M COST ($K/YR)	O&M PERIOD (YRS)	TOTAL PRESENT WORTH ($K)
On-Site Containment: Slurry Wall and Synthetic Membrane Cover	1,980	1.5	105	30	3,589
On-Site Containment: Slurry Wall and Asphalt Cover	1,943	1.5	55	30	2,784
On-Site Containment: Two Slurry Walls with Synthetic Membrane Covers	2,604	1.5	105	30	4,213
On-Site Incineration: Circulating Bed Combuster	11,540	2.3	77	30	12,725
On-Site Incineration: IR System	19,768	1.8	77	30	20,953
On-Site Incineration: Transportable System	13,271	3.0	77	30	14,457
Off-Site Incineration:	65,214	1.0	NA	0	65,214
On-Site Thermal Separation: Closed-Loop System	14,088	1.7	77	30	15,273
On-Site Thermal Separation: Anaerobic Thermal Separation	19,818	2.7	77	30	21,003
On-Site Thermal Separation: Fluidized Bed	20,154	2.1	77	30	21,339
On-Site Solvent Extraction: TEA System	10,605	2.0	77	30	11,790
On-Site Solvent Extraction: Acetone/kerosene/Inorganic System	12,932	2.0	NA	0	12,932
Off-Site Land Disposal	11,964	1.0	NA	0	11,964

TABLE 3.3. SUMMARY OF MAJOR EVALUATION FACTORS

	Compliance with SCGs			Protection of Human Health and the Environment	
	Organic Contaminant Guidelines	Inorganic Contaminant Guidelines	Action Specific Standards	Residual Risk Acceptable	Residual Risk Unacceptable
On-Site Containment	No, But Prevents Migration	No, But Prevents Migration	Yes	Yes	
On-Site Incineration	Yes	No, Metals Need To Be Stabilized	Yes	Yes	
Off-Site Incineration	Yes	No, Metals Need To Be Stabilized	Yes	Yes	
On-Site Thermal Separation	Yes	No, Metals Need To Be Stabilized	Yes	Yes	
On-Site Solvent Extraction w/metals removal	Yes (if proven effective)	Yes (if proven effective)	yes	Yes (if proven effective)	
On-Site Solvent Extraction w/o metals removal	Yes (if proven effective)	No, Metals Need To Be Stabilized	Yes	Yes (if proven effective)	
Off-Site Land Disposal	Yes	Yes	Yes	Yes	
No Action Alternative	No	No	NA		Yes

TABLE 3.3 (continued)

	Short-Term Effectiveness			Long-Term Effectiveness & Permanence		
	Chemical Vapors & Odors Generated	Dust Generated	Mitigative Measures Available	Permanent for Organic Contaminants (if proven effective)	Permanent for Inorganic Contaminants (if proven effective)	Long-Term Monitoring Required
On-Site Containment	Minimal	Minimal	Yes	No	No	Yes
On-Site Incineration	Yes, During Excavation	Yes, During Excavation	Yes, Excavation Under Hood	Yes, Organics Destroyed	Yes, Metals Need To Be Stabilized	Yes, Metals in GW Only
Off-Site Incineration	Yes, During Excavation	Yes, During Excavation	Yes, Excavation Under Hood	Yes, Organics Destroyed	Yes, Metals Need To Be Stabilized	Yes, Metals in GW Only
On-Site Thermal Separation	Yes, During Excavation	Yes, During Excavation	Yes, Excavation Under Hood	Yes. Organics Destroyed	Yes, Metals Need To Be Stabilized	Yes, Metals in GW Only
On-Site Solvent Extraction w/metals removal	Yes, During Excavation	Yes, During Excavation	Yes, Excavation Under Hood	Yes, Organics Destroyed	Yes, Metals Removed	No
On-Site Solvent Extraction w/o metals removal	Yes, During Excavation	Yes, During Excavation	Yes, Excavation Under Hood	Yes, Organics Destroyed	Yes, Metals Need To Be Stabilized	Yes, Metals in GW Only
Off-Site Land Disposal	Yes, During Excavation	Yes, During Excavation	Yes, Excavation Under Hood	No	No	No
No Action Alternative	No	No	NA	No	No	Yes

TABLE 3.3 (continued)

	Reduction of Toxicity, Mobility and Volume					Implementability	
	Toxicity from Organic Contaminants Reduced	Toxicity from Inorganic Contaminants Reduced	Mobility of Organic Contaminants Reduced	Mobility of Inorganic Contaminants Reduced	Volume Increase	Difficulties in Construction	Commercially Available
On-Site Containment	No	No	Yes, Migration Restricted	Yes, Migration Restricted	No	Rail Tracks, Off-Site Construction	Yes
On-Site Incineration	Yes, (if proven effective)	No	Yes, Organics Destroyed	Yes, Metals Need To Be Stabilized	Minor	Vapors & Odors Rail Tracks	Yes
Off-Site Incineration	Yes, (if proven effective)	No	Yes, Organics Destroyed	Yes, Metals Need To Be Stabilized	Minor	Vapors & Odors Rail Tracks	Yes
On-Site Thermal Separation	Yes, (if proven effective)	No	Yes, Organics Removed and Destroyed	Yes, Metals Need To Be Stabilized	Minor	Vapors & Odors Rail Tracks	Yes
On-Site Solvent Extraction w/metals removal	Yes, (if proven effective)	Yes, Metals Removed	Yes, Organics Removed and Destroyed	Yes, Metals Removed	No	Vapors & Odors Rail Tracks	No, Anticipated in 1993.
On-Site Solvent Extraction w/o metals removal	Yes, (if proven effective)	No	Yes, Organics Removed and Destroyed	Yes, Metals Need To Be Stabilized	Minor	Vapors & Odors Rail Tracks	Yes
Off-Site Land Disposal	No	No	Yes, Migration Eliminated	Yes, Migration Eliminated	No	Vapors & Odors Rail Tracks	Yes
No Action Alternative	No	No	No	No	No	NA	NA

Section 4

SECTION 4

TREATABILITY STUDY

4.1 INTRODUCTION

Three vendors were selected for the performance of a laboratory scale treatability study to determine the applicability of treatment processes to the contaminated soil at the Booth Oil Site. The vendors selected represented two technology types for treating soil contaminated primarily with organic materials. The three vendors included Chemical Waste Management (CWM), Inc. which represented the X*TRAX thermal separation technology, Resource Conservation Company (RCC) representing the BEST solvent extraction process and Critical Fluid Systems (CFS) also representing a solvent extraction process. Each of the treatment systems is commercially available.

4.2 PROCEDURE

Samples of soil cuttings believed to be representative of a more highly contaminated area of the site were collected on November 19, 1991, and transmitted to a third party laboratory, Industrial and Environmental Analysis, Inc. (IEA) for initial characterization. The results of the initial characterization are presented as the first column on all tables in this section for comparison purposes. Samples were also sent to CWM and CFS on the same date. The RCC samples were retained at the site for subsequent transmittal on December 16, 1991. The vendors sent feed, treated soil, and in some cases, extracted oil samples directly to IEA for analysis. The run feed, treated soil, and extracted oil samples were transmitted to IEA Laboratories for analysis on December 2, 1991 for CFS, December 20, 1991 for RCC and January 9, 1992 for CWM. The laboratory performed the requested analysis and subsequently transmitted the analytical data to Dvirka & Bartilucci Consulting Engineers (D&B).

The analytical results were then grouped into categories of compounds that were developed in the Phase I/II Remedial Investigation Report dated August, 1991 for the site which best represents groups of compounds for which remediation goals have been developed at the site. The groups include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), two subgroups of SVOCs including total polycyclic aromatic hydrocarbons (PAHs) and supplemental semivolatile organic compounds (SSOCs), total polychlorinated biphenyls (PCBs), total lead and toxicity characteristic leaching procedure (TCLP) lead. These analytical results were then evaluated to determine the efficiency of the vendors treatment process in removing the categories of compounds for which remediation guidelines were presented in the Phase I/II Remedial Investigation Report and whether by comparison these guidelines were achieved.

4.3 RESULTS

4.3.1 RCC's BEST Solvent Extraction Process

Table 4-1 indicates the analytical results for RCC's BEST solvent extraction process. The individual parameters are grouped into categories for the

Table 4-1

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
VOLATILE ORGANICS
VENDOR: RCC

VOLATILE COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids SB-5 (ug/kg)	Treated Solids* SB-5RE (ug/kg)	Product Oil SB-5 (ug/kg)	Product Oil SB-5RE (ug/kg)
Chloromethane	U	U	U	U	U	U
Bromomethane	U	U	U	U	U	U
Vinyl Chloride	U	U	U	U	U	U
Chloroethane	U	U	U	U	U	U
Methylene Chloride	2500 B	2300 B	440 JB	14 B	85000 B	820 B
Acetone	6900	2300 J	1000 J	72 B	85000 J	1400
Carbon Disulfide	U	U	410 J	U	U	120 J
1,1-Dichloroethene	1200 J	U	U	U	U	U
1,1-Dichloroethane	11000	930 J	U	U	U	U
1,2-Dichloroethene (total)	U	9400	U	23	U	U
Chloroform	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U
2-Butanone	U	U	U	U	U	U
1,1,1-Trichloroethane	710 J	U	U	17	U	U
Carbon Tetrachloride	U	U	U	U	U	U
Vinyl Acetate	U	U	U	U	U	U
Bromodichloromethane	U	U	U	U	U	U
1,2-Dichloropropane	U	U	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U	U	U
Trichloroethene	18000	19000	U	17	U	U
Dibromochloromethane	U	U	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U	U	U
Benzene	420 J	U	U	U	U	25000
trans-1,3-Dichloropropene	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U
4-Methyl-2-pentanone	U	U	U	6 J	U	U
2-Hexanone	U	U	U	5 J	U	U
Tetrachloroethene	37000	46000	U	U	17000 J	6400
1,1,2,2-Tetrachloroethane	U	U	U	U	27000 J	U
Toluene	56000 B	53000	140 J	9	24000 J	9900
Chlorobenzene	U	U	U	U	U	U
Ethylbenzene	16000	16000	U	2 J	15000 J	9200
Styrene	U	U	U	1 J	U	U
Xylene (total)	86000 B	89000 E	U	5 J	130000	87000 E
Total VOC's	235730	237930	1990	171	383000	139840

QUALIFIERS

B: Compound found in the blank as well as the sample
E: Compound concentration exceeds istrument calibration range
J: Compound found below the contract required detection limit
U: Compound analyzed for but not detected

NOTES

*: Sample analyzed at low level
RE: Re-analysis

Table 4-1 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
VOLATILE ORGANICS (continued)
VENDOR: RCC

TENTATIVELY IDENTIFIED COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids SB-5 (ug/kg)	Treated Solids* SB-5RE (ug/kg)	Product Oil SB-5 (ug/kg)	Product Oil SB-5RE (ug/kg)
Unknown alkyl benzene	47000 J	77000 J	NA	NA	150000 J	29000 J
Unknown alkyl benzene	31000 J	36000 J	NA	NA	140000 J	24000 J
Unknown alkyl benzene	24000 J	36000 J	NA	NA	130000 J	22000 J
Unknown alkyl benzene	21000 J	32000 J	NA	NA	NA	19000 J
Unknown alkyl benzene	20000 J	21000 J	NA	NA	NA	17000 J
Unknown	20000 J	16000 J	NA	12 J	NA	110000 J
Unknown branched alkane	19000 J	NA	NA	NA	NA	NA
Unknown alkyl benzene	18000 J	20000 J	NA	NA	NA	16000 J
Unknown PAH	16000 J	NA	NA	NA	NA	NA
Unknown alkyl benzene	15000 J	18000 J	NA	NA	NA	NA
Unknown aromatic	NA	NA	NA	NA	180000 J	NA
Unknown	NA	NA	NA	NA	140000 J	24000 J
Unknown alkane	NA	NA	NA	9 J	140000 J	15000 J
Unknown	NA	NA	NA	NA	130000 J	15000 J
Unknown alkyl benzene	NA	18000 J	NA	NA	NA	NA
Unknown branched alkene	NA	22000 J	NA	NA	NA	NA
Unknown dimethyl naphthalene isomer	NA	NA	NA	NA	180000 J	NA
Unknown aromatic	NA	NA	NA	NA	170000 J	NA
Unknown dihydrodimethyl isomer	NA	NA	NA	NA	140000 J	NA
3-Methyl pentane	NA	NA	NA	29 J	NA	NA
2-Methyl pentane	NA	NA	NA	17 J	NA	NA
Unknown aldehyde	NA	NA	NA	12 J	NA	NA
Unknown ketone	NA	NA	NA	11 J	NA	NA

QUALIFIERS

B: Compound found in method blank as well as the sample
J: Estimated value

NOTES

NA: Not Applicable
RE: Re-analysis
*: Sample analyzed at low level

Table 4-1 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
SEMIVOLATILE ORGANICS
VENDOR: RCC

