

APPENDIX A

Feasibility Study Report
Ascon Site, 21641 Magnolia Street
Huntington Beach, California

ENVIRON International Corporation

November 2000

File

**FEASIBILITY STUDY REPORT
ASCON SITE, 21641 MAGNOLIA STREET
HUNTINGTON BEACH, CALIFORNIA**

VOLUME 1 OF 2

FOLDER 1 OF 1

Prepared for:

California/Nevada Development, LLC
Seal Beach, California

Submitted to:

California Environmental Protection Agency
Department of Toxic Substances Control
Site Mitigation Branch
Cypress, California

Prepared by:

ENVIRON International Corporation
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November 2000

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June 22, 2001

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APPROVAL OF REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR THE SOIL/WASTE PERTAINING TO THE ASCON LANDFILL SITE

Dear Mr. Stellar:

The Department of Toxic Substances Control (DTSC) approves of the Remedial Investigation/Feasibility Study (RI/FS) for the soil/waste portion of the Ascon Landfill site (Site). Although limited groundwater data has been collected and reported in the document(s) below, the RI/FS pertaining to groundwater at the Site will be continued during and after remediation of the soil/waste. In addition, it appears that there is not a significant concern regarding the thorium content in groundwater.

Some of the documents which constitute the approved RI/FS for the soil/waste were revised with corrected pages subsequent to the date of the document. The approved RI/FS for the soil/waste is comprised of the following documents, as corrected:

- 1) "Remedial Investigation Report," Volumes I, II, and III, dated June 11, 1997 (Revision 01), prepared by Environmental Science & Engineering, Inc.
[a correction on page 4-44, last paragraph, should read in concentration units "µg/l" (not "mg/l")];
- 2) Results of Site Runoff Incident in 1998:
 - a) Letter to DTSC from California/Nevada Developments, LLC, regarding "Emergency Response Sampling of Runoff Following Recent Rains Ascon Property, Huntington Beach, California," dated May 13, 1998

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- b) Project Memo to Marina Robertson of California/Nevada Developments, LLC from Carl S. Kelley III of QST Environmental regarding "April 3, 1998 Sampling at the Ascon Site," dated May 6, 1998;
- 3) Results of Hexavalent Chromium Sampling Event in 1999 :

Memorandum to DTSC from GreenPark Group, LLC, dated June 18, 2001 regarding "Ascon Landfill, Hexavalent Chromium Sampling Results";
- 4) Results of Site Survey Pertaining to Thorium:
 - a) "Report, Ascon Site Investigation, Huntington Beach, CA," dated October 2000, prepared by Foster Wheeler Environmental Corporation;
 - b) "Addendum to the October 2000 Ascon Site Investigation, Huntington Beach, CA," dated April 2001, prepared by Foster Wheeler Environmental Corporation;
- 5) "Baseline Health Risk Assessment," dated June 9, 1997 (Revision 01), prepared by Environmental Science & Engineering, Inc.;

"Errata Summary, Baseline Health Risk Assessment,....Dated June 9, 1997, Revision No. 1," dated June 12, 2001; and
- 6) "Feasibility Study Report, Ascon Site, 21641 Magnolia Street, Huntington Beach, California," Volumes I and II, dated November 2000, prepared by ENVIRON International Corporation.

Additionally, the letter to DTSC from California/Nevada Developments, LLC (CND) regarding "Outstanding Issues with regard to the Ascon Remediation," dated May 22, 2001, summarizes issues that will be addressed prior to and during soil/waste remediation. This letter is basically a revised version of, and to supplement, the items listed in Section 6.0, Recommendations, of the "Remedial Investigation Report." In some cases, some activities may continue or occur after the soil/waste remediation. Also, it is important to note that the purpose of the future groundwater monitoring system is to adequately characterize groundwater and "answer any remaining questions regarding contaminants and their distribution."

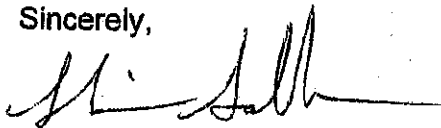
As previously discussed, DTSC highly recommends that an air sampling program for background air contaminants be performed. Again, the purpose of collecting background air samples is to determine the extent to which uncontrolled emissions

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from the Site may be contributing to exposures in the near vicinity, including Edison High School. DTSC believes air background data will be useful in evaluating the efficacy of remedial actions at the Site.

If you have any questions regarding this letter, please contact Ms. Christine Chiu at 714.484.5470.

Sincerely,



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November 2000

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California Professional Civil Engineer Stamp

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**FEASIBILITY STUDY REPORT
ASCON SITE, 21641 MAGNOLIA STREET
HUNTINGTON BEACH, CALIFORNIA**

EXECUTIVE SUMMARY

The Ascon site was operated as a waste disposal facility from approximately 1938 through 1984. Much of the waste disposed of on the site in its early years came from oil drilling operations, including drilling muds, wastewater brines, and other drilling wastes. Records show that from 1957 to 1971, chromic acid, sulfuric acid, aluminum slag, fuel oils, styrene, and other wastes were also disposed on the site. From 1971 to 1984, inert solid wastes such as asphalt, concrete, metal, soil, and wood were disposed on the site.

This Feasibility Study (FS) report was prepared by ENVIRON International Corporation (ENVIRON) under contract with California/Nevada Development, LLC (CND). CND is assisting Signal Mortgage Company, the owner of the property, in satisfying various obligations to the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC). Signal Mortgage Company is required to complete the obligations as outlined in a Voluntary Cleanup Agreement between CND and the DTSC dated May 17, 1996. These obligations include completion of a Remedial Investigation (RI), an assessment of risk to human health and the environment, preparing this FS report, and preparing a Remedial Action Plan (RAP) for the site. The RI and risk assessment reports were prepared by Environmental Science and Engineering, Inc. (ESE) in April 1997. Following the submittal of this FS report, CND intends to present a RAP to the DTSC.

The chemical data presented in the RI show that there are detectable concentrations of chemicals in the soil and on-site ground water that exceed the Preliminary Remediation Goals (PRGs) established by the United States Environmental Protection Agency (USEPA), Region IX and exceed the Resource Conservation and Recovery Act (RCRA) and California criteria for defining materials (soil and ground water) as hazardous wastes.

Based on the results of the baseline health risk assessment completed by ESE in 1997, the waste lagoons, Pit F, and the on-site soils could present a health risk to off-site residents, off-site workers, trespassers, and hypothetical on-site residents. In addition, the presence of open waste lagoons and solid waste piles at the site could present a physical health threat to the trespassers who may frequent the site.

ENVIRON defined the primary remedial action objectives for the Ascon site as follows:

- Reduce human health risks
- Reduce risks to the environment
- Mitigate on-site sources of additional ground water degradation
- Comply with Applicable or Relevant and Appropriate Requirements (ARARs)

As a secondary remedial action objective, it is the intention of CND to facilitate site redevelopment consistent with current zoning.

The objectives of this FS were to evaluate remedial technologies for addressing the affected media at the site and process options for the implementation of those technologies. The affected media at the site are soils and drilling muds in the former and current lagoons and in the pits, liquid hydrocarbon wastes in Lagoons 1 and 2, tarry styrene waste in Pit F, surface water in the current lagoons, construction debris throughout the site, and ground water beneath the site. The following approach was followed in performing the FS:

- An evaluation and screening process was conducted in compliance with the National Contingency Plan (NCP). For this task, ENVIRON generally followed the guidance prepared by the U.S. Environmental Protection Agency (USEPA, 1988) for performing FS under CERCLA. First, remedial action objectives and ARARs were defined for the site. Then, affected media, or waste units, at the site and their volumes were defined. This was followed by evaluating technologies and their associated process options for addressing the wastes at the site. Next, a preliminary screening of the process options was performed based on their effectiveness and implementability.
- Upon completion of the preliminary screening of the process options, three process options were retained for the affected soils, drilling muds, and liquid hydrocarbon wastes, which comprise approximately 99% of the site wastes. *Ex situ*, on-site asphalt recycling and stabilization were selected for the soils and drilling muds; *ex situ*, on-site solvent

extraction was selected for the liquid hydrocarbon wastes. Treatability studies were performed in 1998 on these three process options. In 1999, pilot tests were conducted on the stabilization and solvent extraction processes. For the styrene waste in Pit F, excavation and off-site disposal at a landfill was considered as the most viable option.

- An additional screening of the remaining process options was performed based on relative cost. The processes that were retained following the treatability studies, the pilot tests, and this additional screening were assembled into remedial alternatives. These alternatives included no action (Alternative 1), containment with a soil-bentonite slurry wall and a vegetative, geomembrane cap (Alternative 2), and source removal (Alternative 3). A detailed evaluation of these remedial alternatives was performed in accordance with the NCP. Based on the results, Alternative 3 was considered as the most suitable remedial alternative for the Ascon site.

Alternative 3 consists of removal and off-site disposal of the old drums, tires, pipe, vegetation, and piles of wood that are scattered throughout the site; excavation of the construction debris and segregation into concrete and other debris; removing surface water from the five existing lagoons; removing the liquid hydrocarbon wastes from Lagoons 1 and 2; excavating the tarry styrene wastes from Pit F; and excavating the affected soils and drilling muds from the current lagoons, former lagoons, pits, and the perimeter berm. The concrete debris will be crushed and used for backfill on-site; the remaining construction debris will be transported to a municipal landfill. The surface (rain) water from the lagoons will be run through an on-site wastewater treatment system and used on-site during construction operations with any remaining water to be discharged into Huntington Beach Flood Control Channel. The excavated styrene waste from Pit F will be transported to a landfill for disposal. The removed liquid hydrocarbon waste from Lagoons 1 and 2 will be remediated on-site by solvent extraction; the extracted hydrocarbons will be concentrated for off-site recycling.

Stabilization of the excavated affected soils and drilling muds will be performed on-site. The stabilized materials will be transported off-site for use as road base material and other similar uses (prior to initiation of construction activities, a project site will be identified for accepting the stabilized materials). The remediated site will be regraded for residential redevelopment.

During the implementation of the selected remedy at the site, segregation of the excavated soils and drilling muds will be performed, and the materials will be placed into affected and non-affected stockpiles. Shaker screens and on-site (mobile) and/or off-site laboratories will be used in this

A.

process. A Sampling and Analysis Plan will be prepared for implementation during these segregation activities, and as part of confirmation of the removal actions.

The total estimated cost for Alternative 3 is approximately \$31.5 million, which includes \$23.5 million for construction, \$3.7 for oversight and miscellaneous costs, \$4.1 million for 15 percent contingency, and \$0.2 million for the present worth of five years of ground water monitoring. This alternative, when implemented, will eliminate or reduce to acceptable levels the identified risks from the soil, ground water, and physical conditions of the site. Also, this alternative will provide for the residential development of the site.

With the exception of total dissolved solids (TDS), ground water quality does not appear to be significantly different across the site. Based on the 1997 sampling results obtained by ESE, there are very minimal impacts to ground water in the Semiperched Aquifer at the site. ENVIRON believes that there is no immediate need for ground water remediation. As agreed with DTSC, the need for ground water remediation will be re-evaluated following site remediation. For the selected remedy, ENVIRON assumed that up to five years of ground water monitoring may be required.

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LIST OF ACRONYMS AND ABBREVIATIONS

AF _T	Attenuation factor
ARAR	Applicable or Relevant and Appropriate Requirements
ASB	Asphalt Stabilized Base
ASTM	American Society for Testing and Materials
BHRA	Baseline Health Risk Assessment
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAA	Clean Air Act
Cal/EPA	California Environmental Protection Agency
CCL	Compacted Clay Liner
CCR	California Code of Regulations
CDF	Consolidation and Drainage Fluid
CDWR	California Department of Water Resources
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	Centimeter per second
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CPT	Cone Penetrometer Test
CT	Concentration/Toxicity
CWA	Clean Water Act
cy	Cubic Yard
DCA	Dichloroethane
DCE	Dichloroethene
DHS	Department of Health Services
DQO	Data Quality Objective
DTSC	(California) Department of Toxic Substances Control
EC	Electric Conductivity
ELAP	Environmental Laboratory Accreditation Program
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ESE	Environmental Science & Technology, Inc.
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act

FS	Feasibility Study
FSP	Field Sampling Plan
GCL	Geosynthetic Clay Liner
gpm	gallons per minute
GRA	General Response Action
HDPE	High Density Polyethylene
HSAA	(California) Hazardous Substances Account Act
HI	Hazard Index
HQ	Hazard Quotient
HWCA	Hazardous Waste Control Act
IRIS	Integrated Risk Information System
IWMB	Integrated Waste Management Board
kg	kilogram
MCL	Maximum Contaminant Level
mg/kg	milligram per kilogram
mg/l	milligram per
mil	1/40 of a millimeter (1 in = 10,000 mil)
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear (or Polycyclic) Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
POTW	Publicly-owned Treatment Works
ppbv	parts per billion by volume
ppm	parts per million
ppmv	parts per million by volume
PRG	Preliminary Remediation Goal
psi Hg	pounds per square inch of mercury
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objective

RAP	Remedial Action Plan
RBCL	Risk-Based Cleanup Level
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
rpm	rotation per minute
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SDWA	Safe Drinking Water Act
SOP	Standard Operating procedures
SRC	Savannah Resources Corporation
SSL	Soil Screening Level
STLC	Soluble Threshold Limit Concentration
SVOC	Semi-Volatile Organic Compound
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	(California) State Water Resources Control Board
TCE	Trichloroethene (or Trichloroethylene)
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TEPH	Total Extractable Petroleum Hydrocarbon
TPH	Total Petroleum Hydrocarbon
TRPH	Total Recoverable Petroleum Hydrocarbon
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage, Disposal
TTLC	Total Threshold Limit Concentration
TTU	Transportable Treatment Unit
UBC	Uniform Building Code
UCL	Upper Confidence Level
USEPA	United States Environmental Protection Agency
VFPE	Very Flexible Polyethylene
VOC	Volatile Organic Compound
Water Board	(California) Regional Water Quality Control Board
WET	Waste Extraction Test

μg/kg

microgram per kilogram

μg/l

microgram per liter

FEASIBILITY STUDY REPORT

ASCON SITE, 21641 MAGNOLIA STREET

HUNTINGTON BEACH, CALIFORNIA

1.0 INTRODUCTION

1.1 Background

This report presents the results of a feasibility study (FS) performed for the Ascon property located at 21641 Magnolia Street, Huntington Beach, California ("the Ascon site" or "the site," see Figure 1-1). The site was operated as a waste disposal facility from approximately 1938 through 1984. Much of the waste disposed of on the site in its early years came from oil drilling operations, including drilling muds, wastewater brines, and other drilling wastes. Records show that from 1957 to 1971 chromic acid, sulfuric acid, aluminum slag, fuel oils, styrene, and other wastes were also disposed on the site. From 1971 to 1984 inert solid wastes such as abandoned vehicles, asphalt, concrete, metal, soil, and wood were disposed on the site.

This report was prepared by ENVIRON International Corporation (ENVIRON) under contract with California/Nevada Developments, LLC (CND). CND is assisting Signal Mortgage Company, the owner of the property, in satisfying various obligations to the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC). Signal Mortgage Company is required to complete the obligations as outlined in a Voluntary Cleanup Agreement between CND and the DTSC dated May 17, 1996. These obligations include completion of a Remedial Investigation (RI), an assessment of risk to human health and the environment, preparing this FS report, and preparing a Remedial Action Plan (RAP) for the site. The first two tasks have already been completed. As part of performing the FS, in 1998 CND's contractors performed treatability studies on three treatment options that were selected during the FS process. Further, in 1999 CND's contractors completed pilot tests on two of these treatment options to evaluate the design of the remedial alternatives selected. CND intends to follow this FS report with a RAP.

Between 1966 and 1992 several investigations were conducted at the site. During 1996 and 1997, Environmental Science and Engineering, Inc. (ESE)¹ performed additional field investigations as part of the completion of the RI. The results of ESE's field investigations and past investigations are

¹ ESE was named QST Environmental, Inc. between mid-1997 and mid-1998.

presented in the RI report (ESE, 1997a). The chemical data presented in the RI showed that the site contains detectable concentrations of chemicals in the soil and on-site ground water that exceeded the Preliminary Remediation Goals (PRGs)² established by the United States Environmental Protection Agency (USEPA), Region IX and exceed the Resource Conservation and Recovery Act (RCRA) and California criteria for classifying materials (soil and ground water) as hazardous wastes. Using the data compiled in the RI, a Baseline Health Risk Assessment (BHRA) report was prepared (ESE, 1997b). The BHRA results identified that there are potential risks to human health from the Ascon site. These risks are associated with the chemical constituents in the soils and wastes at the site as well as the physical conditions of the site.

The information presented in Sections 1.2 through 1.6 (site description, site history, site operation, waste types, previous investigations and reports, and previous estimates of waste volumes, respectively) were excerpted by ENVIRON from the RI report (ESE, 1997a). Feasibility study objectives and ENVIRON's approach to performing the FS are described in Section 1.7. The organization of this FS report is described in Section 1.8.

1.2 Site Description

The Ascon site is a square parcel of land located at 21641 Magnolia Street in Huntington Beach, California. The site is at the southwestern corner of the intersection of Hamilton Avenue and Magnolia Street, approximately ¼ mile north of Huntington Beach State Park and the Pacific Ocean (Figures 1-1 and 1-2). The site has an aerial extent of approximately 38 acres and is enclosed by a perimeter chain link fence with two 20-foot-wide locked gates. The gate at the northwest corner of the site provides access from Hamilton Avenue and the second gate provides access from Magnolia Street in the southeastern portion of the site.

In the past, the Ascon site was used as an industrial and oilfield waste disposal facility. The site, no longer in operation, consists of five visible impoundments (referred to as Lagoons 1 through 5), one covered pit (referred to as Pit F), and several former pits and lagoons that are no longer visible. The remaining visible waste handling units cover approximately 30 percent of the property. The approximate locations of these units, the seven former pits no longer visible and other significant features such as buildings, gates, and oil production facilities (on-site and off-site), are presented on Figure 1-3. The locations and boundaries of the waste handling units were originally presented by Radian Corporation (Radian, 1988a).

² In the RI, which was completed in 1997, ESE used the 1996 edition of the PRGs. Currently, the 1999 edition of the PRGs is available. ENVIRON compared the 1996 and 1999 editions of the PRGs for the chemicals detected at the site and confirmed that there are no significant differences between the 1996 and 1999 PRGs.

In 1997, during the site visits made by ESE and ENVIRON, old drums, vehicles, motorcycles, trailers, and piles of cut firewood were found scattered throughout the site. There was an unauthorized firewood operation on portions of the site in 1996 and 1997. Currently, all of the drums are contained within a fenced compound on site and the vehicles and some of the other debris have been removed from the site.

Hazardous waste and California Proposition 65 signs have been placed on the perimeter fence and at the two gates at the site. There is a small storage shed located northwest of Pit F. A 2-acre oil production lease exists in the east central part of the site. There has been evidence that the site may be used by homeless people. To limit access into the site from the oil lease, an additional fence and gate have been installed between Pit F and the fence along Magnolia Street.

1.3 Site History

This section outlines historical ownership of the site and the results of aerial photograph reviews by ESE and past investigators. The site history was developed by ESE from information presented in the documents listed in Section 1.6 of this FS report, primarily Radian (1988) and ISCO Industries/ITARA Engineers (1992). The following site history was excerpted from ESE (1997a):

The site was originally operated as a landfill by the Garrish Brothers, from approximately 1938 to 1950, and by the Steverson Bros., Inc. from 1950 until 1984. In 1984, ASCON Properties, Inc. purchased the site and began negotiation with the DTSC for site cleanup. ASCON Properties was unsuccessful in its attempts to remediate and develop the property and filed bankruptcy in 1989. NESI Investment Group obtained ownership through a foreclosure sale and acquired the site in July 1990. During 1993, the NESI Investment Group filed bankruptcy and Signal Mortgage Company acquired the site in May 1993 through foreclosure. Signal Mortgage Company is the current owner. In 1995, Signal Mortgage Company entered into an agreement with a predecessor of CND to work with the DTSC on the RI/FS and RAP.

ESE completed a limited review of historical aerial photographs of the site (ESE, 1997a). The earliest photographs (1927 and 1928) indicate that the site was undeveloped and may have been used for agricultural purposes. Photographs taken in March 1938 do not indicate industrial or waste handling activities; plowed fields were evident in the southern portion of the site. Historical records indicate that the site began accepting oil-field wastes in 1938.

The photograph from 1947 shows two oil production wells and two small square ponds (sumps) containing liquids in the southeast portion of the site along Magnolia Street. In a 1949 photograph wastes were being handled in an impoundment contained by a berm in the northern part of the site.

Three small impoundments in the northwest quadrant of the site adjacent to Hamilton Avenue appeared in the approximate locations of Pits A, B, and H as shown on Figure 1-3. By the early 1950s, the northern two-thirds of the site was occupied by surface impoundments.

The 1957 photograph shows one large liquid and sediment impoundment on the north end of the site. This northern lagoon appeared in the same location of the current Lagoons 4 and 5 (Figure 1-3). Two lagoons were in the center of the property and a large lagoon was in the south and southwest corner of the site. Three small liquid impoundments and two small impoundments of sediments were located in the southeast corner of the site. These small impoundments appeared in the locations of the currently designated Pits C, D, E, F, and G (Figure 1-3). In the central eastern area of the site, there were two small buildings and six storage tanks. In the northeast area of the site near Magnolia Street, there were three more storage tanks. Near the central portion of the western side, apparently off-site, there were seven storage tanks. In the northwest corner, there were three small liquid impoundments (pits), apparently the same pits noted in the 1949 photograph, and a storage tank.

In a 1958 photograph waste handling activities were visible across majority of the site. More than two-thirds of the surface seemed to be covered with lagoons or pits. The two tanks previously located in the central portion of the east side of the site were not present in the 1958 photograph. By 1961, one pit in the northwest, and the five pits in the southeast corner were still visible. The other pits appeared to have been covered with soil and the rest of the site contained waste impoundments or lagoons.

By 1965, the impoundments appeared to have decreased in size, covering about half of the site. A schematic map drawn in 1966 by PSI Engineering indicates that nearly three-quarters of the site were used for disposal. The photograph from 1967 shows the same four large impoundments as the 1957 photograph; however, they are distorted and appear to be partially filled with sediment. There were five pits in the southeast corner but the building and the storage tanks on the east side were no longer visible.

The photograph from 1978 shows rubble piles in the southeast, southwest, and northwest. Two lagoons in the northeast corner appeared in areas currently designated as Lagoons 4 and 5. A large lagoon in the central portion of the property appeared to be a conglomeration of the lagoons currently designated as Lagoons 1, 2, and 3.

The photograph from 1983 appears very similar to present day conditions. Rubble piles were in the south, southwest corner, and northwest corner. Lagoons 1, 2, 3, 4, and 5 appear as they do

presently. The six storage tanks on the west side were visible. The two storage tanks on the east side were visible and a building in the east side was also visible.

Based on the information presented in this section it appears that essentially the entire Ascon site, except for the perimeter berm and the areas used for oil-and-gas pumping operations, was used at some time for waste disposal. There is evidence that up to eight discrete chemical disposal pits existed in the northwest and southeast portions of the site. These pits appear to have been subsequently backfilled with construction debris and fill material, as have many of the former lagoons.

1.4 Site Operation

A chronology of events at the Ascon site, including pit locations and history, is presented in Tables 1-1 and 1-2. These tables identify the major types of wastes that were handled at the site by year and include some company names associated with specific types of wastes handled at the site. Table 1-1 identifies when the site ceased accepting "hazardous wastes" (1971) and when the site started to accept Class III inert wastes, fill, and concrete (1971 through 1984). The majority of the information presented in Tables 1-1 and 1-2 and in this section was obtained from reviewing previous investigation reports, viewing aerial photographs, and visiting the site. Many of the original sources of historical information such as topographic maps, records, and city documents used to develop the site history and layout presented in these reports were not well documented and are not known.

As described in Section 1.3, the primary types of waste handling units used at the Ascon site were pits and surface impoundments (lagoons). The review of aerial photographs has identified a total of eight pits (Pits A through H). In 1964, the operators of the Ascon site were ordered by Orange County Water Pollution District to cease and desist disposal operations in the waste pits. Subsequent reports indicate the covering of the waste pits with imported fill material. By the early 1970s, all waste pits were covered except for Pit F.

1.5 Waste Types Disposed at the Site

The total number of waste types accepted at the Ascon site is not known. Past investigators have summarized the documented types of wastes possibly disposed of at the site. Radian (1988) had reviewed a report by Ecology and Environment and concluded that the primary type of wastes disposed of at the site were drilling muds and oilfield wastes. These made up the largest volume of wastes accepted at the site. The other wastes that may have been disposed of at the site include:

- Chromic and sulfuric acids
- Aluminum slag

- Magnesium and potassium chloride
- Corrosive material (acid sludges)
- Mercaptans
- Styrene
- Styrene tars
- Dion iso-styrene monomer (sic)
- Polyester resin fractions
- Phenolic wastes
- Synthetic rubber
- Fuel oil (unusable/out of specification)
- Oily wastes
- Construction debris (soil, concrete, asphalt, wood, metal, abandoned vehicles, etc.)

1.6 Past Investigations and Reports

Since 1966, there have been numerous investigations conducted at the Ascon site. The primary scope of these investigations was to characterize the surface materials, subsurface wastes, soils, air, soil vapors, background soils, ground water, and surface water in the Huntington Beach Flood Control Channel (Huntington Beach Channel). The parties performing and the approximate dates of these past investigations are:

- | | |
|---|------------------|
| • PSI Engineering | June 1966 |
| • Civil Engineers, Inc. | 1978-1979 |
| • Smith-Emery | July 1979 |
| • California Department of Health Services | October 1980 |
| • California Department of Health Services | March 1981 |
| • Orange County Environmental Management Agency | October 1981 |
| • Ecology and Environment, Inc./USEPA | 1982 |
| • Woodward-Clyde/Bechtel Corporation | May 1983 |
| • Ecology and Environment, Inc. | July 1983 |
| • Oil Well Research, Inc. | November 1983 |
| • Lockman & Associates | July 1984 |
| • J. W. Barrington/Truesdale Laboratory | March/April 1985 |
| • E. W. Saybolt and Company | August 1985 |
| • South Coast Air Quality Management District | November 1987 |
| • Radian Corporation | December 1988 |
| • H. V. Lawmaster & Co., Inc. | 1988 |
| • Wildan Associates | 1988 |

• Earth Technology Corporation	June 1989
• ISCO Industries/ITARA Engineers	May 1992
• California Department of Toxic Substances Control Memorandum	September 1993
• California Department of Toxic Substances Control Memorandum	February 1995
• Environmental, Science & Engineering, Inc.	January/February 1996
• Environmental, Science & Engineering, Inc.	February/March 1997

The scope of services for these investigations varied considerably. Some investigations only involved a characterization of surface soils or liquids, while other investigations also included the physical and chemical characterization of subsurface materials and ground water. Summaries of the key investigations are presented in the RI report (ESE, 1997a).

From the above investigations, and associated reviews or summaries, the following primary reports were reviewed and incorporated into the RI:

- Woodward-Clyde Consultants, 1983, Subsurface Exploration and Monitoring Well Installation at the Proposed Ryan Waste to Energy Plant Site.
- Lockman & Associates, 1984, Final Site Characterization Plan.
- Bright & Associates, 1985, Remedial Action/Mitigation Plan.
- Radian Corporation, 1988, Volume 1 and Appendices A through J, Final Site Characterization Report for Ascon Site, December.
- H. V. Lawmaster, 1988, Final Site Soils Report.
- ISCO Industries/ITARA Engineers, 1991, Draft Hydrogeological Assessment Report, June 20.
- ISCO Industries, 1991, Removal Action Plan, October 4.
- ISCO Industries/ITARA Engineers, 1992, Draft Remedial Investigation Report, May 11.
- Environmental, Science & Engineering, Inc., 1997, Baseline Health Risk Assessment Report, June 9.
- Environmental, Science & Engineering, Inc., 1997, Remedial Investigation Report, June 11.

Two of these reports evaluated the feasibility of various technologies for the remediation of the site. Bright & Associates (1985) reviewed several technologies potentially applicable to the site. Based on a comparative evaluation of the containment (encapsulation) and source removal alternatives, Bright & Associates concluded that excavation and off-site disposal at a Class I facility was the

preferred alternative for the site. A removal action plan developed by ISCO Industries (1991) addressed the removal of the liquid hazardous wastes and hazardous wastes containing free liquids from the pits and lagoons at the site. The proposed measures included pumping, oil/sediments/water separation, and on-site or off-site soil disposal.

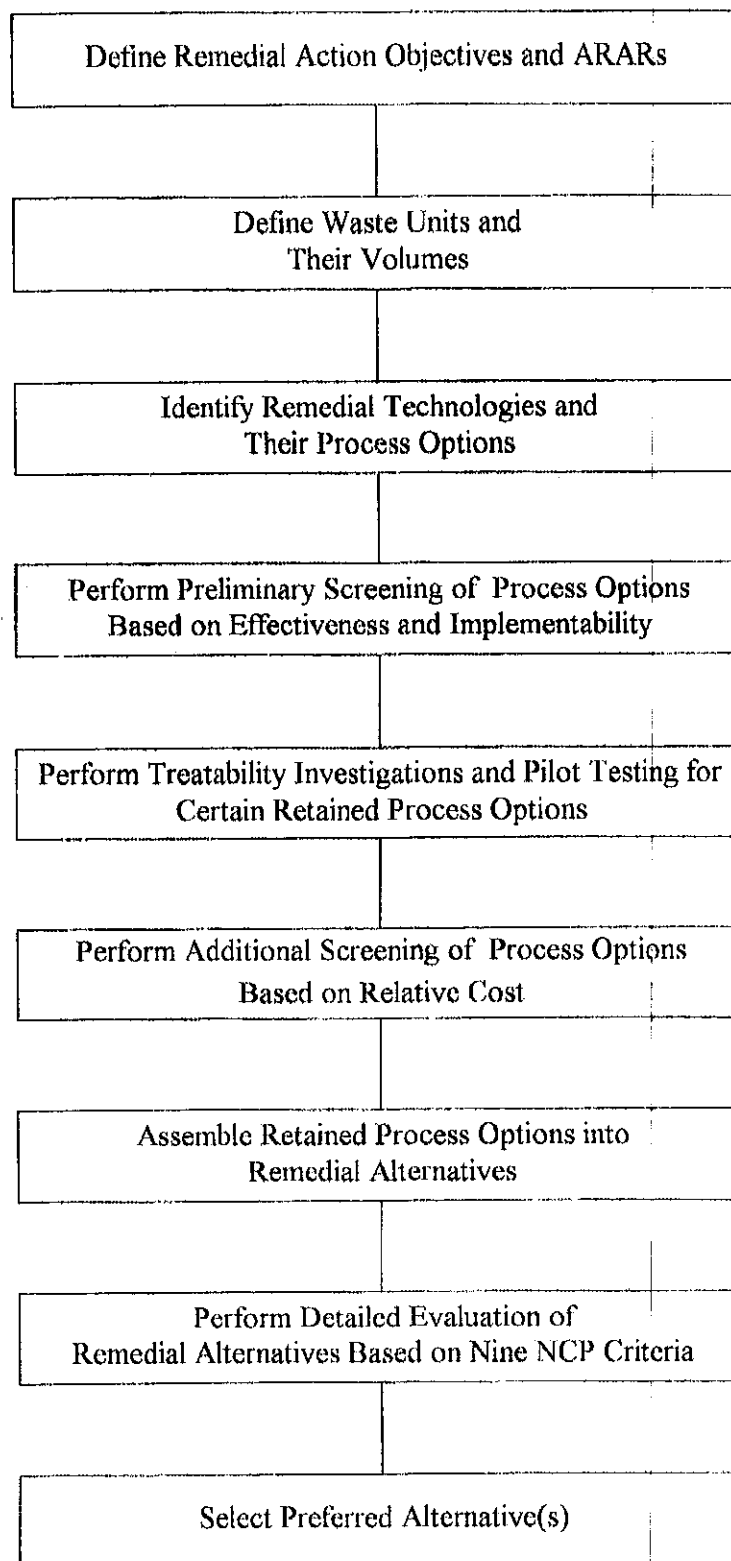
1.7 Feasibility Study Objectives and Approach

The objectives of this FS were to evaluate remedial technologies for addressing the affected media at the site and process options for the implementation of those technologies. The affected media at the site are soils and drilling muds in the former and current lagoons and in the pits, liquid hydrocarbon wastes in Lagoons 1 and 2, tarry styrene waste in Pit F, seasonal surface water in the current lagoons, construction debris throughout the site, and ground water beneath the site. ENVIRON performed an evaluation and screening process in compliance with the National Contingency Plan (NCP), Title 40 of the Code of Federal Regulations (CFR), Part 300 (40 CFR 300). The guidance prepared by the U.S. Environmental Protection Agency (USEPA) for performing FS under CERCLA (USEPA, 1988) was generally followed. The ground water was considered not to require immediate remediation, and is planned for re-evaluation following site remediation, as agreed with DTSC.

The approach used in this FS consisted of several steps, as depicted below in Table 1-A. First, remedial action objectives and Applicable or Relevant and Appropriate Requirements (ARARs) were defined for the site. Then, affected media, or waste units, at the site and their volumes were defined. This was followed by considering various technologies and their associated process options for addressing the wastes at the site. Those process options that were judged not to be applicable to the COCs at the site and specific site conditions were not included. Next, the process options were screened based on their effectiveness and implementability. To provide supporting data for the selection of the process options, treatability studies and pilot tests were performed on selected process options that were retained after screening. Next, an additional screening of the process options was performed based on relative cost. The processes that were retained following this step were assembled into remedial alternatives. A detailed evaluation of these remedial alternatives was performed using the nine criteria required by the NCP. Finally, based on a comparative analysis of the remedial alternatives, a preferred alternative was recommended for the Ascon site.

The FS concludes that when the preferred remedial alternative for the Ascon site, which is source removal and off-site reuse of the affected materials, is implemented, it will achieve the remedial objectives for the site and eliminate or reduce to acceptable levels the identified risks from the soils, drilling muds, liquid wastes, lagoon surface water, construction debris, and physical conditions of the site. It will further provide a long-term, permanent solution for the site and allow the property to be developed for its intended use.

Table 1-A. The FS Process



1.8 Report Organization

This report is divided the following sections:

- Section 1.0: Introduction
- Section 2.0: Environmental and Ecological Setting
- Section 3.0: Summary of Remedial Investigation Findings
- Section 4.0: Summary of Baseline Health Risk Assessment Findings
- Section 5.0: Remedial Action Objectives and ARARs
- Section 6.0: COC-containing Media, Soil Cleanup Action Levels, and Waste Volumes
- Section 7.0: Preliminary Screening of Remedial Technologies and Process Options
- Section 8.0: Treatability Studies
- Section 9.0: Field Pilot Tests
- Section 10.0: Additional Screening of Process Options and Detailed Evaluation of Remedial Alternatives
- Section 11.0: Preferred Alternative for the Ascon Site
- Section 12.0: References
- Section 13.0: Limitations

2.0 ENVIRONMENTAL AND ECOLOGICAL SETTING

2.1 Introduction

The information presented in this section was excerpted from the RI report (ESE, 1997a). Additional information may be found in the RI report and its appendices.

2.2 Topography and Surface Features

The Ascon site is a primarily vacant property consisting of surface features indicative of its past use as a waste disposal site. The perimeter of the site is currently enclosed by a fence. The current locations and configurations of the lagoons and disposal pits, as well as other significant features such as buildings and oil production wells that operate at and adjacent to the site, are shown on Figure 1-3.

Piles of construction debris (primarily concrete and asphalt) are spread out on the surface throughout the site. There is a fence around the perimeter of Pit F and a small metal shed adjacent to Pit F. A concrete pad for equipment decontamination is located southwest of Pit E. Access to the site is obtained through two gates: on Magnolia Street approximately 900 feet south of Hamilton Avenue, and on Hamilton Avenue approximately 1,200 feet west of Magnolia Street (Figure 1-3).

The site is located in a low-lying coastal area that gently slopes to the south/southeast toward the Pacific Ocean. The surface topography of adjacent properties is generally flat with elevations ranging from 5 to 10 feet above mean sea level (MSL, California Department of Water Resources [CDWR], 1967; U.S. Geological Survey [USGS], 1965, as presented on Figure 1-1). The natural topography of the site has been disturbed extensively over the years by the operation of the landfill and waste disposal activities described in Section 1.0. Earthen berm, 10 to 20 feet high, has been constructed around the site perimeter to contain surface impoundments and storage areas in the interior of the site. Elevation across the site ranges from approximately 3 feet above MSL at the southeast corner to approximately 25 feet above MSL near the center of the site. Figure 1-3 presents the topographic contours for the site at 5-foot intervals.

2.3 Adjacent Land Uses

The Ascon site is located in an area of residential, recreational, commercial, and industrial land use (Figure 1-2). The immediately adjacent land uses identified on Figure 1-2 are:

- North: Edison Community Park and William Kettler Elementary School
- Northeast: Edison High School
- East: Single Family Homes
- South: Southern California Edison (SCE) Fuel Oil Storage Tanks, Green Belt
- Southwest: Huntington Beach Channel, AES Corporation (AES; formerly SCE) Fuel Oil Tanks, Light Industry, AES (formerly SCE) Huntington Beach Power Generation Station
- West: Light Industry, Oil Production
- Northwest: Single Family Homes

Other land uses in the vicinity of the site are additional tracts of detached single-family homes, recreation areas (parks and Huntington Beach State Park), wetlands (Talbert Marsh and proposed wetlands), recreational vehicle storage, mobile home trailer park, light industry, and an elementary school (Eader). Approximately 31,000 people live within 1½ miles of the site.

Based on current plans by the City of Huntington Beach, Magnolia Street and Hamilton Avenue are slated for widening in the future. Accordingly, portions of the outlying areas of the site on the eastern and northern sides will be taken up to accommodate the street widening.

2.4 Natural Resources

Natural resources in the vicinity of the site consist of beaches and wetlands. Petroleum reserves exist beneath the surface and idle oil well/pumping operations are present on the eastern portion of the site, and off-site immediately to the west. No other significant natural resources were identified by previous investigators.