SEMIVOLATILE COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Initial Characterization SB-5 RE 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids SB-5 (ug/kg)	Product Oil SB-5 (ug/kg)
Phenol	41000	38000	98000	1100	1400000
bis(2-Chloroethyl)ether	U	U	U	U	U
2-Chlorophenol	U	U	U	U	U
1,3-Dichlorobenzene	U	U	U	U	U
1,4-Dichlorobenzene	U	U	U	U	U
Benzyl alcohol	U	U	U	U	U
1,2-Dichlorobenzene	U	U	U	U	U
2-Methylphenol	5000	4600 J	12000 J	150 J	180000 J
bis(2-chloroisopropyl)ether	U	U	U	U	U
4-Methylphenol	110000 E	110000	250000	3300	3200000
N-Nitroso-Di-n-Propylamine	U	U	U	U	U
Hexachloroethane	U	U	U	U	U
Nitrobenzene	U	U	U	U	U
Isophorone	U	U	U	U	U
2-Nitrophenol	U	U	U	U	U
2,4-Dimethylphenol	56000	54000	150000	1100	1900000
Benzoic acid	U	U	U	U	U
bis(2-Chloroethoxy)methane	U	U	U	U	U
2,4-Dichlorophenol	U	U	U	U	U
1,2,4-Trichlorobenzene	U	U	U	U	U
Naphthalene	7600	7200 J	22000	260 J	230000
4-Chloroaniline	U	U	U	U	U
Hexachlorobutadiene	U	U	U	U	U
4-Chloro-3-methylphenol	U	U	U	U	U
2-Methylnaphthalene	14000	15000	41000	410	420000
Hexachlorocyclopentadiene	U	U	U	U	U
2,4,6-Trichlorophenol	U	U	U	U	U
2,4,5-Trichlorophenol	U	U	U	U	U
2-Chloronaphthalene	U	U	U	U	U
2-Nitroaniline	U	U	U	U	U
Dimethyl Phthalate	U	U	U	U	U
Acenaphthylene	U	U	U	170 J	U
2,6-Dinitrotoluene	U	U	U	U	U
3-Nitroaniline	U	U	U	U	U
Acenaphthene	1600 J	1600 J	3100 J	U	37000 J
2,4-Dinitrophenol	U	U	U	U	U
4-Nitrophenol	U	U	U	U	U
Dibenzofuran	880 J	U	U	U	U
2,4-Dinitrotoluene	U	U	U	U	U
Diethylphthalate	U	U	U	U	U
4-Chlorophenyl-phenylether	U	U	U	U	U
Fluorene	1800 J	1600 J	5700 J	U	60000 J
4-Nitroaniline	U	U	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U	U	U
N-Nitrosodiphenylamine	U	U	U	U	U
4-Bromophenyl-phenylether	U	U	U	U	U
Hexachlorobenzene	U	U	U	U	U
Pentachlorophenol	U	U	U	U	U
Phenanthrene	6300	5700 J	12000 J	640	130000 J
Anthracene	U	U	U	65 J	U
Di-n-Butylphthalate	U	U	U	U	U
Fluoranthene	1800 J	1500 J	U	250 J	33000 J
Pyrene	1600 J	1700 J	4300 J	210 J	38000 J
Butylbenzylphthalate	U	U	U	U	U
3,3'-Dichlorobenzidine	U	U	U	U	U
Benzo(a)anthracene	U	U	U	U	U
Chrysene	U	U	U	U	U
bis(2-Ethylhexyl)Phthalate	4900	5000 J	9700 JB	200 JB	89000 J
Di-n-Octyl Phthalate	U	U	1900 J	70 J	6100 J
Benzo(b)Fluoranthene	U	U	U	U	U
Benzo(k)Fluoranthene	U	U	U	190 J	U
Benzo(a)Pyrene	U	U	1700 J	92 J	U
Indeno(1,2,3-cd)Pyrene	U	U	U	U	U
Dibenz(a,h)Anthracene	U	U	U	U	U
Benzo(g,h,i)Perylene	U	U	U	U	U
Total PAH's	20700	19300	48800	1707	528000
Total SSOC's	185000	183600	453000	4960	5700000
Total SVOC's	252480	245900	611400	8207	7723100

QUALIFIERS

B: Compound found in blank as well as the sample
E: Compound concentration exceeds instrument calibration range
J: Compound found below contract required detection limits
U: Compound analyzed for but not detected

NOTES

RE: Re-analysis

Table 4-1 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
SEMIVOLATILE ORGANICS (continued)
VENDOR: RCC

TENTATIVELY IDENTIFIED COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Initial Characterization SB-5 RE 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids SB-5 (ug/kg)	Product Oil SB-5 (ug/kg)
Unknown alkane	140000 J	51000 J	150000 J	1300 J	2100000 J
Unknown alkane	100000 J	36000 J	130000 J	100 J	1800000 J
Aldol condensation product	96000 JAB	100000 JAB	NA	12000 JAB	NA
Unknown alkane	85000 J	34000 J	91000 J	NA	1500000 J
Unknown branched phenol	83000 J	25000 J	NA	NA	NA
Unknown branched alkane	64000 J	26000 J	180000 J	1900 J	1800000 J
Unknown PAH	56000 J	19000 J	NA	NA	NA
Unknown	43000 J	38000 J	NA	2100 J	360000 J
Unknown cycloalkane	38000 J	12000 J	NA	NA	NA
Unknown branched alkane	34000 J	21000 J	170000 J	1700 J	850000 J
Unknown branched alkane	24000 J	17000 J	75000 J	1200 J	760000 J
Unknown branched phenol	23000 J	15000 J	NA	NA	NA
Unknown branched alkane	23000 J	13000 J	58000 J	NA	460000 J
Unknown branched alkane	22000 J	12000 J	58000 J	NA	430000 J
Unknown	21000 J	NA	NA	1400 J	NA
Unknown alkyl benzene	20000 J	NA	52000 J	NA	NA
Unknown ethylphenol isomer	19000 J	NA	NA	990 J	NA
Unknown alkane	17000 J	20000 J	65000 J	1000 J	1300000 J
Unknown	16000 J	NA	NA	NA	NA
Unknown branched alkane	16000 J	NA	40000 J	NA	NA
Unknown alkane	12000 J	19000 J	62000 J	940 J	1100000 J
Unknown alkane	NA	18000 J	48000 J	940 J	950000 J
Unknown alkane	NA	15000 J	45000 J	NA	760000 J
Unknown alkane	NA	15000 J	54000 J	NA	720000 J
Unknown alkane	NA	12000 J	NA	NA	700000 J
Unknown alkane	NA	12000 J	NA	NA	560000 J
Unknown branched alkane	NA	NA	40000 J	NA	NA
Unknown branched alkane	NA	NA	40000 J	NA	NA
Unknown dimethyl naphthalene isomer	NA	NA	100000 J	NA	880000 J
Unknown trimethyl naphthalene isomer	NA	NA	37000 J	NA	440000 J
Hexadecanoic acid	NA	NA	NA	NA	970000 J
Unknown alkane	NA	NA	NA	NA	470000 J
Unknown branched alkane	NA	NA	36000 J	NA	NA
N,N-Diethyformamide	NA	NA	NA	1600 J	NA
Acetamide	NA	NA	NA	1200 J	NA

QUALIFIERS

A: Aldocondensation
B: Compound found in blank as well as sample
J: Estimated value

NOTES

NA: Not Applicable
RE: Re-analysis

Table 4-1 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
PESTICIDE/PCB's
VENDOR: RCC

PESTICIDE/PCB COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids SB-5 (ug/kg)	Product Oil SB-5 (ug/kg)
Alpha-BHC	U	U	U	U
Beta-BHC	U	U	U	U
Delta-BHC	U	U	U	U
Gamma-BHC(Lindane)	U	U	U	U
Heptachlor	U	U	U	U
Aldrin	U	U	U	U
Heptachlor Epoxide	U	U	U	U
Endosulfan I	U	U	U	U
Dieldrin	U	U	U	U
4,4'-DDE	U	U	U	U
Endrin	U	U	U	U
Endosulfan II	U	U	U	U
4,4-DDD	U	U	U	U
Endosulfan Sulfate	U	U	U	U
4,4'-DDT	U	U	U	U
Endrin Ketone	U	U	U	U
Methoxychlor	U	U	U	U
Chlordane	U	U	U	U
Toxaphene	U	U	U	U
Aroclor-1016	U	U	U	U
Aroclor-1221	U	U	U	U
Aroclor-1232	U	U	U	U
Aroclor-1242	U	U	U	U
Aroclor-1248	8200	9300	350	86000
Aroclor-1254	U	U	U	U
Aroclor-1260	4100	5400	450	57000
Total PCB's	12300	14700	800	143000

QUALIFIERS

U: Compound analyzed for but not detected

Table 4-1 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
INORGANIC CONSTITUENTS
VENDOR: RCC

Constituent	Initial Characterization SB-5 11/19/91 (mg/kg)	Run Feed SB-5 (mg/kg)	Treated Solids SB-5 (mg/kg)	Product Oil SB-5 (mg/kg)
Aluminum	11300	13300	15100	159
Antimony	12.6 B	9.5 B	U	U
Arsenic	13.6	9.2	13.5	0.69 B
Barium	1110	805	919	39.6
Beryllium	0.46 B	U	U	U
Cadmium	13.5	5.6	5.9	0.45 B
Calcium	96200	85400	83600	1130
Chromium	89.4	67	77	3.7
Cobalt	7.4 B	9.8 B	9.8	U
Copper	487	310	353	27.6
Iron	26500	27000	31500	545
Lead	6870	6410	7250	304
Magnesium	25800	17600	18900	77.4
Manganese	468	484	546	5.4
Mercury	1.6	1.6	2.8	0.25
Nickel	75.7	58.9	67.5	5.3 B
Potassium	2350	2870	3120	U
Selenium	U	0.61 B	U	U
Silver	5.1	U	U	U
Sodium	1060 B	1150	2460	2320
Thallium	U	U	0.33	U
Vanadium	23.4	25.9	28.5	1.5 B
Zinc	1400	825	933	35.7
Cyanide	5.5	U	4.9	U
Petroleum Hydrocarbons	27300	24800	1040	NR

QUALIFIERS

B: Result falls between IDL and CRDL
E: Estimated due to interference
U: Analyte analyzed for but not detected

NOTES

NR: Not Required

Table 4-1 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
TCLP METALS
VENDOR: RCC

Constituent	Run Feed SB-5 (ug/l)	Treated Solids SB-5 (ug/l)
Arsenic	U	U
Barium	906	1360
Cadmium	UE	118 E
Chromium	U	13.7
Lead	205	17800
Mercury	U	44.1
Selenium	U	U
Silver	U	U

QUALIFIERS

B: Result falls between IDL and CRDL
E: Estimated due to interference
U: Analyte analyzed for but not detected

Table 4-1 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
TREATMENT EFFICIENCY
VENDOR: RCC

Parameter	Initial Characterization SB-5	Run Feed SB-5	Treated Solids SB-5	Treated Solids SB-5RE	Efficiency	Remediation Guidelines
Total VOC's (ug/kg)	235730	237930	1190	171	99.9 % **	1000
Total SVOC's (ug/kg)	252480	611400	8207	NA	98.7 %	--
Total PAH's* (ug/kg)	20700	48800	1707	NA	96.5 %	100000
Total SSOC's* (ug/kg)	185000	453000	4960	NA	98.9 %	10000
Total PCB's (ug/kg)	12300	14700	800	NA	94.6 %	10000
Total Lead (mg/kg)	6870	6410	7250	NA	--	500
TCLP Lead (ug/l)	NA	205	17800	NA	--	5000

NOTES

NA: Not Analyzed
*: As defined in the Phase I/II RI/FS Report
**: Efficiency based on results from the reanalysis, since those results are more representative of the sample .
--: Not established

initial characterization, run feed and two treated solid products on the last page of Table 4-1. One of the treated solid product columns is based upon the performance of a reanalysis at low level to better quantitate the VOCs present due to instrument detection limits. The treatment efficiencies have been calculated based upon levels of parameters above detection limits. A comparison between the initial characterization and the run feed samples indicates that in the case of the SVOC group, the run feed had a significantly higher concentration with other categories of compounds relatively consistent. This may result from possible nonhomogenity of the samples. The higher concentrations for the SVOCs did not effect this treatment system's ability to achieve the remediation guidelines for the organic parameters. Treatment efficiencies from 94.6% for PCBs to 99.9% for total VOCs were obtained. The results for this vendor's study indicate this system is successful in achieving organic remediation guidelines for the site with high efficiencies.

The treatment process did have the effect of increasing the concentration of total lead in the product. This is a practical limitation since the process was very effective at removing other contamination thus increasing the concentrations of constituents remaining. A very significant consideration, however, is the effect the solvent extraction process had on the leachability of lead. The Toxic Concentration Leaching Procedure (TCLP) lead concentration went from a concentration of 205 ug/l in the run feed to a concentration of 17,800 ug/l in the treated solid. Therefore, the extraction solvents have had the effect of significantly increasing the leachability level of the lead and in this case generating a characteristically hazardous waste by RCRA definition. It is currently planned to follow the solvent extraction process with a stabilization process for inorganic constituents, if required, to minimize leachability concerns. If this process were to be selected as the remediation alternative, subsequent stabilization of the treated material would be required.

4.3.2 CF Systems Solvent Extraction Process

Table 4-2 presents the analytical results for the CF Systems solvent extraction process. The individual parameters are grouped into categories for the initial characterization, run feed and one treated solid product on the last page of Table 4-2. A comparison between the initial characterization and the run feed indicates a significant decrease in total VOCs and an increase in the SVOCs for the run feed. Other categories of compounds were relatively consistent. A possible explanation given by the vendor for the decrease in VOCs is the waste material samples were left in a laboratory ventilation hood overnight prior to treatment to minimize the moisture retained in the sample. This may have had the effect of allowing the volatile compounds to be released prior to treatment. A possible explanation for the SVOCs which may also be partially applicable to VOCs is the lack of homogenity of collected samples. The low initial concentration of the VOCs for this study may have been partially responsible for this system having a very poor performance for removal of VOCs with a calculated efficiency of 13.8%. An additional concern is that the remediation guideline was not achieved as a result of the study. Remediation guidelines

Table 4-2

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
VOLATILE ORGANICS
VENDOR: CF SYSTEMS

VOLATILE COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (mg/kg)	Treated Solids SB-5 (mg/kg)	Treated Oil SB-5 (mg/kg)
Chloromethane	U	U	U	U
Bromomethane	U	U	U	U
Vinyl Chloride	U	U	U	U
Chloroethane	U	U	U	U
Methylene Chloride	2500 B	370 JB	650 B	6500 JB
Acetone	6900	980 JB	930 JB	17000 JB
Carbon Disulfide	U	U	U	U
1,1-Dichloroethene	1200 J	U	U	U
1,1-Dichloroethane	11000	U	U	U
1,2-Dichloroethene (total)	U	820 B	550 JB	8000 JB
Chloroform	U	99 JB	130 JB	U
1,2-Dichloroethane	U	U	U	U
2-Butanone	U	U	U	U
1,1,1-Trichloroethane	710 J	U	88 J	U
Carbon Tetrachloride	U	U	U	U
Vinyl Acetate	U	U	U	U
Bromodichloromethane	U	U	U	U
1,2-Dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
Trichloroethene	18000	370 J	160 J	15000 J
Dibromochloromethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
Benzene	420 J	U	270 J	50000
trans-1,3-Dichloropropene	U	U	U	U
Bromoform	U	U	U	U
4-Methyl-2-pentanone	U	U	150 J	11000 J
2-Hexanone	U	U	U	U
Tetrachloroethene	37000	630 J	640	8500 J
1,1,2,2-Tetrachloroethane	U	U	U	U
Toluene	56000 B	1400	850	33000
Chlorobenzene	U	U	U	U
Ethylbenzene	16000	230 J	190 J	19000 J
Styrene	U	U	U	U
Xylene (total)	86000 B	1200	650	120000
Total VOC's	235730	6099	5258	288000

QUALIFIERS

B: Compound found in the blank as well as the sample
J: Compound found below the contract required detection limit
U: Compound analyzed for but not detected

Table 4-2 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
VOLATILE ORGANICS (continued)
VENDOR: CF SYSTEMS

TENTATIVELY IDENTIFIED COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (mg/kg)	Treated Solids SB-5 (mg/kg)	Treated Oil SB-5 (mg/kg)
Unknown alkyl benzene	47000 J	2400 J	NA	NA
Unknown alkyl benzene	31000 J	2300 J	NA	NA
Unknown alkyl benzene	24000 J	2000 J	NA	NA
Unknown alkyl benzene	21000 J	1900 J	NA	NA
Unknown alkyl benzene	20000 J	1600 J	NA	NA
Unknown	20000 J	3400 JB	5600 J	10000000 JB
Unknown branched alkane	19000 J	NA	6600 JB	2200000 J
Unknown alkyl benzene	18000 J	1500 J	NA	NA
Unknown PAH	16000 J	NA	NA	NA
Unknown alkyl benzene	15000 J	1200 J	NA	NA
Unknown aromatic	NA	5100 J	NA	NA
1-Propanone,1-phenyl	NA	1500 J	NA	NA
Unknown	NA	1400 J	1600 J	4100000 J
Unknown alkane	NA	1400 J	NA	NA
Unknown	NA	1200 J	1500 J	290000 J
Unknown	NA	830 J	980 J	260000 J
Unknown alkyl benzene	NA	820 J	NA	NA
Unknown	NA	810 J	860 J	210000 J
Disulfide,diethyl	NA	NA	11000 J	900000 J
Cyclopentane,methyl	NA	NA	NA	2000000 J
Butane	NA	NA	NA	620000 J
Pentane	NA	NA	NA	310000 J
Unknown branched alkane	NA	NA	NA	250000 J
Unknown branched alkane	NA	NA	NA	150000 J
Unknown	NA	NA	NA	170000 J
Unknown	NA	NA	NA	170000 J
Unknown	NA	NA	NA	110000 J
Unknown	NA	NA	NA	56000 J

QUALIFIERS

B: Compound found in method blank as well as the sample
J: Estimated value

NOTES

NA: Not Applicable

Table 4-2 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
SEMIVOLATILE ORGANICS
VENDOR: CF SYSTEMS

SEMIVOLATILE COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Initial Characterization SB-5 RE 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids SB-5 (ug/kg)
Phenol	41000	38000	37000	3200
bis(2-Chloroethyl)ether	U	U	U	U
2-Chlorophenol	U	U	U	U
1,3-Dichlorobenzene	U	U	U	U
1,4-Dichlorobenzene	U	U	U	U
Benzyl alcohol	U	U	U	U
1,2-Dichlorobenzene	U	U	U	U
2-Methylphenol	5000	4600 J	6500 J	170 J
bis(2-chloroisopropyl)ether	U	U	U	U
4-Methylphenol	110000 E	110000	150000	77000
N-Nitroso-Di-n-Propylamine	U	U	U	U
Hexachloroethane	U	U	U	U
Nitrobenzene	U	U	U	U
Isophorone	U	U	U	U
2-Nitrophenol	U	U	U	U
2,4-Dimethylphenol	56000	54000	89000	1600
Benzoic acid	U	U	U	140 J
bis(2-Chloroethoxy)methane	U	U	U	U
2,4-Dichlorophenol	U	U	U	U
1,2,4-Trichlorobenzene	U	U	U	U
Naphthalene	7600	7200 J	9500 J	U
4-Chloroaniline	U	U	U	U
Hexachlorobutadiene	U	U	U	U
4-Chloro-3-methylphenol	U	U	U	U
2-Methylnaphthalene	14000	15000	24000	70 J
Hexachlorocyclopentadiene	U	U	U	U
2,4,6-Trichlorophenol	U	U	U	U
2,4,5-Trichlorophenol	U	U	U	U
2-Chloronaphthalene	U	U	U	U
2-Nitroaniline	U	U	U	U
Dimethyl Phthalate	U	U	U	U
Acenaphthylene	U	U	U	140 J
2,6-Dinitrotoluene	U	U	U	U
3-Nitroaniline	U	U	U	U
Acenaphthene	1600 J	1600 J	3000 J	U
2,4-Dinitrophenol	U	U	U	U
4-Nitrophenol	U	U	U	U
Dibenzofuran	880 J	U	U	U
2,4-Dinitrotoluene	U	U	U	U
Diethylphthalate	U	U	U	U
4-Chlorophenyl-phenylether	U	U	U	U
Fluorene	1800 J	1600 J	U	U
4-Nitroaniline	U	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U	U
N-Nitrosodiphenylamine	U	U	U	U
4-Bromophenyl-phenylether	U	U	U	U
Hexachlorobenzene	U	U	U	U
Pentachlorophenol	U	U	U	U
Phenanthrene	6300	5700 J	14000	54 J
Anthracene	U	U	U	U
Di-n-Butylphthalate	U	U	U	76 JB
Fluoranthene	1800 J	1500 J	U	53 J
Pyrene	1600 J	1700 J	U	41 J
Butylbenzylphthalate	U	U	U	U
3,3'-Dichlorobenzidine	U	U	U	U
Benzo(a)anthracene	U	U	U	U
Chrysene	U	U	U	U
bis(2-Ethylhexyl)Phthalate	4900	5000 J	12000 J	84 J
Di-n-Octyl Phthalate	U	U	U	U
Benzo(b)Fluoranthene	U	U	U	U
Benzo(k)Fluoranthene	U	U	U	U
Benzo(a)Pyrene	U	U	U	U
Indeno(1,2,3-cd)Pyrene	U	U	U	U
Dibenz(a,h)Anthracene	U	U	U	U
Benzo(g,h,i)Perylene	U	U	U	U
Total PAH's	20700	19300	26500	288
Total SSOC's	185000	183600	269500	78840
Total SVOC's	252480	245900	345000	82628

QUALIFIERS

B: Compound found in blank as well as the sample
E: Compound concentration exceeds instrument calibration range
J: Compound found below contract required detection limits
U: Compound analyzed for but not detected

NOTES

RE: Re-analysis

Table 4-2 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
SEMIVOLATILE ORGANICS (continued)
VENDOR: CF SYSTEMS

TENTATIVELY IDENTIFIED COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Initial Characterization SB-5 RE 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids SB-5 (ug/kg)
Unknown alkane	140000 J	51000 J	200000 J	700 J
Unknown alkane	100000 J	36000 J	190000 J	630 J
Aldol condensation product	96000 JAB	100000 JAB	NA	3400 JAB
Unknown alkane	85000 J	34000 J	140000 J	490 J
Unknown branched phenol	83000 J	25000 J	NA	NA
Unknown branched alkane	64000 J	26000 J	260000 J	430 J
Unknown PAH	56000 J	19000 J	NA	NA
Unknown	43000 J	38000 J	53000 J	3400 J
Unknown cycloalkane	38000 J	12000 J	NA	NA
Unknown branched alkane	34000 J	21000 J	96000 J	NA
Unknown branched alkane	24000 J	17000 J	59000 J	NA
Unknown branched phenol	23000 J	15000 J	NA	NA
Unknown branched alkane	23000 J	13000 J	48000 J	NA
Unknown branched alkane	22000 J	12000 J	43000 J	NA
Unknown	21000 J	NA	51000 J	1600 J
Unknown alkyl benzene	20000 J	NA	NA	NA
Unknown ethylphenol isomer	19000 J	NA	41000 J	1600 J
Unknown alkane	17000 J	20000 J	93000 J	440 J
Unknown	16000 J	NA	40000 J	850 J
Unknown branched alkane	16000 J	NA	39000 J	NA
Unknown alkane	12000 J	19000 J	64000 J	440 J
Unknown alkane	NA	18000 J	58000 J	NA
Unknown alkane	NA	15000 J	NA	NA
Unknown alkane	NA	15000 J	NA	NA
Unknown alkane	NA	12000 J	NA	NA
Unknown alkane	NA	12000 J	NA	NA
Unknown branched alkane	NA	NA	35000 J	NA
Unknown branched alkane	NA	NA	34000 J	NA
Unknown dimethyl naphthalene isomer	NA	NA	58000 J	NA
Unknown trimethyl naphthalene isomer	NA	NA	37000 J	NA
Unknown	NA	NA	NA	600 J
Diethyl disulfide	NA	NA	NA	5200 J
Hexadecanoic acid	NA	NA	NA	4500 J
2,4-Di-isocyanato-1-methyl-benzene	NA	NA	NA	1100 J
Unknown carboxylic acid	NA	NA	NA	910 J
Unknown	NA	NA	NA	470 J
Unknown	NA	NA	NA	390 J
Unknown	NA	NA	NA	350 J
Unknown	NA	NA	NA	320 J
Unknown alkane	NA	NA	NA	NA

QUALIFIERS

A: Aldocondensation
B: Compound found in blank as well as sample
J: Estimated value

NOTES

NA: Not Applicable
RE: Re-analysis

Table 4-2 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
PESTICIDE/PCB's
VENDOR: CF SYSTEMS

PESTICIDE/PCB COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids SB-5 (ug/kg)	Treated Oil SB-5 (ug/kg)
Alpha-BHC	U	U	U	U
Beta-BHC	U	U	U	U
Delta-BHC	U	U	U	U
Gamma-BHC(Lindane)	U	U	U	U
Heptachlor	U	U	U	U
Aldrin	U	U	U	U
Heptachlor Epoxide	U	U	U	U
Endosulfan I	U	U	U	U
Dieldrin	U	U	U	U
4,4'-DDE	U	U	U	U
Endrin	U	U	U	U
Endosulfan II	U	U	U	U
4,4-DDD	U	U	U	U
Endosulfan Sulfate	U	U	U	U
4,4'-DDT	U	U	U	U
Endrin Ketone	U	U	U	U
Methoxychlor	U	U	U	U
Chlordane	U	U	U	U
Toxaphene	U	U	U	U
Aroclor-1016	U	U	U	U
Aroclor-1221	U	U	U	U
Aroclor-1232	U	U	U	U
Aroclor-1242	U	U	U	U
Aroclor-1248	8200	8400 C	U	200000 C
Aroclor-1254	U	U	U	U
Aroclor-1260	4100	4000	U	110000 C
Total PCB's	12300	12400	0	310000

QUALIFIERS

C: Confirmed by GC/MS
U: Compound analyzed for but not detected

Table 4-2 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
INORGANIC CONSTITUENTS
VENDOR: CF SYSTEMS

Constituent	Initial Characterization SB-5 11/19/91 (mg/kg)	*Run Feed* SB-5 (mg/kg)	*Treated Solids* SB-5 (mg/kg)	*Treated Oil* SB-5 (mg/kg)
Aluminum	11300	12100	14300	U
Antimony	12.6 B	9.7 B	8.7 B	U
Arsenic	13.6	11.3	12.1	0.95 B
Barium	1110	701	910	U
Beryllium	0.46 B	0.5 B	0.6 B	U
Cadmium	13.5	4.2	5.5	0.4 B
Calcium	96200	96500	86700	36.4 B
Chromium	89.4	60.3	115	0.78 B
Cobalt	7.4 B	8.2 B	10.1	U
Copper	487	308	381	12.4
Iron	26500	24600	28800	35.1
Lead	6870	5620	7180	8.6
Magnesium	25800	29300	20200	12.7 B
Manganese	468	554	573	0.47 B
Mercury	1.6	1.6	3.1	0.22
Nickel	75.7	53.7 E	94.2 E	U
Potassium	2350	2300	2650	U
Selenium	U	U	U	0.39 B
Silver	5.1	U	U	U
Sodium	1060 B	1050	1240	22.7 B
Thallium	U	U	U	U
Vanadium	23.4	23.5	28.1	U
Zinc	1400	728 E	959 E	1.6 BE
Cyanide	5.5	U	U	U
Petroleum Hydrocarbons	27300	40300	242	NR