2.5 City of Huntington Beach Zoning Districts

The area surrounding the site is generally zoned for industrial, residential, and community facilities (parks, schools) land uses. The City of Huntington Beach Sectional District Maps 13-6-11 (DM 14Z) and 18-6-10 (DM 20Z) identify the zoning designations for the properties surrounding the Ascon site, Figures 2-1 and 2-2. The zoning designations for the properties adjacent to the site are:

- North: CF-R- Community Facilities: Recreational District (Edison Community Park)
- Northeast: CF-E-FP2- Educational District (Edison High School)
- East: R1-CZ - Low Density Residential District
- Southeast: R1-CZ - Low Density Residential District
- South: M2-0-CZ-FP2: Industrial District (Fuel Oil Tanks)
- Southwest: M2-0-CZ-FP2: Industrial District (Edison Power Plant)
- West: M1-A-0-CZ-FP2: Light Industrial District

The City of Huntington Beach has zoned the Ascon site under the Magnolia Pacific Specific Plan. Any future development of the site is directed by this plan and other applicable City of Huntington Beach development regulations. The plan was prepared solely for the Ascon site and provides for development of the site as a residential neighborhood with up to 502 units. The plan was adopted by the Huntington Beach City Council in November 1992. In February 1994, the California Coastal Commission approved, and put into effect, the Magnolia Pacific Specific Plan.

In 1993, a development agreement between the Signal Mortgage Company and the City of Huntington Beach was drafted granting Signal Mortgage Company the right to develop the property upon completion of site cleanup.

2.6 Surface Water

2.6.1 Off-site Surface Water

The major surface waters in the area of the site are the Pacific Ocean ($\frac{1}{4}$ mile), South; Santa Ana River (1 mile), East; and the Orange County Flood Control Channel System: Huntington Beach Channel. This channel borders the Ascon site at the southwest corner (Figures 1-2 and 2-3). The channel runs in a northwesterly direction and roughly parallels the coastline. The channel merges with the Talbert Flood Control Channel between Magnolia and Brookhurst Streets. From this point, the merged channels enter the Talbert Marsh Wetlands and flow eventually into the Pacific Ocean.

The Huntington Beach Channel was constructed during 1965. The channel was constructed with earthen berm and an unlined bottom. The estimated elevation of the top of the berm is 10 feet above MSL and the elevation of the bottom is 1 foot below MSL. Ground water elevations beneath the site during Radian's 1988 investigation ranged from 5.10 feet below MSL in the northwest corner of the site to 1.39 feet below MSL in the southwest corner. This shows that the bottom of the channel is likely in contact with ground water. A typical cross-section of the Huntington Beach Channel adjacent to the Ascon site is presented on Figure 2-4.

2.6.2 On-site Surface Water

Due to historical site operations, the site is topographically higher than the surrounding area. An earthen berm surrounds much of the site, and prevents surface water that may have come into contact with waste material from running off-site. Within the site, surface water from rainfall tends to collect in Lagoons 1 through 5. The surface water that collects in the lagoons has been sampled and analyzed in the past and is discussed in Section 3.3 of this

report. The potential for surface water to flow onto the site is low because the elevations of most of the site range from 2 to 20 feet above the surrounding grade.

Seepage from the external berm along Hamilton and Magnolia Streets has occurred in the past, following major storm events. This is further discussed in Section 3.7 of this report.

2.7 100 and 500 Year Flood Plain

The Ascon site is located within a defined Flood Hazard Area as indicated on a 100 and 500 Year Flood Map obtained from the City of Huntington Beach, California. A copy of this map is presented on Figure 2-5.

2.8 Climate

The climate of the Huntington Beach area, like most of southern California, is controlled by the strength and position of a semi-permanent high-pressure cell over the eastern Pacific Ocean. This high-pressure cell creates a repetitive pattern of frequent early morning cloudiness, afternoon sunshine, daytime onshore breezes, and minor temperature fluctuations throughout the year.

Historic climate data are available for 59 complete years between 1931 and 1995 for the Newport Beach station located at 33° N, 117° W at an elevation of 9 feet above MSL (WorldClimate.com, 2000). According to these data the annual average temperature for the area is 61.2° Fahrenheit (F) with a high average monthly temperature of 68.5° F occurring in August and a low average monthly temperature of 55.0° F in January. Rainfall occurs mostly from November through April as generally mid-latitude storms move through the area. An average of approximately 11.9 inches of rain falls each year. Summers are often completely dry, with the exception of occasional rainfall from thundershowers of tropical origin.

Local meteorological conditions generally conform to the regional pattern of strong onshore winds during the day, especially in summer, and weak offshore winds at night, especially in winter. South Coast Air Quality Management District (SCAQMD) catalogues meteorological data from several data collection locations throughout its district.

The wind rose of data collected from the Newport Beach station covering the period from 1956 to 1975 is presented as Figure 2-6. The wind rose indicates that the prevailing winds are onshore from the west with wind speeds of 4 to 6 miles per hour.

2.9 Biological Survey

A biological survey of the Ascon site was conducted by Dudek & Associates during July 1996. As stated in a summary of this survey presented in the RI (ESE, 1997a), the site does not generally support native plant communities. The dominant vegetation is ornamental and ruderal (weedy). The majority of the site is dominated by the ornamental Surinam cherry and by invasive non-natives, including ripgut grass, white sweet clover, wild heliotrope, and others.

There is a small (less than 0.1 acre), highly disturbed, patch of southern coastal salt marsh (alkali marsh) along the northern edge of the site. Native species present in this small patch include woody glasswort, alkali mallow, alkali weed, rabbit-foot beard-grass, and alkali heath (*Frankenia salina*). Within the ponds there are a few patches of cattails and bulrush. This habitat is not considered a wetland.

No species of plants or animals recognized as rare, threatened, endangered, or otherwise sensitive by the U. S. Fish and Wildlife Service, California Department of Fish and Game, or the California Native Plant Society were observed on-site and none is likely to be present.

2.10 Geology

The site is in the southwest portion of the Coastal Plain of Orange County, which is bordered by the Santa Ana Mountains on the east, the San Joaquin Hills to the south, and the Pacific Ocean to the west. A line of low hills (or mesas) and intervening valleys (or gaps) associated with the Newport-Inglewood structural zone are present across the Coastal Plain of Los Angeles and Orange Counties. This structural zone forms the hills, with the inland synclinal trough consisting of thick sequences of permeable and impermeable sediments that form the Orange County Ground Water Basin in this area.

The Ascon site is located within the physiographic feature known as the Talbert or Santa Ana Gap. The Pacific Ocean is approximately ¼ mile to the south; the Huntington Beach Mesa is approximately 1¼ miles to the northwest; the Santa Ana River and Newport Mesa are approximately 1¼ miles to the east. The site is also within the northwest-trending Newport-Inglewood Fault Zone, immediately north of the "South Branch." Movement along the fault zone has resulted in complex stratigraphy in Pleistocene or older-age sediments (CDWR, 1967).

The Santa Ana Gap was formed during the Pleistocene Glaciation Age sea-level retreat when the ancestral Santa Ana River eroded the uplifted mesas. At the end of the ice age, the sea level rose and the gap was filled with approximately 170 feet of mixed alluvial and coastal sediments. These Holocene-age sediments consist of two units: an upper unit approximately 70 feet thick that consists

of clay and silt with interbedded sands and peat beds, and a lower unit approximately 100 feet thick that consists of sand and gravel. These two Holocene-age units are believed to be present at the site beneath the waste material, soil, and construction debris. These Holocene sediments unconformably overlie faulted marine and alluvial sediments of the Lower Pleistocene San Pedro Formation (CDWR, 1967).

The upper Holocene unit described above makes up the native soil immediately underlying the site. The native soil is described by previous investigators as being composed of an upper silty clay layer that ranges from 2 to 10 feet thick, and a lower water-bearing sand unit (Radian, 1988). The upper silty clay layer was noted in most of the borings drilled throughout the site and, to some extent, may have served to retard waste migration into deeper zones. Cross sections prepared by Radian (1988) illustrate that the silty clay layer is thinner (less than 2 feet) beneath the southern one-third of the site and thicker (greater than 10 feet) beneath the northern two-thirds of the site. Several investigations report shell fragments in the native soil making it easily identifiable.

Based on aerial photograph interpretation, the wastes contained at the Ascon site were placed directly upon the native sediments and soil was used for forming berms for the lagoons and pits. There is no evidence that the wastes were placed into excavated troughs. The drilling mud and oil-saturated wastes have been found to be present throughout most of the site, with the exception of the western margin of the property. The thickness of the waste varies from a few feet to as much as 20 feet. Soil and construction debris, consisting of wood, brick, concrete, and asphalt were placed over much of the waste material and can be seen around the edges and extending into several of the lagoons. It is estimated that solid debris and waste materials combined range in thickness throughout the site from about 5 to 25 feet.

2.11 Hydrogeology

As presented in the Water Quality Control Plan for the Santa Ana River Basin prepared by the California Water Quality Control Board (Water Board) - Santa Ana Region, the Ascon site is within the pressure area of the Orange County Ground Water Basin (Water Board, 1995). Typically, near-surface fine-grained sediments prevent water from percolating downward to production aquifers (San Pedro Formation) in the pressure area. In the site vicinity, shallow ground water is found in one of two units: (1) thin discontinuous sands designated as the Semiperched Aquifer located within the upper unit of Holocene-age alluvium; and (2) sands of the lower unit of Holocene-age alluvium, which is termed the Talbert Aquifer. Ground water in the Semiperched Aquifer has been degraded regionally by high concentrations of total dissolved solids and nitrates and, therefore, has limited use as a water resource. The Water Board's beneficial use designations for ground water in the site area

include municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply (see Section 2.11.2).

The top of the Talbert Aquifer is approximately 70 feet below ground surface and the bottom of the Talbert Aquifer is approximately 200 feet below ground surface in the area of the Ascon site. The Talbert Aquifer appears to be deeper beneath the site than further inland. It appears that towards the ocean, the distinct boundary between the upper Holocene unit and the Talbert Aquifer disappears. The two units essentially merge south of Pacific Coast Highway.

The relatively flat-lying Talbert Aquifer truncates the northeasterly-dipping deeper aquifers. The merging zones between each aquifer act as conduits for ground water to move from one aquifer to another, depending on piezometric gradients. Under conditions of little inland ground water production, the Talbert Aquifer has a seaward ground water flow direction. However, when inland ground water production causes the piezometric head within the deeper aquifers to drop below sea level, ground water in the Talbert Aquifer drains into these lower aquifers, resulting in a northward ground water flow direction and salt water intrusion through much of the gap (CDWR, 1966).

As a result of the salt-water intrusion, an injection barrier system was installed as a measure to control the degradation of the drinking water in the basin. The site is approximately 3 miles south (seaward) of the Talbert Water Injection Barrier. The barrier is a line of wells installed across the Santa Ana Gap in 1976 for injection of recycled potable water. The water is injected at up to 15 million gallons per day along Ellis Avenue to form a seaward piezometric gradient or barrier to prevent the further intrusion of sea water into fresh water aquifers by excessive pumping (overdrafting) of the ground water basin further inland. To maintain a seaward piezometric gradient under severe overdraft conditions, seven extraction wells were placed between the Talbert Water Injection Barrier and the ocean to create a hydraulic trough. When needed, brackish ground water can be withdrawn at rates up to 1,000 gallons per minute from these extraction wells and discharged into the flood control channels (Herndon, 1992; McGillicuddy, 1993). However, available evidence indicates that the injection barrier and associated injection wells have not significantly affected ground water flow at the site since 1988.

Ground water elevations beneath the site during Radian's 1988 investigation ranged from 5.10 feet below MSL in the northwest corner of the site to 1.39 feet below MSL in the southwest corner. Based on these data, ground water was calculated to flow from the southwest corner of the site toward the northeast. Radian's contouring of ground water elevations using September 1988 data indicate an apparent flow direction toward the northeast, the flow direction changes to the northwest and east, and appears to be influenced by the five waste lagoons at the site (Figure 2-7).

The results of the ground water monitoring performed by ESE in 1996 and 1997 are shown in Table 2-1 (see also Section 3.9). Figure 2-8 shows that during the most recent monitoring program, which was performed by ESE in March 1997, ground water beneath the site had an apparent flow direction from the south central border generally toward the northwest and east. It appears that relatively higher ground water levels are present below the lagoons and that ground water diverges and flows to the northwest and east. Based on these and previous data, it appears that ground water flow is influenced by the waste lagoons.

The ground water elevations and flow directions in March 1997 were generally consistent with ESE's earlier ground water data and with previous flow maps prepared by Radian (Figure 2-7) and other investigators.

In March 1997 ground water elevations along the eastern perimeter of the site ranged from 2.14 feet below MSL in Well AW-2 at the southeastern corner to 0.32 foot below MSL in Well MW-4 at the northeastern corner (see Figure 2-8 and Table 2-1). A comparison of these results with the data collected by ESE in January 1996 (Table 2-1) shows that between January 1996 and March 1997 ground water elevations increased by more than 1 foot.

2.11.1 Local Hydrogeology

As discussed in Sections 2.9 and 2.10, the Ascon site is located in the Santa Ana Pressure Ground Water Subbasin of the East Coastal Plain Hydrologic Subarea (Water Board, 1995). Shallow ground water is found in two aquifers beneath the site: the Semiperched and the Talbert. Each aquifer is discussed below.

Semiperched Aquifer. The Semiperched Aquifer consists of clay and silt with interbedded sand and peat beds and extends from the natural ground surface (prior to deposition of any waste materials) to a depth of approximately 20 to 30 feet (ESE, 1997a). Previous investigations (Radian, 1988) identified that a clay layer, of varying thickness from 2 to 10 feet, overlies the water-bearing sand unit of the Semiperched Aquifer. The clay layer is thickest in the northern two-thirds of the site and thins significantly in the southern one-third of the site (ESE, 1997a). The Semiperched Aquifer does not exist south of the site (it pinches out) and the Talbert Aquifer is encountered at the ground surface (CDWR, 1967). It has been asserted by others that the presence of the clay layer may impede the downward migration of waste materials. However, due to the reported depth of some of the lagoons, it is assumed that waste materials are in contact with ground water in some areas of the site.

Ground water flow in the Semiperched Aquifer appears to be controlled to some degree by the following: (1) operation of the Talbert Water Injection Barrier, as discussed in Section 2.11, (2) the ponded water present in the five waste lagoons, and (3) the adjacent Huntington Beach Channel. As stated in Section 2.6.1, the bottom of this channel is likely in contact with ground water. Chemical data from ground water monitoring wells near the channel indicate that the channel appears to be the source of some metals, as discussed in Section 2.11.4.

The latest ground water monitoring data (March 1997) indicate that ground water flow diverges across the site in a pattern consistent with earlier measurements and calculations (see Figure 2-9). Ground water appears to flow onto the site from the southwest and then diverges near the center of the Ascon site with flow directions to the north-northeast, northwest, and east (Figure 2-9).

Prior to the excessive pumping of inland aquifers (which began in the 1960s) and the operation of the Talbert Water Injection Barrier in 1976, the ground water gradient in the Semiperched Aquifer was probably to the south towards the Pacific Ocean or southwest towards the Huntington Beach Channel.

Talbert Aquifer. The Talbert Aquifer is an interfingering sequence of three sandy water-bearing zones separated by clay layers beneath the site. The first zone is found immediately beneath the Semiperched Aquifer at a depth of approximately 20 to 30 feet below the native ground surface and extends to approximately 60 feet (30 to 40 feet thick). The second zone is found from approximately 80 to 105 feet, and the third zone is found from approximately 125 to 190 feet (Radian, 1988; CDWR, 1967).

Orange County Water District (OCWD) maintains three ground water monitoring wells located within 1 mile of the Ascon site. In addition, an SCE ground water production well is located west of the site on Newland Avenue. ENVIRON obtained well construction, water level, and chemical data for these wells. These wells are all screened in the Talbert Aquifer. The OCWD wells were installed to monitor water elevations and chemical concentrations to check for saltwater intrusion. Well construction and water elevation data are presented below in Table 2-A. The information obtained from the OCWD is included in Appendix A.

Table 2-A. Well Construction and Water Elevation Data

Well Number	Well Owner	Distance from Site	Date Drilled	Total Well Depth	Screened Interval	Depth to Water (ft)	Water Elevation (ft MSL)
GWRC-HBF4	SCE	1/3 mi W	4/19/56	200	164-184	NA	NA
OCWD-M1	OCWD	1 mi NE	11/1/67	115	75-110	4.75	-0.56
OCWD-M2	OCWD	½ mi NNW	9/1/67	155	85-150	9.86	0.65
OCWD-M28	OCWD	½ mi E	7/1/69	155	80-145	1.16	0.91

Notes:

Water level information collected by the OCWD on March 5 and 6, 1997.

NA = Not available

Using water level data from the three OCWD wells, the calculated ground water flow direction in the Talbert Aquifer is to the northeast (compass bearing N52E). This flow direction is consistent with the flow component in the Semiperched Aquifer that is not influenced by the water in the waste lagoons (Figure 2-9). Based on water level elevation data, the Talbert Aquifer appears to be confined in these wells. The presence of the first confining layer (Semiperched Aquifer) and hydraulic head present in the Talbert Aquifer is expected to limit the downward migration of chemicals present in the waste materials at the Ascon site.

2.11.2 Ground Water Quality and Potential Uses

The ground water quality and potential uses of each of the two uppermost aquifers beneath the site are discussed in this section.

Semiperched Aquifer. Ground water quality in the Semiperched Aquifer has been regionally degraded by high concentrations of total dissolved solids (TDS) and nitrates (ESE, 1997a). The Semiperched Aquifer is not identified in the Water Board's Water Quality Control Plan for the region. The Semiperched Aquifer is not believed to be used for any beneficial purposes in the vicinity of the Ascon site. Because of its shallow nature and poor water quality, it is doubtful that the Semiperched Aquifer would have any beneficial uses in the future.

Talbert Aquifer. According to the Water Quality Control Plan (Water Board, 1995), ground water in the East Coastal Plain Hydrologic Subarea (which includes the Ascon site) has the following designated beneficial uses: municipal and domestic supply, agricultural

supply, industrial service supply, and industrial process supply. The Talbert Aquifer is utilized as a drinking water source in other areas of the basin. As noted in Section 2.11.1, an SCE industrial well is located approximately 1/3 mile west of the site. It is unknown if this well is currently utilized.

The Water Board has established water quality objectives, as presented in Table 2-B, for the Santa Ana Pressure Ground Water Subbasin (Table 4-1 of Water Board, 1995).

Table 2-B. Water Quality Objectives

Ground Water Quality Objectives (mg/l)					
TDS	Hardness	Sodium	Chloride	Nitrates	Sulfates
500	240	45	55	3	100

Ground water quality in the Talbert Aquifer in the vicinity of the site has been significantly degraded from saltwater intrusion (resulting from the lowering of ground water levels inland due to excessive pumping) and does not meet the water quality objectives listed in the above table. In fact, current ground water quality in the both the Semipierched and Talbert Aquifers beneath the site do not qualify as drinking water resources as defined by State Water Resources Control Board (SWRCB) Resolution No. 88-63 due to the elevated TDS and chloride concentrations (SWRCB, 1988).

Saltwater intrusion has compromised ground water quality in the Talbert Aquifer since at least 1963 according to the CDWR. Chloride concentrations in the uppermost water-bearing zone of the Talbert Aquifer ranged from 100 to 500 µg/l. Deeper zones in the Talbert Aquifer had chloride concentrations in excess of 500 mg/l (CDWR, 1967).

By design, the Talbert Water Injection Barrier has sacrificed water quality south of Ellis Avenue (approximately 3 miles north of the site) in efforts to preserve the larger ground water resources located inland. Therefore, it is unlikely the regulatory agencies will have significant concerns regarding the relatively minor contamination of ground water south of the injection barrier including the shallow ground water beneath the Ascon site.

2.11.3 Contaminant Transport in Ground Water

The dominant contaminants present at the Ascon site (both in quantity and concentration) are petroleum hydrocarbons. These hydrocarbons are believed to be largely crude oil; however other hydrocarbons are known to have been disposed at the site (fuel oils, phenolic wastes, mercaptans, styrene, and synthetic rubber). In addition, chromic and sulfuric acids, aluminum slag, and magnesium and potassium chloride were reportedly deposited in the landfill. The waste materials were deposited on the site over a 20-year period, from 1951 to 1971 (Radian, 1988).

An important factor in contamination of ground water by petroleum hydrocarbons is that very low concentrations of these compounds can give rise to objectionable tastes and odors (Hall and Quam, 1976). However, given the documented saltwater intrusion problem in the vicinity of the site, this is probably not a significant issue.

Migration of petroleum hydrocarbons in ground water is controlled by the following factors: (1) hydraulic gradient, (2) porosity of the aquifer soils, (3) the quantity, density, and solubility of the hydrocarbons, and (4) the degree of advection, dispersion, diffusion, and volatilization that occur within the aquifer (Bonazountas and Kallidromitou, 1992).

The hydraulic gradient under the site is very flat (0.0001 foot per foot) indicating that ground water flow is slow. Therefore, the migration of any contaminants due to ground water flow is expected to be correspondingly slow. The porosity of the fine-grained Semiperched Aquifer soils is expected to be relatively high based on the soil type. However, the effective porosity (the percentage of interconnected pore spaces) is typically low for fine-grained sediments. Therefore, the migration of contaminants through clays and silts is typically limited. The degree of advection, dispersion, and diffusion in the Semiperched Aquifer is unknown. However, the amounts of advection, dispersion, and diffusion occurring in the aquifer is believed to be minimal because of the estimated slow ground water velocities. Soils of the Semiperched Aquifer are predominately fine grained. Therefore, significant volatilization of contaminants is not expected.

The migration potential of the wastes present at the Ascon site is believed to be low to the underlying ground water for the following reasons:

1. The majority of the petroleum hydrocarbons at the site are relatively insoluble and immobile.

2. The fine-grained nature of the drilling muds and native shallow soils are expected to limit the migration of wastes into the underlying ground water through adsorption and cation exchange capacity.
3. Wastes have been present at the site between 28 to 59 years and only minor concentrations of contaminants have been detected in ground water under and adjacent to the site.
4. The hydraulic head present in the Talbert Aquifer is expected to minimize the downward migration of the major contaminants present at the site.

The continued operation of the Talbert Water Injection Barrier will probably maintain the current ground water flow direction to the northeast away from the contaminant-sensitive wetland areas located south of the site.

2.11.4 Comparison of Ground Water Chemistry in Up- and Down-Gradient Monitoring Wells

In its RI report, ESE compared ground water quality parameters to PRGs for tap water developed by the USEPA Region IX. PRGs are developed to protect human health from exposure to site contaminants. Because the water beneath the site is unsuitable for human consumption (due to high salinity), using PRGs as standards for site ground water is very conservative. It should be noted that PRGs are suggested guidelines and not regulatory limits. In many cases the PRGs are lower than the Maximum Contaminant Levels (MCLs), the regulatory limits for ground water established by Cal/EPA and the USEPA, as shown in Table 2-2. ENVIRON used MCLs where available, and used tap water PRGs as secondary criteria for those constituents that do not have established MCLs.

ENVIRON compared the existing ground water chemistry data from the current up-gradient (southern) and down-gradient (northern) monitoring wells. It is possible that for some period of time during early years of the operation of the landfill ground water flowed toward the ocean. ENVIRON reviewed two data sets as part of this ground water chemistry evaluation: the highest concentrations historically detected in ground water compiled by ESE (see Table 2-2) and sampling of ten monitoring wells on the site conducted by ESE in February and March 1997 (ESE, 1997a).

Based on a review of the historical analytical data (prior to 1997), waste materials have impacted ground water in the semi-perched zone beneath the site. This impact appears to be

largely contained on-site with the highest concentrations identified near Pit F (styrene pit). The major contaminants detected in ground water (in order of the number of detections) include: antimony, arsenic, lead, thallium, and benzene (see Table 2-2 and Figure 2-9). Separate phase hydrocarbons have been identified in several wells (Wells WCCB-2, WCCB-5, WCCB-6, and Radian MW-14). Contaminants were previously detected in perimeter monitoring wells and others have stated that these constituents probably migrated off-site.

For the purposes of this assessment, Wells E&E AW-2, E&E AW-4, E&E AW-5, and Radian MW-9 are considered up-gradient. However, Well E&E AW-2 was installed 30 feet south of three waste pits (Pits C, D, and G) and, as a result, was not deemed a reliable up-gradient monitoring well. There are no off-site up-gradient monitoring wells.

The following down-gradient wells were used for the analysis in this section: E&E wells AW-1, AW-3, AW-6, AW-7, and AW-8; and Radian wells MW-4, MW-13, MW-14. There are no off-site down-gradient monitoring wells.

The most recent ground water data, obtained in March 1997 by ESE (1997a), indicate that very little ground water contamination was detected in the wells sampled. Of the ten wells sampled by ESE (Wells AW-2, AW-3, AW-4, AW-5, MW-4, MW-9, MW-13, MW-14, MW-15, and NMW-1), no pesticides, PCBs, or semi-volatile organic compounds (SVOCs) were detected in any of the samples. Petroleum hydrocarbons were only detected in two samples. Well MW-15 had a concentration of 0.77 mg/l (C_8-C_{31}), and Well B-7 had a concentration of 2.1 mg/l (C_8-C_{29}). Volatile organic compounds (VOCs) were detected in two samples. Well B-7 contained a total VOC concentration of 125.2 µg/l. The VOCs detected in this well were benzene (2.2 µg/l), ethylbenzene (13 µg/l), sec-butylbenzene (10 µg/l), and isopropylbenzene (110 µg/l). Carbon disulfide was detected in Well MW-4 at concentrations of 29 and 100 µg/l.

The more recent ESE sampling data did not confirm the historical elevated concentrations of antimony, arsenic, and thallium in the ground water at the site. In fact none of these metals were detected in any of the samples analyzed. The metals listed below in Table 2-C were identified in the samples.

Table 2-C. Metals Identified in Ground Water

Metal	Number of Wells	Maximum Concentration (µg/l)	MCL (µg/l)
Barium	9	110	1,000
Lead	6	21	50
Selenium	3	37	10
Copper	2	190	1,000 ³
Cadmium	1	13	10
Mercury	1	1.1	2
Nickel	1	54	-- ⁴

The metals detected in the ground water samples exceeded the MCLs for selenium, copper, cadmium, and mercury.

Based on our evaluation of the existing ground water data, ENVIRON reached the following conclusions regarding ground water quality at the Ascon site:

1. Electrical conductivity (EC) and TDS are higher in up-gradient wells than in down-gradient wells. The highest concentrations were detected in Wells E&E AW-4 and E&E AW-5. The reason for the higher electrical conductivity readings could be either the result of salt water intrusion in these areas of the Semipatched Aquifer or the fact that the bottom of the adjacent brackish Huntington Beach Channel is in contact with ground water.
2. Elevated concentrations of four metals (antimony, arsenic, lead, and thallium) were historically identified in wells on the site (Figure 2-9). As listed in Table 2-3, the average of the highest antimony concentrations in the up-gradient wells was 58 µg/l and the average of the concentrations in the down-gradient wells was 43 µg/l. The average highest up-gradient arsenic concentration was

³ The indicated MCL for copper is a secondary drinking water standards MCL. The remaining indicated MCLs are primary drinking water standards MCLs.

⁴ There is no published MCL for nickel.

96 µg/l and the average highest down-gradient arsenic concentration was 200 µg/l. The highest arsenic concentrations were detected between Lagoons 2 and 3, and in the northwestern and southeastern corners of the site. The highest concentrations of lead and thallium were found in the southwestern corner of the site (near Wells E&E AW-4 and E&E AW-5). It is possible that the lead and thallium contamination is the result of migration from the adjacent unlined Huntington Beach Channel.

3. Petroleum hydrocarbons were previously detected in monitoring wells on the northern and eastern perimeters of the site. However, with the exception of the liquid hydrocarbons in Well MW-14, only one perimeter well (Well MW-15) contained relatively low concentrations of petroleum hydrocarbons during the 1997 sampling. No petroleum hydrocarbons were detected in any of the off-site samples collected and analyzed by ESE in 1997.
4. With the exception of TDS, ground water quality does not appear to be significantly different across the site. Based on the 1997 sampling results, there are very minimal impacts to ground water in the Semiperched Aquifer at the Ascon Landfill.
5. There is no immediate need for ground water remediation. As agreed with DTSC, ground water will be re-evaluated following site remediation.

3.0 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

3.1 Introduction

The RI report (ESE, 1997a) presented the scope of work and results from past site characterization investigations in addition to providing some new data. The previous investigators of the Ascon site, including ESE, collected soil and waste materials from over 100 locations. The sampled material consisted of soil, sediment, and waste material from the eight pits, five current lagoons, and the area of the former lagoons, perimeter berm, off-site background locations, and seeps. Soil vapor and ground water samples (on-site and off-site) were also sampled and analyzed.

3.1.1 Analytical Database

The analytical data from the previous investigations were compiled by ESE (1997a) into a comprehensive database. The database, which consists of over 20,000 individual entries, was prepared by manually inputting data from available hard copies of the previous investigations and by inputting data electronically from Del Mar Analytical of Irvine, California, a laboratory accredited under the Environmental Laboratory Accreditation Program (ELAP).

Table 3-A on the next page summarizes the analytical methods used for VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs), metals, total petroleum hydrocarbons (TPH), including total recoverable petroleum hydrocarbons (TRPH) and total extractable petroleum hydrocarbons (TEPH), pH, fluoride, cyanide, and sulfur dioxide. Samples were also analyzed for other parameters, such as ignitability, specific gravity, and total dissolved solids (TDS). Compounds of low toxicity, such as alkanes or alkenes, or nutrients, such as iron, were excluded from the database.

Table 3-A. Analytical Methods Used in the RI

Analyte Group	Analyte	Method Number(s)
VOCs	Volatile Organic Compounds	USEPA 8010, 8020, 8240, 8260
SVOCs	Semi-Volatile Organic Compounds	USEPA 8270
Pesticides	Pesticides	USEPA 8080
PCBs	Polychlorinated Biphenyls	USEPA 8080
Metals	Metals	USEPA 6010, 7000 series
TPH	Total Recoverable Petroleum Hydrocarbons (TRPH)	USEPA 418.1
	Total Extractable Petroleum Hydrocarbons (TEPH)	USEPA 3510/8015 modified
	Oil & Grease	USEPA 413.2
Others	PH	USEPA 9040, 9045
	Fluoride	
	Cyanide	USEPA 335.2, 9010
	Sulfur Dioxide	

The data summary tables presented in the RI report list the following summary statistics by analyte for each of the site areas:

- Number of samples tested
- Number of samples with detected concentrations
- Number of samples with detected concentrations greater than the PRGs
- Number of samples with the detection limit greater than the PRGs
- Maximum concentration in waste pit, lagoon, etc.
- 95 percent upper confidence limit (95%UCL)

These statistics provide an overview of the level of effort of sampling and analysis in each of the areas of the site and of the extent to which concentrations exceed the PRGs. In addition, the maximum concentrations were compared to California Total Threshold Limit Concentrations (TTLCs), 10 times the California Soluble Threshold Limit Concentrations (STLCs), and 20 times the federal Toxicity Characteristic Leaching Procedure (TCLP) limits

to determine if any of the materials on the site are or might be considered to be hazardous wastes.

The 95%UCL was calculated using procedures that are applied typically in risk assessments. The data set was first evaluated to determine if it is normally or lognormally distributed. If it were normally distributed, the 95%UCL was calculated using the original data. If it were lognormally distributed, the data were log-transformed, the 95%UCL was calculated, and the log of the 95%UCL was calculated. In some cases in the tables this procedure resulted in 95%UCL values that were very large, often greater than 1 million parts per million (ppm). This usually reflects a small data set with high variability. In such cases the convention is to use the maximum value instead of the 95%UCL. The 95%UCL calculations were made using one-half the detection limits for samples in which a given analyte was not detected.

Summary statistics for analytical data for all the soil (solid) samples are presented in Table 3-1. It is apparent that solids at the site have been extensively sampled. TRPH was reported most frequently (232 times). Various analytical methods were used to analyze for VOCs, SVOCs, pesticides, PCBs, metals, and miscellaneous analytes such as pH and cyanide.

Summary statistics for analytical data for all the water samples, including ground water and water collected from the pits and lagoons, are presented in Table 3-2. Water samples have been analyzed for generally the same types of methods as the soil samples.

3.1.2 Preliminary Remediation Goals

As discussed in Sections 1.1 and 3.1.1, in the RI report the concentrations were compared to residential PRGs for preliminary evaluation of the distribution and significance of the detected chemicals⁵. The PRGs combine toxicity values and exposure factors to yield screening concentrations of compounds in soil, air, and water that are intended to be protective of human health. The PRGs are based on exposure pathways, such as ingestion, dermal contact, and inhalation, for which acceptable models have been developed. A sample concentration greater than a PRG value does not necessarily mean that a site is contaminated above acceptable levels.

⁵ As noted previously, in the RI, which was completed in 1997, ESE used the 1996 edition of the PRGs. Currently, the 1999 edition of the PRGs is available. ENVIRON compared the 1996 and 1999 editions of the PRGs for the chemicals detected at the site and confirmed that there are no significant differences between the 1996 and 1999 PRGs.

3.2 Waste Pits

Soil, waste, and water samples were collected by the previous investigators from the eight disposal pits, designated as Pits A through H. The existence of seven of the pits was established based on past aerial photographs and topographic maps because they are no longer visible at the site. These pits probably were filled in with construction debris and other fill material. Pit F, also known as the styrene pit, is the only remaining visible pit today. It is currently enclosed by a chain link fence and covered by a synthetic liner. The liner was installed following the Radian investigation in 1988 because numerous odor complaints were filed with the SCAQMD by adjacent residents. The pit is filled with a thick, dark brown to black, viscous, and extremely sticky material with great elasticity. Reportedly, Pit F is the source of a strong, sharp, metallic/organic odor, although when ESE sampled the surface material from this pit in January 1996, odors were not noted during sampling (ESE, 1997a). By July of 1996, the cover installed by Radian had deteriorated somewhat and neighbors complained of odors. A temporary visqueen cover was placed over the cracked area of the old cover. The visqueen was replaced with a reinforced polypropylene cover in June 1997.

The pits are of relatively limited areal extent, each less than 100 feet on a side. Pits A, B, and H are in the northwest corner of the site; Pits C, D, E, F and G are in the southeast corner of the site. Locations of the pits are shown on Figure 1-3.

The available records show that Pits A and B were used for disposal of oily wastes and Pits C and D were used for disposal of chromic and sulfuric acids. Oily wastes containing styrene were placed in Pit E; styrene tar and synthetic rubber wastes were disposed of in Pit F. The types of wastes disposed of in Pits G and H are not known (Radian, 1988).

Details regarding the investigations completed for the pits are presented in the RI report. The analytical findings, conclusions, and significant findings are discussed below.

Summary statistics for the analytical data for soil (solid) samples from all eight pits are presented in Table 3-3. The RI report presents summary statistics for soil and water samples collected from each pit, which are not included here. Results of samples from each of the pits with concentrations exceeding the PRGs (Tables 3-4 through 3-11) and water samples from the pits with concentrations exceeding the PRGs (Table 3-12) are presented in this FS report.

Based on the analytical results of the pits, ESE (1997a) concluded that, in general, soil in Pits A through H contains detectable concentrations of TPH, VOCs, SVOCs, and metals. The greatest TRPH concentration of 970,000 mg/kg was detected in Pit F. Pits A, B, and H, which are grouped

together in the northwest corner of the site, had the next highest TPH concentrations, followed by Pits C, D, E, and G located in the southeast corner of the site.

VOCs are found sporadically at varying concentrations in all eight pits and appear to be random in distribution. The highest concentrations were observed in Pits A, B, and H. These three pits exhibited similar concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX). BTEX was also detected in Pits E and F. Pit F had the greatest concentrations of BTEX as well as styrene. This is consistent with the disposal history of Pit F. Pits C, D, and G had very low concentrations of VOCs. No PCBs or pesticides were detected in any of the pit samples.

Low concentrations of SVOCs were detected sporadically throughout the pits. Again, Pits A, B, and H exhibited the greatest concentrations; however, most concentrations of SVOCs were less than 10 mg/kg. In Pits C and G only phthalates were detected in a few samples. Samples from Pits D and E were not analyzed for SVOCs. The highest concentrations and greatest diversity of compounds were found in Pit F. In general, the metal concentrations in Pits A, B, and H are slightly greater than those observed in the other pits.

The contaminated soil and waste materials found in the pits are composed of compounds generally consistent with the historical disposal records with the exception that chromic and sulfuric acids were not confirmed to be major constituents of Pits C and D. Many of the hydrocarbon compounds that were detected, such as straight- and branch-chain alkanes, alkenes, and aromatics, are typical of those found in crude oil and petroleum refining operations.

Significant findings regarding the waste pits are:

- Pits A, B and H, located at the northwest corner of the site contain approximately 5,190 cy of waste material; Pits C, D and G in the southeast corner of the site, contain approximately 570 cy of waste material; Pits E and F, also located in the southeastern portion of the site, contain approximately 2,220 cy and 1,670 cy of waste material, respectively (Radian, 1988).
- The wastes contained in Pits A through H contain TPH, BTEX and other VOCs, and SVOCs. Pit F also contains styrene and has been a source of significant odor as reported by nearby residents. Pit F is shown to contain greater percentages of diesel range hydrocarbons, and lower percentages of waste oil range hydrocarbons than those found in the lagoons.

- Pit A and the shallow subsurface soils in the northwest quadrant exhibit the highest concentrations of many analytes. Pit A also contains the highest concentrations of metals found at the site.
- Samples from Pits A and H have reported benzidine concentrations greater than the 0.001 percent limit, which indicate that these samples would be considered a California hazardous waste. A sample from Pit F has a total beryllium concentration greater than the TTLC, which indicates that this sample would be considered a California hazardous waste. Samples from Pits A, B, and H have total concentrations of chromium and lead greater than 10 times the STLCs or 20 times the TCLP limits. These concentrations indicate that these samples have the potential (based on additional testing) to be California or RCRA hazardous wastes.
- Pits C and D do not exhibit the anomalous pH values that would confirm the reported historical dumping of chromic and sulfuric acid wastes. However, a relatively neutral pH does not indicate that these acids were not dumped; the acids might have been neutralized by natural processes or by other wastes or soil in the pits. Pits C and D did not have total chromium concentrations that exceeded the PRG. Moreover, two samples from Pit C were analyzed for hexavalent chromium and this constituent was not detected in either sample.
- In the water samples from the pits, benzene, arsenic, cadmium, and lead were detected at concentrations greater than the PRGs. However, because several analytes had detection limits greater than the PRGs, it is not known if these analytes are present at concentrations that exceed the PRGs. Conversely, it cannot be concluded that concentrations of these analytes do not exceed the PRGs.