QUALIFIERS

B: Result falls between IDL and CRDL
E: Estimated due to interference
U: Analyte analyzed for but not detected

NOTES

NR: Not Required

Table 4-2 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
TCLP METALS
VENDOR: CF SYSTEMS

Constituent	Run Feed SB-5 (ug/l)	Treated Solids SB-5 (ug/l)
Arsenic	U	U
Barium	1640	2050
Cadmium	12.8	38.2
Chromium	U	6.6 B
Lead	3930	5420
Mercury	U	U
Selenium	U	48.5
Silver	U	U

QUALIFIERS

B: Result falls between IDL and CRDL
U: Analyte analyzed for but not detected

Table 4-2 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
TREATMENT EFFICIENCY
VENDOR: CF SYSTEMS

Parameter	Initial Characterization SB-5	Run Feed SB-5	Treated Solids SB-5	Efficiency	Remediation Guidelines
Total VOC's (ug/kg)	235730	6099	5258	13.8 %	1000
Total SVOC's (ug/kg)	252480	345000	82628	76.0 %	--
Total PAH's* (ug/kg)	20700	26500	288	98.9%	100000
Total SSOC's* (ug/kg)	185000	269500	78840	70.7 %	10000
Total PCB's (ug/kg)	12300	12400	U	100 %	10000
Total Lead (mg/kg)	6870	5620	7180	--	500
TCLP Lead (ug/l)	NA	3930	5420	--	5000

NOTES

NA: Not Analyzed
U: Analyzed for but not detected
*: As defined in the Phase I/II RI/FS Report
--: Not established

were also not achieved for total SSOCs with a treatment efficiency calculated as 70.7%. This treatment system had difficulty treating SVOCs as a group with an efficiency of 76.0% demonstrated. The treatment system however was very effective at treating PCBs, with a calculated efficiency of 100% without consideration of detection limits in the treated solid. The solvent used did not have as significant effect on the leachability of lead as did the previous solvent extraction process. It did, however, still increase the leachability enough so that a TCLP lead value of 5000 ug/l was exceeded creating a characteristic hazardous waste. Therefore, if selected, this process would require subsequent stabilization for the inorganic constituents.

4.3.3 Chemical Waste Management, Inc. X*TRAX Thermal Separation Process

Table 4-3 presents the analytical results for the CWM thermal separation/process. The individual parameters are grouped into categories for the initial characterization, run feed and two treated solid products. Please note that reanalysis of samples was performed due to quality control requirements not being met in the laboratory. The comparison of the initial characterization to the run feed sample indicates that the total VOCs increased, total SVOCs decreased and remaining parameters are relatively close. Since volatile compounds are most likely to be lost instead of gained at these concentrations, it would appear that these discrepancies are best explained by a lack of homogenity of the collected samples.

Table 4-3

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
VOLATILE ORGANICS
VENDOR: CWM

VOLATILE COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids 1 SB-5 (ug/kg)	Treated Solids 1 SB-5RE (ug/kg)	Treated Solids 2 SB-5 (ug/kg)	Treated Solids 2 SB-5RE (ug/kg)
Chloromethane	U	U	U	U	U	U
Bromomethane	U	U	U	U	U	U
Vinyl Chloride	U	U	U	U	U	U
Chloroethane	U	U	U	U	U	U
Methylene Chloride	2500 B	520 JB	5	U	U	3 J
Acetone	6900	5000 B	60 B	32 B	17 B	70 B
Carbon Disulfide	U	U	U	U	U	U
1,1-Dichloroethene	1200 J	U	U	U	U	U
1,1-Dichloroethane	11000	U	U	U	U	U
1,2-Dichloroethene (total)	U	480 J	U	U	U	U
Chloroform	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U
2-Butanone	U	U	9 J	U	U	U
1,1,1-Trichloroethane	710 J	U	U	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U
Vinyl Acetate	U	U	U	U	U	U
Bromodichloromethane	U	U	U	U	U	U
1,2-Dichloropropane	U	U	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U	U	U
Trichloroethene	18000	530 J	U	U	U	U
Dibromochloromethane	U	U	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U	U	U
Benzene	420 J	U	31	18	3 J	11
trans-1,3-Dichloropropene	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U
4-Methyl-2-pentanone	U	U	U	U	U	U
2-Hexanone	U	U	U	U	U	U
Tetrachloroethene	37000	6000	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U
Toluene	56000 B	2700	10	11	2 J	4 J
Chlorobenzene	U	U	U	U	U	U
Ethylbenzene	16000	2900	U	U	U	U
Styrene	U	U	U	U	U	U
Xylene (total)	86000 B	21000	3 J	U	U	U
Total VOC's	235730	39130	118	61	22	88

QUALIFIERS

B: Compound found in the blank as well as the sample
E: Compound concentration exceeds istrument calibration range
J: Compound found below the contract required detection limit
U: Compound analyzed for but not detected

NOTES

RE: Re-analysis

Table 4-3 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
VOLATILE ORGANICS (continued)
VENDOR: CWM

TENTATIVELY IDENTIFIED COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids 1 SB-5 (ug/kg)	Treated Solids 1 SB-5RE (ug/kg)	Treated Solids 2 SB-5 (ug/kg)	Treated Solids 2 SB-5RE (ug/kg)
Unknown alkyl benzene	47000 J	29000 J	NA	NA	NA	NA
Unknown alkyl benzene	31000 J	18000 J	NA	NA	NA	NA
Unknown alkyl benzene	24000 J	16000 J	NA	NA	NA	NA
Unknown alkyl benzene	21000 J	14000 J	NA	NA	NA	NA
Unknown alkyl benzene	20000 J	14000 J	NA	NA	NA	NA
Unknown	20000 J	NA	16 J	140 J	7 J	10 J
Unknown branched alkane	19000 J	NA	NA	NA	NA	NA
Unknown alkyl benzene	18000 J	14000 J	NA	NA	NA	NA
Unknown PAH	16000 J	NA	NA	NA	NA	NA
Unknown alkyl benzene	15000 J	14000 J	NA	NA	NA	NA
Unknown	NA	NA	NA	NA	NA	7 J
Unknown alkane	NA	15000 J	7 J	58 J	NA	8 J
Unknown	NA	NA	NA	13 J	NA	7 J
Unknown alkyl benzene	NA	13000 J	NA	NA	NA	NA
Unknown alkane	NA	15000 J	7 J	25 J	NA	6 J
Unknown cycloketone	NA	NA	7 J	NA	NA	NA
Unknown alkane	NA	NA	5 J	NA	NA	NA
Unknown siloxane	NA	NA	NA	17 J	NA	NA
Unknown	NA	NA	NA	13 J	NA	NA
Unknown	NA	NA	NA	12 J	NA	NA
Unknown	NA	NA	NA	11 J	NA	NA
Unknown	NA	NA	NA	11 J	NA	NA
Freon 1,1,3	NA	NA	NA	22 J	NA	NA

QUALIFIERS

B: Compound found in method blank as well as the sample
J: Estimated value

NOTES

NA: Not Applicable
RE: Re-analysis

Table 4-3 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
SEMIVOLATILE ORGANICS
VENDOR: CWM

SEMIVOLATILE COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Initial Characterization SB-5 RE 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids 1 SB-5 (ug/kg)	Treated Solids 2 SB-5 (ug/kg)
Phenol	41000	38000	15000	U	590
bis(2-Chloroethyl)ether	U	U	U	U	U
2-Chlorophenol	U	U	U	U	U
1,3-Dichlorobenzene	U	U	U	U	U
1,4-Dichlorobenzene	U	U	U	U	U
Benzyl alcohol	U	U	U	U	U
1,2-Dichlorobenzene	U	U	U	U	U
2-Methylphenol	5000	4600 J	1900 J	U	U
bis(2-chloroisopropyl)ether	U	U	U	U	U
4-Methylphenol	110000 E	110000	46000	1500	910
N-Nitroso-Di-n-Propylamine	U	U	U	U	U
Hexachloroethane	U	U	U	U	U
Nitrobenzene	U	U	U	U	U
Isophorone	U	U	U	U	U
2-Nitrophenol	U	U	U	U	U
2,4-Dimethylphenol	56000	54000	26000	U	220 J
Benzoic acid	U	U	U	U	U
bis(2-Chloroethoxy)methane	U	U	U	U	U
2,4-Dichlorophenol	U	U	U	U	U
1,2,4-Trichlorobenzene	U	U	U	U	U
Naphthalene	7600	7200 J	4200 J	360	85 J
4-Chloroaniline	U	U	U	U	U
Hexachlorobutadiene	U	U	U	U	U
4-Chloro-3-methylphenol	U	U	U	U	U
2-Methylnaphthalene	14000	15000	8500	280 J	130 J
Hexachlorocyclopentadiene	U	U	U	U	U
2,4,6-Trichlorophenol	U	U	U	U	U
2,4,5-Trichlorophenol	U	U	U	U	U
2-Chloronaphthalene	U	U	U	U	U
2-Nitroaniline	U	U	U	U	U
Dimethyl Phthalate	U	U	U	U	U
Acenaphthylene	U	U	U	U	U
2,6-Dinitrotoluene	U	U	U	U	U
3-Nitroaniline	U	U	U	U	U
Acenaphthene	1600 J	1600 J	760 J	U	U
2,4-Dinitrophenol	U	U	U	U	U
4-Nitrophenol	U	U	U	U	U
Dibenzofuran	880 J	U	U	180 J	39 J
2,4-Dinitrotoluene	U	U	U	U	U
Diethylphthalate	U	U	U	U	U
4-Chlorophenyl-phenylether	U	U	U	U	U
Fluorene	1800 J	1600 J	1500 J	U	U
4-Nitroaniline	U	U	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U	U	U
N-Nitrosodiphenylamine	U	U	U	U	U
4-Bromophenyl-phenylether	U	U	U	U	U
Hexachlorobenzene	U	U	U	U	U
Pentachlorophenol	U	U	U	U	U
Phenanthrene	6300	5700 J	4600	660	240 J
Anthracene	U	U	400 J	U	17 J
Di-n-Butylphthalate	U	U	U	70 JB	U
Fluoranthene	1800 J	1500 J	1600 J	170 J	63 J
Pyrene	1600 J	1700 J	1300 J	U	65 J
Butylbenzylphthalate	U	U	U	U	U
3,3'-Dichlorobenzidine	U	U	U	U	U
Benzo(a)anthracene	U	U	U	U	U
Chrysene	U	U	U	U	U
bis(2-Ethylhexyl)Phthalate	4900	5000 J	1900 JB	U	U
Di-n-Octyl Phthalate	U	U	U	79 J	U
Benzo(b)Fluoranthene	U	U	870 J	U	U
Benzo(k)Fluoranthene	U	U	U	U	U
Benzo(a)Pyrene	U	U	700 J	U	U
Indeno(1,2,3-cd)Pyrene	U	U	U	U	U
Dibenz(a,h)Anthracene	U	U	U	U	U
Benzo(g,h,i)Perylene	U	U	U	U	U
Total PAH's	20700	19300	15930	1370	470
Total SSOC's	185000	183600	82400	1780	1260
Total SVOC's	252480	245900	115230	3299	2359

QUALIFIERS

B: Compound found in blank as well as sample
E: Compound concentration exceeds instrument calibration range
J: Compound found below contract required detection limits
U: Compound analyzed for but not detected

NOTES

RE: Re-analysis

Table 4-3 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
SEMIVOLATILE ORGANICS (continued)
VENDOR: CWM

TENTATIVELY IDENTIFIED COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Initial Characterization SB-5 RE 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids 1 SB-5 (ug/kg)	Treated Solids 2 SB-5 (ug/kg)
Unknown alkane	140000 J	51000 J	51000 J	2400 J	930 J
Unknown alkane	100000 J	36000 J	42000 J	1800 J	820 J
Aldol condensation product	96000 JAB	100000 JAB	NA	130000 JAB	12000 JAB
Unknown alkane	85000 J	34000 J	39000 J	1800 J	740 J
Unknown branched phenol	83000 J	25000 J	NA	NA	NA
Unknown branched alkane	64000 J	26000 J	22000 J	1400 J	620 J
Unknown PAH	56000 J	19000 J	NA	NA	NA
Unknown	43000 J	38000 J	NA	NA	170 J
Unknown cycloalkane	38000 J	12000 J	8200 J	NA	200 J
Unknown branched alkane	34000 J	21000 J	22000 J	1200 J	470 J
Unknown branched alkane	24000 J	17000 J	16000 J	900 J	220 J
Unknown branched phenol	23000 J	15000 J	NA	NA	NA
Unknown branched alkane	23000 J	13000 J	14000 J	NA	NA
Unknown branched alkane	22000 J	12000 J	13000 J	NA	NA
Unknown	21000 J	NA	NA	NA	NA
Unknown alkyl benzene	20000 J	NA	NA	NA	NA
Unknown ethylphenol isomer	19000 J	NA	NA	NA	180 J
Unknown alkane	17000 J	20000 J	34000 J	1500 J	550 J
Unknown	16000 J	NA	NA	NA	NA
Unknown branched alkane	16000 J	NA	9900 J	NA	NA
Unknown alkane	12000 J	19000 J	28000 J	1500 J	510 J
Unknown alkane	NA	18000 J	23000 J	1400 J	480 J
Unknown alkane	NA	15000 J	20000 J	980 J	480 J
Unknown alkane	NA	15000 J	19000 J	970 J	410 J
Unknown alkane	NA	12000 J	13000 J	840 J	400 J
Unknown alkane	NA	12000 J	NA	840 J	290 J
Unknown branched alkane	NA	NA	9800 J	NA	NA
Unknown dimethyl naphthalene isomer	NA	NA	20000 J	NA	200 J
Unknown trimethyl naphthalene isomer	NA	NA	7900 J	NA	NA
Unknown trimethyl naphthalene isomer	NA	NA	9800 J	NA	NA
1,1-Biphenyl	NA	NA	NA	1200 J	NA
9H-Fluoren-9-one	NA	NA	NA	1200 J	170 J
Benzophenone	NA	NA	NA	730 J	NA
Benzaldehyde	NA	NA	NA	NA	200 J
Unknown aldehyde	NA	NA	NA	NA	150 J

QUALIFIERS

A: Aldocondensation
B: Compound found in blank as well as sample
J: Estimated value

NOTES

NA: Not Applicable
RE: Re-analysis

Table 4-3 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
PESTICIDE/PCB's
VENDOR: CWM

PESTICIDE/PCB COMPOUNDS	Initial Characterization SB-5 11/19/91 (ug/kg)	Run Feed SB-5 (ug/kg)	Treated Solids 1 SB-5 (ug/kg)	Treated Solids 2 SB-5 (ug/kg)
Alpha-BHC	U	U	U	U
Beta-BHC	U	U	U	U
Delta-BHC	U	U	U	U
Gamma-BHC(Lindane)	U	U	U	U
Heptachlor	U	U	U	U
Aldrin	U	U	U	U
Heptachlor Epoxide	U	U	U	U
Endosulfan I	U	U	U	U
Dieldrin	U	U	U	U
4,4'-DDE	U	U	U	U
Endrin	U	U	U	U
Endosulfan II	U	U	U	U
4,4-DDD	U	U	U	U
Endosulfan Sulfate	U	U	U	U
4,4'-DDT	U	U	U	U
Endrin Ketone	U	U	U	U
Methoxychlor	U	U	U	U
Chlordane	U	U	U	U
Toxaphene	U	U	U	U
Aroclor-1016	U	U	U	U
Aroclor-1221	U	U	U	U
Aroclor-1232	U	U	U	U
Aroclor-1242	U	U	U	U
Aroclor-1248	8200	8200	U	U
Aroclor-1254	U	U	40 J	65 J
Aroclor-1260	4100	4200	U	U
Total PCB's	12300	12400	40	65

QUALIFIERS

U: Compound analyzed for but not detected

Table 4-3 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
INORGANIC CONSTITUENTS
VENDOR: CWM

Constituent	Initial Characterization SB-5 11/19/91 (mg/kg)	Run Feed SB-5 (mg/kg)	Treated Solids 1 SB-5 (mg/kg)	Treated Solids 2 SB-5 (mg/kg)
Aluminum	11300	14300	16600	15500
Antimony	12.6 B	U	9 B	6.4 B
Arsenic	13.6	8	14.4	11.3
Barium	1110	777	833	854
Beryllium	0.46 B	0.37 B	0.85 B	0.55 B
Cadmium	13.5	4.4	5.3	5.1
Calcium	96200	93200	94200	89400
Chromium	89.4	67.1	71.6	70.2
Cobalt	7.4 B	9.6 B	10.1	10.1
Copper	487	358 E	315 E	325 E
Iron	26500	29500	28700	30100
Lead	6870	5970	6160	6280
Magnesium	25800	19700	25400	19900
Manganese	468	505	607	599
Mercury	1.6	2.4	U	U
Nickel	75.7	61.4	62.4	63.3
Potassium	2350	3450	3710	3190
Selenium	U	U	U	U
Silver	5.1	U	U	U
Sodium	1060 B	1080 B	1020	1110
Thallium	U	U	U	U
Vanadium	23.4	28.4	30.4	28.9
Zinc	1400	779	856	843
Cyanide	5.5	4.8	2.5	2.5
Petroleum Hydrocarbons	27300	41200	92.2	328
Oil & Grease	NR	53900	148	547
Percent Ash	NR	70.9	97.9	97.3
pH	NR	9.6	10.5	10.2
% Moisture	NR	19.1	2.1	2.7

QUALIFIERS

B: Result falls between IDL and CRDL
E: Estimated due to interference
U: Analyte analyzed for but not detected

NOTES

NR: Not Required

Table 4-3 (*continued*)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
TCLP METALS
VENDOR: CWM

Constituent	Run Feed SB-5 (ug/l)	Treated Solids 1 SB-5 (ug/l)	Treated Solids 2 SB-5 (ug/l)
Arsenic	U	U	U
Barium	1160	654	845
Cadmium	20.8	28.4	36.8
Chromium	U	U	U
Lead	1370	1570	1920
Mercury	3.8	U	U
Selenium	U	U	U
Silver	U	U	U

QUALIFIERS

B: Result falls between IDL and CRDL
E: Estimated due to interference
U: Analyte analyzed for but not detected

Table 4-3 (continued)

BOOTH OIL INACTIVE HAZARDOUS WASTE SITE
TREATABILITY STUDY
TREATMENT EFFICIENCY
VENDOR: CWM

Parameter	Initial Characterization SB-5	Run Feed SB-5	Treated Solids 1 SB-5	Treated Solids 1 SB-5RE	Treated Solids 2 SB-5	Treated Solids 2 SB-5RE	Efficiency for TS1	Efficiency for TS2	Remediation Guidelines
Total VOC's (ug/kg)	235730	39130	118	61	22	88	99.8 % **	99.9 % ***	1000
Total SVOC's (ug/kg)	252480	115230	3299	NA	2359	NA	97.1 %	97.9 %	--
Total PAH's* (ug/kg)	20700	15930	1370	NA	470	NA	91.4 %	97.0 %	100000
Total SSOC's* (ug/kg)	185000	82400	1780	NA	1260	NA	97.8 %	98.5 %	10000
Total PCB's (ug/kg)	12300	12400	40	NA	65	NA	99.7 %	99.5 %	10000
Total Lead (mg/kg)	6870	5970	6160	NA	6280	NA	--	--	500
TCLP Lead (ug/l)	NA	1370	1570	NA	1920	NA	--	--	5000

NOTES

NA: Not Analyzed
TS1: Treated Solids 1
TS2: Treated Solids 2
*: As defined in the Phase I/II RI/FS Report
**: Efficiency based on the reanalysis of the treated solids 1 (TS1).
***: Efficiency based on the initial analysis of the treated solids 2 (TS2).
--: Not established

The treatment efficiencies for the categories of organic compounds were better for treated solids 2 than for the treated solids 1. The two samples were subjected to the exact same treatment system with treated-solids 2 being treated at a temperature 150^{0}F lower than treated solids 1. It appears the lower temperature provided the more optimal conditions for this system. The efficiencies for treated solids ranged from a low of 97.0% for total PAHs to 99.9% for total VOCs. All remediation guidelines for organic constituents for the site were achieved by a significant margin. Total lead and TCLP lead concentrations only increased slightly. Although the TCLP lead concentration did increase slightly from 1370 ug/l to 1920 ug/l, it was still well below the TCLP lead standard of 5000 ug/l. Therefore, based upon the treatability sample, the thermal separation process would not require subsequent treatment by stabilization due to a leachability consideration. However, the total lead concentration of 6,280 mg/l is still well above the remediation guideline value of 500 mg/l recommended in the Phase I/II Remedial Investigation Report dated August 1991. Therefore, subsequent remediation of inorganic constituents may still be required based on total lead concentrations. If stabilization is necessary, it is possible that the quantity of stabilizing agent required would be less due to lower leachability of metals in the treated soil.

4.4 CONCLUSIONS

The results of the treatability study indicate that both solvent extraction and thermal separation processes are capable of achieving recommended remediation guidelines for organic constituents at the Booth Oil Site. It is likely that these processes may require additional treatment to stabilize inorganic constituents. These processes will be further discussed in the subsequent sections of this report.

Section 5

SECTION 5

PREFERRED ALTERNATIVE

In this Phase III Feasibility Study, seven remedial alternatives are analyzed in general conformance with the selection criteria specified in NYSDEC TAGM 4030 (Selecting Remedial Alternatives at Inactive Hazardous Waste Sites). Each alternative consists of a soil treatment technology, combined with extraction of on-site shallow groundwater, onsite pretreatment (via oil/water separation), and discharge of the treated groundwater to the North Tonawanda POTW. The seven soil treatment technologies evaluated herein are:

- o Off-site incineration;
- o On-site incineration;
- o On-site thermal separation;
- o On-site solvent extraction;
- o On-site containment;
- o Off-site land disposal; and
- o No Action.

The selection criteria, as specified in the NYSDEC TAGM, are:

- o Compliance with New York State Standards, Criteria, and Guidelines (SCGs);

- o Overall protection of human health and the environment;
- o Short-term impacts and effectiveness;
- o Long-term effectiveness and permanence;
- o Reduction of toxicity, mobility and volume;
- o Implementability;
- o Cost.

As presented in Table 3.3, each of the alternatives has been ranked for its ability to meet the selection criteria. In this section, the ranking is expanded to include the scoring and weighing system of the NYSDEC TAGM. As specified in the TAGM, the maximum scores for each criteria are as follows:

Points	Evaluation Criteria
10	Compliance with SCGs
20	Overall protection of human health and the environment
10	Short-term impacts and effectiveness
15	Long-term effectiveness and permanence
15	Reduction of toxicity, mobility, and volume
15	Implementability
15	Cost
100	TOTAL

Table 5.1 presents the results of the scoring evalulation. The scores appearing in Table 5.1 were assigned by NYSDEC based on an evaluation of the criteria presented in the TAGM and the information discussed in Sections 2, 3, and 4 herein; note that the TAGM scoresheets were not used directly. Table 5.1 includes two total scores for each alternative: one score represents the total before considering costs, the second includes the cost factor. This approach is presented to indicate both the technical and economic advantages/disadvantages of each alternative.

As can be seen from Table 5.1, the on-site treatment alternatives, (on-site incineration, on-site thermal separation, and on-site solvent extraction) are most successful in meeting the selection criteria. Although off-site incineration scores the highest without considering costs, the disproportionately high cost of this alternative makes it less attractive. Similarly, although on-site containment is the least expensive, this alternative fails to score high enough on the remainder of the criteria to compare favorably with the on-site treatment alternatives. Off-site disposal scores moderately in both technical and economic categories, resulting in a total score which is less than the on-site treatment alternative.

In accordance with the preceeding discussion, the NYSDEC preferred alternative consists of the following components:

- On-site treatment of contaminated soils and sewer sediment by thermal separation, solvent extraction, or incineration technologies;

- Off-site or on-site treatment/destruction of the oily product recovered from the separation process (if separation is performed);

- Stabilization of the treated soils, if necessary, to reduce mobility of inorganic contaminants;

- Placement of the treated soils back on site with a topsoil cover and vegetative layer; and

- Extraction and on-site preatreatment, using an oil/water separator, of shallow groundwater beneath the site for discharge to the POTW. Residues, if any, from on-site groundwater treatment will either be treated/destroyed onsite, or treated, destroyed, and disposed off-site.

Determination of the final on-site treatment technology for contaminated soil will be based on the following:

- Results of on-site pilot-scale treatability studies;

- Construction and treatment bids and technical information obtained from qualified remediation firms; and

- Negotiations with the responsible parties.

TABLE 5.1

NYSDEC ASSIGNED SCORES FOR BOOTH OIL REMEDIAL ALTERNATIVES

Criteria/Alternatives	On-Site Incineration	On-Site Thermal Separation	On-Site Solvent Extraction	On-Site Disposal Containment	Off-Site Disposal	Off-Site Incineration
Compliance with SCGs	8	8	8	6	10	10
Overall Protection of Human Health and Environment	20	20	20	20	20	20
Short-Term Impacts and Effectiveness	4	4	4	9	6	6
Long-Term Effectiveness and Permanence	13	13	13	3	12	12
Reduction of Toxicity, Mobility and Volume	15	14	14	2	2	15
Implementability	11	11	11	14	14	14
SUBTOTAL	71	70	70	54	64	78
Cost ($)*	17.5 M	21.7 M	11.8 M	4.2 M	13.6 M	74.6 M
Cost (score)	11	11	12	15	12	0
TOTAL	82	81	82	69	76	78

* Average of vendors surveyed

Section 6

SECTION 6

CONCEPTUAL DESIGN OF REMEDIAL ACTION

As a result of the detailed analysis of alternatives presented in Section 3 of this Phase III Feasibility Study, and subsequent laboratory-scale treatability studies discussed in Section 4, NYSDEC has selected a preferred alternative for remediation of the Booth Oil Site. The preferred alternative consists of the following components:

- On-site treatment of contaminated soil and sewer sediments by thermal separation, chemical separation (solvent extraction), or thermal destruction technologies;
- Off-site or on-site treatment/destruction of oily product recovered from the separation process (if thermal separation or solvent extraction is used);
- Stabilization of the treated soils, if necessary, to reduce the mobility of the inorganic contaminants;
- Placement of the treated soils back on-site with topsoil cover;
- Extraction and on-site pretreatment of groundwater using an oil/water separator for discharge to the North Tonawanda POTW. Residues from

on-site groundwater treatment will be treated/destroyed/disposed off-site or on-site.

This section details each of the components of the remedial action.