3.3 Current Lagoons

The historical aerial photographs show that most of the site was covered by lagoons. Over the years, the lagoons were divided and enclosed by berms so the number and sizes of the lagoons changed. At the present time there are five lagoons at the site. The lagoons were used mainly for disposal of oil production wastes and petroleum contaminated soil. They were partially filled in with concrete, wood, and other construction debris. Details regarding the investigations completed for lagoons is presented in the RI report. The analytical findings, conclusions, and significant findings are discussed below.

Table 3-13 presents summary statistics for the analytical data for soil (solid) samples from all five lagoons. Summary statistics for soil samples from each lagoon and water samples collected from the lagoons are presented in the RI report and are not repeated here. Results of soil samples from Lagoons 1 through 5 with concentrations exceeding the PRGs are presented in this FS report in Tables 3-14 through 3-18, respectively. Results of water samples from the lagoons are presented in Tables 3-19 and 3.19a.

Concentrations of TPH ranged from a low of 3,800 mg/kg in a sample from Lagoon 4 to a maximum concentration of 40,000 mg/kg in Lagoon 1. BTEX were detected in all five lagoons. SVOCs were detected in most of the lagoon samples.

Table 3-20 presents the results of a simulated distillation of hydrocarbons from several lagoon samples. To compare the hydrocarbon ranges among the lagoons, Table 3-20 data are plotted on Figure 3-1. This figure shows that the ranges of hydrocarbons in the lagoons are similar and do not show significant variability. For comparison, the figure also provides bars showing the hydrocarbons ranges that are generally found in gasoline, diesel, and waste oils.

All five lagoons contain a similar range of hydrocarbons, including significant spikes at C_{22} to C_{23} and C_{32} to C_{35} . Sample 1 from Lagoon 1 contains a greater percentage of short-chain hydrocarbons than the other samples. The only other deviation from the trend was observed in the two samples from Lagoon 4.

All BTEX compounds were detected in each of the five lagoons. Various halogenated and non-halogenated VOCs were detected in the lagoon samples.

Pesticides and PCBs were analyzed in all lagoon samples. No pesticides were detected but PCBs were found at concentrations greater than the PRGs in Lagoons 1, 2, 3, and 4. Lagoons 1, 2, 3, and 4 had arsenic, beryllium, cadmium, and lead concentrations greater than the PRGs. Lagoon 5 had arsenic and lead concentrations greater than the PRGs.

The California Waste Extraction Test (WET) procedure was conducted for two samples with the greatest lead concentrations and with elevated chromium. In a sample from Lagoon 1, Sample L1-1-4, chromium was detected at a concentration of 5.1 mg/l, which is slightly greater than the STLC for chromium compounds of 5 mg/l. In Sample L4-2-5 from Lagoon 4, lead was detected at 58 mg/l, which is an order of magnitude higher than the STLC of 5 mg/l. These concentrations indicate that Samples L1-1-4 and L4-2-5 have the potential to be California hazardous wastes. The WET analytical data are presented in the RI report and are not repeated here.

The water samples from the lagoons had concentrations of benzene, methylene chloride, arsenic, and lead that exceeded the PRGs.

Significant findings regarding the current lagoons are:

- Of the five current lagoons, Lagoon 1 is the smallest, with dimensions of approximately 200 by 300 feet. Lagoon 4 is the largest, measuring approximately 300 by 500 feet. It is estimated that the current lagoons cover approximately 30 percent of the site area.
- The lagoons contain varying percentages of soil by volume. In terms of grain size, the soil from all five lagoons has been found to be primarily in the silt range.
- In terms of the number of analytes with concentrations that exceed the PRGs, the lagoons are more contaminated than the pits. The numbers of analytes with concentrations exceeding the PRGs are: Lagoon 1 (12 analytes), Lagoon 2 (13 analytes), Lagoon 3 (13 analytes), Lagoon 4 (11 analytes), and Lagoon 5 (6 analytes).
- The following analytes were found in the lagoons at concentrations that exceed the PRGs: 1,1-DCE, 1,2-DCA, benzene, benzidine, benzo[a]pyrene, bis (2-ethylhexyl) phthalate, chloroform, methylene chloride, PCB-1016, PCB-1242, PCB-1248, PCB-1254, PCB-1260, arsenic, beryllium, cadmium, and lead. Many of these analytes indicate that wastes other than those from petroleum production were dumped in the lagoons.
- A sample from Lagoon 5 had a reported benzidine concentration greater than the PRG of 0.0019 mg/kg. Samples from Lagoons 3 and 4 had a total lead concentration greater than the TTLC; so these samples, too, could be representative of California hazardous wastes. Various samples from the five lagoons have total concentrations of 1,2-DCA, benzene, arsenic, cadmium, and lead greater than 10 times the STLCs or 20 times the TCLP limits indicating that following extraction and analysis by the STLC and/or TCLP protocol these samples could be representative of California or RCRA hazardous wastes. Analysis of the WET extract of two samples with total concentrations of chromium and lead that exceeded 10 times the STLCs indicated that one sample was representative of California hazardous waste for chromium and the other sample for soluble lead.

3.4 Former Lagoons

Historical aerial photographs of the site indicate that at various times most of the site was covered by one or more large lagoons. For that reason most of the area of the site that is not a pit, lagoon, or perimeter berm is designated as part of the former lagoons. Samples were collected from the soil surface and subsurface to assess the degree of contamination from the former lagoons and to locate any buried pits or other areas of more concentrated contamination, if they exist. Details regarding the investigations completed for former lagoons are presented in the RI report. The analytical findings, conclusions, and significant findings are discussed below.

Summary statistics for the analytical data for soil (solid) samples from the former lagoons area are presented in Table 3-21. Table 3-22 lists analytes that had detected concentrations greater than the PRGs. Six analytes were found to exceed their respective PRGs: benzene, PCB-1260, arsenic, beryllium, lead, and thallium. Also listed in Table 3-22 are areas, locations, and depths of the samples associated with these analytes.

As listed in the fourth data column of Table 3-21 several analytes had detection limits greater than the PRGs. For example, in 18 out of 21 samples the PCB detection limit was greater than the PRG. Some of the detection limits for PCBs were as high as 10 mg/kg. It is not known if these analytes are present at concentrations that exceed the PRGs. Conversely, it cannot be concluded that concentrations of these analytes do not exceed the PRGs.

Samples from the former lagoons had a maximum TPH (USEPA 3510/8015 modified) concentration of 18,000 mg/kg and a maximum TRPH (USEPA 418.1) concentration of 20,000 mg/kg. Thus, the former lagoons are much less contaminated than the pits or current lagoons.

Portions of the former lagoons have concentrations of benzene, PCB-1260, arsenic, beryllium, lead, and thallium that exceed the residential PRGs for soil.

None of the total concentrations exceed California TTLCs, so none of the samples would be hazardous waste. However, all three of the samples listed for lead and the thallium-containing sample from the depth of 14 feet at Sample Location Radian B-5 have total concentrations greater than 10 times the STLCS. Moreover, the three lead samples have total concentrations greater than 20 times the TCLP limit for lead. Upon extraction and analysis by the STLCS and TCLP protocols, these samples could indicate that portions of the former lagoon material could be a California or RCRA hazardous waste.

As indicated in the RI report, ISCO Industries/ITARA Engineers Sample II-50-240 had a mercury concentration greater than the TCLP limit. Therefore, the material represented by this sample would be a RCRA hazardous waste.

Significant findings regarding the former lagoons are:

- Based on a comparison of TPH concentrations, the former lagoons are much less contaminated than the pits or current lagoons.
- The following analytes were found in the former lagoons at concentrations that exceed the PRGs: benzene, PCB-1260, arsenic, beryllium, lead, and thallium.
- No samples from the former lagoons had total concentrations greater than the TTLCs. However, three samples had total lead concentrations and one sample had a total thallium concentration greater than 10 times the STLCs or 20 times the TCLP limits.
- The material represented by the soil sample with a mercury concentration greater than the TCLP limit would be a RCRA hazardous waste.

3.5 Perimeter Berm

An earthen berm, 10 to 20 feet high, has been constructed around the northern and eastern perimeter of the site to contain the pits and lagoons. The perimeter berm is covered over much of its outer surface with vegetation and scattered small trees and shrubs.

The height of the perimeter berm relative to the land surface outside and within the site varies. It is the highest on the north side of the site, along Hamilton Avenue, and on the north half of the east side of the site, along Magnolia Street. The perimeter berm still exists but is lower along the south side of the site. There is virtually no berm in the southeast corner of the site and along most of the west side of the site.

To continue a convention started by Radian (1980), in the RI report ESE assumed the perimeter to extend from the northwest corner of the site clockwise around the site to the southwest corner. In other words, the perimeter berm is assumed to exist on the entire north, east, and south sides of the site. Any soil sample that was collected in those areas was assigned to the perimeter berm.

Details regarding the investigations completed for the perimeter berm are presented in the RI report. The analytical findings and conclusions are discussed below.

Summary statistics for the analytical data for soil (solid) samples from the perimeter berm are presented in Table 3-23. Concentrations of seven analytes exceeded the PRGs: benzene, benzidine, PCB-1260, arsenic, beryllium, lead, and thallium. The areas, sample locations, analytes, results, and depths are listed in Table 3-24.

As listed in the fourth data column of Table 3-23, several analytes had detection limits greater than the PRGs. Therefore, it is not known if these analytes are present at concentrations that exceed the PRGs. Conversely, it cannot be concluded that concentrations of these analytes do not exceed the PRGs.

3.6 Background Sampling

In 1988 Radian collected one background soil sample from a grassy area in Edison Community Park, approximately 800 feet north of Hamilton Avenue and 600 feet east of the residential area and sports complex. The sample was collected from a depth of 3 feet below ground surface and was analyzed for TPH and priority pollutant metals. At the request of DTSC, in February 1997 ESE collected seven background soil samples. The samples were collected along the north side of Hamilton Avenue and the east and west sides of Magnolia Street from depths of 5.5 to 8 feet below ground surface using a cone penetrometer. The samples were analyzed for TPH and metals. Details regarding the investigation completed for background are presented in the RI report. The analytical findings and conclusions are discussed in the following paragraph.

Summary statistics for the analytical data for the background soil samples are presented in Table 3-25. The concentration of arsenic in all eight background samples and the concentration of beryllium in one of the eight samples exceeded the PRGs for arsenic and beryllium.

3.7 Seeps

Historical site operations have caused the site to be topographically higher than the surrounding area. Since water accumulates in the lagoons and across the surface of the site, there have been occasions during the winter rainy season when water has been observed to discharge from the site.

Details regarding the investigations completed for seeps prior to 1997 are presented in the RI report. The analytical findings and conclusions from the RI report are discussed below.

Summary statistics for the analytical data for water samples from the seeps, as presented in the RI report, are presented in Table 3-26. Concentrations of four analytes exceeded the PRGs: antimony, arsenic, lead, and thallium. The areas, sample locations, analytes, results, and depths are listed in Table 3-27.

Runoff and/or seepage from the perimeter berm contained four metals at concentrations that exceed the tap water PRGs. The DTSC stated in its February 1995 memorandum that seepage water was a concern to the public because it came from a disposal site (DTSC, 1995). At that time, the DTSC recommended that any seepage be controlled by construction of sand bag berm.

The 1997/1998 winter rainy season was characterized by unusually frequent and occasionally very heavy rainfall. In March 1998, water seepage began at the Hamilton Avenue gate and along the northern berm. The water accumulated in the street. Water samples were collected by ESE (then known as QST) on April 3, 1998 and analyzed for TRPH, pesticides and PCBs, VOCs, SVOCs, California Title 22 metals, pH, chlorides, and organic lead. The results of the analyses are as follows: No pesticides, PCBs, VOCs, SVOCs, or organic lead were detected in any of the samples. The pH was normal (7.5 and 7.9). TRPH was detected at low concentrations (1.8 and 1.9 mg/l). The sample collected from the gate area contained antimony virtually at the PRG concentration. The sample collected from the northern berm area contained arsenic and lead exceeding the PRG. By early May 1998, the seepage had ceased.

3.8 Soil Vapor and Air Investigation

Soil vapor and air investigations were performed by Radian in 1988 and by ESE in 1997. The purpose of these investigations was to determine if detectable volatile components of petroleum materials at the site are impacting off-site receptors or might impact on-site workers during site remediation. Details regarding the investigations completed for soil vapor and air are presented in the RI report. The analytical findings and conclusions are discussed below.

Summary statistics for the analytical data for soil gas samples that were reported in units of parts per billion by volume (ppbv) are presented in Table 3-28; this table includes all Radian data and the ESE data for methane and TPH. The remaining ESE data that were reported in micrograms per liter ($\mu\text{g/l}$) of air are summarized in Table 3-29.

The samples for the Radian and the ESE investigations were collected using significantly different procedures. Consequently, the VOC data for the two investigations are presented separately in the RI report. The ESE data for methane and TPH that were reported in units of parts per million by volume (ppmv) are included in Table 3-28 together with the Radian data because the units are the same as the Radian data. There are no PRGs for methane or TPH so it is not possible to compare the data for these two analytes with the PRGs in Table 3-29.

For the off-site soil gas investigation, methane concentrations ranged from a low of 2.8 ppmv in Sample SVS-2 collected across Hamilton Avenue north of the site, to a high of 5,880 ppmv in Sample SVS-1, located adjacent to Pit H (see Figure 1-3 for the locations of these samples). The latter concentration is much less than the lower explosive limit of 5.3 percent (53,000 ppmv). The upper explosive limit for methane is 15 percent (150,000 ppmv).

Except for methane and TPH, no organic compounds were detected in the soil gas samples collected from the off-site locations. These data seem to indicate that significant concentrations of the more toxic VOCs are not migrating off the site in the subsurface. This could be attributed to the clay layer beneath the site.

According to ESE (1997a), the methane may have several possible sources in addition to the on-site petroleum wastes. The area has had several active producing oil wells, local native subsurface soils contain naturally occurring peat, and there was a landfill just north of Hamilton Avenue, in what is now Edison Park. Moreover, methane is the lightest hydrocarbon and so has the highest migration potential through interstitial pore spaces in soil.

3.9 Ground Water

Because of shallow ground water conditions at the Ascon site, some of the deeper wastes at the site may be in direct contact with ground water. Between 1983 and 1992, Ecology and Environment, Woodward-Clyde, Radian, and ISCO Industries/ITARA Engineers installed 20 ground water monitoring wells at the site to determine if ground water was contaminated because of contact with the on-site waste or by water percolating through the contaminated soil and other wastes. Locations of these wells are shown on Figure 1-3.

The most comprehensive ground water sampling program from the on-site wells was completed by Radian in 1988. In January and February 1996 and in February and March 1997, ESE conducted two rounds of ground water monitoring at the site. ESE also performed a cone penetrometer test (CPT) investigation that consisted of advancing seven off-site CPT borings down-gradient from the site.

During ESE's 1996 and 1997 investigations, the following two wells could not be located or were observed to be damaged:

- Wells AW-6 and AW-7. These wells were not found during the Radian and ESE investigations. They were probably destroyed or paved over during the widening of Hamilton Avenue in 1986 (Radian 1988). ESE recommended that these wells be located

and abandoned properly, if needed, prior to implementing the chosen remedial alternative for the site.

- Well AW-8. This well is located outside of the gate on Hamilton Street. The casing for this well was noticed to be either broken or bent, and the well could not be used as a ground water monitoring well. ESE recommended that this well be abandoned.

Details regarding the investigations completed for ground water are presented in the RI report. The analytical findings and conclusions are discussed below.

Summary statistics for the analytical data for ground water samples are presented in Table 3-30. Concentrations of 24 analytes exceeded the PRGs: 1,1-dichloroethene, benzene, bromodichloromethane, carbon disulfide, chloroform, ethylbenzene, methylene chloride, styrene, tetrachloroethene, toluene, trichloroethene, xylenes (total), 1,1'-biphenyl, acenaphthene, anthracene, bis (2-ethylhexyl) phthalate, naphthalene, pentachlorophenol, antimony, arsenic, beryllium, cadmium, lead, and thallium. The areas, sample locations, analytes, results, and depths are listed in Table 3-31.

As listed in the fourth data column of Table 3-30 several analytes had detection limits greater than the PRGs. According to ESE, it is not known if these analytes are present at concentrations that exceed the PRGs, and conversely, it cannot be concluded that concentrations of these analytes do not exceed the PRGs. ENVIRON has prepared a discussion of the detected ground water concentrations with respect to drinking water standards MCLs, as presented in Section 2.11.4.

TPH, VOCs, SVOCs, pesticides, and metals were detected in the ground water samples. PCBs were not detected. As explained above, concentrations of 24 analytes exceeded the PRGs. The benzene concentration in one sample from Well WCC B-6 (0.52 mg/l) was greater than the TCLP limit of 0.5 mg/l indicating that this sample could be considered representative of a RCRA hazardous waste. This well is located a few feet down-gradient from Pit F. According to Radian, ground water monitoring results indicate that oil and waste products are present in ground water in the immediate vicinity of the lagoons and former disposal pits, particularly Pit F.

Analytical results for ground water samples from perimeter wells indicate that low levels of some VOCs are present in ground water and may be migrating off-site toward the northwest, northeast, and east. However, of the ground water samples collected from the seven down-gradient off-site CPT borings, only one, the sample collected from CPT-3, had a concentration that exceeded a PRG. The lead concentration in that sample was 8 µg/l, greater than the PRG of 4 µg/l. As shown on

Figure 1-3, this CPT boring was located off-site, approximately 100 feet down-gradient from (north of) Lagoon 4.

Significant findings regarding the ground water are:

- Concentrations of 24 analytes exceeded the PRGs in several ground water samples mainly from on-site wells.
- The lead concentration in the ground water sample from CPT-3 located off-site, approximately 100 feet north of Lagoon 4 exceeded the PRG. This indicates that some off-site migration of ground water from the site may be occurring.
- The clay layer underlying the site may separate the waste from the Talbert Aquifer that has been degraded locally by seawater intrusion. Because investigations were not conducted in the center of the lagoons, it is not known if the clay is continuous beneath them. Soil and ground water data show that the clay/silt layer underlying the site has not prevented migration of contaminants into the ground water directly beneath the site. Boring logs indicate that the clay/silt layer is not continuous across the site and organic odors and contamination have migrated through or around the clay/silt layer. It also appears that the observed ground water contamination is partially a result of improper well drilling and poor well construction. Analytical results from ground water samples collected from Wells B-6, B-7, and AW-1, located in the area of detectable concentrations of Pit F, have indicated a trend of detectable concentrations of VOCs.
- Free-phase hydrocarbons have been observed on the ground water surface at locations between Lagoons 2 and 3, northwest of Lagoon 4, and adjacent to Pit F. Due to improper well screen placement, the extent of free-phase hydrocarbons is not known.
- Ground water generally flows from the southwestern corner toward the north and northeast, and appears to be influenced by the waste lagoons.
- Based on the off-site ground water monitoring completed, off-site migration of free-phase hydrocarbons has not been found in the direction of ground water flow.

3.10 Construction Debris

It is apparent from an inspection of the site that large quantities of construction debris, such as concrete rubble, wood, and other construction wastes have been disposed of at the site. Some of the

previous investigations included inspections of the surface and subsurface to assess the type and estimate the volumes of these waste materials deposited on the site. Details regarding the investigations completed for the construction debris are presented in the RI report.

In January 1996 ESE performed an investigation at the site, which consisted of excavating four test pits each approximately 15 feet deep, 5 feet long, and 5 feet wide. The locations of these test pits are shown on Figure 1-3. The material removed from the test pits was visually examined.

The material removed from Test Pit No. 1 was mostly oil-stained soil with some unstained soil, wood debris, bricks, and plastic wrap. No concrete rubble was observed in this test pit.

Approximately 25 to 35 percent of the material excavated from Test Pit No. 2 consisted of concrete and asphalt rubble and the remainder consisted of oil-stained soil, unstained soil, and brick.

Generally clean soil was found from the surface to a depth of 5 feet. In Test Pit No. 3 approximately 10 to 15 percent of the excavated material was concrete and asphalt rubble and the rest consisted of oil-stained soil, unstained soil, steel, and PVC pipe. Again, the top 5 feet was primarily clean soil. Test Pit No. 4 contained clayey soil with slight oil staining; petroleum hydrocarbon odors increased with depth. There was no rubble in this pit.

4.0 SUMMARY OF BASELINE HEALTH RISK ASSESSMENT FINDINGS

4.1 Introduction

The BHRA was performed to identify and evaluate the potential risks to human and ecological receptors posed by the current conditions at the Ascon site. The BHRA was completed by ESE and submitted to DTSC (ESE, 1997b). This section provides a summary of the BHRA.

In the BHRA, special consideration was given to evaluating potential health risks to off-site residents, off-site workers, on-site workers and trespassers. In addition, the BHRA evaluated the potential health risks that may be encountered by hypothetical on-site residents (adults and children). Both residential and occupational exposure scenarios were evaluated for exposure via inhalation of volatile chemicals and dust particles that may be released from the site. On-site workers and trespassers were evaluated by quantifying their potential exposures through the pulmonary, oral, and dermal exposure pathways while at the site.

The BHRA was performed in conformance with guidance from the USEPA and the Cal/EPA. For example, in an attempt to bracket the potential risks from chemical exposures at the site, both an average exposure case and a reasonable maximum exposure (RME) case were considered in ESE's risk assessment. The average exposure scenario was evaluated using the arithmetic mean chemical concentration in soil combined with average intake values describing the extent, frequency, and duration of exposure.

The RME scenario represents the highest hypothetical exposure at the site. To determine potential exposures associated with the RME scenario, the 95%UCLs of the mean concentration values in soil, lagoons, and pits were used to represent the exposure point concentrations, combined with reasonable maximum intake values describing the extent, frequency, and duration of exposure.

Estimated non-carcinogenic adverse health effects were compared to USEPA-established acceptable daily intake, and potential carcinogenic health risks were compared to the USEPA acceptable risk range of $1.0\text{E-}04$ to $1.0\text{E-}06$. The range, $1.0\text{E-}04$ to $1.0\text{E-}06$, is equivalent to one excess cancer in 10,000 exposed individuals to one excess cancer in 1,000,000 exposed individuals, respectively.

4.2 Chemicals of Potential Concern (COPCs)

The COPC selection process began with a review of the nature of the waste materials that currently remain at the Ascon site. Historical records show that the bulk of the materials deposited at the site consisted of oil-field wastes, drilling muds and brine wastewater, fuel oil (unusable/out of specification), and construction/demolition debris (soil, concrete, asphalt, metal, abandoned vehicles, etc.). The construction/demolition debris was assumed to be inert and would not include any materials that could pose a chemical exposure risk. However, the debris could pose a physical hazard risk to individuals present on the site.

As discussed in Section 3.1.1 of this report, all available characterization data for soil, waste, ground water, soil gas, and background soil collected by the numerous investigators for the Ascon site were compiled into an electronic database. This database consists of over 20,000 records and over 300 chemicals.

Not all chemicals detected at the Ascon site were included in the BHRA. A formal selection of COPCs was conducted to identify those chemicals that could be responsible for more than 95 percent of the health and environmental risks. The selection criteria were initiated by eliminating from consideration those chemical families known to have low toxicity potential under environmental exposure conditions. Three chemical families that were eliminated were the petroleum derived alkanes, alkenes and cycloalkanes. These chemicals were not included as COPCs because they are, in general, only slightly toxic to humans and there is no evidence that these chemicals are mutagenic, teratogenic, or carcinogenic (Sandmeyer, 1981).

After elimination of the alkanes, alkenes, and cycloalkanes, the remaining chemicals that were detected at the site were included in a final selection of COPCs using the Concentration/Toxicity Scoring method (USEPA, 1989 and Cal/EPA, 1992). This method was used so that those chemicals potentially responsible for more than 96 percent of the health risks would be included in the risk assessment. The chemicals finally selected as COPCs for the BHRA are presented in Tables 4-1 and 4-2.

As a result of pilot testing conducted in 1999, as described in Section 9.0, some additional chemicals, which were previously not identified in soil, lagoon, or pit samples at the site, were detected in air samples. These chemicals were evaluated in terms of background concentrations and the concentration/toxicity (CT) score evaluation. Two chemicals, 4-methyl-2-pentanone and bis (2-ethylexyl) phthalate, were found to merit inclusion in the list of COPCs for the site. These COPCs should be considered in future risk assessments.

4.3 Toxicity Assessment

In order to evaluate the potential adverse effects associated with exposure to chemicals, the relationship between the dose of each chemical and the probability of an adverse health effect in an exposed population must be determined. This is known as dose-response assessment and is based on data collected from animal studies and theoretical precepts about what might occur in humans. The BIIRA considered both the carcinogenic and non-carcinogenic health effects associated with chemical exposures based on dose-response criteria published by various regulatory agencies. Published toxicity values for each COPC were obtained from either the Cal/EPA's Cancer Potency Factors (Cal/EPA, 1994), the USEPA's Integrated Risk Information System (IRIS; USEPA, 1996a), or USEPA's Health Effects Assessment Summary Tables (USEPA, 1995a).

4.4 Exposure Assessment

Waste disposal activities at the site were terminated in 1984. The only authorized activity at the site is petroleum extraction from a well located along Magnolia Avenue. However, the site is known to be frequented by trespassers even though it is fenced along its perimeter. Potentially exposed on-site individuals therefore include both oil company workers who maintain the oil well and trespassers.

The site is bounded to the east by a residential neighborhood, to the north by the Edison Community Park, to the south by a power generation station, and to the west by commercial/industrial development (Figure 1-2). Potential off-site receptors, under current conditions, include adult and child residents as well as workers employed in establishments west of the site.

The land uses surrounding the Ascon site suggest that reasonable future site uses include commercial, residential, or recreational use (or perhaps a combination of these uses). Currently, the site is zoned residential by the City of Huntington Beach. However, under current conditions, the Ascon site is not suitable for human habitation. The lagoons and the construction/demolition debris represent a physical health hazard to any residents at the site. In addition, soil at the site may not have the bearing capacity and stability required for construction of buildings. Under current conditions, the only on-site receptors at the site are oil well workers and trespassers. At the request of the Cal/EPA, the hypothetical on-site residential exposure scenario was included in the risk assessment.

The routes of exposure considered for current and hypothetical receptors were the inhalation, oral, and dermal exposure. The exposure media considered were air, soil, surface water, and ground water impacted by wastes at the Ascon site.

All off-site receptors considered (adult and child residents and workers) only have contact with Ascon-related chemicals when those chemicals are transported off-site by respirable air. On-site receptors (workers, trespassers, and hypothetical residents) are directly exposed to impacted soil; therefore, oral and dermal contact with impacted soil was considered to be a complete exposure pathway in the risk assessment for these receptors.

On the other hand, exposure to impacted ground water could occur if ground water is pumped for use, or if it is discharged into a surface water body. Ground water beneath the site has a limited beneficial use as a water source given its high content of dissolved solids¹. Also, drinking water in the area is obtained from municipal distribution lines. Thus, on-site residents and off-site residents are not currently exposed to impacted ground water.

It could be postulated that ground water under the site may be in contact with waste materials. Under these conditions, ground water may dissolve some components of the waste and transport them to an off-site drinking water well. The limited ground water data from on-site wells support this theory. Analytical results from samples collected from the on-site wells do have contaminants above PRGs. Migration of this contamination has not been observed at the Ascon site. Off-site ground water monitoring conducted in 1997 showed that ground water samples collected across the streets (Hamilton Avenue and Magnolia Street) and from two off-site locations adjacent to the site did not contain petroleum hydrocarbons at concentrations above detection limits.

A significant portion of the site area is covered by the current lagoons and Pit F. Volatile waste components now present in the lagoons and Pit F may volatilize from the surface and disperse in the atmosphere. When this occurs, on-site and off-site receptors could potentially be exposed to volatile chemicals through the inhalation route. Therefore, inhalation of vapors emitted from the lagoons and Pit F were considered to be a complete exposure pathway for all potential receptors.

In addition to chemical volatilization, on-site and off-site respirable air quality may be impacted by chemical-laden soil particles (fugitive dusts) especially during high wind conditions and/or during movement of vehicular traffic over erodible surfaces of the site. The potential for dust dispersion is a function of factors such as the nature of surface cover at the site, soil moisture, soil temperature, the physical and chemical properties of chemicals in the soil, chemical concentrations at the site,

¹ Designated beneficial uses of ground water in the site area, as noted in Section 2.11.2, are municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply.

meteorological conditions, and the level of disturbance of the soil. The dust release pathway was considered to represent a complete exposure pathway for both on-site and off-site receptors. Oral and dermal exposure to the chemicals at Ascon could occur for any on-site receptors through the consumption of or contact with soils or liquids on-site. Thus, complete pathways were assumed for on-site workers, trespassers, or anticipated future residents or recreational users of the site. No food products are grown on the site so there is no possibility of a secondary pathway through the consumption of contaminated food.

4.5 Chemical Fate and Transport

The concentration of a chemical in a medium to which a receptor is considered exposed is referred to as the exposure point concentration (EPC). For pathways involving direct contact (soil ingestion and dermal contact) with the contaminated media, the EPCs were derived directly from the measured site soil concentrations (Tables 4-3 and 4-4). For indirect pathways, including inhalation of vapors and dusts, the EPCs were estimated by mathematical modeling, using the measured soil concentrations as input, and considering relevant transport mechanisms.

To estimate EPCs for the different exposure pathways, the following receptor locations were selected:

- Off-site residents were assumed to be located at the residential development located adjacent to the site just across Magnolia Street.
- Hypothetical on-site residents were assumed to be located at any point within the site not occupied by a lagoon, debris pile, pit, or gravel road.
- Off-site workers were assumed to be located at one of the small shops located adjacent to the site at its northwest fence.
- On-site workers and trespassers were considered to be located at any point within the site not occupied by a lagoon.

There are many sources of volatile chemicals and airborne dust in the air. In the BHRA, it was assumed that VOCs in lagoons, soil, and pits will volatilize and migrate in the air to on-site or off-site receptors. It was also assumed that nonvolatile chemicals in soil can become airborne through the action of wind erosion and dispersion. Given that the actual chemical flux and ambient air concentrations of each COPC at the site are unknown, appropriate fate and transport models were used to estimate ambient chemical concentrations that can be generated at the site. The resultant

ambient air chemical concentrations attributed to volatilization and dust dispersion were used to assess inhalation exposure for on-site as well as off-site receptors. The estimated ambient chemical concentrations for each COPC in the BHRA are presented in Tables 4-3 and 4-4.

4.6 Risk Characterization

Incremental cancer risks and the potential for non-carcinogenic adverse health effects were estimated using methodology approved by both the USEPA and Cal/EPA. Estimated carcinogenic health risks were compared to agency benchmarks of increased average lifetime cancer risks ranging from one-in-ten-thousand to one-in-a-million ($1.0\text{E-}4$ to $1.0\text{E-}6$). For the ESE risk assessment, a mid-level cancer risk benchmark was used. The $1.0\text{E-}5$ level is commonly used by California regulatory agencies in programs such as Proposition 65 and AB 2588 (Air Toxic Hot Spots) as the benchmark for notification of risks to the public. Non-carcinogenic health risk estimates were conducted by estimating a Hazard Quotient (HQ) for each chemical and then a Hazard Index (HI) for each exposure pathway. Any estimated HI with a value equal or less than 1.0 was considered to be acceptable.

4.6.1 Estimated Health Risks

Estimated health risks are presented in the following sections for all receptors considered under both the average and RME exposure scenarios. All health risk estimates that were found to exceed standard "benchmarks" are presented in bold letters. The tables in the BHRA that were used to derive the health risks are presented in brackets "[]".

4.6.1.1 Adult Off-site Receptor

For this receptor the only exposure pathway considered to be feasible was inhalation. The estimated health risks for the off-site adult receptor can be summarized as follows:

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **$1.46\text{E}+00$** whereby 97% of the risk is represented by 1,2-dichloroethane (55%), benzene (39%) and 1,1,1-trichloroethane (3%) from the lagoons and Pit F [BHRA Table 24].
- HI under the RME scenario: **$9.10\text{E}+00$** whereby 96% of the risk is represented by 1,2-dichloroethane (64%), and benzene (32%) from the lagoons and Pit F [BHRA Table 25].

Incremental Cancer Risk

- Under the average exposure scenario: $6.56\text{E-}05$ whereby 89% of the risk is represented by 1,2-dichloroethane (42%), benzene (25%) and methylene chloride (22%) from the lagoons and Pit F [BHRA Table 26].
- RME scenario: $9.15\text{E-}04$ whereby 84% of the risk is represented by 1,2 dichloroethane (44%), methylene chloride (22%), and benzene (18%) from the lagoons and Pit F [BHRA Table 27].

4.6.1.2 Child Off-site Receptor

Off-site child receptors were also considered to be exposed only through the inhalation pathway. The estimated health risks for the off-site child receptor can be summarized as follows:

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: $6.60\text{E+}00$ whereby 94% of the risk is represented by 1,2-dichloroethane (55%) and benzene (39%) from the lagoons and Pit F [BHRA Table 28].
- HI under the RME scenario: $2.53\text{E+}01$ whereby 96% of the risk is represented by 1,2-dichloroethane (64%), and benzene (32%) from the lagoons and Pit F [BHRA Table 29].

Incremental Cancer Risk

- Under the average exposure scenario: $1.48\text{E-}04$ whereby 89% of the risk is represented by 1,2-dichloroethane (42%), benzene (25%) and methylene chloride (22%) from the lagoons and Pit F [BHRA Table 30].
- RME scenario: $6.37\text{E-}04$ whereby 99% is 1,2-dichloroethane (44%), methylene chloride (22%), benzene (18%) and benzidine (15%) from the lagoons and Pit F [BHRA Table 31].

4.6.1.3 Off-site Worker

The only pathway of concern for off-site workers was considered to be inhalation. The results are summarized below.

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **1.05E+00** whereby 94% of the risk is represented by 1,2-dichloroethane (55%) and benzene (39%) from the lagoons and Pit F [BHRA Table 32].
- HI under the RME scenario: **4.06E+00** whereby 96% of the risk is represented by 1,2-dichloroethane (64%) and benzene (32%) from the lagoons and Pit F [BHRA Table 33].

Incremental Cancer Risk

- Under the average exposure scenario: **4.71E-05** whereby 89% of the risk is represented by 1,2-dichloroethane (42%), benzene (25%), and methylene chloride (22%) from the lagoons and Pit F [BHRA Table 34].
- RME scenario: **4.25E-04** whereby 99% is 1,2-dichloroethane (44%), methylene chloride (22%), benzene (18%) and benzidine (15%) from the lagoons and Pit F [BHRA Table 35].

4.6.1.4 On-site Worker and Trespasser

The receptor for on-site workers and trespassers was assumed to be an adult. These receptors were assumed to be exposed through the pulmonary, oral, and dermal pathways. The estimated health risks under each exposure pathway are summarized in the following paragraphs:

Inhalation Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **1.56E-01** whereby 94% of the risk is represented by 1,2-dichloroethane (55%) and benzene (39%) from the lagoons and Pit F [BHRA Table 36].
- HI under the RME scenario: **9.71E+00** whereby 96% of the risk is represented by is 1,2-dichloroethane (64%) and benzene (32%) from the lagoons and Pit F [BHRA Table 37].

Incremental Cancer Risk

- Under the average exposure scenario: **5.48E-06** whereby 96% of the risk is represented by is 1,2-dichloroethane (45%), benzene (27%),

and methylene chloride (24%) from the lagoons and Pit F [BHRA Table 38].

- HI under the RME scenario: $7.33\text{E-}05$ whereby 94% is 1,2-dichloroethane (49%), methylene chloride (25%) and benzene (20%) from the lagoons and Pit F [BHRA Table 39].

Oral Exposure Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: $3.59\text{E-}02$ whereby 83% of the risk is represented by thallium (64%) and arsenic (19%) in soil [BHRA Table 40].
- HI under the RME scenario: $1.16\text{E-}01$ whereby 91% of the risk is represented by thallium (52%), arsenic (29%) and benzidine (10%) in soil [BHRA Table 41].

Incremental Cancer Risk

- Under the average exposure scenario: $3.57\text{E-}04$ whereby 99.4% of the risk is represented by benzidine in soil [BHRA Table 42].
- Under the RME scenario: $4.82\text{E-}04$ whereby 99.8% of the risk is represented by benzidine in soil [BHRA Table 43].

Dermal Exposure Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: $8.33\text{E-}03$ whereby 84% of the risk is represented by thallium (32%), arsenic (29%) and benzidine (23%) in soil [BHRA Table 44].
- HI under the RME scenario: $3.73\text{E-}02$ whereby 85% of the risk is represented by benzidine (35%), arsenic (31%) and thallium (19%) in soil [BHRA Table 45].

Incremental Cancer Risk

- Under the average exposure scenario: $4.12\text{E-}04$ whereby 99.9% of the risk is represented by benzidine in soil [BHRA Table 46].
- Under the RME scenario: $5.58\text{E-}04$ whereby 99.9% of the risk is represented by benzidine in soil [BHRA Table 47].

4.6.1.5 Hypothetical Adult On-site Resident

These hypothetical receptors were assumed to live at the site. One pathway of concern was considered to be inhalation. These receptors were also assumed to have direct contact with soil through the oral and dermal route. However, given the physical conditions of the lagoons, these receptors were not assumed to consume or have dermal contact with the materials in the lagoons. The estimated health risks under each exposure pathway are presented in the following paragraphs:

Inhalation Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **4.35E+00** whereby 94% of the risk is represented by 1,2-dichloroethane (55%) and benzene (39%) from the lagoons and Pit F [BHRA Table 48].
- HI under the RME scenario: **2.72E+01** whereby 96% of the risk is represented by 1,2-dichloroethane (64%) and benzene (32%) from the lagoons and Pit F [BHRA Table 49].

Incremental Cancer Risk

- Under the average exposure scenario: **1.83E-04** whereby 96% of the risk is represented by 1,2-dichloroethane (45%), benzene (27%), and methylene chloride (24%) from the lagoons and Pit F [BHRA Table 50].
- RME scenario: **2.46E-03** whereby 94% of the risk is represented by 1,2-dichloroethane (49%), methylene chloride (25%) and benzene (20%) from the lagoons and Pit F [BHRA Table 51].

Oral Exposure Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **6.28E-02** whereby 83% of the risk is represented by thallium (64%) and arsenic (19%) in soil [BHRA Table 52].
- HI under the RME scenario: **1.62E-01** whereby 91% of the risk is represented by thallium (52%), arsenic (29%) and benzidine (10%) in soil [BHRA Table 53].

Incremental Cancer Risk

- Under the average exposure scenario: **7.50E-04** whereby 99.5% of the risk is represented by benzidine in soil [BHRA Table 54].
- Under the RME scenario: **8.09E-03** whereby 99.9% of the risk is represented by benzidine in soil [BHRA Table 55].