6.1 ON-SITE TREATMENT OF CONTAMINATED SOIL

The estimated 29,300 cy of contaminated soil and sewer sediment at the Booth Oil Site will be excavated and treated using one of three effective technologies:

- o Thermal Separation;
- o Chemical Separation (Solvent Extraction); or
- o Incineration.

Excavation of the contaminated soil will be performed beneath a hooded structure with a gas collection and treatment system. Air quality inside the hood will be monitored continuously to ensure that the site workers are wearing appropriate levels of personal protective equipment. Air quality outside the structure will also be monitored continuously to ensure that the gas collection and treatment system is operating properly and public health is protected. Excavated soil will be transported to a staging area adjacent to the treatment system. The stockpile will be covered with a hood, tarpaulin, or similar device to control release of contaminants. The stockpile will not contain, at any one time, a volume of soil greater than the treatment system's one-day capacity.

Excavation of the contaminated soil will be performed after the railroad removes the railroad tracks running through the site. Afer removal of the tracks, the clean area north of the contaminated portion of the site will be graded as needed so that the treatment system can be set up. To prevent contamination of this area, a temporary liner may be placed in the equipment area.

Potential thermal separation systems evaluated in this Feasability Study for use at the Booth Oil Site include the closed-loop system of Chemical Waste Management, the anaerobic system of SoilTech, and the fluidized bed system of Recycling Sciences International. Each of these systems is described in detail in Section 2.2.4 of this document. Site set-up using the closed-loop system, which was evaluated as part of the treatability study described un Section 4, is presented in Figure 6-1. The closed-loop system equipment shown in Figure 6-1 includes a feed system, rotating kiln, burner system, wet scrubber, two heat exchangers, phase separator, electric induction heater, particulate filter, carbon adsorption unit, and stabilization system.

Potential chemical separation systems for treatment of the contaminated soil include the triethylamine extraction system (BEST) of Resource Conservation Company. This system is described in detail in Section 2.2.5 and treatability results are discussed in Section 4. Site set-up using the system is shown in

Figure 6-2. BEST system equipment would include a feed system, combination soil washer/dryer, decanter, centrifuge, solvent evaporator, water stripper, solids holding tank, two solvent holding tanks, two wash tanks, stabilizing agent feed system, and a decontamination trailer.

On-site incineration systems that may be used at the Booth Oil Site include ECOVA's infrared incineration system, OH Material's infrared incineration system and Weston Services' Transportable Incineration System. These systems are described in detail in Section 2.2.2. Site set-up using the OHM infrared sytem is presented in Figure 6-3. The OHM system equipment would include a feed system, the incinerator with primary and secondary combustion chambers, treated soil storage drums, wet scrubber with water circulation system, propane fuel supply, blowers, and stack.

6.2 DISPOSAL OF RESIDUALS

Each of the three treatment systems which may be used at the Booth Oil Site will generate residues requiring on-site or off-site treatment/destruction. The on-site separation processes will produce an oily product for destruction and the on-site incineration system may generate scrubber blowdown water for treatment prior to discharge/treatment. Assuming that the average organics content of the soil is 1.0 weight percent, the separation processes would produce approximately 440 tons of oily product. This oil would be stored in drums in an area adjacent to the treatment system for on-site or off-site destruction. If scrubber water is generated, it may be passed through an oil/water separator and/or carbon adsorption unit (as needed) before discharge, or transported off-site for treatment.

6.3 STABILIZATION OF TREATED SOIL

The need to stabilize the treated soils to immobilize the lead will be evaluated based on the total concentration and mobility of the lead. The total concentration relates to the risk posed by inhalation and ingestion and the mobility relates to the potential for off-site migration.

If the treated residuals would leach lead in excess of 5 mg/l, the residuals would meet the definition of a state RCRA characteristic hazardous waste. In this instance, the lead in the residuals would be immobilized by stabilization, thereby rendering the residues non-hazardous prior to backfilling on-site.

If lead leaches at a concentration less than 5 mg/l, the need for stabilization will be evaluated based on the total lead values ater remediation, and the potential for off-site migration after remediation. Determination of the need for soil stabilization will be based, in part, on results of pilot-scale, on-site treatability studies. The determination will also consider the ultimate treatment technology to be employed. Additional controls such as protective capping and site access restrictions may also be instituted in response to excessive total lead concentrations regardless of leachability.

Based upon the results of the RI, the combined average total lead values for th surface and subsurface soils indicate that the remediation goal of 500 ppm wuld be met for most of the site. The one exception is the lagoon area which contains sludges with a total lead concentration in excess of 27,000 ppm, far exceeding the remediation goal. Regardless of the selected treatment method, the remediation goal for total lead would be exceeded in the residuals from these sludges. In addition, based upon the results of the treatability study, the solvent extraction processes increase the leachability of the lead in excess of the regulatory level of 5 mg/l.

In response to the anticipated high total and leachable lead levels in the treatment residuals from the lagoon areas, additional treatment by stabilization and/or other controls, such as capping, will be required. Of the approximately 30,000 cubic yards of contaminated soils estimated on-site, aproximately 3,000 yards are estimated in the lagoon area. As such, approximately 15 percent of the treatment residuals would requirefurther treatment or control in response to eleveted lead levels.

6.4 PLACEMENT OF TREATED SOIL ON-SITE

After the contaminated soil has been processed in one of the three treatment systems and stabilized if necessary, it will be stockpiled in an area adjacent to the treatment system prior to backfilling. Treated soil from the stockpile would be backfilled continuously using a backhoe. After backfilling and compacting, a protective cover will be placed over the treated soils and graded. The protective cover could consist of topsoil with vegetative cover, asphalt, or a combination of these covers as necessary to prevent direct contact or off-site migration of dust.

6.5 GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE

On the basis of data collected in the Phase I/II Remedial Investigation, it is estimated that approximately 300,000 gallons of groundwater will be extracted from the aquifer beneath the Booth Oil Site. The majority of this water is found under the southwest corner of the site. Extraction of the groundwater will be accomplished using recovery wells. The exact number and placement of wells required will be determined after performing a pump test on the aquifer. Extracted water will be processed through an oil/water separator sized to handle the maximum flow of groundwater that will be produced by the recovery wells. Effluent from the oil/water separator will be discharged to the North Tonawanda POTW. Any oily product collected by the oil/water separator will be stored in drums prior to on-site or off-site destruction.

Figure 6-1
Site Set-Up with CWM's X*TRAX Thermal Separation Process

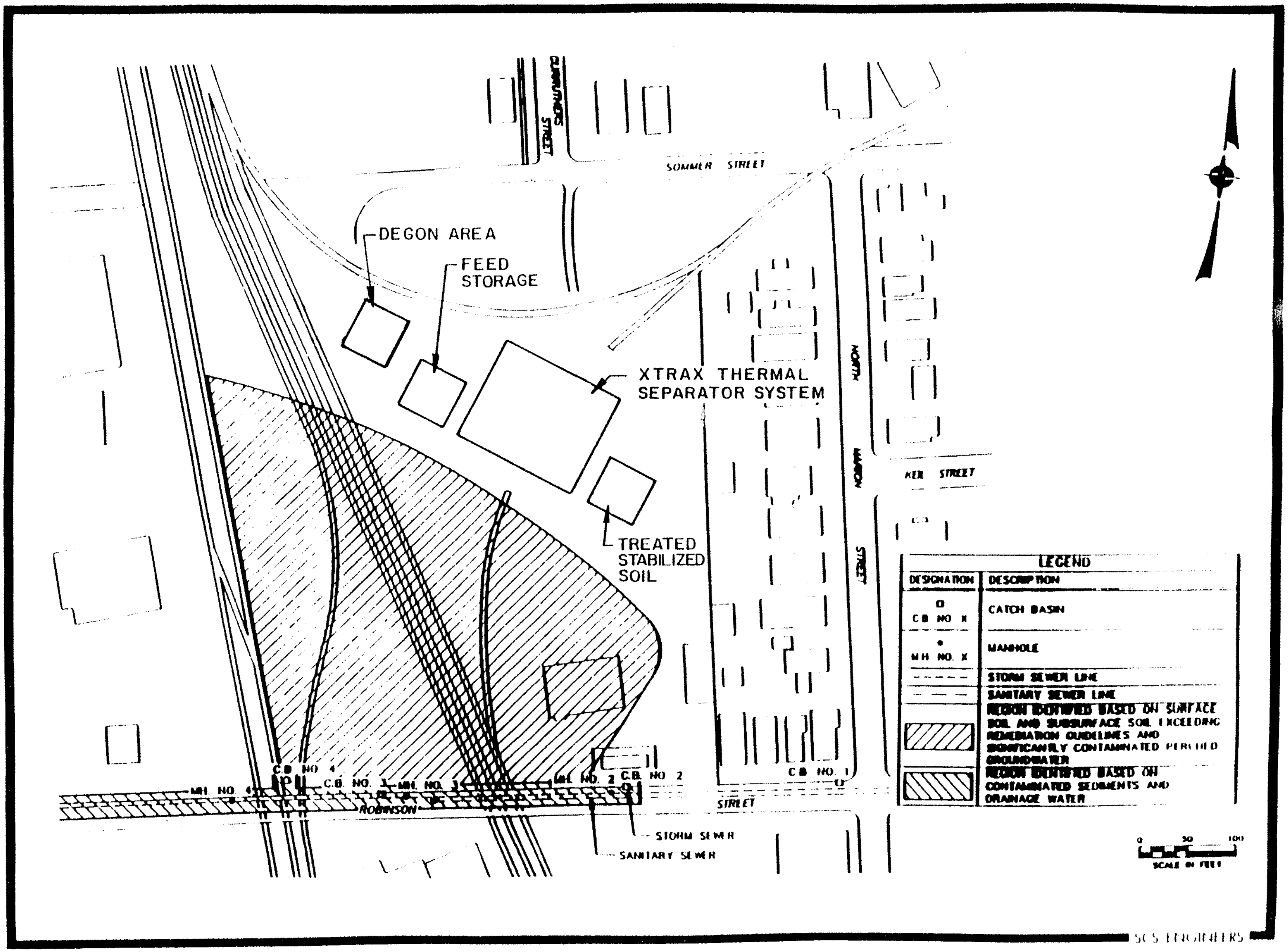


Figure 6-2
Site Set-Up with RCC's BEST Process

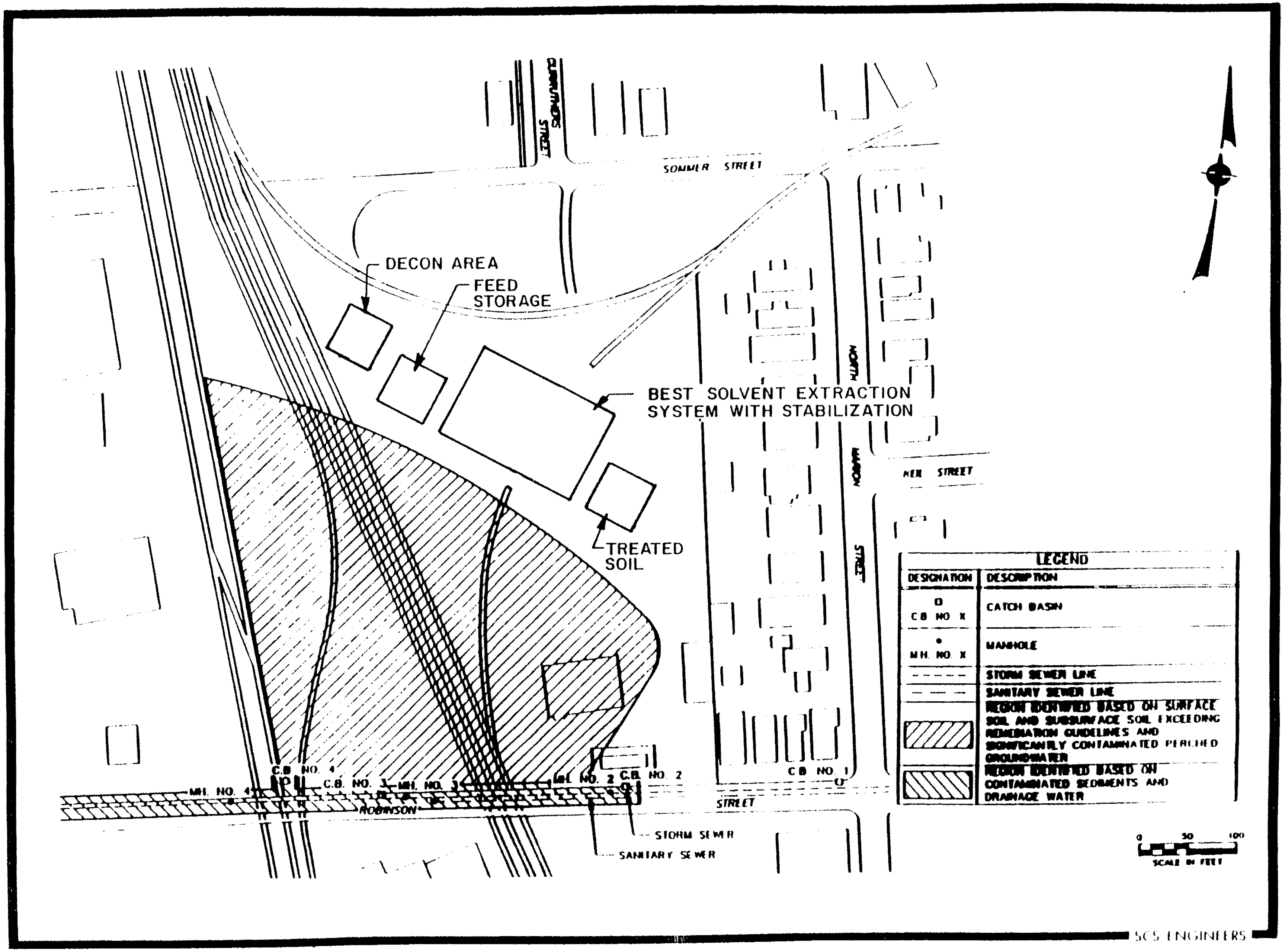
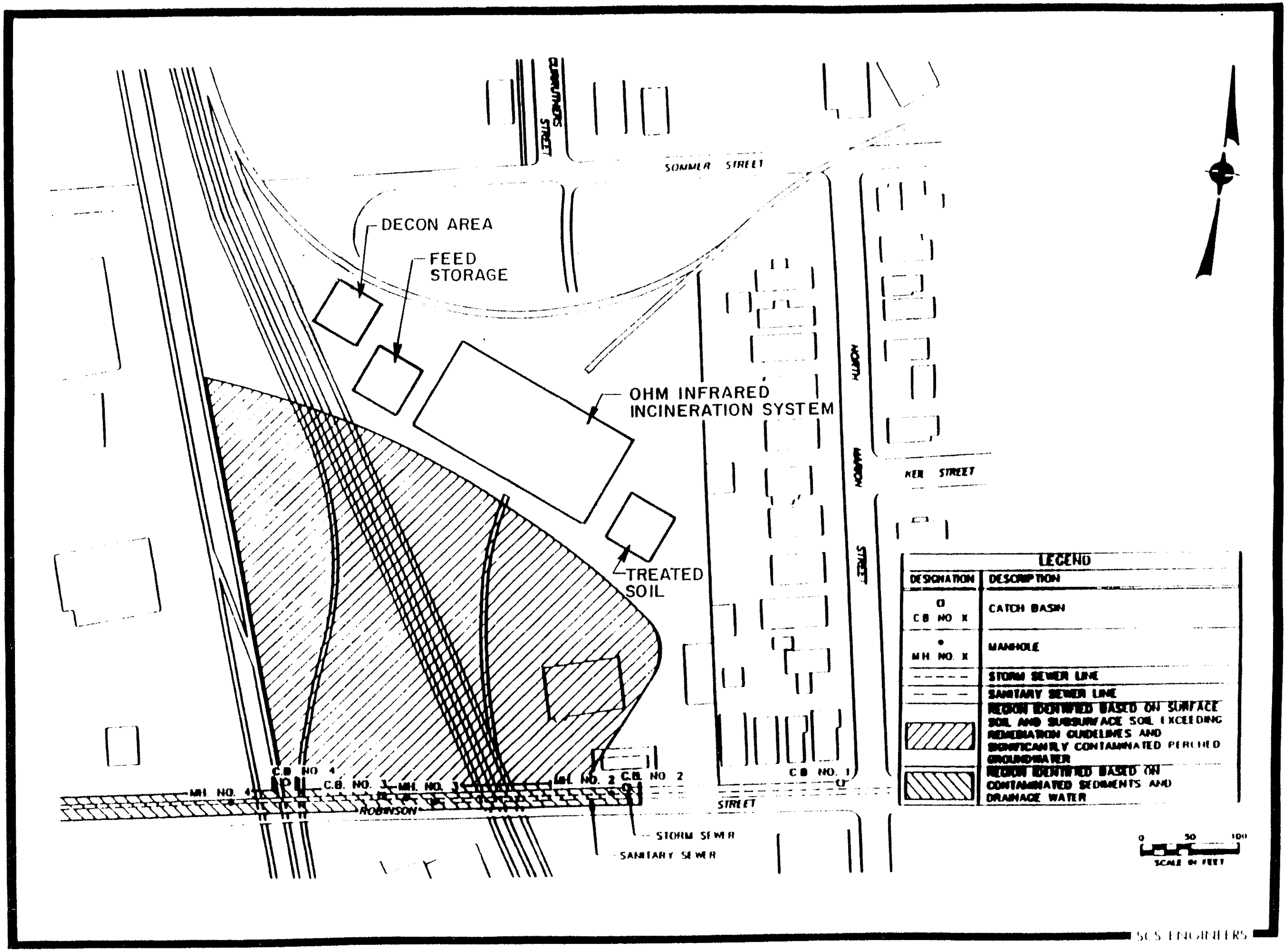


Figure 6- 3
Site Set-Up with OHM's Infrared Incineration System



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APPENDICES

A. OES Circulating Bed Combustor Cost Estimate
B. OHM Materials' Infrared Incineration System Cost Estimate
C. Weston Transportable Incineration System Cost Estimate
D. Chemical Waste Management X*TRAX System Cost Estimate
E. Recycling Sciences International Desorption and Vaporization Extraction System Cost Estimate
F. Soil Tech Anaerobic Thermal Processor Cost Estimate
G. ART International METALEEP System Cost Estimate
H. Resource Conservation Company BEST System Cost Estimate

Appendix A

APPENDIX A

OES CIRCULATION BED COMBUSTOR COST ESTIMATE

OGDEN ENVIRONMENTAL SERVICES, INC.

POST OFFICE BOX 85178
SAN DIEGO, CALIFORNIA 92186-5178

3550 GENERAL ATOMICS COURT
SAN DIEGO, CALIFORNIA 92121

TEL [illegible] FAX [illegible]

August 29, 1991
OES-CBC-BE-91-026

Mr. Warren Wright
SCS Engineers
11260 Roger Bacon Drive
Reston, VA 22090

Subject: Ogden Environmental Services Circulating Bed Combustor (CBC) - Budget Estimate for Site Remediation - New York State Superfund Site

Dear Mr. Wright:

Thank you for your interest in OES' Transportable Circulating Bed Combustor. We are pleased to provide you with a budget estimate for a feasibility study of on-site treatment of soil contaminated with PCBs, volatiles, semi-volatiles, and lead at a used oil re-refining site in New York.

For purposes of this budget estimate, we have used the site and waste composition you provided. At this time we would not identify a maximum upper limit of lead concentration in ppms for wastes treated in the CBC. We do not anticipate a problem with the concentrations of lead in this waste (1900 high, 2500 average, and 171 ppm median) and assume blending of the excavated soil waste feed. For your application, one of our 36-in transportable CBCs could process the estimated 51,000 tons of waste in 87 weeks at an estimated treatment cost of $7,710,000 ($151/ton).

The incineration estimate is based on 80% availability. The estimate includes mobilization, incineration, and demobilization. Excavation may range from $10 to $40/ton and on-site ash disposal from $10 to $15/ton if required. In response to your concern about dust emissions, Ogden has successfully managed this problem during complex excavations around working facilities in a populated industrial area of Stockton, CA and at OES' PCB site remediation in an Alaskan wildlife refuge.

These estimates are based on a 1991 start of field work and are provided for budgetary purposes only and do not represent a commitment by Ogden Environmental Services. We will be glad to provide a firm proposal upon your request.

We have equipment available and would expect to place one of our 36-in CBCs on site approximately 120 days after receipt of order.

Ogden's turnkey remediation service features our Circulating Bed Combustion System; a clean and efficient incineration technology. Rapid and complete combustion of waste feed and quick neutralization of acid gases within the combustor eliminate the need for afterburners and add-on scrubbers. It has demonstrated the ability to destroy hazardous solids, liquids, sludges, and soils to levels over 99.99%; to levels over 99.9999% for PCBs. The CBC is very effective in cleaning soils contaminated with PCB, oil/grease, PCP/creosote, and town gas residues.

Ogden's transportable CBC is specifically designed for on-site remediation and each unit can process 100-150 tons of waste per day. Its modular sections are transported to the site aboard 17-19 standard tractor trailers without the need for special road permits. It can then be fully assembled and ready to operate in three to four weeks. The CBC has a relatively small footprint of 60 ft x 100 ft. Currently there are two units in operation; one in a wildlife refuge in Alaska burning PCB-contaminated soil and another in California burning hydrocarbon contaminated soil. Two additional units are available.

Ogden Environmental Services, Inc. is listed on the U.S. EPA Qualified Bidders List (QBL), Specification No. PQOPS-TQS-89-TIS1, for Transportable Incineration Systems used in the thermal treatment of hazardous wastes at Superfund Sites. In addition, we have Toxic Substances Control Act (TSCA) permits, applicable in all 10 EPA regions, for our transportable CBCs that allow us to burn soil contaminated with PCB.

Thank you again for your interest in our site remediation capabilities. If you have any questions, please call me at 1-800/876-4336.

Sincerely,

Sherin A. Sexton

Sherin A. Sexton
Marketing Sales Coordinator

SAS/kc

cc: D. Young

Appendix B

APPENDIX B

OHM MATERIALS' INFRARED INCINERATION SYSTEM COST ESTIMATE

OHM Corporation

August 28, 1991

Mr. Warren Wright
SCS Engineers
11260 Roger Bacon Drive
Reston, VA 22090

Dear Mr. Wright:

Subject: On-Site Incineration Feasibility

Regarding your telephone inquiry of August 27, 1991, OHM Corporation is pleased to provide the following information relative to the technical and economic feasibility of on-site incineration for the remediation of 34,000 cubic yards of soils contaminated with PCBs and lead. Based upon the general waste characteristics and concentrations (10-300 ppm PCB and 300-1,900 ppm lead), we believe that on-site incineration utilizing OHM's Mobile Infrared Incinerator is a feasible treatment alternative.

The estimated on-site incineration costs are as follows:

- o Mobilization/Demobilization $800,000
- o Soil Incineration $250 per ton

The costs include all ancillary processes and equipment related to the incineration facility which are provided by OHM including waste preprocessing (conveyors, shredders, crushers, feed hoppers), scrubber blowdown treatment (clarifier, sand and bag filters, ion exchange, holding tanks), personnel facilities, health and safety gear, maintenance facilities, decon equipment, etc.

Soil excavation and backfill costs are not included in the estimate. Additional site-specific information such as the vertical and horizontal extent of contamination, ground water elevation, surface obstructions, etc. would be required to estimate the soil excavation effort. Generally, the cost for excavation and backfill is in the range of $25 to $30 per cubic yard.

The installed utility and space requirements for the infrared incinerator are as follows:

o Electric	1800 KVA
o Propane/Natural Gas/Fuel Oil	10 MMBtu/hr
o Water	30 gpm
o Space Requirement	100' x 200'

The throughput of the system is primarily a function of the physical and chemical characteristics of the waste including density, moisture content, heating value, and the requisite cleanup (i.e. ash quality) criteria. Based upon typical soil data, the estimated throughput for this waste stream is approximately 150 tons per day.

I trust that you will find this information useful in conducting the feasibility study. Please feel free to contact me should you have any questions or require additional information.

Sincerely,

George H. Hay

George H. Hay
Director, Thermal Technologies

GHH:has

Appendix C

APPENDIX C

WESTON TRANSPORTABLE INCINERATION SYSTEM COST ESTIMATE

WESTON
MANAGERS DESIGNERS.CONSULTANTS
WESTON WAY
WEST CHESTER, PA 19380
PHONE: 215-692-3030
TELEX 83-5348

27 September 1991

SCS ENGINEERS
11260 Roger Bacon Dr.
Reston, VA 22090

Attention: Mr. Warren Wright

Reference: Cost Estimate for a Remediation of a New York State Superfund Site

Subject: Your 11 September 1991 letter requesting Budgetary Information

Dear Mr. Wright:

WESTON owns and operates transportable incineration systems (TIS). Based on the project information you have provided, we would supply an incineration system similar to our TIS-5. Enclosed is information on TIS-5. Included in this information is a facts sheet on the system. This sheet contains a brief description of the system components, and the required area and utilities. WESTON has obtained both TSCA and RCRA permits to operate this system.

The following budgetary information is provided for WESTON to own and operate 7 days per week, 24 hours per day, a similar TIS-5, to incinerate 34,000 cubic yards of waste:

1. Mobilization, erection, commissioning, startup, and testing to acquire a permit (permitting and other plans are not included): $3,802,945.

2. Operations and maintenance (utilities, Environmental Impact Liability/Pollution Liability insurance, and laboratory and/or analytical costs not included): $629,672. per month.

   You did not provide sufficient information concerning density and heat and moisture content. WESTON has operated this system and we acquired a National TSCA permit at 7 tons per hour. If the waste is similar we would estimate $176/ton. Note that with a throughput of 3 tons per hour, the estimate would be $410/ton. We would estimate that the operations cost would fall somewhere in this range.

3. Demobilization (analytical costs not included): $918,310.

ESTIMATE SUMMARY

1. Fixed costs (Mobilization, Testing, & Demobilization): $4,721,255.

2. Operations (assuming 5 tons/hr, @ 70% availability, & 2200 pounds per cu. yd.: $9,191,933.

   Total: $13,913,188.

This total costs translates to $372.03/ton or $0.186 per pound.

The unknowns for thermal treatment are limited, thus we can supply you the above budgetary cost figures. Regarding your request for other budgetary cost; more information must be given and plans developed. WESTON performs this work as part of FS work in our concept group. If you are interested, we would gladly quote you a price for assisting you in this endeavor.

We appreciate the opportunity you have given us to submit this budgetary estimate. If your client shows an interest in contracting a turnkey, own and operate thermal system, we are available to make a presentation to discuss in detail our qualifications, experience, assumptions, and terms and conditions.

We sincerely hope that we may have the opportunity of working with you on this project.