Dermal Exposure Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **2.92E-02** whereby 84% of the risk is represented by thallium (32%), arsenic (29%) and benzidine (23%) in soil [BHRA Table 56].
- HI under the RME scenario: **5.23E-02** whereby 85% of the risk is represented by benzidine (35%), arsenic (31%) and thallium (19%) in soil [BHRA Table 57].

Incremental Cancer Risk

- Under the average exposure scenario: **1.73E-03** whereby 99.9% of the risk is represented by benzidine in soil [BHRA Table 58].
- Under the RME scenario: **9.37E-03** whereby 99.9% of the risk is represented by benzidine in soil [BHRA Table 59].

4.6.1.6 Hypothetical On-site Child Resident

These hypothetical receptors were assumed to live at the site. One pathway of concern was considered to be inhalation. These receptors were also assumed to have direct contact with soil through the oral and dermal route. However, given the physical conditions of the lagoons, these receptors are not assumed to consume or have dermal contact with the materials in the lagoons. The estimated health risks under each exposure pathway are presented in the following paragraphs:

Inhalation Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **1.97E+01** whereby 94% of the risk is represented by 1,2-dichloroethane (55%) and benzene (39%) from the lagoons and Pit F [BHRA Table 60].
- HI under the RME scenario: **7.57E+01** whereby 96% is 1,2-dichloroethane (64%) and benzene (32%) from the lagoons and Pit F [BHRA Table 61].

Incremental Cancer Risk

- Under the average exposure scenario: **4.14E-04** whereby 96% of the risk is represented by 1,2-dichloroethane (45%), benzene (27%), and methylene chloride (24%) from the lagoons and Pit F [BHRA Table 62].
- RME scenario: **1.71E-03** 94% is 1,2-dichloroethane (49%), methylene chloride (25%) and benzene (20%) from the lagoons and Pit F [BHRA Table 63].

Oral Exposure Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **5.86E-01** whereby 83% of the risk is represented by thallium (64%) and arsenic (19%) in soil [BHRA Table 64].
- HI under the RME scenario: **1.52E+00** whereby 91% of the risk is represented by thallium (52%), arsenic (29%) and benzidine (10%) in soil [BHRA Table 65].

Incremental Cancer Risk

- Under the average exposure scenario: **3.50E-03** whereby 99.4% of the risk is represented by benzidine in soil [BHRA Table 66].
- Under the RME scenario: **1.89E-02** whereby 99.9% of the risk is represented by benzidine in soil [BHRA Table 67].

Dermal Exposure Pathway

Non-Carcinogenic Hazard Index

- HI under the average exposure scenario: **4.69E-02** whereby 84% of the risk is represented by thallium (32%), arsenic (29%) and benzidine (23%) in soil [BHRA Table 68].

- HI under the RME scenario: **8.41E-02** whereby 85% of the risk is represented by benzidine (35%), arsenic (31%) and thallium (19%) in soil [BHRA Table 69].

Incremental Cancer Risk

- Under the average exposure scenario: **1.39E-03** whereby 99.9% of the risk is represented by benzidine in soil [BHRA Table 70].
- Under the RME scenario: **3.77E-03** whereby 99.9% of the risk is represented by benzidine in soil [BHRA Table 71].

4.6.2 Ecological Risk Characterization

As discussed in Section 2.9, a biological survey of the Ascon site was conducted by Dudek in July of 1996 (Dudek, 1996). The survey was conducted to determine the plant and animal species that inhabit the site. Data from survey plus information collected from the site during previous site investigations were used to conduct an Ecological Risk Assessment (ERA). Details about the ERA and the results obtained are presented in the BHRA. This section summarizes the most important conclusions of the ERA.

The Dudek survey indicated that the open lagoons and Pit F could pose a significant hazard to wildlife. Animals, especially birds attracted to surface water pooled in the lagoons, are exposed to a real and lethal threat because the animals may perish if they become ensnared in the lagoons. The rate of incident of ensnarement is unknown, but the potential population impacts would be minor for any common receptors with large ranges, or large contiguous interbreeding populations. Impacts to rare organisms could be of potential concern, but no rare, threatened, or endangered species have been reported at the site.

Potential terrestrial receptors at the site include reptiles, birds, and mammals. The site is highly disturbed and supports little in the way of natural habitats that would serve as significant areas for the establishment of populations of important species. Potential risks to wildlife exist; but based on available data, do not appear significant to wildlife populations.

4.7 Nonchemical Health Risks

In addition to the chemical health risks discussed in the previous sections, the BHRA also evaluated the potential for additional health threats that may be posed by the Ascon site under current conditions. These other risks are described in this section.

4.7.1 Ground Water

Currently little or no use is made of the ground water beneath the Ascon site and the general vicinity. However, future beneficial uses of this ground water are still possible according to its designated "beneficial use" in the Water Board's basin plan (Water Board, 1995). Moreover, ground water beneath the site may have some connection to the wetlands area to the south-southeast of the site (the Huntington Beach Channel is unlined, as discussed in Section 2.6.1) and these wetlands are reportedly slated for enhancement.

Although a native clay layer has been identified beneath the waste and fill materials at many locations on the Ascon site, this layer was thin or absent in some borings. Moreover, this layer has not been tested for its ability to contain liquid wastes. Given the characteristics of the clay layer and its absence in some locations, it is possible that the waste materials are not completely contained in a vertical direction.

It is also worth noting that the Ascon site is located within an area that is designated as having high susceptibility to liquefaction-related ground failure during significant seismic events (Ziony, et al., 1985; California Department of Conservation, 1996). If soil liquefaction did occur as a result of seismic activity, breaching of the clay layer could occur, allowing the waste material to migrate deeper into the subsurface.

4.7.2 Horizontal Movement of Wastes

There is no vertical containment to prevent horizontal, subsurface movement of waste from the site. A factor that has limited the horizontal subsurface migration of waste from the site has been the relatively high viscosity of the waste materials rather than any natural or man-made barrier. Although subsurface migration is very slow, it will continue as long as the wastes remain on-site unless a subsurface, vertical barrier is put in place or the wastes are removed.

The berm that surrounds the Ascon site was constructed to contain the surface wastes as dumping activities took place in the 1940s, 1950s, and 1960s. Although the berm has generally fulfilled its purpose, it is currently in a state of significant disrepair. Lateral migration of lagoon liquids has impacted the soil in some portions of the berm. Numerous rodent burrows have been observed at several locations along the berm. The top of the berm along Hamilton Avenue is exhibiting vertical cracking. Furthermore, the berm has experienced leakage problems during routine rainfall events. The berm cannot be expected to continue to act as an aboveground barrier to the horizontal movement of surface wastes

without substantial redesign and reconstruction. An important factor to be considered in relation to the current or any future berm at the site is that, as noted in Section 2.3, based on current plans by the City of Huntington Beach, Magnolia Street and Hamilton Avenue are slated for widening in the future. Accordingly, portions of the outlying areas of the site on the eastern and northern sides will be taken up to accommodate the street widening.

4.7.3 Risk of Berm Failure

From an engineering point of view, the berm at the Ascon site is not in compliance with the Uniform Building Code (UBC, 1997) requirements for the construction of fill slopes, which state that fill slopes shall not have a horizontal to vertical ratio that is steeper than 2:1. The Orange County Grading and Excavation Code contains essentially the same requirement. The perimeter berm along Hamilton Avenue and part of Magnolia Avenue has almost 1:1 side slopes.

In addition, it is likely that the berm, as well as all other areas of fill on the property, was not constructed with a minimum 90% relative compaction in accordance with American Society for Testing and Materials (ASTM) Method D 1557-91, as required in the UBC. Fill areas that are not required to meet specific structural performance criteria are sometimes allowed to be constructed to a minimum of 80% relative compaction. However, the berm at the Ascon site was intended to perform as a containment structure, and should therefore meet structural fill criteria (90% relative compaction) in addition to permeability requirements and possibly other criteria. The original structural integrity of the berm, which may have always been inadequate relative to current construction standards, has been further significantly degraded over time as noted in Section 4.7.2. Failure of the berm could result in the release of waste materials to the residential areas, public park, public streets, or Huntington Beach Channel in the site vicinity.

4.7.4 Soil Bearing Capacity

Current data available from the site, coupled with the historical conditions present when the site was constructed, indicate that the entire site does not currently have adequate bearing capacity to support the construction of buildings. As noted earlier, at least 90% relative compaction is needed for areas intended to support structures and 80% would be required for non-structural fill areas. The fill present on the site is not certified as meeting either of these criteria. In order to support conventionally designed structures, the poorly consolidated subsurface materials would have to be removed followed by proper placement

and compaction of approved fill material. Otherwise, future uses of the site will be severely restricted and those uses will also be subject to differential settlement problems.

4.7.5 Physical Hazards

Even though the site is completely fenced and has posted warning signs, trespassers periodically visit the site. In the past, both adult and older children trespassers have been seen at the site. A major concern is that a trespasser might fall into one of the lagoons at the site, especially at night and if under the influence of drugs or alcohol. The risk of trespasser injury cannot be quantified as the frequency of trespasser visits is unknown. Evidence at the site indicates that the visits are continuing in spite of the site owner's posting of warning signs and other efforts to control site access and the periodic patrol of the site by Huntington Beach City Code Enforcement personnel.

4.7.6 Styrene Pit Odors

In addition to chemical risk concerns that may result from chemical emissions arising from Pit F, odorous emissions from the Pit have been known to impact the adjacent community. This problem is most prevalent during hot periods in the summer and early fall months of the year. During past periods of hot weather, the odors have been strong enough and persistent enough to cause minor respiratory problems, headaches, and nausea. Residents who live immediately east of the site, across Magnolia Street, have been the most impacted and have reportedly complained to the SCAQMD. Although interim measures, such as covering the pit with synthetic liners, have helped to minimize the odor, continuous maintenance and monitoring is required. The covers have degraded due to continued exposure to sunlight and continuous efforts to control the odor must be undertaken. Until a permanent solution, such as complete removal, is implemented, odor problems from Pit F could recur.

5.0 REMEDIAL ACTION OBJECTIVES AND ARARs

5.1 Chemicals of Concern

As presented in Section 4.0, the COPC selection process began with a review of the nature of the waste materials that currently remain at the Ascon site. Historical records show that the bulk of the materials deposited at the site consist of oil-field wastes, drilling muds and brine wastewater, fuel oil (unusable/out of specification), and construction/demolition debris (soil, concrete, asphalt, metal, abandoned vehicles, etc.). The construction/demolition debris was assumed to be inert and would not include any materials that could pose a chemical exposure risk. However, the debris could pose a physical hazard risk to individuals present on the site.

Also as discussed in Section 4.0, oral and dermal contact with impacted soil was considered to be a complete exposure pathway in the risk assessment for these receptors. On-site residents (hypothetical) and off-site residents are not currently exposed to impacted ground water. The dust release pathway was considered to represent a complete exposure pathway for both on-site and off-site receptors. Complete pathways were assumed for on-site workers, trespassers, or anticipated future residents or recreational users of the site. No food products are grown on the site, so there is no possibility of a secondary pathway through the consumption of contaminated food. Inhalation of vapors emitted from the lagoons and Pit F were considered to be a complete exposure pathway for all potential receptors.

Not all chemicals detected at the Ascon site were included in the BHRA. A formal selection of COPCs was conducted to identify those chemicals that could be responsible for more than 95 percent of the health and environmental risks. The selection criteria were initiated by eliminating from consideration those chemical families known to have low toxicity potential under environmental exposure conditions. Three chemical families that were eliminated were the petroleum derived alkanes, alkenes, and cycloalkanes. These chemicals were not included as COPCs because they are, in general, only slightly toxic to humans and there is no evidence that these chemicals are mutagenic, teratogenic, or carcinogenic (Sandmeyer, 1981).

After elimination of the alkanes, alkenes, and cycloalkanes, the remaining chemicals that were detected at the site were included in a final selection of COPCs using the Concentration/Toxicity Scoring method (USEPA, 1989 and Cal/EPA, 1992). This method was used so that those chemicals potentially responsible for more than 96 percent of the health risks would be included in the risk

assessment. The chemicals finally selected as COPCs are presented in Tables 4-1 and 4-2. As noted in Section 4.2, the two chemicals, 4-methyl-2-pentanone and bis (2-ethylexyl) phthalate, which were detected in air samples during the 1999 pilot testing, remain as COPCs and should be considered in future risk assessments.

5.2 Development of Remedial Action Objectives

The California Hazardous Substances Account Act (HSAA) incorporates the NCP by reference⁷, including its broad directive to protect public health and the environment, and to comply with ARARs. The primary remedial action objectives (RAOs) for the Ascon site are as follows:

- Reduce human health risks
- Reduce risks to the environment
- Mitigate on-site sources of additional ground water degradation
- Comply with ARARs

A secondary RAO is to allow future site use consistent with its designated zoning.

5.2.1 Reduction of Human Health Risks

In 1997 ESE completed a BHRA for the Ascon site, the main results of which are summarized in Section 4.0. According to these results the site, under current conditions, presents a potential health risk to current off-site residents and workers. Waste pits and lagoons at the site present a continuous source of chemicals that can migrate to on-site and off-site receptors through the air and ground water. Furthermore, the physical and geotechnical conditions of the site present a threat to current and future occupants of the site.

It is stated in 40 CFR 300.430(e)(2)(I) that remediation goals shall establish acceptable exposure levels that are protective of human health and the environment. The USEPA acceptable cancer risk range, as defined by the NCP, is $1.0E-6$ to $1.0E-4$. A cancer risk of $1.0E-6$ is used as the point of departure for assessing an acceptable risk level as an RAO. In addition, a level that will not result in adverse effects is used for noncarcinogens (i.e., HI less than 1). Therefore, consistent with the NCP, an acceptable cancer risk range of $1.0E-6$ to $1.0E-4$, and a final noncancer HI of less than 1 have been identified as the specific RAOs for the site.

⁷ Health & Safety Code Sections 25350 and 25356.1(d).

5.2.2 Reduction of Risks to the Environment

Besides reducing human health risk, another RAO for the site is to reduce risks to the environment. Adverse impact to the environment may occur via the migration of COCs to shallow ground water and the Huntington Beach Channel. The site, in its current state with open lagoons, poses a threat to wildlife, particularly birds, which could mistake the lagoons for clean water ponds.

5.2.3 Mitigation of On-site Sources of Additional Ground Water Degradation

Several organic compounds and metals have been detected in shallow ground water beneath the site at concentrations greater than the California or federal MCLs. However, as discussed in Section 2.11, the ground water beneath the site contains high concentrations of total dissolved solids (TDS) and nitrates in the Semiperched and Talbert Aquifers, mostly because of saltwater intrusion. Current ground water quality in both the Semiperched and Talbert Aquifers beneath the site do not qualify as drinking water resources as defined by SWRCB Resolution No. 88-63 due to the elevated TDS and chloride concentrations. Thus, the shallow ground water should not be considered a source of drinking water and is not considered a complete exposure pathway of concern.

Based on the guidance established in SWRCB Resolution No. 88-63, the Water Quality Control Plan for the site region (Water Board, 1995), and the ground water data, the present use of ground water in the East Coastal Plain Hydrologic Subarea (which includes the Ascon site) is limited to the following designated beneficial uses: municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply. Therefore, the RAO is to mitigate on-site sources that could inhibit the designated beneficial use of ground water beneath the site by mitigating migration of COCs into ground water. This objective can be accomplished by minimizing the potential for chemical migration through a capping solution that incorporates chemical stabilization of the wastes at or near the water table, or removing the affected wastes altogether from contact with the ground water.

5.2.4 Compliance with ARARs

The ARARs for remedial actions at the site are discussed in Section 5.4. All remedial actions proposed in this FS must comply with the ARARs.

5.2.5 Consideration of Designated Future Land Use

As described in Section 2.5, the City of Huntington Beach has zoned the Ascon site under the Magnolia Pacific Specific Plan. The plan was adopted by the Huntington Beach City Council in November 1992. In February 1994, the California Coastal Commission approved the plan, putting it into effect. The plan provides for development of the site as a residential neighborhood with up to 502 units. It is ENVIRON's understanding that DTSC promotes the selection of remedial actions that are consistent with future intended land use. As noted in Section 2.3, based on current plans by the City of Huntington Beach, Magnolia Street and Hamilton Avenue are slated for widening in the future. Accordingly, portions of the outlying areas of the site on the eastern and northern sides will be taken up to accommodate the street widening.

5.3 Preliminary Remediation Action Levels

As noted in Section 3.1.2, in the RI report ESE compared the concentrations of chemicals at the site to the PRGs to help evaluate the distribution and significance of the detected chemicals. The RI report identified the COCs, that is, compounds that are detected at concentrations exceeding the PRGs. The RI also identified the areas of the site where such concentrations have been found. As part of the FS, risk-based cleanup levels (RBCLs) were developed for the Ascon site. RBCLs, which are discussed in Section 6.3, are media-specific (soil, water or air) concentrations that are believed to be protective of human health and the environment.

5.4 Description of ARARs

5.4.1 General

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, requires that remedial actions achieve the protection of human health and the environment. In addition, the remedial actions must attain and be consistent with ARARs, unless waived or granted a variance by the USEPA. ARARs are legally enforceable standards, criteria, or limits promulgated under federal or state law.

The terms "applicable" and "relevant or appropriate" requirements are defined in the NCP⁸ as follows:

⁸ 40 CFR 300.5.

- The term "Applicable Requirements" means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site..."
- The term "Relevant and Appropriate Requirements" means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility citing laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site..."

Federal and state non-promulgated standards (standards which are not of general applicability or are not legally enforceable), policies, or guidance documents, and local requirements are not ARARs. However, these criteria may be considered for a particular release when evaluating remediation necessary to protect human health and the environment.

In preparing the list of potential ARARs for the Ascon site, ENVIRON reviewed three letters received by the DTSC in response to the DTSC's request to other agencies for input for preparing ARARs for the site. These letters were received from the Orange County Health Care Agency (on April 15, 1997), the SCAQMD (on April 16, 1997), and the Water Board (on May 29, 1997). The ARARS summarized in these letters can be grouped into three major categories of requirements: Chemical-Specific, Location-Specific, and Action-Specific. The following sections describe these three groupings of ARARs in more detail.

5.4.2 Potential Chemical-Specific Requirements

The potential chemical-specific ARARs identified for remedial action alternatives at the Ascon site include the Clean Air Act (CAA)⁹ and the regulations promulgated under the CAA.¹⁰ The CAA regulates air emissions of substances that may harm public health or natural resources. Certain remedial action alternatives that may produce regulated emissions include loading, unloading, compaction of contaminated soil and transfer operations, which may lead to volatilization of organic contaminants.

⁹ 42 USC 7401 *et seq.*

¹⁰ 40 CFR 50-80.

Potential chemical-specific ARARs also include:

- The Hazardous Waste Control Act (HWCA), as administered by the DTSC. The HWCA mandates the control of hazardous wastes from point of generation through accumulation, transportation, treatment, storage, and ultimate disposal.
- The Porter-Cologne Water Quality Control Act, as administered by the SWRCB and Water Board.

Details and descriptions of each potential chemical-specific ARARs applicable to the site are summarized in Table 5-1.

5.4.3 Potential Location-Specific Requirements

The location-specific ARARs identified for proposed remedial alternatives at the site include the RCRA¹¹ and the regulations promulgated under RCRA.¹² RCRA regulates the generation, management, and disposal of solid and hazardous waste.

RCRA has limited application as an ARAR for remedial actions at the site. Original waste disposal at the Ascon site ceased in 1971 prior to RCRA regulations becoming effective in November 1980. However, certain remedial actions may include generation and disposal of solid or hazardous waste subject to RCRA requirements. RCRA requirements are therefore potentially applicable or relevant and appropriate to the Ascon site.

Potential water quality ARARs for remedial action alternatives at the Ascon site include the Clean Water Act (CWA)¹³ and the regulations promulgated under the CWA.¹⁴ ARARs are also identified in the Safe Drinking Water Act (SDWA)¹⁵ and the regulations promulgated under the SDWA¹⁶.

¹¹ 42 USC 6901 *et seq.*

¹² 40 CFR 240-271.

¹³ 33 USC 1251 *et seq.*

¹⁴ 40 CFR 100-140, and 40 CFR 400-470.

¹⁵ 42 USC 300 (f) *et seq.*

¹⁶ 40 CFR 140-149

The CWA regulates the discharge of nontoxic and toxic pollutants into surface water by municipal sources, industrial sources, and other specific and nonspecific sources. The CWA also specifies water quality criteria, requirements for state water quality standards based on these criteria, and wetlands regulations. Potential location-specific ARARs under the CWA are summarized in Table 5-1.

The SDWA specifies drinking water standards, technologies, and treatment techniques for public drinking water supplies. Federal MCLs promulgated under the SDWA are generally used as RAOs for ground water and ARARs for the site. However, federal MCLs are only considered potential ARARs if the ground water is a "current or potential source of drinking water."¹⁷ Ground water quality under the site is degraded, as evidenced by the high TDS and salinity levels (see Sections 6.7). Ground water beneath the site is not suitable for drinking water use, and MCLs are neither applicable nor relevant and appropriate requirements for the ground water beneath the site.

5.4.4 Potential Action-Specific Requirements

The potential action-specific ARARs identified for remedial action alternatives at the site include the National Pollution Discharge Elimination System (NPDES) under the CWA. In addition, the HWCA, Mulford-Carrell Air Resources Act as implemented by the SCAQMD and administered by the California Air Resources Board, the California Safe Drinking Water and Toxic Enforcement Act, and the California Occupational Safety and Health Act (OSHA) are potential action-specific ARARs applicable for the site. Table 5-1 provides a summary of the potential action-specific ARARs.

5.4.5 Potential "To-Be-Considered" Criteria

In addition to ARARs, other nonenforceable criteria, policies, or guidance may be used to establish remedial action objectives and screen remedial alternatives under 400 CFR 300.430(e)(2)(I). These "To-Be-Considered" criteria are listed in Table 5-2.

5.4.6 Other Federal and State Laws

Other federal laws were reviewed as potential ARARs but were judged not to contain standards or regulations pertinent to the RAOs at the Ascon site. These laws include, but are not limited to, the Toxic Substances Control Act (TSCA), the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and the National Environmental Policy Act (NEPA).

¹⁷ 40 CFR 300.430(e)(f)(1)(B).

In addition, laws regulating activities based on specific historical or environmental features do not appear to be potential ARARs at the site. These laws include, but are not limited to, the National Historic Preservation Act, the Wild and Scenic Rivers Acts, the Fish and Wildlife Coordination Act, the Wilderness Act, and the Coastal Zone Management Act.

6.0 COC-CONTAINING MEDIA, SOIL CLEANUP LEVELS, AND WASTE VOLUMES

6.1 Introduction

As described in Section 3.0, several areas of the Ascon site contain chemicals of concern (COCs). The COC-containing areas of the site are:

- Current waste lagoons
- Former waste lagoons
- Waste pits
- Perimeter berm
- Surface areas containing construction debris
- Ground water

Lagoons 1 and 2 contain COC-impacted surface water, liquid petroleum waste, drilling muds, and soil. Lagoons 3, 4, and 5 contain COC-impacted surface water, drilling mud, and soil. Based on the results presented in Section 3.0, Pit F contains COC-impacted styrene waste and soil. The remaining waste pits, as well as the former lagoons, are believed to contain COC-impacted soil. COCs have been detected in soil and seep water samples of the perimeter berm. Finally, the ground water at the site contains some COCs. In addition to these COC-containing media, there is construction debris at the site that is generally believed not to contain COCs.

Following discussions of COCs and proposed soil cleanup levels at the site (Sections 6.2 and 6.3, respectively), estimated volumes are presented in Section 6.4. A discussion of ground water at the site is presented in Section 6.5.

6.2 Chemicals of Concern

As discussed in Section 4.2, not all chemicals detected at the Ascon site were included in the BHRA. A formal selection of COPCs was conducted to identify those chemicals that could be responsible for more than 95 percent of the health and environmental risks. The COPCs selected are presented in Tables 4-1 and 4-2. As noted in Section 4.2, the two chemicals, 4-methyl-2-pentanone and bis (2-ethylexyl) phthalate, which were detected in air samples during the 1999 pilot testing, remain as COPCs and should be considered in future risk assessments.

6.3 Proposed Soil Cleanup Action Levels

RBCLS were developed for the site assuming a residential development scenario. RBCLs are media-specific (soil, water, or air) concentrations that are believed to be protective of human health and the environment. RBCLs developed for the Ascon site express both a contaminant concentration and an exposure route, rather than contaminant concentrations alone, because protectiveness may be achieved by reducing exposure by means other than contaminant removal (such as capping an area, limiting access, or by waste stabilization). Appendix B describes the procedures used for developing RBCLs for the Ascon site and the results obtained. Appendix B was prepared by Dr. Heriberto Robles of Levine-Fricke-Recon who was formerly with ESE.

The development of soil RBCLs for the Ascon site required the following data:

- The COPCs at the site.
- Potentially exposed population(s) and exposure route(s) based on the most probable future land use.
- An acceptable daily exposure level for each non-carcinogenic COPC and an acceptable incremental cancer risk for carcinogens.

The COPCs selected are presented in Tables 4-1 and 4-2. The potentially exposed populations were assumed to be adult and child residents living in a house to be constructed at the site in its current condition. The potential exposure pathways included inhalation of volatile chemicals in air, inhalation of dust particles, and oral and dermal contact with chemical-impacted dust and soil.

RBCLs for the Ascon site were developed using applicable USEPA, DTSC, and ASTM (1995) methodology and development criteria. The final step in the derivation of RBCLs was the selection of cleanup levels for the protection of non-carcinogenic and carcinogenic effects. For chemicals having target cleanup levels for the protection of carcinogenic and non-carcinogenic effects, the lower of the two values was selected as the RBCL. For all other chemicals not known to be carcinogenic, the RBCL adopted was the cleanup level estimated to protect from non-carcinogenic effects. RBCLs for lead were calculated using DTSC's Lead Spreadsheet model (DTSC, 1996). Table 6-1 presents the RBCLs for the Ascon site soils.

In addition to the RBCLs discussed previously, City of Huntington Beach Soil Clean-up Standards should be considered, where applicable, as soil cleanup levels for the Ascon site. As presented in Table 6-2, petroleum hydrocarbon cleanup levels were obtained from the City of Huntington Beach's

Specification 431-92 for residential land use. ENVIRON proposes that the City of Huntington Beach Clean-up Standards be used as cleanup levels for materials containing concentrations of TPH and/or TRPH.

6.4 Estimated Volumes of Wastes

6.4.1 General

As discussed in Section 3.3, historically most of the site was covered by lagoons. Over the years, the lagoons were divided and enclosed by berms so the number and sizes of the lagoons changed. The lagoons were used mainly for disposal of oil production wastes and petroleum contaminated soil. They were partially filled in with concrete, wood, and other construction debris. Currently there are five lagoons present at the site. Lagoons 1, 2, and 3 are oriented in a north-south direction and stretch from the south central to the central portion of the site. Lagoons 4 and 5 lie in the north central and northeast portion of the site. Lagoon 1 is the smallest, with dimensions of approximately 200 by 300 feet. Lagoon 4 is the largest, measuring approximately 300 by 500 feet.

The pits are of relatively limited areal extent, with sides less than 100 feet long. The available records show that Pits A and B were used for disposal of oily wastes and Pits C and D were used for disposal of chromic and sulfuric acids. Oily wastes containing styrene were placed in Pit E; styrene tar and synthetic rubber wastes were disposed of in Pit F. The types of wastes disposed of in Pits G and H are not known (Radian, 1988).

Waste volume estimates were made by several previous investigators and evolved over time. The first comprehensive estimate was conducted by Radian (1988). ESE (1997a) modified Radian's estimates based on assumptions of soil expansion, waste migration and other factors. In 1998, J & W refined these estimates as described in Section 6.4.2.

The lagoon and pit depths were estimated by Radian (1988) using the boring logs and cross-sections prepared by Radian and others. Borings were drilled through the center of all pits except Pit F. The depth of Pit F was estimated to be 20 feet, which corresponds to the depth at which liquid hydrocarbons were observed in an adjacent ground water monitoring well. Radian estimated the depths of the current lagoons from nearby borings and assumed that the lagoons extend down to the native clay layer. In the areas formerly covered by lagoons, the thickness of the surface fill and the hydrocarbon waste underneath were estimated using the average fill and hydrocarbon waste thickness found in the borings in the former lagoon area.

drilled by Radian. This resulted in an average surface fill thickness of 5 feet and an average hydrocarbon waste thickness of 15 feet.

ESE (1997a) stated that the typical volume percent expansion of compacted soil upon excavation ranges from 15 to 30 percent. ESE noted that the soil at the Ascon site is not compacted and some of the soil is saturated such that it is already in an expanded state. ESE also noted that Radian's estimates strictly assumed vertical migration of contaminants with no horizontal component, which ESE believed not to be a reasonable assumption and may actually underestimate the volume of contaminated materials present at the site. Consequently, ESE used a conservative approach consisting of estimating an increase in area with depth amounting to an up to 20 percent increase in total volume. For more information regarding previous estimates, refer to the RI report (ESE 1997a).

Piles of construction debris (primarily concrete and asphalt, including also bricks and rubble) are spread out on the surface throughout the Ascon site. It is believed that wood, brick, concrete, and asphalt were placed over much of the waste material in the current and former lagoons and in the pits. In addition to the construction debris in the pits and lagoons, construction debris is present across the site. In January 1996 ESE performed an investigation at the site, which consisted of excavating four test pits each approximately 15 feet deep, 5 feet long, and 5 feet wide (ESE, 1997a).

Section 6.4.2 presents volume estimates developed by J&W (1998b). J&W performed a detailed review of historical site information, boring logs, historical aerial photographs, and analytical data to provide an estimate of the volume of site materials. J&W's estimates are considered to be the most current and valid estimates.

6.4.2 J&W's Volume and Weight Estimates

J&W (1998b) evaluated historical site information, site boring logs and analytical data and prepared volume and weight estimates. As noted by J&W, the wastes contained within the current and past waste management units are as follows:

- Five current lagoons (1 through 5) – These lagoons are currently open at the top and contain oily wastes, mostly in a semi-solid to solid state, comprised of drilling muds and affected soils (Lagoons 1 and 2 contain approximately 45% tarry liquid wastes).

- Seven former pits (A through E, G, and H) -- These pits are covered over and contain oily wastes comprised mostly of solid drilling muds and affected soils (Pits C and D also reportedly contain chromic and sulfuric acids)
- Pit F -- This pit, which is not buried like the other seven pits, is currently covered with a temporary polypropylene liner. The pit contains approximately 70% liquid styrene tars and synthetic rubber wastes and approximately 30% solid drilling muds and affected soils.
- Former lagoon areas -- These areas are currently covered over by approximately 6 feet of relatively clean soils and contain oily wastes comprised of solid drilling muds and affected soils.
- Perimeter berm -- The berm currently has a height of 5 to 15 feet above ground surface on the northern, eastern, and southern sides of the site. The berm primarily consists of unaffected soil but potentially contains some migrated oily wastes.
- Surface water -- This water is rain water seasonally contained within Lagoons 1 through 5 and is potentially affected by oily wastes.
- Construction debris -- This material is present at the surface and buried on-site and is comprised of concrete, rubble, asphalt, bricks, and other debris potentially affected by oily wastes.
- Clean fill -- Cover and fill soils on-site assumed to be clean and unaffected by oily wastes.

J&W (1998b) evaluated the available site information to arrive at volume estimates for the wastes at the site. J&W prepared Table 6-3, which presents the basis for estimating the volumes of the site materials. In summary, J&W used the following assumptions and procedures to prepare these estimates:

- The surface areas of Lagoons 1 through 5, Pits A through H, and the perimeter berm were measured from the available boring location plans. The surface areas of the former lagoon areas were measured from the 1957 aerial photograph.

- The volumes of the various waste features were calculated by an analysis of the available boring logs, photoionization detector (PID) readings, prepared cross-sections, and site analytical data.
- The volumes for Lagoons 1 through 5 were calculated by multiplying the measured surface area of each lagoon by the average depth of impact as estimated from PSI Engineering (1966) boring logs, cross-sectional analyses, and/or the depth of impact assumed to be to the top of native clay. In some instances, the current lagoons were situated over the former lagoon areas, and the volume associated with this additional thickness of impact under the current lagoon was added to the total estimated volume. In addition, 2 feet of affected soil underlying each feature were added to the assumed depth.
- The volume of the construction debris was estimated by reviewing the 112 boring logs available for the site. Concrete/rubble was indicated in approximately 45.6% of the boring logs. The average thickness of concrete/rubble occurrence on the boring logs was approximately 38% of the total average depth (26 feet) or approximately 10 feet. J&W multiplied this 10-foot thickness of concrete/rubble by the impacted area corresponding to 45.6% of the total surface area of the former lagoons (1,081,800 sq. ft.) to establish an estimated construction debris volume.
- The volumes for the former lagoon areas were estimated by measuring the surface area from the 1957 aerial photograph (1,081,800 sq. ft.), subtracting the surface area of the current lagoon areas, and multiplying by the average depth of impact as described on 11 selected borings and 4 test pits in the area. The thickness of impact was assumed to be approximately 16 feet on the average situated below an average of approximately 6 feet of overlying relatively clean soils. Because 75% of the construction debris/concrete volume is located within this affected material, J&W subtracted it to obtain a more realistic estimate of the volumes of impacted muds and affected soils. Further, J&W assumed that the affected lagoon material is underlain by 2 feet of affected soil.
- The volume for the perimeter berm was calculated using the Radian (1988) estimated berm heights of 5 to 15 feet, a crown width of 5 feet, and 1:1 side slopes. The berm borders the site on three sides, the north (15 feet high), east (one-half 15 feet high and one-half 10 feet high), and south (two-thirds 10 feet

high and one-third 5 feet high). The affected soil volume was estimated assuming that 20% of the berm soil is affected.

- The volume for the surface water (5.6 million gallons) was estimated by multiplying the total area measured for Lagoons 1 through 5 (373,632 sq. ft.) by an assumed maximum seasonal depth of 2 feet.
- The volume for the clean surface fill was obtained by reviewing the boring logs within the former lagoon areas (did not include the current lagoons). The surface area was multiplied by an average clean fill thickness of 6 feet to calculate the volume. The total volume of the clean fill material at the site was obtained by adding the volume of the clean surface fill and the 80% volume of the perimeter berm material, which was assumed to be clean.
- *Ex situ* waste volumes were calculated by using an expansion (or fluff) factor of 1.2 (20% bulking) times the *in situ* volumes to arrive at an excavated volume for the site wastes. The fluff factor was assumed to be zero for Pit F material, Lagoon 1 tars and liquids, and the construction debris.
- Various densities were used for the different site materials to estimate the weight of site materials (1.1 tons/cy for muds, 1.3 tons/cy for soils, 1.5 tons/cy for construction debris, and 1.0 ton/cy for tarry wastes [water and liquids, including styrene]).

Based on the volume calculation procedures described previously, J&W estimated the volume of site wastes to be handled during full-scale site remedial activities, as presented in Table 6-3. J&W noted that the drilling mud estimate, which was based on old visual observations of the boring logs, is really comprised of actual drilling mud and affected soils.

6.4.3 Summary of Estimated Waste Volumes and Weights

Using J&W's Table 6-3 estimates, ENVIRON prepared Table 6-A, which shows a summary of the estimated wastes at the site, rounded to the nearest 100 cy or ton. As noted in Section 6.4.2, the maximum volume of surface water was estimated to be 5.6 million gallons. ENVIRON assumed that because of evaporation, and the fact that this extreme volume is generally not reached, a more probable volume is one half of the maximum volume or approximately 2.8 million gallons.

Table 6-A. Estimated Volumes and Weights of Wastes

Waste Type	<i>In Situ</i> Volume (cy)	<i>Ex Situ</i> Volume (cy)	Unit Weight (ton/cy)	Weight (ton)
Drilling Mud	524,900	629,900	1.1	692,900
Tars/Liquid Wastes	40,200	40,200	1.0	40,200
Styrene Waste	1,500	1,500	1.0	1,500
Affected Soil	88,000	105,600	1.3	114,400
Clean Surface Soil	157,400	188,900	1.3	245,600
Affected Berm Soil	5,900	7,100	1.3	9,100
Clean Berm Soil	23,400	28,100	1.3	36,500
Concrete Debris	146,200	146,200	1.5	219,300
Non-Concrete Debris	36,500	36,500	1.5	54,700

6.5 Ground Water

In Section 2.11 the known and possible impacts to the ground water medium from the wastes in the Ascon site are discussed, including discussions of local hydrogeology, ground water quality and potential uses, contaminant transport mechanisms, and the extent of contaminated ground water at the site. As noted in Section 2.11.4, the most recent ground water data, performed in March 1997 (ESE, 1997a), indicate that very little ground water contamination was detected in the on-site ground water monitoring wells sampled. No PCBs were detected in any of the samples. Relatively low concentrations of SVOCs and pesticides were detected in a few of the samples analyzed.

As discussed in Section 2.11, the ground water beneath the site contains high concentrations of TDS and nitrates in the Semiperched and Talbert Aquifers, mostly because of saltwater intrusion. Current ground water quality in both the Semiperched and Talbert Aquifers beneath the site do not qualify as drinking water resources as defined by SWRCB Resolution No. 88-63 due to the elevated TDS and

chloride concentrations. Thus, the shallow ground water should not be considered a source of drinking water and is not considered a complete exposure pathway of concern.

Based on ENVIRON's evaluation of the existing ground water data, ENVIRON concluded that ground water remediation was not immediately required at the Ascon site. As agreed with DTSC, the need for ground water remediation will be re-evaluated following site remediation.

7.0 PRELIMINARY SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

7.1 Introduction

As discussed in Section 1.7, the FS for the media of concern at the Ascon site was conducted in general accordance with the USEPA (1988) guidance for conducting FS under CERCLA. The FS was conducted to formulate and evaluate remedial alternatives responsive to the RAOs identified in Section 5.2. The soil remediation required at the site was assessed based on potential risks to human health and the environment and the need to mitigate further risks to the underlying shallow ground water.

The FS was conducted using the following steps (see Section 1.7, Table 1-A). Those general response actions that are appropriate for addressing the remediation of the waste and waste-containing materials at the site were identified, as discussed in Section 7.2. For each general response action, remedial technologies (Section 7.3) and their associated process options (Section 7.4) were identified. This identification relied on available site data and ENVIRON's experiences at other similar sites. Those process options that were judged not to be applicable to the COCs at the site and specific site conditions were not included. Next, as presented in Section 7.5, a preliminary screening of the process options was performed based on effectiveness and implementability of the processes. The treatment options that were retained at the conclusion of this preliminary screening evaluation were subjected to the treatability studies and field pilot testing described in Sections 8.0 and 9.0, respectively.

For those processes that were not rejected based on the preliminary screening evaluation and treatability and pilot testing, an additional screening was performed based on relative cost of the process options within each technology, which is discussed in Section 10.1. As described in Sections 10.2 through 10.6, the processes that were retained following the activities described in Sections 7.0, 8.0, 9.0, and 10.1 were assembled into remedial alternatives. A detailed evaluation of these remedial alternatives was performed using the nine criteria required by the NCP. Finally, as described in Section 11.0, based on a comparative analysis of the remedial alternatives, a preferred alternative was recommended for the Ascon site.

7.1.1 Primary Waste Types Receiving Full Technology Screening

The majority of the site wastes consist of drilling mud, oily soil and liquid petroleum

hydrocarbons and are contained in the current and former lagoons and in all but one of the pits (see Section 6.4 for volume estimates). The formal or full screening of remedial technologies was conducted for these wastes. Secondary site materials with potential chemical impact requiring remediation or special handling are the Pit F styrene tar, perimeter berm and cover soil, surface water that collects seasonally due to rainfall and, to some extent, the construction debris (see Table 7-A).

7.1.2 Secondary Waste or Material Types Receiving Limited Screening

The Pit F styrene tar waste is unique in terms of its chemistry, odor and other properties and must be handled separately. In fact, following research of available proven technologies for this waste, it was concluded that excavation with off-site disposal is the only reasonable option (see Section 7.4.4.11).

Perimeter berm and cocopy copver soil can be chemically analyzed (screened) during remediation and if impacted, grouped with lagoon drilling muds. If not impacted, the soil can be used as backfill in accordance with site grading requirements.

Surface water accumulates seasonally due to rainfall and may contain some petroleum hydrocarbons resulting from contact with the lagoon surfaces. Conventional wastewater treatment systems can be utilized either on-site or off-site for this water. No further screening of technologies was conducted for water (see Section 7.4.4.9). Conventional wastewater treatment may also be used on ground water that may accumulate as a result of denaturing of deep excavations. As mentioned previously in this report, ground water treatment is not being mandated at this time and is not included in this RAP. During site excavation, any incidental ground water encountered can be skimmed if an oil sheen is visible. The need for ground water remediation will be re-evaluated following the remediation of the site.

Table 7-A. Waste Types and Technology Screening

Waste Type	Location	Approximate % of site wastes	Remedial Technology Screening Level
Drilling Mud	All lagoons and former lagoons	65%	Full Screening
Liquid petroleum hydrocarbons	Lagoons 1 and 2	4%	Full Screening
Affected Soils	Pits and throughout site	15%	Full Screening
Styrene Tar	Pit F	1%	Limited Screening
Surface Water	Lagoons (seasonal)	- NA -	Limited Screening
Construction Debris	Throughout site	15%	Limited Screening

The construction debris contains primarily concrete with lesser amounts of asphalt, metal and other debris. This material will be sorted into two categories. One category is material that can be used in structural fill either on or off-site if crushed. The other category is material that must be disposed of off-site. If coated with oil, the concrete may require steam cleaning prior to crushing (see Section 7.4.4.10).

7.2 Identification of General Response Actions

Based on the RAOs described in Section 5.2, the General Response Actions (GRAs) that may be appropriate for the affected materials at the Ascon site were identified. The identified GRAs, as listed in Table 7-1, include:

1. No action
2. Limited action
3. Containment (or isolation)
4. Removal and *ex situ* treatment and/or disposal or recycling (source removal)
5. *In situ* treatment

The GRAs are discussed in the following sections:

7.2.1 No Action

A no action response provides a baseline assessment for comparison with other GRAs that consist of greater levels of response. A no action response may be considered appropriate when the associated risk is within the acceptable range, or when an alternative response

action may cause a greater environmental or health danger than the no-action response itself. An evaluation of the no action response is required by the NCP as part of the FS process.

7.2.2 Limited Action

Limited action refers to means of limiting or eliminating potential exposures to the COCs present at a contaminated site by relatively simple physical barriers or institutional controls.

7.2.3 Containment

Containment actions are designed to reduce the infiltration of surface water into ground water and to prevent the migration of COCs to other media. In addition, containment action may eliminate certain exposure pathways (e.g., ingestion and dermal contact) for human and biological receptors. Therefore, the results of containment actions at a site may include reduction of risks to human health and the environment and maintenance of ground water quality.

7.2.4 Removal with *Ex Situ* Treatment and/or Disposal or Recycling

Affected materials at the site can be removed by excavation or pumping. The removed affected materials can be (1) treated and re-used on-site, (2) treated on-site and transported off-site for disposal or recycling, or (3) transported off-site for treatment, disposal, or recycling. Removal and treatment/disposal (collectively referred to as source removal) can reduce or eliminate the COCs present in the affected materials as well as the exposure pathways for human and other biological receptors. Therefore, GRAs involving source removal are consistent with the site's RAOs of reducing risks to human health and the environment, and mitigating the on-site sources of additional ground water degradation.

Removal can be achieved by excavation or pumping using conventional construction equipment. Removal requires ambient air monitoring, implementation of dust, odor, and volatile emission control measures, and storm water management, as described in Sections 10.3.4 through 10.3.6. Removal will also need proper on-site or off-site treatment and/or disposal or recycling of the removed material.

7.2.5 *In Situ* Treatment

In situ treatment provides for immobilization, destruction, breakdown, or removal of contaminants from the medium without removing the medium itself.

7.3 Identification of Remedial Technologies

The identified remedial technologies for the affected materials at the Ascon site are listed in Table 7-1 and discussed in the following sections.

7.3.1 No Action

There are no remedial technologies required for this option. As required by the NCP, the no action response was retained for detailed analysis to serve as a baseline case against which other technologies can be compared.

7.3.2 Limited Action

Limited action includes the implementation and maintenance of controls designed to inhibit or limit access to a contaminated area or medium. A limited action can include physical barriers (e.g., reconstruction of a berm and fencing at the site) or institutional controls (e.g., deed restrictions), as listed in Table 7-1. Berm reconstruction followed by the reconstruction of the current fencing may prevent direct contact with the affected materials at the site and run-off from the site. Deed restrictions may prevent direct contact with the affected soils at the site.

7.3.3 Horizontal and Vertical Barriers

Potential containment technologies may include horizontal barriers (cap) and vertical barriers (e.g., slurry wall), as listed in Table 7-1. These technologies are discussed in the following paragraphs.

7.3.3.1 Horizontal Barriers

A horizontal barrier consists of incorporation of a low permeability cover or cap system to minimize infiltration by diverting surface water.

7.3.3.2 Vertical Barriers

As noted in Section 4.7.2, there is no subsurface, vertical barrier to prevent horizontal, subsurface movement of waste from the site. Although subsurface migration is very slow, it will continue as long as the wastes remain on-site unless a subsurface, vertical barrier is constructed or the wastes are removed. If the wastes are not to be removed, the future widening of Magnolia Street and Hamilton Avenue, as discussed in Section 2.3, would be an additional factor that would necessitate the construction of a vertical barrier at the eastern and northern sides of the site.

Vertical cutoff walls are traditionally considered for environmental applications as circumferential barriers (Evans, 1993). In this system, an inboard subsurface drainage system and cover over the contaminated area are typically used in conjunction with the circumferential vertical cutoff wall to protect off-site ground water. An added objective of the vertical cutoff walls at the Ascon site is to protect the off-site soil from the lateral spreading of the waste at the site. Traditionally low permeability vertical cutoff walls are constructed by installing a vertical barrier into the subsurface.

7.3.4 *Ex Situ* Remedial Technologies

Potential *ex situ* remedial technologies considered included the following (see Table 7-1):

- Stabilization
- Biological treatment
- Thermal treatment
- Physical separation of contaminants from the medium, e.g., by soil washing
- Soil vapor extraction
- Solvent extraction
- Wastewater treatment
- Debris crushing
- Off-site disposal or recycling (which could include one or more of the above technologies)

Process options associated with these *ex situ* remedial technologies are discussed in Section 7.4.4.

7.3.5 *In Situ* Remedial Technologies

Potential *in situ* remedial technologies considered included the following (see Table 7-1):

- Stabilization
- Biological treatment
- Immobilization of contaminants, e.g., by vitrification
- Physical separation of contaminants from the medium, e.g., by soil flushing
- Soil vapor extraction

The process options associated with these *ex situ* remedial technologies are discussed in Section 7.4.5.

7.4 Identification of Process Options

The process options for the affected materials at the Ascon site are listed in Table 7-1 and discussed in the following sections. Screening of the process options is described in Section 7.5.

7.4.1 No Action

There are no process options required for the no action response. The no action response was retained for detailed analysis to serve as a baseline case, as mandated by NCP.

7.4.2 Limited Action

Limited action options could include physical barriers (e.g., reconstruction of berm and fence at the site) or institutional controls (e.g., deed restrictions). An additional action that may be required by the agencies in relation to the limited action response is performing long-term ground water monitoring. Note that a fence currently exists around the site perimeter and public access to the site is restricted. Also, a partial, possibly not engineered, berm currently surrounds the site. However, because of the occurrence of COC-containing seeps through the existing berm, as described in Section 3.7, it would be required that the existing berm be replaced with a new, engineered berm around the entire site. The reconstruction of the new berm would necessitate the reconstruction of the current fence, and may need to take into consideration future road widening along Magnolia Street and Hamilton Avenue.

7.4.3 Horizontal and Vertical Barrier Process Options

The process options considered for the horizontal and vertical barriers are discussed in the following sections.

7.4.3.1 Horizontal Barrier Process Options

A horizontal barrier consists of incorporation of a low permeability cover or cap system to minimize infiltration by diverting surface water. One of the primary functions of the cover (cap) system is to minimize percolation of precipitation through the cap and into the underlying waste. The three general types of cap systems considered by ENVIRON were clay caps, geomembrane caps, and multi-layer caps. When constructing a new permanent containment facility, a horizontal barrier is placed beneath the waste to prevent vertical migration. At Ascon, without complete excavation, a horizontal barrier cannot be placed beneath the waste.

Clay Cap. This cap system consists of a compacted layer of imported clay. The clay layer is typically underlain by a gas collection layer and a foundation layer and is overlain by a coarse sand or gravel drainage layer and a protective vegetative cover.

Geomembrane Cap. In this type of cap system the clay layer is replaced with a geomembrane sheet (see Appendix C for a definition of geomembrane).

Multi-layer Cap. In this type of cap system the clay layer is replaced with a composite layer consisting of geomembrane over a geosynthetic clay liner (GCL). The GCLs typically consist of thin unhydrated bentonite mats encased in a geotextile or adhered to a geomembrane (Sharma and Lewis, 1994).

The main advantages and disadvantages of the various cap options considered by ENVIRON are presented in Table C-1 of Appendix C.

7.4.3.2 Vertical Barrier Process Options

The types of vertical barriers depend on the method of construction. The two types of vertical barriers considered by ENVIRON were slurry trench cutoff walls and grout curtains.

Slurry Trench Cutoff Walls. Slurry trenching is a means of placing a low permeability, subsurface, cutoff or wall, near a polluting waste source in order to capture or contain contamination (USEPA, 1984). For pollution migration control, most vertical barriers are constructed by the slurry wall technique (Sharma and Lewis, 1994). The slurry wall can be formed by excavating a trench along the entire perimeter of the site and using a bentonite/water slurry to support the trench wall. The trench should then be backfilled with materials having a lower permeability than the surrounding soil, typically trench soil mixed with bentonite clay and water. Soil-bentonite and cement-bentonite slurry trench cutoff walls are the two most prevalent construction techniques. The difference between these two techniques is that in the cement-bentonite technique the slurry used in the excavation process is not replaced with a low permeability material as in the soil-bentonite technique (Evans, 1993). Bentonite, a montmorillonitic clay, swells in the presence of water, imparting a viscous nature to the fluid and aiding in the formation of a filter cake along the walls of the trench.

The main advantages and disadvantages of soil-bentonite cutoff walls are the following:

Advantages

- Process offers the widest range of waste compatibilities.
- Because of the high elasticity of the material, the wall is able to deform, which reduces cracking.
- Installation cost is relatively low.

Disadvantages

- Process implementation requires employment of specialty contractors.

ENVIRON retained the soil-bentonite slurry trench cutoff wall option for further evaluation.

Grout Curtains. Grout curtains are vertical cutoff walls constructed using one of the traditional grouting techniques. Grouting is the process of injecting under pressure a slurry or grout of cement, bitumen, or clay into the voids of the soil to solidify them. When the grout sets, the soil transforms into a solid mass (curtain), reducing water flow through the curtain. Grouting is generally effective in gravelly soils, and coarse and medium-coarse sand. It is less effective in fine-particled soil, and is ineffective in clayey soil (Jumikis, 1971). Therefore, the grout curtain was not retained for further evaluation.

7.4.4 *Ex Situ* Treatment, Disposal, and Recycling Process Options

"Treatment" is broadly defined by the USEPA (1982) as "any method of modifying the chemical, biological, and/or physical character or composition of a waste." *Ex situ* treatment may include on-site or off-site treatment of the removed materials. Table 7-1 lists the *ex situ* processes that ENVIRON considered potentially applicable to the Ascon site. These processes are discussed in the following sections.

7.4.4.1 *Ex Situ* Stabilization by Asphalt Recycling

This process option involves using the soil from the site to make commercial grade asphalt. California law states that recyclable materials which are representative of a non-RCRA hazardous waste (i.e., a waste not identified as a hazardous waste by the federal government, but regulated by the state of California) are subject to full regulation if the materials are used in a manner constituting disposal or used to produce products that are applied to the land as a fertilizer, soil amendment,

agricultural mineral, or an auxiliary soil and plant substance.¹⁸ "Use constituting disposal" refers to materials that are applied to or placed on the land, without mixing with other materials, or after mixing with other materials.¹⁹

Regulations have been developed by the DTSC that provide for non-RCRA hazardous wastes to be eligible for the statutory exemptions and exclusions for recyclable materials (found in HSC Section 25143.2). More specifically, the regulations specify conditions under which a recyclable material placed on the land (i.e., used in a manner constituting disposal) would not be subject to the statutory "use constituting disposal" prohibition²⁰.

The main advantages and disadvantages of stabilization by asphalt recycling are the following:

Advantages

- Process is simple, can use readily available equipment.
- Relatively high throughput rates compared to other process options.

Disadvantages

- Effectiveness of process in treating certain metals will need to be demonstrated.
- Satisfying the requirement that the end product must meet the requirements for commercial grades can generally be difficult.

In this process, the affected materials are mixed with aggregates and emulsion.

7.4.4.2 *Ex Situ* Stabilization

The USEPA (1986b) has defined the term "stabilization" as "those techniques that reduce the hazard potential of a waste by converting the contaminants into their least soluble, mobile, or toxic form," and "solidification" as "techniques that encapsulate the waste in a monolithic solid of high structural integrity." Stabilization generally involves one or more physicochemical reactions that transform the contaminant to a

¹⁸ Ref. Section 25143.2(e)(2) of the California Health and Safety Code (HSC).

¹⁹ Ref. Section 66261.2(d)(1), Title 22, California Code of Regulations (22 CCR).

²⁰ Ref. in HSC Section 25143.2(e)(2).

less mobile or less toxic form, whereas solidification may or may not involve a chemical reaction. The terms "fixation" and "immobilization" are sometimes used to refer to stabilization and solidification technologies. In this FS, the term "stabilization" has been used to broadly represent these process options. Stabilization can be applied as either an *in situ* or *ex situ* process.

According to the Department of Health Services (DHS, now the DTSC) and the California Base Closure Environmental Committee (CBCEC), often the stabilized product has structural strength sufficient to help protect itself from future fracturing, thereby preventing increased leaching (DHS, 1991; CBCEC, 1994).

The following are the main advantages and disadvantages of stabilization, as noted by DHS (1991) and CBCEC (1994):

Advantages

- Process is simple, can use readily available equipment.
- Relatively high throughput rates compared to other process options.
- Generally less expensive than land disposal for wastestreams with total metals concentration less than the TMLC.

Disadvantages

- Process is only effective at reducing soluble metals.
- May be ineffective in treating certain metals (e.g., copper, mercury, and arsenic).
- Once the waste has been stabilized it may still require special handling.

The process options available for *ex situ* stabilization include blending with Portland cement, lime, kiln dust, flyash, and/or silicates. These processes are generally effective in immobilizing metal contaminants and reducing the mobility of organic contaminants, including petroleum hydrocarbons. High cost and/or low availability were two reasons for not considering the use of other stabilization agents such as silicates, organophilic clays, and polysilicates as stabilization options. Also, polysilicates might not be effective for oily soils. Although emulsifiers and silica would be effective in reducing COC concentrations in the affected soils and drilling muds, ENVIRON judged that the relatively high cost of implementation is not warranted.

7.4.4.3 *Ex Situ* Bioremediation

Bioremediation involves supplying oxygen and nutrients to microorganisms present in soil to enhance biological degradation of COCs that are organic in nature. Like stabilization, biological treatment may be applied as an *in situ* or *ex situ* process.

According to the DHS (1991) and CBCEC (1994), the main advantages and disadvantages of bioremediation are the following:

Advantages

- Applicable to mixtures of contaminants.
- On-site native organisms can frequently be used.
- Large scale systems possible and inexpensive.
- Relatively low capital and operation and maintenance (O&M) costs compared to other technologies.
- Operation requires minimal operator training and attention.

Disadvantages

- Biological treatment does not generally reduce total metal concentrations.
- Potential degradation products not known for many contaminants. Degradation products could be more toxic than parent compounds.
- Lower solubility contaminants are more difficult to biodegrade.
- High moisture content (e.g., 75 percent) affects availability of oxygen for bacterial activity.
- Requires treatability tests.

Ex situ bioremediation options that include supplied nutrients and oxygen are favored because they would likely be more effective than bioremediation options without supplied nutrients and oxygen in treating recalcitrant high molecular weight organic compounds, such as those compounds typically associated with crude oil. The *ex situ* bioremediation options considered were biopile, bioreactor, and land treatment. In these processes, soils are treated aboveground. The primary advantages of these *ex situ* options is the degree of control that can be exerted over the processes being used to manipulate the system (Reisinger, 1995). Land treatment or landfarming has been used successfully as a treatment and disposal technique in the petroleum industry for decades (Bleckmann et al., 1995). As practiced, biopile treatment is an *ex situ* process whereby soils can be mixed with amendments, then ventilated to promote

biological oxidation of hydrocarbon contaminants. As noted by Hayes et al. (1995), the biopile process has been considered ideal for treating soils with volatile constituents because of optional use of a vacuum aeration system that allows such compounds to be collected and treated, if necessary. Similarly, controlled moisture conditions prevent soluble constituents from leaching.

7.4.4.4 *Ex Situ* Thermal Desorption

Thermal energy is used to destroy contaminants or to separate contaminants from the waste. Low temperature thermal desorption uses relatively low amounts of energy to physically separate organic contamination from wastes at temperatures of 300°F to 700°F. In this process soils and drilling muds containing organic contaminants are heated, driving off the water and organic contaminants and producing a dry solid containing trace amounts of the organic residues. The volatilized contaminants are not oxidized and require a condenser, an afterburner, or must be captured on a carbon bed (DHS, 1991).

Thermal desorption can be applied either on-site in a transportable treatment unit (TTU) or off-site at a fixed facility. Thermal TTUs have been demonstrated to have the capacity to treat large volumes of material.

According to DHS (1991) and CBCEC (1994), the main advantages and disadvantages of thermal desorption are the following:

Advantages

- Process is simple, can use readily available equipment.
- Energy costs are generally lower than high temperature systems, such as the rotary kiln, as discussed in Section 7.4.4.5.
- The system can potentially handle large volumes of waste.

Disadvantages

- Some systems are effective only in treating VOCs.
- Application of this process to the soils and muds at the Ascon site, which are too wet, may require a centrifuge to pre-dry these materials.
- The system may require subsequent treatment of the removed vapors.

7.4.4.5 *Ex Situ* Incineration

High temperature thermal technologies use combustion temperatures in excess of 1,650°F to destroy or detoxify hazardous wastes. As described by DHS (1991) and CBCEC (1994), rotary kiln is a high temperature incinerator that consists of a slightly inclined, refractory-lined cylinder to control combustion of organic wastes under excess air conditions (i.e., the final oxygen concentration is significantly greater than zero). Wastes are introduced into the high end of the kiln and passed through the combustion zone as the kiln slowly rotates. Rotation of the combustion chamber enhances heat transfer to the wastes, improving the degree of burnout of the solids. Retention times can vary from several minutes to an hour or more. Wastes are substantially oxidized to gases and inert ash within the combustion zone. Ash is removed at the lower end of the kiln. Flue gases are normally passed through a secondary combustion chamber and then through conventional air pollution control units, which limit the emissions of particulate matter, acid gases and oxides of nitrogen.

The rotary kiln can incinerate a wide variety of liquid, sludge, and solid wastes independently or in combination. However, operation of the kiln near the ash fusion temperature can cause melting and agglomeration of inorganic salts (DHS, 991).

According to DHS (1991) and CBCEC (1994), the main advantages and disadvantages of incineration are the following:

Advantages

- Process can incinerate a wide variety of liquid, sludge, and solid waste.
- The system can achieve high destruction and removal efficiency.

Disadvantages

- Process does not treat wastes that contain heavy metals.
- Application of the process to the wet soils and muds at the Ascon site will affect handling and feeding, and will reduce throughput rates with major impact on process energy requirements.

7.4.4.6 *Ex Situ* Soil Washing

The soil washing process extracts contaminants from soil or sludge matrices using an aqueous-based washing fluid. The process can treat both metals and hydrocarbons simultaneously. The washing fluid may be composed of water, water/chelating

agents, water/surfactants, acids, or bases, depending on the contaminant to be removed (DHS, 1991) and CBCEC (1994).

All soil washing techniques involve four basic components (1) materials handling; (2) soil contaminant extraction; (3) water clarification; and (4) water purification.

According to the DHS (1991) and CBCEC (1994), the main advantages and disadvantages of soil washing are the following:

Advantages

- Potential for removal and recovery of metal contaminants from wastes versus stabilization processes where total metals remain in the treated wastes.
- Can clean a wide range of organic and inorganic contaminants from coarse-grained soils.
- Equipment used for technology is readily constructed and easily operated.

Disadvantages

- Excessive volume of leaching medium required for contaminants with unfavorable separation coefficients.
- Complex waste mixtures (e.g., metals with organics) make washing fluid formulations difficult.
- Fine soil particles (e.g., silts, clays) are difficult to remove from washing fluid. An additional treatment step, such as settlement of these particles in settling tanks, may be required to remove fines from the process wastewater.
- Additional treatment steps may be required to address hazardous levels of washing fluid remaining in the treated residuals. It is important that the washing fluid have good treatability characteristics.
- Removal of organics adsorbed onto clay sized particles may prove difficult.

According to Trost (1993), the biggest problem with application of soil washing processes is the diversity of contaminants combined with the diversity of soil types. Soil washing of organic and inorganic contaminants usually requires combining two operational processes. Organic contaminant removal may be accomplished by froth flotation or a solvent extraction process; however, inorganic contaminant removal will

require a counter current decantation circuit or other leach circuit having acids/bases/chelating agents to solubilize the metals followed by precipitation of the removed metals or a significant volume of finer rejection. The need for two operational processes will therefore increase the cost, especially for projects with less than 10,000 tons of contaminated soil. Regarding the diversity of soil types, Trost notes that the soil wash system should be capable of handling relatively high percentages of fine-grained fractions. Trost also notes that prudent application of any soil washing system will generally be in four stages: bench-scale testing; process engineering; field pilot testing; and full-scale operation.

7.4.4.7 *Ex Situ* Soil Vapor Extraction

In this process a vacuum is applied to the excavated soils placed in a covered aboveground stockpile to volatilize and remove contaminants. A soil vapor extraction system at the Ascon site could be effective in removing BTEX compounds and VOCs that exhibit significant volatility at ambient soil temperatures. The main advantages and disadvantages of soil vapor extraction are the following:

Advantages

- Process is relatively well understood, and the remediation system can be designed and constructed with relative ease.
- Process is quite effective in removal of VOCs.
- Relatively high capital cost and O&M costs compared to *ex situ* bioremediation.
- Operation requires relatively extensive training and attention.

Disadvantages

- SVOCs and metals will not be removed by this process.

7.4.4.8 *Ex Situ* Solvent Extraction

In the solvent extraction process, solvents are used to extract oil from solids. Physical properties of the solvent are such that it can be easily separated from the contaminants for reuse in the process (DHS, 1991).

The main advantages and disadvantages of solvent extraction are the following:

Advantages

- Process can result in recovery of oil from the waste.
- Low air emissions can be achieved.

Disadvantages

- Contaminants with vapor pressures similar to that of the process solvent require additional steps to remove.
- Waste must be compatible with the process solvent.
- Organic compounds are difficult to remove from clay soils.

Wastewater, if generated as part of the operations associated with this process, can be treated in an on-site wastewater treatment system, as described in Section 7.4.4.9.

7.4.4.9 Surface Water Treatment

As described in Section 6.4.2, surface water collects in the five current lagoons during the rainy months of the year. J&W estimated that the maximum volume of surface water in the five lagoons is approximately 5.6 million gallons (see Table 6-3).

Depending on the time of the year, the volume of surface water can vary highly.

As noted in Section 6.4.3, ENVIRON assumed that because of evaporation, and the fact that this extreme volume is generally not reached, a more probable volume is one half of the maximum volume or approximately 2.8 million gallons.

ENVIRON compared the results of the surface water samples from the lagoons, as presented in Tables 3-19 and 3-19a, with the typical requirements for discharge into storm drains or sanitary sewers. ENVIRON concluded that hydrocarbon compounds, with the highest concentrations of 19 mg/l of TPH and 500 µg/l of benzene, had the most significant concentrations of contaminants in the surface water. Also, depending on the discharge requirements issued, fluoride, with a maximum concentration of 6.8 mg/l may be significant.

ENVIRON considered two options for the treatment of the surface water, on-site and off-site. In the on-site option, a 6-inch high-lift pump will be used for the removal of the surface water from the lagoons. The collected surface water will be treated at the site using standard wastewater engineering techniques, which potentially include chemical, biological, or physical systems for water treatment. All or a portion of the treated surface water could be used at the site for dust control, and soil compaction. Any unused portion of the treated water could be discharged into a surface water

body or a publicly-owned treatment works (POTW). An NPDES permit will need to be obtained for discharge into the Huntington Beach Channel.

Discharge options are available for the treated surface water. One option is to discharge the treated water into the Huntington Beach Channel under an NPDES permit from the Water Board. The second option is to discharge the treated water into the sanitary sewer system operated by the County Sanitations Districts of Orange County. ENVIRON was advised by the Districts that the Flood Control Channel should be considered first. The Districts would consider an application for accepting the treated water only after the Water Board has declined issuing an NPDES permit.

As noted in Section 2.6.1, the Huntington Beach Channel borders the Ascon site at the southwest corner (Figures 1-2 and 2-3). The channel merges with the Talbert Flood Control Channel between Magnolia and Brookhurst Streets, and the merged channels enter the Talbert Marsh Wetlands and flow eventually into the Pacific Ocean. ENVIRON confirmed with the County of Orange Environmental Management Agency that it owns the Huntington Beach Channel. ENVIRON also confirmed with the Water Board that an NPDES permit will be required to discharge the treated surface water into this channel.

In the off-site wastewater treatment process, the surface water will be pumped from the lagoons directly into vacuum trucks and can then be taken to one or more of several commercially available recycling facilities in Los Angeles. The main advantage of this option is that it does not need any design or treatability investigation. However, because of the potentially large volume of surface water, the process would require a large number of vacuum trucks that would generate added traffic over a long period of time (approximately 1,200 vacuum truck loads would be required). Furthermore, because of the large volume, one single facility may not be able to accept all the waste within a reasonable period of time. Finally, the cost of this option is significantly higher than the on-site treatment option²¹. Because of these disadvantages, ENVIRON did not consider the off-site option any further.

²¹ Quoted costs are approximately \$0.25 per gallon, which includes removing the surface water by vacuum trucks, transportation, and recycling of the surface water at an off-site facility. Excessive solids contents would increase this rate.

Advantages

- Process requires only standard engineering design and construction.
- Permitting and agency approval will be relatively simple.

Disadvantages

- Significantly more expensive than on-site treatment followed by discharge into Huntington Beach Channel.

7.4.4.10 Concrete Debris Crushing

The options for addressing the concrete debris include on-site and off-site crushing. The on-site crushing options consist of bringing concrete crushers to the site for crushing the concrete debris. The concrete materials should be first steam cleaned, if necessary, and then separated into 2-ft. plus and 2-ft. minus sizes. The 2-ft. size is the maximum size for rubble to be processed through a crusher. The 2-ft. plus size materials can be sized to 2-ft. minus size using an excavator with pulverizer and hammer attachments. The wastewater from the steam cleaning operations can be treated at the site in the wastewater treatment system. The steel reinforcing from the concrete should be removed either directly by the crusher during crushing, or by laborers using torch-cutting equipment. Steel can be stockpiled and then removed as scrap salvage. The concrete sized to 2-ft. minus size can then be loaded with a track loader into trucks and hauled to an on-site rubble stockpile for crushing into a ¾-inch base product. The generated crushed concrete can be used on-site as backfill. Dust should be controlled at all times by water spraying using a water hose and/or a water truck.

Advantages

- Process is simple, can use readily available equipment.
- The generated crushed concrete can be used on-site as backfill.

Disadvantages

- Dust generated during the crushing operations will need to be controlled.

7.4.4.11 Off-site Disposal or Recycling

In this FS report, the term "disposal" refers to landfill disposal, and the term "recycling" in this context refers to use of the site soil for landfill cover material or similar uses. The land disposal restrictions require hazardous wastes, e.g., soil

containing hexavalent chromium, to be treated to meet either RCRA or non-RCRA treatment standards prior to land disposal.

ENVIRON considered off-site disposal to be too expensive to be considered for the bulk of the drilling muds and affected soils at the site. However, this option is potentially attractive for relatively small volumes of waste at the site.

ENVIRON reviewed several potentially available remediation process options for the tarry styrene waste, but was not able to collect the necessary level of detail and testing data to demonstrate that these options have been or could be successfully applied to the styrene tar waste at the Ascon site. ENVIRON identified excavation and off-site disposal as the only option that can be presented in this FS with sufficient detail for the styrene waste.

Advantages

- Process is simple, can use readily available equipment.
- Process is effective in removing wastes from the site.

Disadvantages

- Land disposal restrictions may apply to the disposal of affected soils and drilling muds from the Ascon site for some types of contaminants.
- This option generates significant dust and truck traffic.
- There is potential liability with disposal at off-site locations.

7.4.5 In Situ Treatment Process Options

In situ treatment generally refers to the reduction in mobility of the COCs or reduction of COC concentrations by either natural or enhanced degradation processes, without prior removal of the contaminated media.

In considering *in situ* treatment options for the Ascon site, it should be noted that the site was a landfill, and *in situ* processes are not generally applicable to landfills. Additional considerations for using *in situ* treatment at the Ascon site are as follows (DHS, 1991):

- Extensive subsurface characterization is required, which is difficult and costly.
- Monitoring of *in situ* processes and verification of remediation are difficult.

- Complete remediation cannot be guaranteed.
- There is potential for migration of contaminant(s) and nutrients to the underlying soils and ground water.

Table 7-1 lists the *in situ* processes that ENVIRON considered potentially applicable to the Ascon site. The processes are discussed in the following sections.

7.4.5.1 *In Situ* Cement Stabilization

This process is similar to *ex situ* stabilization; however, it is an unproven process for *in situ* treatment. Fine-grained soils can be problematic for uniform mixing of cement and increased volatilization is likely to occur during curing.

7.4.5.2 *In Situ* Bioremediation

This process is similar to *ex situ* biological treatment. However, *in situ* bioremediation requires a medium (ground water reinjection) to introduce nutrients and microorganisms into the subsurface. It also requires hydraulic control by ground water pumping to prevent migration of contaminant plume.

7.4.5.3 *In Situ* Vitrification

Vitrification is a thermal treatment process by which contaminated soils are converted into chemically inert and stable glass and crystalline materials. Field application requires the insertion of large electrodes into contaminated soils containing significant silicate material and the generation of high temperature (1,500 to 2,000° C) by passing electric current through the electrodes (Nyer, et al., 1996). The process requires special equipment and trained personnel.

Soil moisture is an important factor in the operation of the *in situ* vitrification process. More power and time are required to evaporate the water as soil moisture increases. Engineered barriers may be required to vitrify soils below the water table.

According to the DHS (1991), the main advantages and disadvantages of vitrification are the following:

Advantages

- Applicable to organic and inorganic contaminants.

- Generally applicable to treatment of the unsaturated zone. Also applicable to saturated zone contamination if the hydraulic conductivity is sufficiently low.

Disadvantage

- Presence of an aquifer with high hydraulic conductivity (e.g., soil permeability $> 1 \times 10^{-4}$ cm/sec) limits economic feasibility due to excessive energy required to drive off water.

Radio frequency (RF) heating is a process whereby the contaminated soil is heated to remove volatile chemicals by exciting an array of excitor electrodes, placed either vertically in the ground or horizontally along the ground surface, with a radio frequency generator (Nyer, et al., 1996). The RF process has limited field experience and, therefore, was not considered for the Ascon site.

7.4.5.4 *In Situ* Soil Flushing

The use of soil flushing to remove soil contaminants involves the elutriation of organic and/or inorganic constituents from soil for recovery and treatment. The site is flooded with the appropriate washing solution, and the elutriate is collected in a series of shallow wellpoints or subsurface drains (Chambers et al., 1991). The elutriate is then treated and/or recycled back into the site.

The system includes extraction wells drilled in the contaminated soils zone, reinjection wells up-gradient of the contaminated area and a wastewater treatment system. Following treatment, the ground water is reinjected up-gradient of the extraction wells and leaches through the contaminated soils. The leachate is then collected, treated and reinjected back into the system, creating a closed loop system. This process is applicable only to sites with favorable hydrogeology where flushed contaminants and soil flushing fluids can be contained and recaptured.

Flushing solutions may include water, acidic aqueous solutions (sulfuric, hydrochloric, nitric, phosphoric, and carbonic acid), basic solutions (e.g., sodium hydroxide), and surfactants (e.g., alkylbenzene sulfonate). Soil heterogeneities may cause inconsistent flushing, fine-grained soils limit flushing fluid recovery, and liquid treatment is required (Chambers et al., 1991). Furthermore, because flushed contaminants and soil flushing fluids cannot be contained and recaptured, a potential exists for solvents to transport contaminants away from the site into uncontaminated areas.

7.4.5.5 *In Situ* Soil Vapor Extraction

This process is similar to *ex situ* soil vapor extraction except that the VOCs are removed directly from the *in situ* soils. Hot air may also be used to enhance volatilization of contaminants. SVOCs and metals are not removed by this process.

7.5 Preliminary Screening Based on Effectiveness and Implementability

ENVIRON performed a screening of the identified process options listed in Table 7-1. A preliminary evaluation of these processes was performed based on the following two criteria:

- Effectiveness
- Implementability

Effectiveness was evaluated based on the proven reliability of the process option to achieve the RAOs. The implementability evaluation focused on the availability of the technology and ease of permitting. Cost comparisons were made among the process options within a single technology type.

In terms of effectiveness, a process option was categorized as effective (meets the RAOs for the Ascon site), or not effective (cannot meet the RAOs). In terms of implementability, a process was categorized as implementable (commercially available and used at other sites), difficult to implement (used at other sites but there are anticipated problems regarding capacity, site characteristics, or permitting), potentially implementable (demonstrated by bench-scale or pilot-scale testing but not implemented at other sites), or not implementable (not demonstrated for treatment of the COCs or incompatible with the medium).

The results of the screening based on effectiveness and implementability are presented in Table 7-2. This table describes the reasons for retaining (or rejecting) each process. The no action response is presented in Table 7-2 as a baseline process option, as required by the NCP. The process options for limited action response did not meet the RAOs and were therefore rejected.

The process options were screened for containment process. Regarding horizontal barrier process options (clay, geomembrane, and multi-layer caps), Daniel and Koerner (1993) considered several possible options, including single, two-component, and three-component combinations of compacted clay liner, geomembrane, and GCL. They concluded that "Compacted clay liners (CCLs) are *not* the general answer for the hydraulic barrier in the closure of a solid waste landfill or site remediation project. With desiccation from above the liner in arid or seasonally dry climates, drying of the liner from beneath, and cracking from differential settlement, CCLs *cannot* be expected to maintain their

initially low hydraulic conductivity." Therefore, ENVIRON rejected the clay cap option, as shown in Table 7-2. Regarding the vertical barrier process options, as shown in Table 7-2 grout curtain was rejected because of the difficulty to implement this option.

Several of the *ex situ* process options listed in Table 7-1 were rejected, as shown in Table 7-2. Biological and thermal treatment options were rejected because they are not effective on metals. Soil washing was rejected because it is not effective on fine-grained materials. Finally, vapor extraction was rejected because it is not effective on metals or SVOCs or heavy, long-chain petroleum hydrocarbons such as those present at the Ascon site.

In situ cement stabilization, bioremediation, and soil flushing were eliminated because these processes cannot be successfully implemented in fine-grained soils with low permeabilities. These processes rely on the ability to (1) mix cement with the subsurface soils and drilling muds, (2) circulate nutrients to the subsurface soils (*ex situ* options are expected to achieve more favorable results than *in situ* options because the soils would be excavated and placed at the ground surface with the addition of nutrients and placement of air and nutrient supply piping), or (3) provide consistent flushing to the subsurface soils. Vitrification was eliminated because the high soil moisture content of the affected soils and drilling muds at the site will require more power and time to evaporate the water, and engineered barriers may be required to vitrify soils below the water table. Finally, *in situ* soil vapor extraction was eliminated because it cannot treat metals and SVOCs.

Upon completion of the preliminary screening of the process options performed based on effectiveness and implementability, Table 7-2 was prepared, which shows a summary of the results of the screening. The following process options were retained:

- No action (retained as baseline)
- Containment
- *Ex situ* options, which include
 - on-site asphalt recycling
 - on-site stabilization
 - on-site solvent extraction
 - on-site wastewater treatment
 - on-site debris crushing
 - Excavation and off-site disposal

Three on-site processes, asphalt recycling, stabilization, and solvent extraction were selected for conducting treatability studies. As discussed in Section 8.0, in 1998 CND conducted treatability studies to investigate the effectiveness of these three process options. CND supplemented these studies in 1999 by conducting pilot tests on the stabilization and solvent extraction processes, which are described in Section 9.0. Table 7-3 presents a summary of these treatability studies and pilot tests.