Very truly yours,

ROY F. WESTON, INC.

Luis A. Velazquez, P.E.
Vice President
Thermal Systems

LAV:imn

Enclosure

SCSENGIN.927/LAV

Appendix D

APPENDIX D

CHEMICAL WASTE MANAGEMENT X+TRAX SYSTEM COST ESTIMATE

Chemical Waste Management, Inc.

3001 Butterfield Road
Oak Brook, Illinois 60521
708 218-1500

September 25, 1991

Mr. Warren Wright
SCS Engineers
11260 Roger Bacon Drive
Reston, VA 22090

Dear Mr. Wright:

Listed below is the information you requested regarding Chemical Waste Management, Inc.'s X*TRAX low temperature treatment process. These numbers are purely budgetary estimates. If you require a firm quotation please contact me and we would be glad to develop a proposal.

Budgetary Estimates for the X*TRAX process:

Mobilization/Demobilization	$500,000
Excavation of Contaminated Soil	$20 - 25/c.y.
Treatment Including Disposal of Residuals	$150 - 300/c.y.
Space Requirements	200' x 200'
Capacity	150 - 200 tons/day

If you have any other questions, please call me at (708) 218-1785.

Sincerely,

Daniel S. Schleck
Corporate Project Development Manager

DSS:prj

APPENDIX E

RECYCLING SCIENCES INTERNATIONAL DESORPTION AND VAPORIZATION EXTRACTION SYSTEM COST ESTIMATE

RECYCLING SCIENCES INTERNATIONAL, INC.
An Environmental Restoration Company
30 South Wacker Drive, Suite 1420
Chicago, Illinois 60606
(312) 559-0122

Mr. Warren Wright
Staff Engineer
SCS Engineers
11260 Roger Bacon Dr.
Reston, VA 22090

September 24,1991

Dear Mr. Wright,

Thank you for your inquiries regarding RSI's Desorption and Vaporization Extraction System. This letter is to confirm our interest in being included in your estimate of the Phase III FS of the New York State Superfund Site which you have sent us information on.

Specifically addressing your inquiries of cost estimates for remedial activity with the DAVE System:

* Mobilization & Demobilization- approximately $92,000 plus $42/line mile from the Arizona facility;

* Treatment of Soil- $200-$340/ton; Additional information we require to give a more definitive bid includes moisture content, specific soil matrix, BTU value, etc.; We also would need to do a treatability study on the material in order to give a final proposal; refer to attachment 'A';

* Disposal of Residuals- these costs are included in our per ton rate, please refer to Attachment 'A'; On average, less than 2.5 lbs of residue would be produced for every ton of material treated;

* Excavation & Back filling- We would subcontract out this portion of the contract. Because of the lack of information(i.e. site layout, etc.)we are unable to obtain any realistic estimate;

Additionally, there are several treatability and site specific requirements that we wish to address:

* Site specific information- we would need specifics on the site of concern, its size and the space available for the System, and if utilities are readily available;

-110' X 175' area for confined treatment

-40' X 70' area for feed preparation

-soil classification/storage area will vary according to amount being treated

-decon area 25' X 30'

* Timing of Treatability Testing- treatability testing on ten drums could be provided at our Arizona facility and could be completed no later than the spring of 1992.

* Materials Handling- other than any performed during the SOP of the DAVE System, is additional to RSI normal operations. However, in a typical onsite project there are protocols which should apply:

-Because of the fact that a contaminated site could contain varying substrate material i.e. sand, clay, soils, large rock etc., a process and classification system would be located in the contaminated material storage area, to sort and classify material for distribution to the DAVE System. Large rock would be crushed and blended with soil, clay, sand, etc., for uniform distribution of material to the processing section.

-The treated material would be discharged into enclosed storage bins, for analysis. Under normal procedures, after confirmation by analysis that material has been cleaned to at or below treatment standards, the material can then be used to back fill the original excavation.

Again thank you for the consideration, and we look forward to the completion of a successful project. Please call if you should have any questions.

Sincerely

Ricardo L Gomez
Recycling Sciences

enclosure: Attachment 'A',

RSI Attachment 'A'

Unless Otherwise agreed Upon, We Require:

1. Treatability study results upon which we will base firm bid.
2. No regulatory issues outstanding.
3. Access on and off the property.
4. Sufficient space prepped for set-up of the DAVE System.
5. Classified material delivered to our feed system.
6. Clean solids taken from RSI clean solids storage hopper.

Unless Otherwise Agreed Upon Costs Include:

1. Processing material in the DAVE System from RSI's main feed hopper through the system and into clean material hoppers.
2. RSI will dispose of all concentrated contaminants and RSI disposables.
3. Energy costs for DAVE System are covered in our costs, however, bringing utilities to site is not.
4. All personnel for operation of machine are included.

Unless Otherwise Agreed Upon, Our Costs Do Not Include:

1. Providing sampling and testing of material, but RSI reserves the right to perform such tests for its own use on the incoming and/or the outgoing material.
2. Providing monitoring beyond that which is part of the DAVE System.
3. MOB/DEMOB is not included in RSI's cost per ton and is additional expense to the customer.

Appendix F

APPENDIX F

SOIL TECH ANAEROBIC THERMAL PROCESSOR COST ESTIMATE

SoilTech

SoilTech, Inc.
94 Inverness Terrace East - Suite 100
Englewood, Colorado 80112

Phone: (303) 790-1410
Fax: (303) 799-0186

October 4, 1991

89-039-01

Mr. Warren Wright
Staff Engineer
SCS Engineers
11260 Roger Bacon Dr.
Reston, VA 22090

Transmittal
Cost Estimate for Remediating
a New York Superfund Site

Dear Mr. Wright:

In response to your request regarding the Booth Oil site in Tonowanda, New York, SoilTech, Inc. (SoilTech) submits the following cost estimate to SCS Engineers (SCS) for remediating soils contaminated with polychlorinated biphenyls (PCB).

This cost estimate focuses on the limited tasks that you requested. It includes costs for mobilization/demobilization of the SoilTech Anaerobic Thermal Processor (ATP) plant, excavation of contaminated soils, treatment of contaminated soils, disposal of treatment residuals, and backfilling of the excavation. Please bear in mind that these estimates are very preliminary, but realistic, considering the minimal information and time available to us for consideration. Each of the work tasks is described below.

Mobilization/Demobilization

Mobilization/demobilization costs vary depending on site location, site preparation and plant configuration. Six weeks from arrival on site are required for setup. Up to four weeks are required to decontaminate and demobilize the treatment system at the end of soil treatment.

Excavation

Excavation costs are based on removing 34,000 cubic yards of contaminated soils. We assume these soils will have a minimal water content, i.e., the ground water depth shall be greater than the 7-foot excavation depth that you specified. The excavation zone dewatering costs are not included in this estimate. The range of excavation costs takes into account only the amount of water entrained in the soil.

This estimate is also based on the soils being excavated while work crews are wearing Environmental Protection Agency (EPA) level D personnel protection. Costs will increase if the level of protection must be increased.

You indicated the soils are sandy silt and gravel fill, with some clay. We understand underground pipes need removal and railroad tracks need replacment, in cooperation with the rail owner. The estimated excavation costs do not account for the removal and replacement of railroad tracks, debris or underground piping. These tasks will increase the excavation costs.

Note that the SoilTech ATP unit can pass rocks of 3-inch dimension and smaller without limit. A small percentage of larger rocks can be processed, too. Metal and wood debris should be screened out of the feed.

Treatment

SoilTech proposes to use the SoilTech ATP unit to treat the soils. This technology is based on thermal desorption, with optional dechlorination. Soils are treated at high temperatures [up to 1100 degrees Fahrenheit (° F)] in an oxygen-starved atmosphere. High-energy tumbling results in an efficient, deep removal of adsorbed organics from the soils, including fine clays.

At the Wide Beach site and in earlier test operations, the ATP system reduced PCB levels from a high value of 16,000 parts per million (ppm) to non-detectable residual values of 0.1 ppm and lower. The Wide Beach soils averaged nearly 50 percent clay and silt, and the system consistently maintained rigorous clean up standards.

The modest average contamination levels shown in the data you provided are similar to the levels found at Wide Beach. There, the SoilTech ATP plant utilized dechlorination to completely and safely destroy PCBs in a single process operation. Dechlorination is accomplished by adding proprietary reagents to the feed, and SoilTech is the only commercially proven vendor of chemical dechlorination waste treatment services.

A range of prices for treatment is included in this estimate. The ATP system operates most efficiently on soils containing no more than 10 to 15 percent moisture, less than 10 percent (i.e. 100,000 ppm) organics concentration and low fines. This budget estimate is based on these conditions. Debris screening has not been taken into account for this estimate.

The processed soil is expected to meet landfill criteria therefore, it will be used for on-site backfill material, which will decrease disposal costs, as well as backfill material costs. Condensate water from the ATP system is expected to be discharged into the local, publicly owned treatment works (POTW). Lacking sufficient data on the soils' organic content, this estimate does not take into account any disposal costs for oils that may be produced as by-products of this process.

Prices

The following is SoilTech's cost estimate for excavating, remediating and backfilling the 34,000 cubic yards of contaminated soils at the New York State Superfund site. We assume the soil density is about 1.5 tons per cubic yard (cy).

Task Description	Unit Cost
Mobilization/Demobilization	$500,000 - $850,000
Excavation	$6.00 - $7.00 per cy
Treatment (thermal desorption only)	$150 - $250 per ton of feed
Treatment (including dechlorination option)	$175- $320 per ton of feed
Backfill	$3.00 - $5.00 per cy

To reduce the total treatment costs, SoilTech proposes using soil washing on the materials, which would cost approximately $75-$100 per ton of soil washed, and could significantly reduce the amount of soil requiring treatment for PCB removal/destruction - i.e., by the ATP system.

Assumptions Included in This Estimate

The following assumptions were taken into account in this estimate:

- Site setup by others, including security, utilities, plant foundations,
- All excavating work will be done in Level D,
- Any preprocessing of soils to remove debris, reduce water content or improve conditions will be extra,

- Removal/replacement of underground pipes and railroad tracks by others,

- QA/QC testing of soils into and out of unit, plus environmental testing and monitoring, is a separate task item,

- Continuous operation until processing is done, assuming no weather delays in processing, and

- No delays in operations commencement for agency evaluation of performance.

Included with this estimate is literature that explains the ATP system in more detail. SoilTech looks forward to working with you in the future on this project. Should you have any questions, please call me at (303) 790-1410.

Very truly yours,

Martin Vorum
Project Manager

MV/mc

Appendix G

APPENDIX G

ART INTERNATIONAL METALEEP SYSTEM COST ESTIMATE

ART INTERNATIONAL INC.

September 25, 1991

Mr. Warren Wright
Staff Engineer
SCS Engineers
11260 Roger Bacon Drive
Reston, Va 22090

Dear Mr. Wright,

Reference is made to your September 11, 1991 request for a cost estimate for remediation of a New York State Superfund site. We have reviewed the Phase 1 and Phase 2 contaminated soil summaries and are confident that the METALEEP process, which combines the LEEP technology (a solvent extraction process for the remediation of soils contaminated with organics), with the METLEX technology (an extraction process for the remediation of soils contaminated with toxic metals), is ideally suited for the remediation of the Booth Oil site.

Our commercial scale facility has a nominal capacity of 10 dry tons/hr., and for METALEEP remediation, process trains are mounted on five 40' trailers, which are mobilized at the site. Based on a 7 day/wk, 24 hr/day schedule, the remediation of a site the size of the Booth Oil site is estimated to cost between $175 and $200/ cu. yd. This cost includes mobilization, excavation, treatment, backfilling, disposal and demobilization. Costs associated with permitting and allied issues are not included.

I have enclosed a package describing the ART technologies and would welcome any comments or questions you or your associates may have.

Sincerely,

Werner Steiner
President

273 FRANKLIN ROAD • RANDOLPH, NJ 07869 • 201-361-8840 • FAX: 201-361-1021

Appendix H

APPENDIX H

RESOURCE CONSERVATION COMPANY BEST SYSTEM COST ESTIMATE

RCC Resources Conservation Company

3630 Cornus Lane
Ellicott City, Maryland
21043

Phone: 301 596-6066
Fax: 301 465-2887
RCC Headquarters: 206 828-2400

September 27, 1991

Mr. Warren Wright
Staff Engineer
SCS Engineers
11260 Roger Bacon Drive
Reston, VA 22090

Subject: **B.E.S.T.© Solvent Extraction Treatment Cost Estimate for Soils Remediation at a New York State Superfund Site**

Reference: **Letter to Paul S. McGough, RCC dated September 11, 1991**

Dear Mr. Wright;

Based in the information contained in the reference letter, Resources Conservation Company (RCC) estimates the cost for treating the contaminated soils with the B.E.S.T. solvent extraction process at about $180/yd^3. This cost estimate assumes that all 34,000 yd^3 of soils will be treated with the B.E.S.T. process.

This cost estimate is on a "hopper to hopper" basis. The treatment costs do not include: site excavation, civil work, applicable taxed, pre-screening of feed, or overall site management. Any costs for destruction of the recovered oils are also not included in the treatment costs. An allowance for mobilization/demobilization is included in the treatment costs. This cost estimate assumes the use of a mobile B.E.S.T. Model 615 unit. Capacity of the B.E.S.T. Model 615 is 150-200 yd^3/day.

I hope this information meets your current needs. If you have any questions, please call me directly at (301)596-6066.

Sincerely,

RESOURCES CONSERVATION COMPANY

Lanny D. Weimer

Lanny D. Weimer
Manager, Business Development