As described in Section 10.1, ENVIRON then performed an additional screening of the retained process options based on relative cost. The processes that survived this additional screening evaluation were assembled into remedial alternatives and subjected to detailed evaluation as part of selecting a preferred alternative for the Ascon site, as described in Sections 10.2 through 10.6.

8.0 TREATABILITY STUDIES

8.1 Introduction

Based on the results of the screening of the process options performed by ENVIRON, in 1998 and 1999 CND conducted treatability studies and pilot tests, respectively, for the *ex situ* stabilization and solvent extraction process options, as summarized in Table 7-3. This section describes a summary of the treatability studies; a summary of the pilot tests is described in Section 9.0. The objectives of the treatability studies were to (1) provide sufficient data to allow the treatment process to be developed and evaluated to support the remedial design of a selected alternative, and (2) reduce cost and performance uncertainties for the treatment process to acceptable levels so that a remedy could be selected (USEPA, 1988).

On March 30, 1998, QST, under contract with CND, completed a Treatability Study Workplan that was approved by the DTSC. The following two treatment technologies were considered applicable to treat the different waste materials in the current and former lagoons at the Ascon site:

- *Ex situ* stabilization for the affected soils and drilling muds from Lagoons 1 through 5, the former lagoons, pits (excluding Pit F), and perimeter berm
- *Ex situ* solvent extraction for the liquid hydrocarbon waste from Lagoons 1 and 2

For the stabilization treatability study, CND selected two different companies, Environmental Recycling, LLC (ER) of Prairieville, Louisiana, and Global Solutions, Inc. (Global) of Signal Hill, California. These companies use different stabilization methodologies, and CND wanted to evaluate and compare the resultant product characteristics. For the solvent extraction study, ER was selected to perform this testing together with NW Technologies (NW Tech) of Houston, Texas. J&W performed quality assurance and quality control (QA/QC) and documentation services during the stabilization and solvent treatability studies performed by ER and NW Tech on the solid and/or liquid wastes from Lagoons 1, 2, and 4. J&W's stabilization and *ex situ* solvent extraction treatability studies report is included as Enclosure A of Volume II of this FS report (J&W Engineering, 1998a). QST performed oversight and documentation for the stabilization treatability study by Global. Global/QST stabilization treatability study report is included as Enclosure B of Volume II of this FS report (Global/QST, 1998).

ER performed its treatability study for an *ex situ*, on-site stabilization technology that uses an asphaltic emulsion, crushed concrete and proprietary additives/agents to stabilize mobile COCs within a waste matrix. The resulting treated matrix is no longer considered a waste as it has been recycled into a commercial product that may be used as an effective substitute for conventional commercial products. The recycled products are ASB, engineered backfill, and/or embankment material, which possess engineering characteristics that meet industry and client specifications. The leachability testing results of the COCs are considered to be protective of residential ground water/drinking water quality. Specific design mixes of proprietary agents and additives can be introduced to meet various performance specifications of the stabilized product's end use. This proven technology is currently being used at various Superfund and industrial sites to treat soil and sludges containing petroleum hydrocarbons, VOCs, SVOCs, and metals. The structural character of the stabilized material from the ER process allows it to be used for a wide variety of uses.

ER and NW Tech performed a treatability study for an *ex situ*, on-site solvent extraction technology that uses a biosurfactant/solvent to mix with the Ascon site oily sludges and sediments from Lagoons 1 and 2 to extract and concentrate petroleum hydrocarbons. The technology is carried out with a hot water extraction process coupled with various surfactants and physical processes to decrease the viscosity of the oils and extract oils from sludges and sediments during the separation step. The extracted or concentrated oils are subsequently collected for commercial reuse or appropriate off-site disposal. Depending on characterization data, the recovered oil may be delivered to a refinery, recycler, or fuel blender. The washed solids may then be characterized for reuse on-site, or further stabilization/recycling or disposal off-site. The process is designed as a self-contained system with internal recycling of the leaching solutions.

Global, with assistance from QST, conducted a stabilization treatability study on wastes collected from the Ascon site. Global has developed a stabilization/fixation technology that has been used on wastes similar to those found at the Ascon site. This process has been used on material ranging from low level hydrocarbon contaminated soils to tank bottom sludges consisting of hydrocarbon-saturated solids from refineries and oilfield production facilities. The resulting end product is soil-like and can be recycled. The structural character of the stabilized material from Global's process makes it suitable for a wide variety of uses such as a fill material, landfill cap material, structural fill in private developments or State of California Department of Transportation (Caltrans) projects, or as a commercial road sub-grade material.

Global's process uses proprietary chemical agents and additives to stabilize mobile constituents of concern within a waste matrix. The process can be either completed in a pugmill mixer where contaminated soil and sludges are mixed with the chemical reagents and additives or on the ground

surface in 12-inch lifts where the wastes are blended with the appropriate chemical reagents and additives.

The main results of the ER/J&W's and Global/QST's studies are summarized in Sections 8.2 and 8.3, respectively.

8.2 Summary of Results of ER and NW Tech Solvent Extraction Treatability Studies

J&W (1998a) reported the results of treatability studies performed on the Ascon site's semi-solid material (Lagoons 1 and 2), solid material (Lagoon 4), and the "Taffy" or tarry material (Lagoon 2). As documented by J&W, during March through May 1998, ER performed a stabilization treatability study on five mix designs of the semi-solid and solid materials. These mix ratios were intended to mimic likely on-site conditions as impacted Ascon site materials were mixed with aggregate/stabilizers and emulsion. The initial Ascon site waste characterization screening, observations, and analytical data did not identify any waste characteristics inhibitory to the ER's stabilization process of generating an ASB commercial product from the waste materials. Initial screening/observations performed during the treatability study indicated favorable results for all five mix designs, and the resultant laboratory analytical data confirmed their success. Based on field observations, the mix designs did not produce any swelling or volume increase greater than the added components. The best mix design that passed all the chemical and geotechnical analysis requirements of the treatability study Data Quality Objectives (DQOs) was 40% affected solid/semi-solid material from the site, 58% aggregate/stabilizers (available at the site), and 2% emulsion. It should be noted that in the subsequent pilot testing that was conducted in 1999, different mix designs and additives were used, as discussed in Section 9.0.

Comparing the analytical results for the best mix design before and after treatment, before treatment the results included total petroleum hydrocarbon concentrations of 3,520 ppm in the C₆-C₁₀ hydrocarbon range, and 22,700 ppm in the C₁₀-C₂₈ hydrocarbon range. After treatment, when analyzed for leachability, these concentrations were less than 5 ppm.

In general, for all mix designs, the leachable concentrations of VOCs, SVOCs, and metals in the final product were substantially less than the original total concentrations. In the best mix design, many of these compounds were reduced to non-detectable concentrations in the leachate collected from the final product.

J&W also documented ER's second phase of the treatability study program, the *ex situ* solvent extraction treatability study, which was performed by NW Tech in May 1998 in its facility in Houston, Texas. Two different biosurfactant/solvents were screened: Biosolve and Natures Way

"HS". The Biosolve initial screening failed, and it was dropped from further consideration. Utilizing the "HS" biosurfactant/solvent, three separate runs (or mix designs) were developed for treatability testing (two from the tarry material from Lagoon 2 and one from the semi-solid material from Lagoon 1). The initial screening, observations, and characterization data of these materials prior to *ex situ* solvent extraction treatability study commencement did not identify any waste characteristics inhibitory to the extraction process. The extraction process included a hot water and biosurfactant/solvent wash to decrease viscosity (increase pumpability) and provide oil separation for potential oil recovery. Initial screening/observations performed during this treatability study indicated favorable oil/water separation and increased pumpability for the two runs of the tarry material. The results of the run of the semi-solid material exhibited no separation potential and were precluded from confirmatory analyses. The best mix design that passed all the analysis requirements of the treatability study DQOs was recirculated with a Magnetic Frequency Component, which favorably decreased the product's viscosity and exhibited superior separation qualities.

Based on the results of the treatability tests, J&W (1998a) presented the following conclusions:

- The two technologies of generating ASB material and *ex situ* solvent extraction appear to be beneficial for use in combination at the Ascon site to provide a turn-key, full-scale remedial program.
- These two technologies appear to promote an efficient and cost effective alternative with possible value-added commercial products as an end result.

8.3 Summary of Results of Global's Stabilization Treatability Study

The TPH results for the pre-treatment wastes were 3,400 mg/kg for Lagoon 3; 22,000 mg/kg for Lagoon 4; and 490 mg/kg for the soils. The Lagoons 3 and 4 materials were blended in equal proportions and soil was added to the mix at 10 to 40% by weight. The estimated average TPH concentration for the blended mix for this testing was 9,000 mg/kg. After treatment, three mixes that exhibited good geotechnical properties were sampled for chemical analysis. The TCLP-TPH extraction results for the three samples ranged from 15 to 58 mg/l.

All TCLP-VOC, and TCLP-SVOC concentrations were reported below the method detection limits and below the regulatory limits.

A review of the total metal results on the pre-treatment samples showed that only lead in the sample from Lagoon 3 exceeded either ten times the STLC or twenty times the TCLP values. The post-treatment lead leachability results were reported as non-detect (at a detection limit of 0.16 mg/l),

which is thirty times below the hazardous waste level of 5.0 mg/l. All the metal solubility results were exceptionally low when compared to regulatory limits. Virtually, all TCLP results were at or below detection limits for the 22 CCR metals.

Based on the results of the treatability study and past actual field application of its technology, Global believed that this stabilization process could be taken directly from the treatability test phase to full scale operations without any additional field testing. However, as odor and VOC emissions may be a concern during full scale operations, Global/QST (1998) recommended that a pilot project using full scale equipment be conducted to determine the odor and volatile vapor impacts of the process when performed at the Ascon site so that appropriate mitigative actions can be designed and implemented.

Based on the results of the treatability tests, Global and QST presented the following conclusions:

- Three different additives produced an acceptable recyclable product meeting the compression, strength and environmental criteria.
- The recyclable product can be produced with a mixture of 70% by weight waste (lagoon material) and 30% by weight on-site collected soil, then blended with additives (7 to 10% by weight) using either the land application or pug mill mixing processes.

Based on the conclusions of the treatability study, Global/QST made the following recommendations:

- Prior to full-scale implementation, design and complete a pilot scale study using field equipment at the site to collect information and data that would be used for final design of the stabilization remedial system. This pilot scale study should focus on odor and VOC emissions during the excavation, treatment, and curing processes.
- The pilot scale study should be used to develop full scale design and cost estimates.
- Various mix designs resulting in acceptable products in sufficient quantities should be prepared to assist in marketing of the recyclable product.

9.0 FIELD PILOT TESTS

9.1 Introduction

Based on the successful results of the treatability studies performed on the Ascon site wastes, as described in Section 8.0, two field pilot tests were performed to evaluate the remedial design of the selected remedial alternatives. This section describes the field pilot testing procedures and provides summaries of the results. The pilot tests were conducted on selected treatment options that were retained at the conclusion of the FS process described in Section 7.0. Table 7-3 presents a summary of the treatability studies and pilot tests conducted.

The objectives of the pilot tests were to simulate full-scale remedial activities. Pilot Test No. 1, which was conducted in March 1999, was designed to simulate full-scale waste excavation and handling and field solvent extraction while evaluating the associated emissions. Pilot Test No. 2, which was conducted in October 1999, was designed to simulate full-scale stabilization. The scopes of work for the two tests were as follows:

- Pilot Test No. 1 – Conduct waste excavation, handling, and mixing from current Lagoons 2, 3 and 4 and solvent extraction of liquid wastes extracted from Lagoon 2 while performing emissions testing.
- Pilot Test No. 2 – Utilize a surface mixing stabilization process with wastes excavated from Lagoons 3 and 4, a Former Lagoon Area, and impacted site soils with various additives to generate and test a reusable product from five mix designs. Conduct simultaneous emissions testing.

J&W prepared a work plan that described the procedures to be implemented during each of the two pilot tests. These work plans were approved by DTSC.

CND selected Global to implement the construction aspects of the two pilot tests. J&W was selected to perform the regulatory negotiations, engineering, air monitoring, QA/QC, and documentation services during the pilot tests. J&W's solvent extraction and field emissions pilot testing report (Pilot Test No. 1) is included as Enclosure C of Volume II of this FS report (J&W, 1999a), and J&W's stabilization pilot testing report (Pilot Test No. 2) is included as Enclosure D

of Volume II of this FS report (J&W, 1999b). The implemented procedures and main results presented in these two reports are summarized in the following sections

9.2 Pilot Test No. 1 – Field Solvent Extraction and Emissions Testing

Pilot Test No. 1 was performed by Global for excavation and materials handling and Industrial Innovations, Inc. (3i) of Stockton, California for solvent extraction and was documented by J&W. The pilot test was designed to evaluate excavation, waste handling, waste mixing, and *ex situ* solvent extraction testing in the presence of a thorough air monitoring/sampling program.

9.2.1 Excavation and Material Handling Procedures

J&W's main site preparation activities included the following:

- Erection and baseline monitoring of on-site weather station.
- Erection of site personnel decontamination areas.
- Selection of air sampling locations (see Figure 9-1).
- Calibration of all field monitoring and air sampling equipment.
- Preparation and completion of the required on-site documentation forms.

The purpose of the excavation process in each excavation area (1, 2, 3) was to mimic material handling and mixing procedures as they would be implemented during full-scale remedial efforts. These three specific excavation areas were selected as they represent the three distinct and representative waste types found at the site. In addition, the described corresponding air samples were strategically located and collected to evaluate the air emissions associated with each excavation activity (see Figure 9-1). The excavation process, as implemented during Pilot Test No. 1, is described below:

- Each Soils Laydown Area was lined with a 20-mil flexible membrane liner (FML), a soil berm was erected around the area for runoff control, and a barrier fence was erected for personnel security.
- J&W performed project documentation and air monitoring/sampling services during the excavation activities (see Tables 9-1 and 9-2).

- Global mixed the drilling muds and soils to simulate material handling processes.
- Global sprayed the vapor suppressing USEPA-approved dust control agent (Simple Green) onto the excavated area and the soils laydown area to control any fugitive dust and to evaluate Simple Green's vapor suppressant capabilities.
- J&W performed air monitoring and/or sampling directly downwind to document the comparative air emission levels.

9.2.2 *Ex Situ* Solvent Extraction Testing Procedures

In order to evaluate the ability to separate and extract reusable oil from the liquid, tarry wastes contained within Lagoons 1 and 2 at the Ascon site, J&W contracted with 3i to perform the *ex situ* solvent extraction testing on these wastes during Pilot Test No. 1. These procedures were conducted simultaneously with the air monitored/sampled excavation and materials handling/mixing procedures to closely mimic full-scale remedial actions at the site, and generate data regarding the associated VOC air emissions.

The purpose of the solvent extraction process was to evaluate how effectively, efficiently, and successfully, 3i could extract the oily liquid wastes from Lagoon 2, considered representative of Lagoons 1 and 2, and separate the oily waste into water, sediment, and reusable oil.

The solvent extraction process, as implemented during Pilot Test No. 1, is described below:

- A front tank, known as the SuperMacs, was filled to a specific level (2,700 gallons) with the selected liquifier (water). Nature's Way (bioremediating cleaner) was added at a rate of 1 % (or 27 gallons) per minute. Then this solution was preheated using the heat exchanger set to a preset temperature (160° F).
- A sump was excavated adjacent to Lagoon 2 and properly prepared to accommodate the Sludge Bug, a pumping device.

- The sludge (initially sampled and characterized) of an area of Lagoon 2, adjacent to the edge, was collected using an excavating machine and deposited inside the sump.
- The sludge collection process then began. The operator maneuvered the Sludge Bug to collect the sludge. Hot water was injected into the Sludge Bug progressive cavity pump at a pressure of approximately 100 pounds per square inch of mercury (psi Hg) by the SuperMacs pressure wash pump, and the diluted sludge was then pumped via hose to the SuperMacs.
- The diluted sludge was "scalped" through a vibro-mechanical separator fitted with a 0.5-inch orifice screen. Rocks, wood, and other large debris were then removed from the influent and deposited into a container.
- The diluted-scalped sludge was pumped into the SuperMacs front tank for initial oil and solid separation and then transferred to the Phaser 600 to separate the solid, liquid, and oily phases by centrifugal action. Periodically, centrate samples (oil and water with some sediment) were collected for further analysis (see Table 9-3).

Prior to, during, and upon completion of the field emissions testing, J&W performed a round of air monitoring at the 24 site points.

9.2.3 Data Validation Procedures for Pilot Test No. 1 DQOs

In order to evaluate the performance and validation of the field emissions pilot test, J&W implemented an analytical data management program to ensure the defensibility and application of the pilot test results through the use of Data Quality Objectives (DQOs). The DQOs are qualitative and quantitative statements and goals specifying the quality of the data required to justify decisions concerning remedy implementation. The DQOs were established as minimum treatment objectives for this site-specific pilot test and took into consideration the following, in accordance with Standard Operating Procedures (SOPs) from USEPA (1992):

- Precision
- Accuracy
- Representativeness
- Completeness

- Comparability

Based upon these general DQO objectives, certain site and project-specific DQOs were developed and approved by DTSC for the field emissions pilot test, including:

- The selected analytical testing methods must incorporate all the COPCs likely to be present during the pilot test.
- DTSC had suggested the inclusion of hexavalent chromium as a COPC. However, previous site sampling as well as special recent sampling and analysis of lagoon materials in late February 1999 indicated that hexavalent chromium was not present at concentrations of concern. Therefore, hexavalent chromium was dropped as a COPC.
- On-site weather conditions must be within acceptable ranges (i.e. no rain, no elevated wind speeds, representative temperatures, etc.) and be periodically monitored during the testing procedures for potential field sampling/monitoring adjustments.
- On-site noise levels must be monitored during the testing procedures and maintained below 85 decibels (db) within the site work zones (unless hearing protection worn as in the Exclusion Zone [EZ]) and 65 db on the site perimeter (in accordance with local noise ordinances).
- On-site light levels must be periodically monitored and maintained above 3 foot-candles (FC) at all times during testing procedures.
- Continuous air monitoring must be performed during the testing procedures at each work face, along the site perimeter and at the 24 site monitoring points to document compliance with the DTSC-approved real-time action levels.
- Periodic air samples must be collected and analyzed at an approved state-certified laboratory for the parameters of concern in accordance with the DTSC-approved air sampling plan.
- Representative solvent extraction samples must be collected and analyzed prior to and during the solvent extraction testing procedures to document compliance with

the SCAQMD permit and obtaining a successful extraction process.

- The analytical data generated from the air sampling must be in compliance with regulatory action and exposure levels approved for the site and within recommended QA/QC analytical testing limits.

9.3 Pilot Test No. 2 – Field Stabilization Testing

Pilot Test No. 2 was also performed by Global and documented by J&W. The pilot test was designed to evaluate the various site wastes that could be excavated and stabilized using a surface mixing stabilization process (rather than a more costly and material handling-intensive pug mill process), to produce a reusable product (engineered backfill) without the emission of elevated VOC concentrations. The low levels of VOCs, detected during Pilot Test 1, permitted the application of surface mixing during Pilot Test 2.

The purpose of the stabilization pilot study was to mimic material excavation, handling, and mixing procedures as they would be implemented during full-scale remedial efforts. The DTSC-approved air sampling scheme was designed to evaluate potential air emissions associated with the surface mixing stabilization technology. To evaluate the impact to native surface soil conditions caused by the pilot study activities, a soil sampling scheme was implemented with five-point composited samples (see Table 9-6).

9.3.1 Surface Mixing Stabilization Testing Procedures

J&W's main site preparation activities included the following:

- Construction of on-site weather station.
- Preparation and posting of site personnel Decon Areas, material handling/staging/mixing/laydown areas, and viewing areas.
- Selection of air sampling locations (see Figure 9-2).
- Calibration of field monitoring and air sampling equipment.
- Performing pre-pilot study soil sampling in the operational areas designated at the site (Waste Stockpile Staging Area, Material Surface Mixing Area, and Product Stockpile Staging Area).

- Preparation and completion of the required on-site documentation forms.

Each morning J&W implemented the air monitoring and sampling plan. The fresh excavation areas, the operational areas, and the site perimeter were monitored on a continuous basis to document if the DTSC-approved action levels were exceeded (see Table 9-4).

On each given day, only the material needed for the individual mix design was excavated and processed, in order for air sampling efforts to reflect emissions potentially generated from site materials from the specific mix design. A long-reach trackhoe excavator was used to remove sufficient amounts of materials from Lagoon 4 (E1), Lagoon 3 (E2), and a former lagoon area (E3) west of Lagoon 3 throughout the week (see Figure 9-2).

From the Waste Stockpile Area, specified amounts of each material were loaded by a front-end loader into the dump trucks and transported to the Surface Mixing Area, which was adjacent to and west of the Waste Stockpile Area. The bulk of the mix materials (Lagoon 3 and 4 materials, the former lagoon area, site soils, and gravel) were uniformly spread to an approximate 12-inch depth using a bulldozer. When prescribed by the Mix Design, a dry Portland cement powder or a special dry mix (30% Portland cement + 70% cement kiln dust [PCKD]) was applied by a specialized J.A. James Construction Company hooded spreader truck. Once these mix design components were placed in the Mixing Area and distributed evenly, J.A. James Construction Company utilized a hooded CAT Reclaimer/Pulverizer to thoroughly mix the materials. Approximately 200 cubic yards of each of Mix Designs #1, #2 and #4, and approximately 100 cubic yards of each of Mix Designs #3 and #5, were produced during the stabilization pilot study. The production volume was reduced because of equipment cost/scheduling constraints and the need to conform to the SCAQMD permit requirements. Five mix designs were evaluated, and consisted of the materials listed in Table 9-A, as follows:

Table 9-A. Stabilization Pilot Test Mix Designs

Mix Design No.	Lagoon 3 Wastes (cy)	Lagoon 4 Wastes (cy)	Former Lagoon Area (cy)	Site Soils (cy)	Gravel (cy)	Portland Cement (cy)	PCKD (cy)	Total Mix Volume (cy)
1	-	176	-	-	-	24	-	200
2	-	70	80	20	20	-	10	200
3	35	-	35	10	15	-	5	100
4	-	80	80	20	-	-	20	200
5	40	-	40	10	-	-	10	100
Total	75	326	235	60	35	24	45	800

After several passes through the material by the Reclaimer/Pulverizer and the addition of water (rarely necessary due to the very moist nature of excavated wastes), each mix design was allowed to cure undisturbed for 2 hours in the Mixing Area, then reloaded and transported via dump trucks to segregated stockpiles south of the Mixing Area. To evaluate the effectiveness of the stabilization process, the following sampling scheme was implemented (these sampling locations are shown on Figure 9-2, and the data are summarized in Table 9-6):

- Collection of representative samples of the three different combinations of site waste materials (Lagoons 3 and 4 materials, the former lagoon area, and site soils) used as bases for the five mix designs.
- Collection of representative samples of each mix design products after the initial 2-hour curing time.
- Physical testing of the five mix designs after 8 days of curing time in the physical laboratory.

9.3.2 Generated Product Handling Procedures

To evaluate the quality and reuse/resale value of the products generated during the stabilization pilot test, each of the five mix designs were allowed to cure, and then the products were cored and analyzed for various chemical and physical properties (see Table 9-6). Upon completion of the surface mixing and initial curing, approximately 30 to 40

cy of each mix design were transported separately via dump trucks to a final laydown area east of Lagoons 1 and 2 (see Figure 9-2). Each mix design was spread out in an approximately 8-inch lift and compacted by a rubber-tired backhoe. The mix designs were laid down next to one another for visual and physical comparison over time.

If, at any point during these described excavation and stabilization pilot study procedures, elevated air monitoring measurements or nuisance dust/odors were observed, the on-going activities would have been immediately ceased until such time as regulatory approval was provided to resume field activities, the air emission source was mitigated and/or the air monitoring data supported the resumption of field activities.

Certain mitigative measures were designed into the Pilot Study and on hand if needed. These mitigative measures were largely not needed but served as emergency and contingency options. These measures included:

- Emergency field signals (used periodically).
- Simple Green dust suppressant/odor suppressant (used for minor dust control).
- ATF vapor emission control foams (not required or used).
- Emergency plastic sheeting cut and staged to cover soil laydown areas or excavations (not required or used).

Upon completion of the stabilization pilot testing, the following procedures were implemented:

- All affected soils placed and mixed in the Surface Mixing Area were backfilled into the lagoons, and each Excavation Area and Stockpiling Area (which was not covered by remaining product) was backfilled and restored as near as possible to its original condition.
- The excavation and mixing equipment was decontaminated (along with the excavator) in the Equipment Decon Area (Figure 9-2).
- All unused mix design component residuals generated during the stabilization testing process were deposited back into their respective locations.

9.3.3 Data Validation Procedures for Pilot Test No. 2 DQOs

In order to evaluate the performance and validation of the stabilization pilot test, J&W implemented an analytical data management program similar to that utilized during the field emissions pilot test. This program was designed to ensure the defensibility and application of the stabilization pilot test results through the use of site-specific DQOs. The DQOs were based upon the general DQOs stated above in Section 9.2.3 and established as minimum treatment objectives for this site-specific pilot test in accordance with SOPs from USEPA (1992).

Based on a review of the known COPCs at the site identified during the RI, the findings of J&W's treatability study performed in May 1998, the results of Pilot Test No. 1, and the desired results of the stabilization pilot testing study, the following site-specific DQOs were established in order to consider this pilot study as successful:

- On-site Health & Safety Assessment -- Air Monitoring and Sampling for evaluation of worker safety during the Pilot Test and future worker's safety during Full-Scale Remediation (see Tables 9-1 and 9-2 for pilot testing action levels).
- Evaluation of community safety during the pilot test with consideration given to full-scale remediation.
- Evaluation of the effectiveness of various mitigative measures to reduce VOC emissions during the pilot test.
- The achievement of various specific treatment goals for the stabilized product generated by various mix designs tested in terms of physical and chemical performance criteria such as:

TCLP VOCs (Toxicity Characteristic [TC] Values and Ascon-derived and DTSC-approved Action Levels [ALs] and Exposure Levels [ELs]).

TCLP SVOCs (TC Values and ALs / ELs).

TCLP metals (TC Values and ALs / ELs).

TCLP TPH (<1,000 ppm).

Optimum moisture content (12% to 30%).

Maximum dry density (85 to 120 pounds per cubic foot [pcf]).

Marshall Stability (> 750 lbs.).

Unconfined compressive strength (> 35 psi).

- Analytical detection limits should be lower than the treatment goals or performance criteria.
- Resultant QA/QC and project data should be within quantification limits and be legally and scientifically defensible.

9.4 Summary of Results of Field Solvent Extraction and Emissions Testing

Based on the findings and results of the field activities and laboratory analyses associated with the field emissions testing pilot study performed in March 1999, as described above, J&W presented the following conclusions:

- The pilot test procedures were implemented in accordance with the Ascon Field Emissions Testing Work and Health and Safety Plan, as amended and approved by DTSC.
- All of the COPCs established in the baseline health risk assessment for the Ascon site (ESF, 1997b) were analyzed.
- The weather data were within all SCAQMD permit requirements.
- On-site noise levels were below the regulatory guidelines for each area of the site.
- On-site light levels were above the DTSC regulatory lower limit for *on-site* working conditions.
- Continuous air monitoring was performed at each work face, along the perimeter and periodically at the 24 site-monitoring points, and at no time were the DTSC-approved air monitoring action levels exceeded.

- Fourteen air samples were collected and analyzed. The resultant data generated were compared to the DTSC-approved actual COPC analytical action levels (if available), Agency for Toxic Substance and Disease Registry (ATSDR) Minimal Risk Levels (MRLs, if available), and/or the PRGs exposure levels (which are allowable ambient air lifetime exposure concentrations). The comparison of these most conservative action/exposure concentrations to the resultant field emissions testing data showed that no on-site worker was exposed or off-site release generated above these exposure levels.
- Representative solvent extraction influent and effluent samples were collected and analyzed, and no emissions were generated during the process in excess of the various SCAQMD operating permits.
- Based on the results that were obtained, excavation and on-site handling of the various lagoon wastes were feasible from both a physical and community safety point of view.
- The solvent extraction system did achieve successful separation of the sludge into water, oil, and sediment; however, the separated waste streams appear to still require additional effort to yield cleaner separated products. The water exhibited elevated concentrations of petroleum due to the fact that it was continuously recirculated during the pilot test. Cleaner water is anticipated during full-scale remediation with further processing, centrifuging, and additional on-site treatment (i.e. settling tank). Likewise, the sediment would likely be further cleaned and utilized in the on-site stabilization process during full-scale remediation. The characteristics of the resultant oil (although possibly masked by not driving off enough entrained moisture) appear to suggest that resale is unlikely; however, its reuse at no cost to the overall remediation project should be explored and evaluated.
- Based on an overall evaluation of the project compared to the established DQOs, the field emissions pilot study was highly successful and met or exceeded all project goals and requirements.

J&W recommended that modification of the 3i Solvent Extraction Process to generate more fully separated process products should be further investigated.

9.5 Summary of Results of Stabilization Testing

Based on the findings and results of the field activities and laboratory analyses associated with the stabilization testing pilot study performed in October 1999, as described above, J&W presented the following conclusions:

- The pilot test procedures were implemented in accordance with the Ascon Stabilization Pilot Testing Work and Health and Safety Plan, as amended and approved by DTSC.
- The pilot test schedule was adhered to, and all field work related to the stabilization testing procedures was completed in four days.
- All of the DQOs were evaluated against the resultant pilot study data with the following conclusions:
 - All of the COPCs were analyzed, and the analytical method detection limits were lower than all action levels, treatment goals, and performance criteria.
 - The weather data were within all SCAQMD permit requirements.
 - On-site noise levels were below the regulatory guidelines for each area of the site.
 - On-site light levels were above the DTSC regulatory lower limit for *on-site* working conditions.
 - Continuous air monitoring was performed in each work area, stockpile area, along the perimeter and periodically at the 24 site monitoring points, and at no time were the DTSC-approved air monitoring action levels exceeded.
 - Thirty-seven air samples were collected and analyzed. The resultant data generated were compared to the DTSC-approved actual COPC analytical action levels (if available), Agency for Toxic Substance and Disease Registry (ATSDR) Minimal Risk Levels (MRLs, if available), and/or the PRGs exposure levels (which are allowable ambient air lifetime exposure concentrations). The comparison of these most conservative action/exposure concentrations to the resultant stabilization pilot testing data showed that no on-site worker was exposed or off-site release generated above these conservative and approved exposure levels.

- The generated stabilized product from the five mix designs passed all the chemical and physical DQO evaluation criteria.
- The QA/QC program instituted and implemented during the stabilization pilot study included procedures for appropriate sampling practices and evaluation of sampling and laboratory handling/analytical methods integrity.
- Based on an overall evaluation of the project compared to the established DQOs, the stabilization pilot study was highly successful and met and exceeded all project goals and requirements.

10.0 ADDITIONAL SCREENING OF PROCESS OPTIONS AND DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

10.1 Additional Screening of Process Options Based on Relative Cost

As described in Section 7.5, the remediation technology process options that were identified for the wastes at Ascon were screened for effectiveness and implementability resulting in several process options being rejected, as shown in Table 7-2. Of those processes that were retained, many, such as wastewater treatment and cap construction are proven "off-the-shelf" technologies or practices and do not require treatability testing or pilot testing. The stabilization process options and solvent extraction, however, were deemed necessary to undergo bench scale treatability testing (Section 8.0), followed by on-site pilot testing (Section 9.0) to demonstrate that these processes were effective on specific wastes at Ascon. These tests confirmed the effectiveness and implementability of cement stabilization and solvent extraction on the particular wastes present at Ascon. The tests further confirmed that these processes could be conducted safely and efficiently and provided a basis for estimating their costs. All of the technologies retained on the basis of effectiveness, implementability and treatability/pilot testing were subsequently screened based on relative cost.

In terms of relative cost, a process was categorized as high cost, moderate cost, or low cost relative to other process options within the same technology type. The result of this additional screening is presented in Table 10-1. The multi-layer cap and asphalt recycling were rejected because their costs with respect to comparative process options were considerably higher. Again the no action response was retained as a baseline process option, as required by the NCP.

Following the cost evaluation, the following process options were finally retained for use at the Ascon site:

- No action (retained as baseline)
- Containment options, which include
 - Horizontal barriers (monolithic cap and geomembrane cap)
 - Vertical barriers (slurry wall and containment berm)
- *Ex situ* options, which include

- On-site stabilization
- On-site solvent extraction
- On-site wastewater treatment
- On-site debris crushing
- Excavation and off-site disposal

10.2 Development of Remedial Alternatives

Based on the results of the treatability studies and the pilot tests described in Sections 8.0 and 9.0, respectively, the remedial technologies and process options retained from the screening process presented in Sections 7.0 and 10.1 were assembled into remedial alternatives for the Ascon site. These remedial alternatives include Alternative 2 (containment) and Alternative 3 (source removal). As required by NCP, Alternative 1 (no action) was retained for evaluation as a baseline for comparison with other remedial alternatives.

Detailed descriptions of Alternatives 1 through 3 are presented in Section 10.3. Detailed evaluation of these alternatives are included in Section 10.4. Estimated costs of the alternatives are discussed in Section 10.5. A comparative evaluation of the alternatives is presented in Section 10.6.

10.3 Detailed Descriptions of the Alternatives

10.3.1 Alternative 1 - No Action

Under the no action alternative, no action will be taken to contain, treat, or remove the affected soils present at the site. The existing fencing at the site would restrict direct contact with affected soils by trespassers.

Based on the results of the BHRA for the site, ESE concluded that the waste lagoons and Pit F, in their current conditions, i.e., under a no action scenario, represent a health risk to off-site residents, off-site workers, trespassers, and hypothetical on-site residents. In addition, ESE noted that the presence of open waste lagoons and solid waste piles at the site make it a health threat to the trespassers who may frequent the site.

The Ascon site is located within an area that is designated as having high susceptibility to liquefaction-related ground failure during significant seismic events. If soil liquefaction occurs as a result of seismic activity, slope failure of the existing perimeter berm, and disintegration of the underlying clay layer could occur, allowing the release of waste material to the surrounding areas and deeper into the subsurface.

Although the no action alternative does not reduce risk at the site, a detailed evaluation of the alternative was performed, as required by NCP (see Section 10.4).

10.3.2 Alternative 2 - Containment

This alternative involves the containment of the affected soils by the construction of a cap system, a slurry trench cutoff wall and a containment berm as described in Appendix C. The cap will minimize the vertical infiltration of surface water, the cutoff wall will minimize horizontal, subsurface movement of waste from the site and the containment berm will provide permanent lateral support for the aboveground wastes.

Alternative 2 is designed to minimize the mobility and transport of contaminants through air, water, and ingestion pathways. This alternative, with drainage and gas emissions controls, can isolate the waste, diminishing the potential for direct human contact with the COCs. Surface water infiltration can be mitigated, thereby reducing the potential for mobilization of constituents in the affected soils above ground water. Stabilization of low strength sludges will be required to increase their strength and consolidation characteristics to provide adequate foundation for cap construction and ensure long-term performance. The cap components should undergo routine inspection and maintenance to ensure the long-term effectiveness of the containment features.

The area identified for containment of the Ascon site is the entire 38 acres of the site less the area located within the right-of-ways of the lanes proposed to be added to Hamilton Avenue and Magnolia Street. Because the waste at the site was placed upon the original native ground surface and built up over time, the majority of the waste is above ground. The existing perimeter berms are cracked, degraded, and located in future street right-of-ways along Magnolia Street and Hamilton Avenue. A new perimeter containment berm is needed for long-term containment of the on-site waste above ground. For the wastes that are now located below street grade and are in contact with ground water, a slurry trench cutoff wall will be constructed to physically contain the wastes and minimize lateral migration of wastes dissolved or carried in ground water. Alternatively, all the sludge in the lagoons and former lagoons could be excavated, stabilized and backfilled, eliminating the need for the slurry trench cutoff wall. This would also minimize further ground water impact from the waste being left in place.

The specific major measures required for the implementation of the containment alternative at the Ascon site include the following:

- Removal and off-site disposal of the old drums, tires, pipe, vegetation, and piles of wood that are scattered throughout the site.
- Excavation of construction debris and segregation into stockpiles of concrete, asphalt, bricks, rubble, and wood. Off-site disposal of the non-concrete stockpiles (approximately 54,700 tons) at a municipal landfill; crushing of the concrete stockpiles (approximately 219,300 tons) on-site and using the crushed concrete as backfill in excavated lagoon areas.
- Pumping of seasonal surface water from the five existing lagoons, if necessary (with an estimated likely average volume of 2.8 million gallons), and treating it in a wastewater treatment system to be constructed at the site.
- Treatment of the liquid hydrocarbon waste in Lagoons 1 and 2 (with an estimated total volume of approximately 40,200 cy) using on-site solvent extraction, a separation process that produces three categories of product: 1) oil; 2) soil/solids; and 3) water. Transportation of the concentrated oils to a refinery, recycler, or fuel blender, on-site placement of the recovered solids and on-site treatment of any recovered wastewater.
- Excavation of tarry styrene waste from Pit F (with an estimated total volume of approximately 1,500 cy). The excavated material will be transported to the Class I landfill in Kettleman Hills, California.
- Excavation of low strength materials from the upper portions of the lagoons (assuming about 20 percent of the drilling muds in these lagoons will be excavated with an *in situ* volume of approximately 46,900 cy). Excavation of all wastes within the areas to be occupied by future street widening and by the new containment berm (estimated at 37,000 cy *in situ*). On-site cement stabilization of the excavated materials (with an estimated *ex situ* volume of 100,700 cy) for use as structural backfill.
- Excavation of the existing perimeter berm with an estimated total *in situ* soil volume of 29,300 cy.

- Construction of a circumferential slurry trench cutoff wall (soil excavated for the construction of the slurry wall will have an estimated *ex situ* volume of 10,500 cy; the excavated soil will be used as backfill material on-site).
- Construction of a new perimeter containment berm. The berm must be sufficiently high to contain all site wastes and connect to the cap. This height is estimated to be about 13 feet above surrounding street grade.
- The excavated solid materials through shaker screens to remove larger (2-inch plus) debris and rocks.
- Filling of the excavated areas first with on-site crushed concrete, and then with soil excavated from the perimeter berm and the slurry wall locations, and on-site stabilized materials from the lagoons. Running all backfill materials through shaker screens and performing moisture conditioning.
- Construction of an underdrain collection system for the post-construction removal of fluids from the capped waste. The removed fluids will be disposed off-site, as described in Section C.2 of Appendix C.
- Construction of a cap system across the entire site, including a soil foundation layer, a landfill gas control system, a composite layer of a VFPE geomembrane over GCL, a coarse sand or gravel drainage layer, and a protective vegetative cover (see Appendix C for a conceptual design of the cap system).
- Construction of a surface water control system for managing run-off from the site.
- Implementation of site security measures, as described in Appendix C.
- Long-term (up to 30 years of) monitoring of soil gas, underdrain fluids, cap surface integrity and ground water.

Permits will be required from SCAQMD and the City of Huntington Beach for excavation and other construction activities, and from the Water Board for issues related to storm water. A waste discharge requirement permit from the Water Board for placement of treated soils may also be required. Ambient air monitoring, dust and odor control measures, and storm

water management should be implemented during all construction activities, as discussed in Sections 10.3.4, 10.3.5, and 10.3.6, respectively.

During the remedial design phase of the project, any applicable follow-up recommendations as outlined in the RI should be implemented.

In order to develop cost estimates for the containment alternative, a conceptual design was developed by ENVIRON, as presented in Appendix C. The estimated cost of implementing the containment alternative is discussed in Section 10.5. Note that although the monolithic cap has been retained through the various evaluations and screening processes, the final cap design and cost estimate are based on a geomembrane design due to the lack of an established track record of agency approvals and as-built costs for monolithic caps.

10.3.3 Alternative 3 - Source Removal

The source removal alternative was developed by assembling the process options that survived the screening process described in Section 7.0 and 10.1. ENVIRON concluded that no single technology appears to be capable of treating all the excavated materials.

The specific major measures required for the implementation of the source removal alternative at the Ascon site include the following:

- Removal and off-site disposal of the old drums, tires, pipe, vegetation, and piles of wood that are scattered throughout the site.
- Excavation of construction debris and segregation into stockpiles of concrete, asphalt, bricks, rubble, and wood. Off-site disposal of the non-concrete stockpiles (approximately 54,700 tons) at a municipal landfill; crushing of the concrete stockpiles (approximately 219,300 tons) on-site and using the crushed concrete as backfill. If oil-stained, the concrete surface will be steam washed prior to crushing.
- Pumping of seasonal surface water from the five existing lagoons, if necessary (with an estimated average volume of 2.8 million gallons), and treating it in a wastewater treatment system to be constructed at the site.
- Treatment of the liquid hydrocarbon waste in Lagoons 1 and 2 (with an estimated total volume of approximately 40,200 cy) using on-site solvent extraction, a

separation process that produces three categories of product: 1) oil; 2) soil/solids; and 3) water. Transportation of the concentrated oils to a refinery, recycler, or fuel blender, on-site stabilization of the recovered solids followed by off-site transport and on-site treatment of any recovered wastewater.

- Excavation of the tarry styrene waste from Pit F (with an estimated total volume of approximately 1,500 cy). The excavated material will be transported to the Class I landfill in Kettleman Hills, California.
- Excavation of the clean cover soil overlying the former lagoons (with an estimated *in situ* volume of approximately 157,400 cy).
- Excavation of the affected soils and drilling muds²² from all the current and former lagoons and all the pits, excluding Pit F (with an estimated *in situ* volume of approximately 88,000 cy of affected soils and approximately 524,900 cy of drilling muds, as shown in Table 6-A).
- Excavation of the perimeter berm (with an estimated total *in situ* clean soil volume of approximately 23,400 cy, and affected soil volume of approximately 5,900 cy).
- Stabilizing the affected soils and drilling muds on-site (with an estimated *ex situ* volume of approximately 735,500 cy, excluding the 2-inch plus materials). Stabilization of the affected soils and drilling muds will be performed using the process described in Section 9.0. Transporting the stabilized materials off-site for use as road base material and other similar uses (although candidate sites have been identified, prior to initiation of construction activities, actual project sites will be confirmed for accepting the stabilized materials).
- Backfilling of the excavations with on-site, clean soils (with an estimated *ex situ* volume of approximately 363,600 cy) and regrading the site.
- Importing clean soil to make up for a portion of the solid material removed from the site. For each foot of site elevation raised, assuming a 20% reduction in soil volume upon compaction, approximately 73,500 cy of imported soil would be

²² The soil cleanup action levels discussed in Section 6.3 will be used to guide in removing the affected materials.

needed. Approximately 3 feet of imported fill across the site will be needed (approximately 220,000 cy). This amount of import will provide the property with sufficient gradient for storm drainage.

- Short-term (5 years) of ground water monitoring.

As noted in Section 2.11.2, by design, the Talbert Water Injection Barrier has sacrificed water quality south of Ellis Avenue (approximately 3 miles north of the site) in efforts to preserve the larger ground water resources located inland. Therefore, it is unlikely the regulatory agencies will require a major ground water remediation effort at the Ascon site. However, the agencies have indicated objections to simply leaving site wastes in place without some type of containment or stabilization efforts.

As agreed with the DTSC, ground water will be re-evaluated following site remediation. ENVIRON assumed that short-term (up to five years) post-remediation ground water monitoring may be required at the site for Alternative 3 and longer for Alternative 2. The need for longer term ground water monitoring can be assessed based on the results of the short-term ground water monitoring.

10.3.4 Air Monitoring during Implementation of Alternative 2 or 3

Ambient air monitoring will be implemented continuously during all construction activities. The major equipment needed at the site include organic vapor analyzers (OVAs), hydrogen sulfide analyzers, and a meteorological station. There will be real-time monitoring and sampling with laboratory analysis at a frequency to be determined during construction activities. An Air Monitoring Plan will be prepared prior to the initiation of construction activities at the Ascon site.

Air monitoring measures that will be implemented at the site will include, but will not be limited to, the following:

- Erect on-site weather stations and perform baseline air monitoring.
- Select and stake on-site air monitoring points.
- Collect pre-remedial action baseline light, noise, weather, and air monitoring data.

- Select air sampling locations.
- Calibrate field monitoring and air sampling equipment.
- Perform project documentation and air monitoring/sampling services during the excavation activities.

Perform air monitoring and/or sampling directly downwind to document the comparative air emission levels.

10.3.5 Mitigation of Emissions and Odors during Implementation of Alternative 2 or 3

Constituents in the soil can potentially migrate via air dispersion as dusts (particulates) or vapors. The requirements of the SCAQMD as well as the Site Health and Safety Plan should be met to control particulates and vapors that may be released during the implementation of Alternative 2 or 3. The Site Health and Safety Plan will need to include the California Occupational Safety and Health (Cal OSHA) regulations governing air emissions monitoring for workplace safety²³. A Dust and Odor Control Plan will be prepared prior to the initiation of construction activities at the Ascon site.

Dust and odor control mitigation measures that will be implemented at the site will include, but will not be limited to, the following:

- Minimize soil disturbance/transfer.
- Minimize contaminated soil and waste exposure.
- Spray work areas, excavated materials, and dirt roads with water, as necessary, until the surface is moist, and keep in moist condition.

²³ The significant SCAQMD air monitoring rules and regulations that are potential ARARs for implementing the remedial alternative include Regulation IV rules for particulate matter generation and Regulation XI rules for VOC emissions. Significant Regulation IV rules include Rule 401 for visible emissions, Rule 402 for nuisance emissions, and Rules 403 through 405 for fugitive dust and particulate generation. Regulation XI rules (Rules 1150 and 1166) address potential emissions of VOCs during excavation, stabilization, and transportation/backfilling activities at the site.

- If, at any time during the excavation procedures, elevated nuisance dust or odors occur, cease the on-going activities immediately until the air emission source is mitigated and/or the air monitoring data support the resumption of field activities.
- Implement vapor suppression measures if a distinct odor is detected at the site boundary. These measures may include spraying of water, use of non-toxic vapor suppressant, placement and securing down of heavy plastic sheeting, or reducing of exposed working face.
- Use long-duration VOC suppressants, plastic sheeting, and/or non-VOC-containing soil during non-working hours and when high dust and odor emissions are detected.
- Brush dirt off all trucks before they leave the site.

In addition to dust and odor control, unintentional release of emissions due to accidental fire at the site should be controlled. Fire fighting equipment and foam will be kept on-site at all times and ignition sources prohibited.

10.3.6 Storm Water Management during Implementation of Alternative 2 or 3

A Storm Water Pollution Prevention Plan (SWPPP) will be prepared. The SWPPP will include procedures and activities that are required to comply with the requirements of NPDES permit and State Water Resources Control Board, as applicable. Storm water management activities will include activities to keep all portions of the work free of standing water. This may require excavating ditches to drain the storm water runoff. If necessary, the storm water collected will be passed through the water treatment system that will be constructed at the site. No storm water will be discharged from the site without verification that it meets the requirements for discharge.

10.4 Estimated Costs of the Alternatives

In order to perform a detailed evaluation of the remedial alternatives as mandated by the NCP (Section 10.5), estimated costs must be determined (NCP Criterion 7 is cost). The cost associated with the implementation of Alternative 1 (no action) is zero. Order of magnitude costs for Alternatives 2 and 3 are presented in Table 10-6, details of some of the estimated costs for Alternative 2 are presented in Table 10-7, and estimated O&M costs for Alternatives 2 and 3 are presented in Tables 10-8 and 10-9, respectively.

Items 1 through 25 of Table 10-6 are construction costs and include all the main construction tasks involved with the remediation project. Items 27 through 30 of Table 10-6 are engineering and consulting costs typically performed by an environmental consulting firm. The consulting firm typically conducts the O&M tasks listed in Tables 10-8 and 10-9. A contingency of 15% is included in the total costs of the alternatives presented in Table 10-6.

As presented in Table 10-6, the total estimated cost for the containment alternative is approximately \$26.7 million, which includes \$18.4 million for construction, \$2.5 million for oversight and miscellaneous costs, \$3.1 million for 15 percent contingency, and \$2.7 million for the present worth cost of 30 years of monitoring and O&M costs. The monitoring and O&M costs include 30 years of monitoring of ground water, surface water, and the vadose zone; and O&M of the vegetative cover, underdrain and surface drainage systems, surveyed monuments, and landfill gas.

The total estimated cost for the source removal alternative is approximately \$31.5 million, which includes \$23.5 million for construction, \$3.7 for oversight and miscellaneous costs, \$4.1 million for 15 percent contingency, and \$0.2 million for the present worth of five years of ground water monitoring.

For both Alternatives 2 and 3, the oversight costs include design, preparation of work plans (SAP, Air Monitoring Plan, Dust and Odor Control Plan, and SWPPP), construction quality control, and the analytical laboratory costs associated with the excavation, stockpiling, and verification of the removed wastes. Oversight costs also include all of the documentation and reporting required to obtain site closure.

The cost estimates presented in Tables 10-7 through 10-9 should be viewed as order-of-magnitude estimates, or more precisely the cost within a range of plus 30 percent to minus 50 percent (Rowings, 1995). The costs presented in this section were developed from the information available at the time of the estimates, and should be considered as guidance for project evaluation and preliminary budgeting purposes. The final costs for the project will depend on actual labor and material costs, actual site conditions, productivity, final project scope and schedule, competitive market conditions, and other variables.

10.5 Detailed Evaluation of the Alternatives

The NCP mandates a detailed evaluation of the remedial alternatives retained after the screening analysis. The detailed evaluation involves assessing each of the remedial alternatives against nine NCP criteria and a comparison of the relative performance of the remedial alternatives against those criteria. The nine NCP evaluation criteria are:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

An alternative must meet Criteria 1 and 2, known as "threshold criteria," in order to be recommended. Criteria 3 through 7, known as "balancing criteria," are evaluated to determine the best overall solution. After public comment, the DTSC may alter its preference on the basis of the last two "modifying" criteria. A discussion of the nine criteria follows:

1. *Overall protection of human health and the environment* determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
2. *Compliance with ARARs* evaluates whether the alternative meets state and federal environmental laws, regulations, and other requirements that pertain to the site and, if not, whether a waiver justified.
3. *Long-term effectiveness and permanence* considers the ability of an alternative to maintain protection of human health and the environment over time, and the reliability of such protection.
4. *Reduction of toxicity, mobility, or volume* evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of residual contamination remaining.
5. *Short-term effectiveness* considers how fast the alternative reaches the cleanup goal and the risks the alternative poses to workers, residents, and the environment during construction or implementation of the alternative.

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6. *Implementability* considers the technical and administrative feasibility of implementing the alternative, such as relative availability of goods and services. Also, considers if the technology has been used successfully on other similar sites.
 7. *Cost* includes estimated capital and O&M costs, as well as present worth costs.
 8. *State acceptance* considers whether the DTSC agrees with the analyses and recommendations of the RI/FS and the RAP.
 9. *Community acceptance* should be evaluated after public comment period on the RAP.

Detailed evaluation criteria for the nine NCP criteria are summarized in Table 10-2. Application of these criteria to the three alternatives are presented in Tables 10-3 through 10-5 for Alternative 1 (no action), Alternative 2 (containment), and Alternative 3 (source removal), respectively.

10.6 Comparative Evaluation of the Alternatives

Table 10-10 summarizes and presents the relative performance of Alternatives 1, 2, and 3 against the nine NCP criteria based on the information in Tables 10-3, 10-4, and 10-5. The purpose of this evaluation was to select a preferred remedial alternative that will be most suitable for the site, based on the NCP criteria.

Alternative 1 (no action) fails to meet the site RAOs, i.e. reduce human health and environmental risks, comply with ARARs and provide for future land use. As shown in Table 10-10, the No Action alternative has low scores using the nine NCP criteria.

Alternative 2 (containment) satisfactory meets the primary RAOs for protection of human health and the environment, but does not meet the secondary RAO of site reuse. The NCP criteria ratings are presented in Table 10-10. A "medium" rating was given to this alternative on Overall Protection of Human Health and the Environment, since containment is provided on the top and sides of the waste but not on the bottom. This alternative also received a "medium" rating on Long-term Effectiveness and Permanence because on going O&M services are require. In addition, the containment alternative's long-term effectiveness contains some risk of damage from future seismic events. Since containment doesn't treat or reduce toxicity, this alternative was given a "low" rating on the Reduction of Toxicity, Mobility, and Volume through Treatment criteria. Medium ratings were assigned to the State and Community Acceptance criteria since residences and a school are adjacent to the site. While this alternative does not allow for reuse of the property for multi-family residential as zoned, it does provide for the widening of Magnolia Street and Hamilton Avenue.

Alternative 3 (source removal) meets the primary RAOs for the site, meets the secondary RAO of providing for the reuse the site as anticipated by the site's current residential zoning, and meets most of the NCP criteria. As presented in Table 10-10, in meeting the NCP criteria, high ranking was given to all NCP criteria except for (1) short-term effectiveness because of air emissions during remedy implementation, which can be generally monitored and mitigated, as demonstrated during pilot testing, and (2) cost, which is estimated to be approximately 40 percent greater than the cost of implementing the containment alternative. State and community acceptance ranking is anticipated to be the highest for Alternative 3 as compared to Alternatives 1 and 2. Based on the this final rating and comparison of the alternatives, source removal (Alternative 3) is recommended for further development as the proposed alternative in the RAP.

11.0 PREFERRED ALTERNATIVE FOR THE ASCON SITE

11.1 Introduction

The FS process followed by ENVIRON consisted of several steps. The general response actions that are appropriate for addressing the remediation of the waste and waste-containing materials at the site were first identified. For each general response action, remedial technologies and their associated process options were identified. Those process options that were judged not to be applicable to the COCs at the site and specific site conditions were not included. Next, a preliminary screening of the process options was performed based on effectiveness and implementability of the processes. For the primary waste types present at the site, the process options that were retained at the conclusion of this preliminary screening evaluation were subjected to the treatability studies and field pilot testing. The process options that were not rejected based on the preliminary screening evaluation, including those that underwent treatability and pilot testing, received additional screening based on relative cost. The processes that were retained were assembled into remedial alternatives.

The alternatives developed included no action (Alternative 1), containment (Alternative 2), and source removal (Alternative 3). In Section 10.0, a detailed evaluation of these remedial alternatives was performed in accordance with NCP. Based on the results of this evaluation, Alternative 3 was considered as the most suitable remedial alternative for the Ascon site.

Alternative 3 consists of off-site disposal of the old drums, tires, pipe, vegetation, and piles of wood scattered throughout the site, crushing of the on-site concrete debris and using the crushed material as stabilization additive or backfill, removing surface water from the five existing lagoons, if necessary; removing the liquid hydrocarbon wastes from Lagoons 1 and 2; excavating the tarry styrene waste, and excavating the soils and drilling muds from the current lagoons, former lagoons, pits and the perimeter berm. After running the surface water through an on-site wastewater treatment system, it may be discharged into Huntington Beach Channel, or used on-site during construction operations. The removed styrene waste from Pit F will be transported off-site and disposed at a landfill. The removed liquid hydrocarbon waste from Lagoons 1 and 2 will be separated on-site into oil, water and soil by solvent extraction; the extracted hydrocarbons will be concentrated and transported off-site for possible commercial re-use or disposal.

On-site stabilization of the affected soils and drilling muds will be performed using the process demonstrated during Pilot Test 2. The stabilized materials will be transported off-site for use as road

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road base material and other similar uses (prior to initiation of construction activities, one or more project sites will be confirmed for accepting the stabilized materials).

During the implementation of the remedy at the site, segregation of the excavated soils and drilling muds will be performed, and the materials will be placed into affected and non-affected stockpiles. Shaker screens will be utilized and on-site (mobile) and/or off-site laboratories will be used to assist in chemically evaluating site soils to aid in the segregation process. A Sampling and Analysis Plan (SAP) will be prepared for implementation during these segregation activities, and as part of confirmation of the removal actions.

As noted previously, piles of construction debris (primarily concrete and asphalt, but also including bricks and rubble) are spread out throughout the Ascon site. It is believed that wood, brick, concrete and asphalt were placed over much of the waste material in the current and former lagoons and in the pits. Initially, the concrete portion of the construction debris will be segregated from asphalt, bricks, rubble, wood, and other debris. ENVIRON estimates that the concrete portion of the construction debris has an approximate weight of 219,300 tons, and the remaining non-concrete portion has an approximate weight of 55,000 tons. The non-concrete portion will be transported off-site and disposed of in a municipal landfill.

The remediated site will be regraded for residential redevelopment in accordance with the Specific Plan for the property. ENVIRON assumed that up to five years of ground water monitoring may be required at the site..

11.2 Conceptual Design of the Main Alternative 3 Processes

The main processes that will be included in the implementation of Alternative 3 include the following:

- Excavation of the primary waste types throughout the site
- Excavation and off-site transport of Pit F wastes with special handling procedures
- Solvent extraction of liquid hydrocarbon wastes from Lagoons 1 and 2
- Stabilization of the affected soils and drilling muds
- Wastewater treatment

Conceptual designs for these processes are presented in the following sections.

11.2.1 Waste Excavation

Primary Waste Types - Conventional construction procedures will be followed for the excavation of the materials from the current and former lagoons; Pits A through E, G, and H; and clean and affected soils. The excavated soil will be segregated into clean and affected stockpiles

One or more large track-mounted excavators with up to 10-ton capacity buckets will be used to excavate the majority of site wastes. Loaders and dump trucks will be used to transport excavated materials to staging areas. Affected soils and drilling mud will then go through the stabilization process while clean soil will be sampled and analyzed for verification of its suitability for use as on-site backfill.

During the remedial design phase of the project, applicable RI recommendations will be implemented. For example, some of the pit areas will receive special screening for chromium and acid compounds that were noted in historical records but were not identifiable during the RI. Segregation of the excavated soils and drilling muds into affected and non-affected stockpiles will be performed at the site during the implementation of the remedy using on-site (mobile) and/or off-site laboratories. A SAP will be prepared and implemented during the segregation of the affected and non-affected soils, and as part of confirmation of the removal actions²⁴.

Permits from SCAQMD for excavation and other construction activities, and from the Water Board for issues related to storm water will be required. A waste discharge requirement permit from the Water Board for placement of treated soils will also be required. Ambient air monitoring, dust and odor control measures, and storm water management should be implemented during all construction activities, as discussed in Sections 10.3.4, 10.3.5, and 10.3.6, respectively.

Pit F Wastes - A special design will be implemented for the excavation of the styrene waste from Pit F. Prior to uncovering Pit F for excavation purposes, a temporary structure with footprint dimensions of approximately 70 feet by 120 feet will be constructed over the styrene pit. The structure will consist of an aluminum frame covered with a polyvinyl chloride (PVC) fabric that will be coated with acrylic or Tedlar. Sprung Instant Structures, Inc. (Sprung) of Riverside, California, was selected to supply the temporary structure because of the frequent and successful application of its structures for similar remediation projects. Sprung is a large company with nearly 30 years of experience with these types of structures on a worldwide basis for environmental and non-environmental projects. Sprung has provided shelter systems to a large

²⁴ As described in USEPA (1988), the SAP will consist of two parts, a Quality Assurance Project Plan (QAPP), and a Field Sampling Plan (FSP).

segment of the hazardous waste industry, and have become a recognized industry standard. A Sprung Structure was used on the McColl Superfund Site in southern California, where it was concluded that emissions should be treated within an enclosure in order to provide maximum protection to the environment.

Figure 11-4 shows a typical Sprung Instant Structure that will be used to contain the emissions during the excavation of the styrene waste from Pit F. The structure will have an end sliding cargo door large enough to permit a large semi-trailer truck to enter. The structure will be able to contain the pit, excavation equipment, and the semi-trailer truck for off-site transportation of the waste. Negative air pressure will be maintained to minimize the escape of odors and vapors from the structure. Activated carbon air handling units will be connected to the end of the structure opposite the cargo door to maintain negative pressure and purify the air prior to release into the atmosphere. This system will be permitted through SCAQMD. Similar systems by Sprung have been permitted and used at several other sites within the district for similar purposes.

Prior to final design and procurement of the air treatment unit for the temporary structure, a small-scale emissions test, such as a flux chamber test, will be performed on Pit F wastes. The test will be performed after the temporary structure is erected on site and before Pit F excavation, to protect the neighborhood from odor emissions during the test. The field test will provide odor emission flux rates and chemical speciation data for final design of the air emission treatment unit.

The actual excavation of the styrene waste will be conducted using a backhoe. The excavated material will be directly placed by the backhoe into 20-cy roll-off boxes lined with "Macrosecure" containers or an equivalent product. Macrosecure containers are patented 300 mil polypropylene vaults that fit inside the roll-off box. The vault has a sealable top and is disposed of with the waste. A tarp will be placed between the pit and the containers to collect any spillage during excavation. Upon filling each container, hand tools, such as shovels and rakes, may be used to remove strings of styrene between the backhoe bucket and container prior to sealing the container.

Pits A through E, G, and H Wastes – Historic records indicate that styrene may have been dumped into Pit E. As a contingency, the temporary structure used during excavation of Pit F will be deployed if initial excavations in Pit E or any other pits, result in air emission rates that exceed predetermined emission action levels.

11.2.2 Solvent Extraction

The solvent extraction process is intended for use for the liquid petroleum hydrocarbon material present in the upper 7 to 10 feet of Lagoons 1 and 2. An estimated volume of 40,200 cubic yards of this material is present in these two lagoons and will undergo treatment by solvent extraction.

The following presents a conceptual design for the implementation of solvent extraction at the site. It is anticipated that the 3i automated lagoon-cleaning system, as shown on Figures 11-1 through 11-3, or an equivalent system will be used during the full-scale remediation project. The major steps involved in the process are as follows:

- Using an excavator, an approximately 25 feet by 25 feet area within Lagoon 1 or 2 will be cleared of debris such as wood, old visqueen, and trash.
- A specially constructed pump, enclosed within a containment box to keep debris from entering and clogging the pump, will be placed into the cleared area within the lagoon. The pump will be connected to the 3i SuperMacs tank with hoses designed to accommodate sludges. The liquid hydrocarbon material will be pumped out of the lagoon and transferred to the SuperMacs tank. A non-hazardous cleaning solution, such as "Simple Green" or "Nature's Way" together with hot water may be used as a liquifier to aid in the pumping process.
- The SuperMacs tank will be filled to a specific level (2,700 gallons) with water. A cleaning solution, such as Nature's Way, will be added at a rate of 1% (or 27 gallons) per minute. The water will be preheated using a heat exchanger set to a preset temperature (160° F).
- Sludge collection will begin by activating the pump and transferring the sludge into the SuperMacs via hose. Prior to actually entering the SuperMacs, the sludge will be "scalped" through a vibro-mechanical separator fitted with a 0.5-inch orifice screen. This process removes smaller debris that may have passed through the pump containment box. The vacuum pump of the SuperMacs will be activated to maintain a negative pressure environment within the entire system at a pressure of approximately 5. Exhaust will be discharged from the vacuum pump into the wet condenser scrubber system.
- Once the sludge enters the SuperMacs, it will be diluted with the hot water and the oil and solids separation process will begin. The mixture will pass through a weir in which the solids drop to the bottom and the floating oil flows into an adjacent vessel that is also

inside the SuperMacs unit. This vessel contains a skimmer and further separates the oily phase from the water and collects additional solids. The solids will be transferred to the Phaser 600-centrifuge unit.

- Inside the Phaser 600, centrifuges will extract additional liquid from the solids to form a "filter cake" material that drops out of the unit and can be collected in drums. The collected oil will go to a valve at which it can be collected into another vessel. The water will be recirculated and reused.
- Any excess water from the solvent extraction process will be treated using the on-site wastewater treatment system described in Section 11.2.4 and subsequently discharged under NPDES permit.

11.2.3 Stabilization

Stabilization of the affected soils and drilling muds will be performed at the site using the following conceptual design:

- Excavate the materials to be stabilized and place them in stockpile areas.
- Load specified amounts of each material by a front-end loader into the dump trucks and transport to a surface mixing area.
- Spread the material uniformly to an approximate 12-inch depth using a bulldozer.
- Apply, using a hooded spreader truck, dry Portland cement powder (similar to Mix 1 of the pilot test) ²⁵.
- Thoroughly mix the materials using a hooded CAT Reclaimer/Pulverizer.
- After several passes through the material by the Reclaimer/Pulverizer and the addition of water, if necessary, allow the mixed material to cure.

²⁵ Because the other four mixes tested during the pilot testing program produced good final results, and because all these four mixes used PCKD, as shown in Table 9-A, during the full-scale remediation project the possibility of using PCKD will be explored with the various contractors.

- Perform physical and chemical testing of the mixed materials after curing. A testing program will be developed based on the requirements of the end user of

the stabilized material. Physical tests may include optimum moisture content, maximum dry density, expansion index, Marshall Stability, unconfined compressive strength, and shear strength. Chemical tests may include leachability testing with analysis of the leachate for total petroleum hydrocarbons, certain metals and other compounds.

11.2.4 Wastewater Treatment

A wastewater treatment system will be designed to treat wastewater from the solvent extraction process and any accumulated surface water in the lagoons. Options for the treatment of the wastewater at the site include engineered systems, such as oil-water separators and sedimentation tanks. In both oil-water separators and sedimentation tanks the force of gravity can be used to separate two or more immiscible liquids with sufficiently different densities, such as oil and water. In oil-water separators, liquid/liquid separation occurs when the liquid mix settles. Thus, flow rates in continuous processes must be kept low. The waste flows into a chamber, where it is kept quiescent and permitted to settle. The floating oil is skimmed while the water flows out of the lower portion of the chamber. Acids may be used to break oil/water emulsions to enhance this process for efficient oil removal (Liu et al., 1997).

In addition to inert chemical substances, the wastewater may contain microorganisms: bacteria, molds, and yeasts. For this group, the settling rates are often low, and the filtration resistance is high (Liu et al., 1997). This problem can be solved by filtration with generous amounts ($\frac{1}{2}$ to 1 lb per pound dry solids) of filter aid, usually diatomaceous earth.

Prior to the construction of the wastewater treatment system at the site, an NPDES permit will be obtained from the RWQCB. A conceptual design for the wastewater treatment system at the site is expected to include the following main components or activities. The components listed below are in the order they will be installed with respect to the lagoons:

- Shaker screen to remove 1-inch plus size solids.
- Pump to suck the water out of the lagoons.
- An oil-water separator.

- A pond, to be constructed at the southwest corner of the site and lined with a geomembrane, to function as a clarifier for removing solids from the wastewater. To enhance filtration, diatomaceous earth will be added to the pond as filter aid, and compressed air will be used for mixing the filter aid.
- Filter press (e.g., a plate-and-frame filter press) to remove the residual solids from the wastewater.
- Storage tanks (in 21,000-gallon Baker tanks).
- Testing of water in the storage tanks to confirm compliance with the NPDES permit discharge requirements.
- If discharge limits are not met, additional treatment, e.g., bio-treatment for organics, air stripping and catalytic oxidation of off-gas vapors for removing benzene, and lime precipitation for reducing fluoride concentrations, will be implemented.

Prior to construction, the wastewater system will be designed and permits will be obtained from the RWQCB, the SCAQMD, and the City of Huntington Beach, as necessary.

11.3 Implementation Schedule

Table 11-1 shows a preliminary project implementation schedule. As shown in this table, completion of the project is estimated to take approximately 3 years. This schedule assumes 2 years for the completion of the main remediation activities.

11.4 Final Cut and Fill Volumes

The majority of the 38-acre site surface is currently at an elevation of 20 feet above MSL; some central portions are at an elevation of 25 feet MSL or higher and most of the outlying areas of the site slope down to elevations of 5 feet MSL or lower. For preliminary design purposes, ENVIRON assumed that the average site elevation is currently at 20 feet MSL across the entire site. To estimate the average site elevation after the implementation of Alternative 3, ENVIRON estimated that after all the excavated materials are transported off-site, based on the volumes shown in Table 6-A of Section 6.4.3, a total of 667,700 cy of *in situ* material would be lost from the site.

The loss of 667,700 *in situ* cy of material from the site represents an average loss of approximately 11 feet in height over the entire 38 acres area of the site. Because the adjacent streets are generally

at elevations of between 5 and 10 feet above MSL (see Section 2.2), the current ground surface at the site is on the average between approximately 10 and 15 feet above the adjacent streets.

Therefore, after the excavated materials are removed from the site, the surface of the site would be at the same elevation as, or at a few feet below, the adjacent streets. To raise the average elevation of the site after Alternative 3 is implemented, soil would need to be imported to the site and compacted. For raising the site elevation by 1 foot, assuming a 20% reduction in soil volume upon compaction, approximately 73,500 cy of imported soil would be needed. Figure 11.5 presents illustrative cross-sections of the site before and after remediation.

11.5 Alternative 3 Conclusions

On-site stabilization of the affected soils and drilling muds will be performed using the Global process. The stabilized materials will be transported off-site for use as road base material and other similar uses (prior to initiation of construction activities, a project site will be identified for accepting the stabilized materials). Make-up soil will be imported to the site to raise the average elevation of the site. The remediated site will be graded for residential redevelopment. ENVIRON assumed that up to five years of ground water monitoring may be required at the site. Alternative 3 will be discussed in detail in the RAP.

In conclusion, Alternative 3, when implemented, will eliminate or reduce to acceptable levels the identified risks from the soil, ground water, and physical conditions of the site. Also, this alternative will provide for the residential development of the site. As agreed with DTSC, the need for ground water remediation will be re-evaluated following site remediation.

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13.0 LIMITATIONS

This FS report has been prepared exclusively for use by CND and may not be relied upon by any other person or entity without ENVIRON's express written permission. The conclusions presented in this report represent ENVIRON's professional judgment based on the information available to us during the course of this assignment and is true and correct to the best of ENVIRON's knowledge as of the date of the assignment. ENVIRON made reasonable efforts to verify the written and oral information provided in this FS report. Nevertheless, this report is accurate and complete only to the extent that information provided to ENVIRON was itself accurate and complete.

TABLES

Table 1-1
Chronology of Events
Ascon Site, Huntington Beach, California

1938-1971	Rotary drilling muds, wastes and waste water brines were the major wastes deposited at the site. Garrish Brothers owned and operated the facility from 1938-1950. Steverson Brothers owned and operated the facility from 1950-1971.
1949	Department of Health Services issued permit to Garrish Brothers to operate the site as a rotary mud dump.
1950	Twenty-two areas used for oil field wastes. Ponds designed to flow to the east with 25 to 30 foot berms.
1955	Pit E was in use.
1957-1971	"Unusable oil" dumped by General Edison Power Co. (256,000 gals.) in big lagoon (Carl Steverson of Steverson Bros., Inc.).
1957	Three-hundred barrels of chromic and sulfuric acid wastes dumped into Pits C, D and F (M & M Pumping, 12,600 gallons for period).
1958	Shell Chemical disposed of "dregs from Bunker C fuel oil" containing "light hydrocarbon" conglomerate mixture of C and C; and styrene tar to Pit F.
1951-1959	Aluminum and Magnesium, Inc., disposed of aluminum slag and other process wastes (magnesium chloride and potassium chloride) at a rate not exceeding 25 tons per month (maximum 2,700 tons for period).
1958-1971	AQMD received persistent complaints of odors from the site.
1962	Shell Chemical deposited corrosive materials.
1964	Shell Chemical deposited polyester resins and phenolic laden compounds (20 percent free phenol).
1962-1964	Numerous mercaptan and styrene odors reported. Most of the styrene waste went to Pit F. Some may have gone to Pit E. Pit E was covered in 1964 with soil (1968 aerial shows Pit E covered).
1971	Oily waste disposed in Pits A and B by Douglas Oil.
1971	ALL HAZARDOUS WASTE DISPOSAL CEASED.
1971-1984	Class III inert wastes accepted.
1980-1984	Site Sampling conducted by Oil Well Research, Inc.
	Site Investigation conducted by Woodward-Clyde Consultants.
	Site Characterization conducted by J.W. Barrington.
	Site Investigation conducted by Ecology and Environment, Inc.
	Site Investigation conducted by Orange County Health Department.
	Site evaluated by U.S. EPA for inclusion on the National Priorities Ranking List.

Table 1-1 (continued)
Chronology of Events
Ascon Site, Huntington Beach, California

1984	<p>The site was purchased by ASCON Properties. All disposal activities ceased.</p> <p>The site was listed on the State Department of Health Services, Toxic Substances Control Program, Site Ranking and Priorities List. ASCON Properties started negotiations with the Department for site cleanup.</p> <p>The Regional Water Quality Control Board became responsible for the cleanup of on site pits.</p> <p>Site characterization report prepared by Lockman & Associates.</p> <p>ASCON Ad-Hoc Committee is established.</p>
1985	Waste characterization study prepared by Proteck Environmental.
1987	AQMD issues odor violation report to ASCON Properties.
1987-1988	<p>Site Investigation conducted by H.V. Lawmaster.</p> <p>Site Investigation conducted by Radian Corporation.</p>
1988	AQMD issued ASCON Properties an excavation permit under Rule 1150.
1989-1990	<p>ASCON Properties filed for protection under Bankruptcy Court.</p> <p>NESI Investment Group acquired the site through foreclosure.</p>
1991-1992	<p>NESI executed a Consent Agreement with the Department of Toxic Substances Control and initiated Site Remediation activities.</p> <p>NESI prepared Remedial Investigation/Feasibility Study and Removal Action Workplans for the site.</p> <p>NESI implemented Remedial Investigation Workplan.</p> <p>NESI submitted to AQMD permit application under Rules 203, 1150 and 1166.</p>
1993	<p>NESI Investment Group Files for Bankruptcy.</p> <p>Property ownership transferred to Signal Mortgage Company.</p>
1995	<p>Signal Mortgage Company entered into agreement with Savannah Resources Corporation to complete DTSC-required RI/FS and Remedial Action Plan (RAP).</p> <p>Savannah Resources Corporation entered into a Voluntary Cleanup Agreement (VCA) with the DTSC for the oversight, review and approval of RI/FS and RAP.</p>
1997	RI report and Baseline Health Risk Assessment completed by ESE. California/ Nevada Developments, LLC acquired the interests of Savannah Resources Corporation and assumed responsibility for completion of the RI/FS and RAP.
1998	Treatability testing conducted as a part of the FS.
1999	Pilot Testing conducted as a part of the FS.
2000	Feasibility Study Completed. Draft RAP preparation in progress.

ESE's Source: ISCO Industries/TTARA Engineers (1992)
Reference: ESE (1997a)

Table 1-2
Pit Locations and History
Ascon Site, Huntington Beach, California

Pit	Site Quadrant	Waste
A&B	NW	Oily wastes disposed of by Douglas Oil - 1971; Pit not shown in 1973 photograph.
C&D	SE	A portion of 300 barrels of chromic and sulfuric acid disposed of by M & M Pumping - 1957; Pit not shown in 1978 photograph.
E	SE	Styrene - 1962 to 1964; pit covered with soil in 1964. Liquid present in pit in 1965 photograph; office trailer located over pit area in 1973 photograph.
F	SE	Styrene tar disposed of by Shell Chemical - 1957; Synthetic rubber disposed of by Shell Chemical. Pit still present, covered with tarp.
G	SE	Waste of unknown source; Pit not shown in 1978 photograph.
H	NW	Waste of unknown source; Pit not shown in 1973 photograph.

ESE's Source: Radian (1988)
Reference: ESE (1997a)

TABLE 2-1 GROUND WATER MONITORING WELL SPECIFICATIONS AND RESULTS
Ascon Property, Huntington Beach, California

Well ID.	Date	Well Diameter (inches)	Anticipated Well Depth (feet)	Actual Well Depth (feet)	Product	Depth to Product (feet)	Depth to Water (feet)	Groundwater Elevation (feet rel. to MSL)	Comments
AW-1									
	Reference elevation: 6.54								
AW-2									
	Reference elevation: 5.72								
	01/31/97	2	25.0	27.00	No	NA	6.20		
	03/12/97				No	NA	7.86		
AW-3									
	Reference elevation: 8.58								
	01/31/97	2	20.0	19.90	No	NA	9.20		
	03/12/97				No	NA	10.56		
AW-4									
	Reference elevation: 6.32								
	01/15/96	2			No	NA	7.63		
	01/31/97	2	25.0	21.15	No	NA	6.65		
	03/12/97				No	NA	6.84		
AW-5									
	Reference elevation: 5.14								
	01/31/97	2	20.0	20.50	No	NA	5.50		
	03/12/97				No	NA	6.22		
AW-8									
	Reference elevation: 6.17								
	01/15/96				No	NA	11.23		
	01/31/97	2	20.0	20.00	No	NA	10.15		
B-2									
	Reference elevation: 24.68								
	01/31/97	2	77.0		Yes	26.0	NA		could not penetrate past 4 inches
B-4									
	Reference elevation: 19.12								
	01/31/97	2	47.5	36.25	Yes	19.5	NA		
B-5									
	Reference elevation: 26.33								
	01/31/97		45.0						
B-6									
	Reference elevation: 8.27								
	01/31/97		35.0						
B-7									
	Reference elevation: 15.32								
	01/31/97	2	37.0	27.10	No	NA	15.72		
	03/12/97				No	NA	16.96		

TABLE 2-1 GROUND WATER MONITORING WELL SPECIFICATIONS AND RESULTS
 Asccon Property, Huntington Beach, California

Well I.D.	Date	Well Diameter (inches)	Anticipated Well Depth (feet)	Actual Well Depth (feet)	Product	Depth to Product (feet)	Depth to Water (feet)	Groundwater Elevation (feet rel. to MSL)	Comments
N MW-1	Reference elevation: 17.42								
	01/31/97	4	39.0	38.65	No	NA	23.90		
	03/12/97				No	NA	18.87		
N MW-2	Reference elevation: 21.37								
	01/31/97	4	38.0	38.40	No	NA	18.38		
B-4 (MW-4)	Reference elevation: 23.94								
	01/15/96				No	NA	26.61		
	01/31/97	4	43.0	45.00	No	NA	23.65		
	03/12/97				No	NA	24.26		
B-9 (MW-9)	Reference elevation: 17.06								
	01/15/96				No	NA	18.69		
	01/31/97	4	28.0	30.40	No	NA	15.18		
	03/12/97				No	NA	16.10		
B-13 (MW-13)	Reference elevation: 8.28								
	01/15/96				No	NA	11.11		
	01/31/97	4	23.0	7.90	No	NA	25.40		
	03/12/97				No	NA	9.10		
B-14 (MW-14)	Reference elevation: 23.87								
	01/15/96				Yes	26.48	NA		
	01/31/97	4	43.0	44.70	Yes	23.7	NA		
B-15 (MW-15)	Reference elevation: 6.35								
	01/15/96				No	NA	9.32		
	01/31/97	4	23.0	25.45	No	NA	6.67		
	03/12/97				No	NA	7.92		

NOTES:

MSL - mean sea level
 NA - not applicable

Table 2-2
Summary of Ground Water Analyses Exceeding PRGs and MCLs
Ascon Site, Huntington Beach, California

Constituent	No. Of Wells Exceeding PRGs	No. Of Wells Exceeding MCLs	Regulatory Limit or Guideline (µg/l)		Maximum Concentration Detected (µg/l)	Well With Maximum Detection
			PRG - tap water	MCL		
Antimony	19	19	15	4	100	WCC B-5
Arsenic	11	6	0.045	50	270	E&E AW-1, E&E AW-6, E&E AW-7, WCC B-5
Lead	10	1	4	50	110	E&E AW-5
Thallium	9	9	2.6	2	140	Radian AW-4
Benzene	7	6	0.39	1	520	WCC B-6
Chloroform	5	0	0.16	100	9.4	WCC B-8
Beryllium	3	1	0.016	4	6	WCC B-5
Carbon disulfide	3	—	21	NE	100	MW-14
Ethylbenzene	3	3	1,300	700	160,000	WCC B-6
Naphthalene	3	—	240	NE	64,000	WCC B-6
Bromodichloromethane	2	0	0.18	100	0.22	MW-14, MW-15
Methylene chloride	2	—	4.3	NE	54	E&E AW-4
Toluene	2	2	720	150	1,200	WCC B-7
Acenaphthene	1	—	370	NE	5,000	WCC B-8
Anthracene	1	—	1,800	NE	130,000	WCC B-6
1,1'-biphenyl	2	—	300	NE	410,000	WCC B-6
Bis(2-ethylhexyl)phthalate	1	1	4.8	4	98	II NMW-1
Cadmium	1	1	18	5	29	MW-9
1,1-dichloroethene	1	1	56	6	56	II NMW-1
Pentachlorophenol	1	1	0.56	0.1	4.2	II NMW-1
Styrene	1	1	1,600	100	310,000	WCC B-6
Tetrachloroethene	1	1	1.1	5	6.1	II NMW-1
Trichloroethene	1	0	1.6	5	3.8	II NMW-1

Table 2
 Summary of Ground Water Analyses Exceeding PRGs and MCLs
 Ascon Site, Huntington Beach, California

Notes:

PRG = Preliminary remediation goal for tap water
 MCL = Maximum contaminant level
 µg/l = Micrograms per liter
 NE = None established

Table 2-3
Comparison of Ground Water Quality
in Up- and Down-gradient Monitoring Wells
Ascon Site, Huntington Beach, California

Aquifer and Location	Average Ground Water Quality Parameter Concentrations (mg/l)					
	EC	Chloride	TPH	Total VOCs	Antimony	Arsenic
<i>In down-gradient monitoring wells</i>						
Semiperched	7,000	NA	<0.002	0.011	0.043	0.200
Talbert	12,733	4,383	NA	ND	NA	NA
<i>In up-gradient monitoring wells</i>						
Semiperched	17,075	NA	<0.002	0.007	0.058	0.096
Talbert	NA	NA	NA	NA	NA	NA
Water Quality Objectives (mg/l)	500 (TDS)	55	NE	Various	0.004	0.05

Notes:

mg/l = Milligram per liter
 EC = Electric conductivity
 TPH = Total petroleum hydrocarbons
 VOCs = Volatile organic compounds
 TDS = Total dissolved solids

Table 3-1
Summary Statistics for All Soil Samples

Analyte (units mg/kg unless otherwise noted)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
TPH							
OIL & GREASE, EPA 413.2	24	24	NA	NA	NA	688,000	698,702
TPH, EPA 3510/8015	81	61	NA	NA	NA	520,000	579,163
TPH, EPA 418.1	232	173	NA	NA	NA	970,000	396,906
VOCs							
(1,1-DIMETHYLBUTYL)BENZENE	1	1	NA	NA	NA	3.30	NA
(1,1-DIMETHYLPROPYL)BENZENE	1	1	NA	NA	NA	8.30	NA
(1-METHYLBUTYL)BENZENE	1	1	NA	NA	NA	6.10	NA
(1-METHYLETHENYL)BENZENE	3	3	NA	NA	NA	180	5.4E+40
(1-METHYLPROPYL)BENZENE	1	1	NA	NA	NA	41	NA
(1-PROPENYL)CYCLOHEXANE	2	2	NA	NA	NA	40	114
(2-METHYLPROPYL)BENZENE	1	1	NA	NA	NA	5.3	NA
1,1,1-TRICHLOROETHANE	104	6	0	0	1200	240	2
1,1,2,2-TETRACHLOROETHANE	98	0	0	21	0.45	2.2	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	3	3	0	0	5600	8.6	11
1,1,2-TRICHLOROETHANE	98	0	0	5	0.65	2.0	NA
1,1,4,6-TETRAMETHYLBENZENE	1	1	NA	NA	NA	2.0	NA
1,1-DICHLOROETHANE	74	1	0	0	500	0.70	0.34
1,1-DICHLOROETHENE	124	1	1	32	0.037	8.9	0.30
1,1-DIMETHYLCYCLOPENTANE	1	1	NA	NA	NA	0.0010	NA
1,2,3,4-TETRAHYDRO-1,1,8-TRIMETHYLNAPHT	1	1	NA	NA	NA	0.13	NA
1,2,3,4-TETRAHYDRONAPHTHALENE	1	1	NA	NA	NA	12	NA
1,2,3,5-TETRAMETHYLBENZENE	3	3	NA	NA	NA	70	3.8E+10
1,2,4,5-TETRAMETHYLBENZENE	1	1	NA	NA	NA	13	NA
1,2-DICHLOROETHANE	104	6	6	22	0.25	55	1.8
1,2-DICHLOROETHENE (TOTAL)	68	1	0	0	35	1.2	0.021
1,2-DICHLOROPROPANE	98	0	0	22	0.31	2.0	NA
1,4-DIETHYLBENZENE	2	2	NA	NA	NA	480	1785
1,4-DIMETHYLCYCLOOCTANE	1	1	NA	NA	NA	14	NA
1-(1-METHYLETHENYL)-2-(1-METHYLETHYL)BE	1	1	NA	NA	NA	7.7	NA
1-(1-METHYLETHENYL)-4-PROPYLBENZENE	1	1	NA	NA	NA	3.4	NA
1-ETHENYL-3-ETHYLBENZENE	1	1	NA	NA	NA	21	NA
1-ETHENYL-4-ETHYLBENZENE	1	1	NA	NA	NA	31	NA
1-ETHYL-3,4-DIMETHYLBENZENE	1	1	NA	NA	NA	7.3	NA
1-ETHYL-3,5-DIMETHYLBENZENE	3	3	NA	NA	NA	25	33
1-ETHYL-3-METHYLBENZENE	1	1	NA	NA	NA	0.090	NA
1-ETHYL-3-METHYLCYCLOPENTANE	1	1	NA	NA	NA	1.6	NA
1-ETHYL-4-(1-METHYLETHYL)BENZENE	1	1	NA	NA	NA	2.7	NA
1-METHYLETHYLBENZENE	1	1	NA	NA	NA	0.65	NA
1-METHYLETHYLCYCLOPENTANE	1	1	NA	NA	NA	4.2	NA
1-PHENYL-1-HEXANONE	1	1	NA	NA	NA	0.0010	NA
1-PROPENYLBENZENE	2	2	NA	NA	NA	100	354
2,3-DIMETHYLBUTANONE	1	1	NA	NA	NA	0.22	NA
2,4-DIMETHYLHEXANE	1	1	NA	NA	NA	0.030	NA
2-BUTANONE	69	23	0	0	7100	5.2	4.7
2-CHLOROETHYL VINYL ETHER	73	0	NA	NA	NA	2.0	NA
2-CYCLOHEXYLDECANE	5	5	NA	NA	NA	8.1	6.9
2-ETHYL-4-METHYL-1-PENTANOL	1	1	NA	NA	NA	0.0010	NA
2-ETHYLHEXANOL	1	1	NA	NA	NA	3.2	NA
2-HEXANONE	66	1	NA	NA	NA	0.0034	0.0014
2-METHYLDECAHYDRONAPHTHALENE	2	2	NA	NA	NA	16	21
2-PROPYL-1-HEPTANOL	2	2	NA	NA	NA	19	69
4-(2-BUTENYL)-1,2-DIMETHYLBENZENE	1	1	NA	NA	NA	1.8	NA
4-METHYL-2-PENTANONE	66	0	0	0	770	5.8	NA
6-ETHYL-1,2,3,4-TETRAHYDRONAPHTHALENE	1	1	NA	NA	NA	4.1	NA
6-METHYL-1,1-HEPTANOL	1	1	NA	NA	NA	10	NA
8-METHYLHEPTANOL	6	6	NA	NA	NA	30	23
ACETONE	71	30	0	0	2100	0.95	0.15
BENZENE	103	36	17	4	0.63	17	3.7
BROMODICHLOROMETHANE	98	0	0	5	0.63	2.0	NA
BROMOFORM	100	2	0	0	56	15	2.7
BROMOMETHANE	98	0	0	0	6.8	5.0	NA
CARBON DISULFIDE	66	1	0	1	7.5	1.3	1.6
CARBON TETRACHLORIDE	98	0	0	25	0.23	5.0	NA
CHLOROBENZENE	128	2	0	0	65	6.6	0.18
CHLORODIBROMOMETHANE	98	0	0	0	5.3	2.1	NA
CHLOROETHANE	98	0	0	0	1100	5.0	NA
CHLOROFORM	105	7	7	21	0.25	25	3.2
CHLOROMETHANE	98	0	0	6	1.2	5.0	NA

Summary Statistics for All Soil Samples

Analyte (units mg/kg unless otherwise noted)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRO	No. of Samples with the Detection Limit Greater than the PRO	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
CIS-1,2-DICHLOROETHENE	41	0	0	0	31	2.0	NA
CIS-1,2-DICHLOROPROPENE	27	0	NA	NA	NA	0.25	NA
CIS-1,3-DICHLOROPROPENE	71	0	NA	NA	NA	2.0	NA
DECAHYDRONAPHTHALENE	2	2	NA	NA	NA	15	41
DIETHYLBENZENES	1	1	NA	NA	NA	63	NA
DIETHYLMETHYLBENZENE ISOMERS	2	2	NA	NA	NA	37	120
DIMETHYLINDAN	1	1	NA	NA	NA	1.1	NA
DIMETHYLINDANE ISOMERS	2	2	NA	NA	NA	25	25
DIMETHYLNAPHTHALENE	1	1	NA	NA	NA	300	NA
ETHYLBENZENE	113	51	2	0	230	670	57
ETHYLDIMETHYLBENZENE ISOMERS	3	3	NA	NA	NA	27	27
ETHYLDIMETHYLNAPHTHALENE ISOMERS	1	1	NA	NA	NA	25	NA
ETHYLMETHYLBENZENE ISOMERS	5	5	NA	NA	NA	32	23
HEXANEDIOIC ACID, DIOCTYL ESTER	1	1	NA	NA	NA	700	NA
INDAN	1	1	NA	NA	NA	2.2	NA
INDENE	1	1	NA	NA	NA	8.8	NA
ISOCTANOL	3	3	NA	NA	NA	11	12
METHYLDCAHYDRONAPHTHALENE ISOMER	1	1	NA	NA	NA	25	NA
METHYLENE CHLORIDE	107	18	4	4	7.8	110	7.5
METHYLINDAN	1	1	NA	NA	NA	1.1	NA
METHYLINDANE ISOMERS	1	1	NA	NA	NA	17	NA
METHYLNAPHTHALENE	1	1	NA	NA	NA	0.88	NA
METHYLNAPHTHALENE ISOMERS	3	3	NA	NA	NA	210	1.3E+91
METHYLPROPYLBENZENE ISOMERS	1	1	NA	NA	NA	12	NA
OCTAHYDROINDENE	11	11	NA	NA	NA	31	22
PROPYLBENZENE	7	7	NA	NA	NA	7.7	4.3
STYRENE	70	7	1	0	880	720	36
TETRACHLOROETHENE	98	0	0	0	5.4	2.0	NA
TETRAMETHYLBENZENE	1	1	NA	NA	NA	2.3	NA
TOLUENE	114	71	0	0	790	6.4	3.9
TRANS-1,2-DICHLOROETHENE	41	0	0	0	78	2.0	NA
TRANS-1,3-DICHLOROPROPENE	98	0	0	22	0.25	2.0	NA
TRICHLOROETHENE	98	0	0	0	3.2	2.0	NA
TRICHLOROFLUOROMETHANE	74	4	0	0	380	0.057	0.0082
TRIMETHYLBENZENE ISOMERS	11	11	NA	NA	NA	130	52
TRIMETHYLINDANE ISOMERS	1	1	NA	NA	NA	6.7	NA
TRIMETHYLPENTANE ISOMERS	6	6	NA	NA	NA	71	64
VINYL ACETATE	66	0	0	0	780	5.0	NA
VINYL CHLORIDE	98	0	0	59	0.016	6.5	NA
XYLENES (TOTAL)	111	66	0	0	320	40	50
SVOCs							
1,1'-(1,2-ETHENEDIYL)BISBENZENE	1	1	NA	NA	NA	2800	NA
1,1'-BIPHENYL	2	2	1	0	350	1200	4311
1,2,4-TRICHLOROBENZENE	83	0	0	1	570	1100	NA
1,2,4-TRIMETHYLBENZENE	3	3	NA	NA	NA	80	119
1,2-DICHLOROBENZENE	145	1	0	1	700	0.15	0.025
1,3-DICHLOROBENZENE	145	0	0	1	500	1100	NA
1,4-DICHLOROBENZENE	145	0	0	25	3.6	1100	NA
1-ETHENYL-2-METHYLBENZENE	1	1	NA	NA	NA	770	NA
1-METHYLETHENYLBENZENE	1	1	NA	NA	NA	1200	NA
1-METHYLNAPHTHALENE	3	3	NA	NA	NA	65	1.1E+08
1-METHYLPROPYLBENZENE	1	1	NA	NA	NA	370	NA
2,4,5-TRICHLOROPHENOL	83	0	0	0	6500	2000	NA
2,4,6-TRICHLOROPHENOL	84	1	0	4	40	0.16	0.057
2,4-DICHLOROPHENOL	84	1	0	2	200	0.59	0.17
2,4-DIMETHYLPHENOL	83	1	0	1	1300	39	14
2,4-DINITROPHENOL	83	0	0	4	130	8500	NA
2,4-DINITROTOLUENE	83	0	NA	NA	NA	1200	NA
2,6-DINITROTOLUENE	83	0	0	56	0.65	1100	NA
2-BUTOXYETHANOL	1	1	NA	NA	NA	13	NA
2-CHLORONAPHTHALENE	83	0	0	2	110	1100	NA
2-CHLOROPHENOL	83	0	0	4	91	2800	NA
2-ETHYL-1,1'-BIPHENYL	1	1	NA	NA	NA	580	NA
2-METHYL-1,1'-BIPHENYL	1	1	NA	NA	NA	490	NA
2-METHYLNAPHTHALENE	89	41	0	0	3300	100	94
2-METHYLPHENOL	83	0	0	0	3300	2000	NA
2-NITROANILINE	83	0	0	46	3.9	10000	NA
2-NITROPHENOL	83	0	NA	NA	NA	1100	NA
3,3'-DICHLOROBENZIDINE	83	1	0	67	0.89	0.082	NA
3-NITROANILINE	83	0	NA	NA	NA	10000	NA
4,6-DINITRO-2-METHYLPHENOL	83	0	NA	NA	NA	4800	NA

Summary Statistics for All Soil Samples

Analyte (units mg/kg unless otherwise noted)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRO	No. of Samples with the Detection Limit Greater than the PRO	Preliminary Remediation Goal (PRO)	Maximum Concentration	Upper 95% Confidence Limit
4-BROMOPHENYL PHENYL ETHER	83	0	NA	NA	NA	1700	NA
4-CHLORO-3-METHYLPHENOL	83	0	NA	NA	NA	1100	NA
4-CHLOROANILINE	83	0	0	2	280	2000	NA
4-CHLOROPHENYL PHENYL ETHER	83	0	NA	NA	NA	1100	NA
4-METHYLPHENOL	83	0	0	2	330	2000	NA
4-NITROANILINE	83	0	NA	NA	NA	10000	NA
4-NITROPHENOL	83	0	NA	NA	NA	6500	NA
ACENAPHTHENE	83	5	0	2	110	2.3	0.60
ACENAPHTHYLENE	83	0	NA	NA	NA	1100	NA
ANILINE	58	0	0	3	10	1700	NA
ANTHRACENE	87	0	1	10	5.7	180	11
AZOBENZENE	8	0	0	8	4	1700	NA
BENZALDEHYDE	1	1	0	0	6500	12	NA
BENZIDINE	58	5	5	51	0.0019	280	76
BENZOIC ACID	83	1	0	0	100000	0.16	NA
BENZO(A)PYRENE	83	2	2	74	0.061	1.2	0.32
BENZO(B)FLUORANTHENE	83	1	0	56	0.61	0.11	0.053
BENZO(G,H)PERYLENE	83	0	NA	NA	NA	1700	NA
BENZO(K)FLUORANTHENE	83	1	0	17	6.1	0.14	0.058
BENZYL ALCOHOL	83	0	0	0	20000	10000	NA
BENZYL BUTYL PHTHALATE	83	1	0	1	930	0.63	0.18
BENZ(A)ANTHRACENE	83	4	0	54	0.61	0.11	0.082
BIS(2-CHLOROETHOXY)METHANE	83	0	NA	NA	NA	1100	NA
BIS(2-CHLOROETHYL) ETHER	83	0	0	83	0.043	1200	NA
BIS(2-CHLOROISOPROPYL) ETHER	83	0	0	27	2.5	1200	NA
BIS(2-ETHYLHEXYL) PHTHALATE	83	27	2	8	32	460	39
CHRYSENE	83	13	1	9	6.1	11	8.3
DI-N-BUTYL PHTHALATE	85	25	NA	NA	NA	4.3	0.86
DI-N-OCTYL PHTHALATE	83	0	0	1	1300	5500	NA
DIBENZOFURAN	83	1	0	2	140	0.54	0.17
DIBENZO(A,H)ANTHRACENE	83	2	2	73	0.061	1.7	0.38
DIETHYL PHTHALATE	83	0	0	0	52000	1100	NA
DIMETHYL PHTHALATE	83	0	0	0	100000	1100	NA
FLUORANTHENE	84	9	0	0	2600	1100	9.7
FLUORENE	84	9	0	4	90	8.9	8.2
HEXACHLORO BENZENE	83	0	0	64	0.28	1100	NA
HEXACHLOROBUTADIENE	83	0	0	8	5.7	1100	NA
HEXACHLOROCYCLOPENTADIENE	83	0	0	2	450	5500	NA
HEXACHLOROETHANE	83	0	0	4	32	2200	NA
INDENO(1,2,3-CD)PYRENE	83	0	0	64	0.61	2200	NA
ISOPHORONE	83	0	0	1	470	1100	NA
N-NITROSO-DI-N-PROPYLAMINE	83	0	0	75	0.063	2400	NA
N-NITROSODIPHENYLAMINE	83	1	0	4	91	0.68	0.18
NAPHTHALENE	113	51	0	2	240	110	28
NITROBENZENE	83	0	0	11	18	5500	NA
PENTACHLOROPHENOL	83	0	0	53	2.5	5500	NA
PHENANTHRENE	95	38	NA	NA	NA	21000	49
PHENOL	84	4	0	0	39000	0.80	0.22
PYRENE	85	18	0	2	100	15	11
PESTICIDES							
4,4'-DDD	67	1	0	7	1.9	0.011	0.0080
4,4'-DDE	69	3	0	8	1.3	0.017	0.0091
4,4'-DDT	68	0	0	10	1.3	5.0	NA
ALDRIN	68	0	0	46	0.028	2.5	NA
ALPHA-BHC	67	0	0	28	0.071	2.5	NA
ALPHA-CHLORDANE	33	0	NA	NA	NA	25	NA
BETA-BHC	67	3	0	15	0.25	0.075	0.022
CHLORDANE	35	0	0	15	0.34	5.0	NA
DELTA-BHC	67	1	NA	NA	NA	0.038	0.011
DIELDRIN	68	0	0	52	0.028	5.0	NA
ENDOSULFAN I	87	0	0	0	390	5.0	NA
ENDOSULFAN II	67	2	NA	NA	NA	0.011	0.0068
ENDOSULFAN SULFATE	67	0	NA	NA	NA	25	NA
ENDRIN	68	0	0	0	20	5.0	NA
ENDRIN ALDEHYDE	34	0	NA	NA	NA	7.5	NA
ENDRIN KETONE	33	0	NA	NA	NA	5.0	NA
GAMMA-BHC (LINDANE)	68	1	0	14	0.34	0.065	0.019
GAMMA-CHLORDANE	33	1	NA	NA	NA	0.017	NA
HEPTACHLOR	68	0	0	29	0.089	2.5	NA
HEPTACHLOR EPOXIDE	68	0	0	40	0.049	2.5	NA
METHOXYCHLOR	68	0	0	0	330	75	NA

Summary Statistics for All Soil Samples

Analyte (units mg/kg unless otherwise noted)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
TOXAPHENE	68	0	0	51	0.4	88	NA
PCBs							
PCB-1016	81	6	6	66	0.066	3.0	0.99
PCB-1221	74	0	0	67	0.066	60	NA
PCB-1232	74	0	0	67	0.066	50	NA
PCB-1242	75	1	1	67	0.066	4.2	4.0
PCB-1248	79	5	5	67	0.066	10	5.8
PCB-1254	81	8	8	66	0.066	13	6.0
PCB-1260	80	8	8	66	0.066	3.3	1.1
METALS							
ANTIMONY	132	54	0	0	31	8.7	3.5
ARSENIC	159	79	79	75	0.38	100	16
BARIUM	159	156	0	0	5300	1800	318
BERYLLIUM	133	74	65	1	0.14	89	0.61
CADMIUM	161	58	7	0	9	78	1.9
CHROMIUM, TOTAL	163	150	1	0	210	660	65
CHROMIUM, VI	41	0	0	17	0.2	0.26	NA
COBALT	103	98	0	0	4600	19	8.0
COPPER	137	133	0	0	2800	1300	53
LEAD	164	118	36	0	130	1800	321
MERCURY	106	49	0	0	23	1.9	0.19
MOLYBDENUM	103	22	0	0	380	6.3	0.79
NICKEL	136	133	0	0	150	140	29
SELENIUM	180	24	0	0	380	75	5.1
SILVER	167	5	0	0	380	7.6	0.37
THALLIUM	130	6	6	0	5.4	100	4.2
VANADIUM	121	115	0	0	540	75	36
ZINC	137	134	0	0	23000	1600	253
OTHER							
CYANIDE	39	0	0	0	1300	0.10	NA
IGNITABILITY (F)	14	NA	NA	NA	NA	140	111
SULFUR DIOXIDE	3	3	NA	NA	NA	11	14
pH (standard units)	38	NA	NA	NA	NA	11	NA

* = maximum concentration shown is maximum detection limit.
 NA = not applicable or not available.

Source: ESE (1997).

Table 3-2
Summary Statistics for All Water Samples

Analyte (units µg/L unless otherwise noted)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
TPH							
OIL & GREASE	10	10	NA	NA	NA	18000	11737
ORGANIC CARBON (TOTAL)	1	1	NA	NA	NA	73	NA
PETROLEUM DISTILLATE - TRACE	1	1	NA	NA	NA	0.000050	NA
TPH, EPA 3510/0016	12	2	NA	NA	NA	2100	747
TPH, EPA 418.1	27	1	NA	NA	NA	2200	891
VOCs							
(1-METHYLETHENYL)BENZENE	3	3	NA	NA	NA	1100	3.4E+27
(1-METHYLETHYL)BENZENE	1	1	NA	NA	NA	30000	NA
(1-METHYLPROPYL)BENZENE	4	4	NA	NA	NA	6700	1.8E+18
1,1-(1-METHYL-1,2-ETHENEDIYL)BISBENZENE	2	2	NA	NA	NA	3.4	6.0
1,1-ETHYLIDENEBISBENZENE	2	2	NA	NA	NA	6.8	13
1,1'-METHYLENEBISBENZENE	3	3	NA	NA	NA	0.2	10
1,1,1,2-TETRACHLOROETHANE	27	0	NA	NA	NA	5.0	NA
1,1,1-TRICHLOROETHANE	44	2	0	0	700	230	4.0
1,1,2,2-TETRACHLOROETHANE	44	0	0	44	0.056	5.0	NA
1,1,2-TRICHLOROETHANE	44	0	0	30	0.2	5.0	NA
1,1-DICHLOROETHANE	69	1	0	0	810	0.11	0.058
1,1-DICHLOROETHENE	20	1	1	28	0.048	5.0	4.3
1,1-DICHLOROPROPENE	27	0	NA	NA	NA	5.0	NA
1,2,3-TRICHLOROBENZENE	27	0	NA	NA	NA	5.0	NA
1,2,3-TRICHLOROPROPANE	27	0	NA	NA	NA	10	NA
1,2,3-TRIMETHYLBENZENE	1	1	NA	NA	NA	0.30	NA
1,2,4-TRIMETHYLBENZENE	28	2	NA	NA	NA	2.4	1.5
1,2-DIBROMO-3-CHLOROPROPANE	22	0	NA	NA	NA	6.0	NA
1,2-DIBROMOETHANE	27	0	NA	NA	NA	5.0	NA
1,2-DICHLOROETHANE	44	0	0	30	0.12	5.0	NA
1,2-DICHLOROETHENE (TOTAL)	16	0	0	0	65	1.0	NA
1,2-DICHLOROPROPANE	49	0	0	35	0.16	5.0	NA
1,3,5-TRIMETHYLBENZENE	27	0	NA	NA	NA	5.0	NA
1,3-DICHLOROPROPANE	22	0	NA	NA	NA	2.0	NA
1,3-DIMETHYLBENZENE	1	1	NA	NA	NA	21	NA
1,4-DIETHYLBENZENE	4	4	NA	NA	NA	170000	1.2E+36
1-ETHENYL-2-METHYLBENZENE	1	1	NA	NA	NA	8.7	NA
1-ETHENYL-3,5-DIMETHYLBENZENE	1	1	NA	NA	NA	4600	NA
1-ETHENYL-4-ETHYLBENZENE	2	2	NA	NA	NA	80	283
1-ETHYL-3,5-DIMETHYLBENZENE	3	3	NA	NA	NA	11	16
1-METHYLBENZENE	1	1	NA	NA	NA	4.0	NA
1-PENTANOL	1	1	NA	NA	NA	5.9	NA
2,2-DICHLOROPROPANE	27	0	NA	NA	NA	5.0	NA
2-BUTANONE	20	0	0	0	1900	80	NA
2-CHLOROETHYL VINYL ETHER	39	0	NA	NA	NA	20	NA
2-CHLOROTOLUENE	27	0	NA	NA	NA	5.0	NA
2-ETHYLHEXANOL	1	1	NA	NA	NA	0.30	NA
2-ETHYLHEXANOL	1	1	NA	NA	NA	30	NA
2-HEXANONE	29	0	NA	NA	NA	80	NA
2-METHYLINDAN	1	1	NA	NA	NA	0.70	NA
3-HEXEN-2-ONE	1	1	NA	NA	NA	27	NA
3-METHYL-1,1'-BIPHENYL	1	1	NA	NA	NA	2.1	NA
3-METHYL-2-BUTANONE	1	1	NA	NA	NA	22	NA
3-PENTANONE	1	1	NA	NA	NA	20	NA
4-CHLOROTOLUENE	27	0	NA	NA	NA	5.0	NA
4-METHYL-2-PENTANONE	29	0	0	0	180	80	NA
4-METHYL-3-PENTEN-2-ONE	1	1	NA	NA	NA	18	NA
4-METHYL-4-HYDROXY-2-PENTANONE	1	1	NA	NA	NA	170	NA
ACETONE	33	8	0	0	610	77	24
BENZENE	52	16	15	28	0.39	520	22
BROMOBENZENE	27	0	NA	NA	NA	5.0	NA
BROMOCHLOROMETHANE	27	0	NA	NA	NA	5.0	NA
BROMODICHLOROMETHANE	44	3	3	30	0.18	0.22	0.12
BROMOFORM	44	0	0	1	8.5	20	NA
BROMOMETHANE	39	0	0	1	8.7	10	NA
CARBON DISULFIDE	25	4	3	0	21	100	11
CARBON TETRACHLORIDE	44	0	0	44	0.17	5.0	NA
CHLOROBENZENE	57	0	0	0	30	5.0	NA
CHLORODIBROMOMETHANE	2	0	0	0	1	1.0	NA
CHLOROETHANE	39	0	0	0	710	5.0	NA
CHLOROFORM	46	6	6	30	0.16	9.4	3.3
CHLOROMETHANE	37	0	0	23	1.6	5.0	NA
CIS-1,2-DICHLOROETHENE	29	0	0	0	61	5.0	NA
CIS-1,3-DICHLOROPROPENE	40	1	NA	NA	NA	0.30	NA
DIBROMOCHLOROMETHANE	42	0	NA	NA	NA	5.0	NA
DIBROMOMETHANE	27	0	NA	NA	NA	5.0	NA
DICHLORODIFLUOROMETHANE	19	0	NA	NA	NA	5.0	NA
DICHLORODIFLUOROMETHANE	3	0	NA	NA	NA	5.0	NA

Summary Statistics for All Water Samples

Analyte (units µg/L unless otherwise noted)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
DICHLOROMETHANE	1	1	NA	NA	NA	5.4	NA
DIETHYLBENZENES	3	3	NA	NA	NA	17000	2.6E+54
ETHANOL	1	1	NA	NA	NA	6.6	NA
ETHYLBENZENE	50	14	4	0	1300	160000	6612
ETHYLMETHYLBENZENE	1	1	NA	NA	NA	23	NA
ETHYLMETHYLBENZENES	1	1	NA	NA	NA	4.5	NA
INDAN	2	2	NA	NA	NA	20	71
INDENE	2	2	NA	NA	NA	58	199
ISOPROPYLBENZENE	27	1	NA	NA	NA	110	3.4
METHYLENE CHLORIDE	46	8	3	28	4.3	99	13
N-BUTYLBENZENE	27	0	NA	NA	NA	5.0	NA
N-PROPYLBENZENE	27	0	NA	NA	NA	5.0	NA
OCTAHYDROINDENE	1	1	NA	NA	NA	3.8	NA
P-ISOPROPYLTOLUENE	27	0	NA	NA	NA	5.0	NA
PROPYLBENZENE	5	5	NA	NA	NA	6.7	6.7
SEC-BUTYLBENZENE	27	1	NA	NA	NA	10.0	3.3
STYRENE	41	12	1	0	1800	310000	2080
TERT-BUTYLBENZENE	27	0	NA	NA	NA	5.0	NA
TETRACHLOROETHENE	45	5	1	26	1.1	6.1	1.2
TETRAHYDROFURAN	1	1	NA	NA	NA	210	NA
TOLUENE	51	15	2	0	720	1200	28
TRANS-1,2-DICHLOROETHENE	29	0	0	0	120	5.0	NA
TRANS-1,3-DICHLOROPROPENE	39	0	0	39	0.081	4.0	NA
TRICHLOROETHENE	44	1	1	27	1.6	3.8	1.1
TRICHLOROFLUOROMETHANE	39	0	0	0	1300	5.0	NA
TRIMETHYLBENZENE ISOMERS	3	3	NA	NA	NA	6000	3.6E+38
VINYL ACETATE	2	0	0	0	410	2.0	NA
VINYL CHLORIDE	39	0	0	39	0.02	5.0	NA
XYLENES (TOTAL)	48	8	1	0	1400	14200	45
SVOCs							
1,1-(1,2-ETHENEDIYL)BISBENZENE	3	3	NA	NA	NA	660000	3.4E+156
1,1'-BIPHENYL	8	8	3	0	300	410000	2.6E+12
1,2,4-TRICHLOROBENZENE	42	0	0	0	180	10	NA
1,2-DICHLOROBENZENE	71	1	0	0	370	0.10	NA
1,3-DICHLOROBENZENE	70	0	0	0	180	20	NA
1,4-DICHLOROBENZENE	70	0	0	44	0.47	10	NA
1-ETHYL-2-METHYLBENZENE	3	3	NA	NA	NA	130	1.3E+37
1-METHYL-3-PROPYLBENZENE	1	1	NA	NA	NA	110	NA
1-METHYLETHENYLBENZENE	3	3	NA	NA	NA	300000	2.0E+88
1-METHYLETHYLBENZENE	1	1	NA	NA	NA	210	NA
1-METHYLNAPHTHALENE	1	1	NA	NA	NA	11000	NA
1-METHYLPROPYLBENZENE	1	1	NA	NA	NA	180	NA
1-PHENYLETHANONE	3	3	NA	NA	NA	1600	1.6E+41
1-PROPENYLBENZENE	6	6	NA	NA	NA	180000	3.7E+11
2,3-DIHYDRO-1-METHYLINDANE	1	1	NA	NA	NA	15000	NA
2,3-DIHYDROINDENE	1	1	NA	NA	NA	4200	NA
2,4,5-TRICHLOROPHENOL	16	0	0	0	3700	20	NA
2,4,6-TRICHLOROPHENOL	15	0	0	11	8.1	20	NA
2,4-DICHLOROPHENOL	15	0	0	0	110	10	NA
2,4-DIMETHYLPHENOL	19	4	0	0	730	49	3204384
2,4-DINITROPHENOL	15	0	0	11	73	100	NA
2,4-DINITROTOLUENE	15	0	NA	NA	NA	10	NA
2,6-DINITROTOLUENE	15	0	0	15	0.090	10	NA
2-CHLORONAPHTHALENE	15	0	0	0	490	10	NA
2-CHLOROPHENOL	15	0	0	0	38	10	NA
2-ETHYL-1,1'-BIPHENYL	2	2	NA	NA	NA	230000	841078
2-HYDROXYBENZALDEHYDE	1	1	NA	NA	NA	110	NA
2-METHYL-1,1'-BIPHENYL	1	1	NA	NA	NA	140000	NA
2-METHYLNAPHTHALENE	19	4	NA	NA	NA	4200	249
2-METHYLPHENOL	15	0	0	0	1800	10	NA
2-NITROANILINE	15	0	0	15	2.2	20	NA
2-NITROPHENOL	15	0	NA	NA	NA	10	NA
2-PHENYLNAPHTHALENE	1	1	NA	NA	NA	200000	NA
3,3'-DICHLOROBENZIDINE	15	0	0	15	0.15	40	NA
3-NITROANILINE	15	0	NA	NA	NA	20	NA
4,6-DINITRO-2-METHYLPHENOL	15	0	NA	NA	NA	40	NA
4-BROMOPHENYL PHENYL ETHER	15	0	NA	NA	NA	10	NA
4-CHLORO-3-METHYLPHENOL	15	0	NA	NA	NA	20	NA
4-CHLOROANILINE	15	0	0	0	150	10	NA
4-CHLOROPHENYL PHENYL ETHER	15	0	NA	NA	NA	10	NA
4-HYDROXY-4-METHYL-2-PENTANONE	6	6	NA	NA	NA	12000	3.7E+08
4-METHYLPHENOL	15	0	0	0	180	10	NA
4-NITROANILINE	15	0	NA	NA	NA	100	NA
4-NITROPHENOL	15	0	NA	NA	NA	100	NA
ACENAPHTHENE	15	1	1	0	370	6000	292
ACENAPHTHYLENE	15	0	NA	NA	NA	10	NA

Summary Statistics for All Water Samples

Analyte (units µg/L unless otherwise noted)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	3	3	NA	NA	NA	380	456
ALPHA-METHYL BENZENEMETHANOL	1	1	NA	NA	NA	710	NA
ANILINE	15	0	0	0	11	10	NA
ANTHRACENE	21	6	1	0	1800	130000	4076
AZO BENZENE	11	0	0	11	0.61	20	NA
BENZALDEHYDE	2	2	0	0	3700	350	1278
BENZIDINE	15	0	0	15	0.00020	100	NA
BENZOIC ACID	15	0	0	0	150000	100	NA
BENZO[a]PYRENE	15	0	0	15	0.0015	10	NA
BENZO[b]FLUORANTHENE	15	0	0	15	0.092	10	NA
BENZO[g,h,i]PERYLENE	15	0	NA	NA	NA	10	NA
BENZO[k]FLUORANTHENE	15	0	0	15	0.92	10	NA
BENZYL ALCOHOL	15	0	0	0	11000	20	NA
BENZYL BUTYL PHTHALATE	15	0	0	0	7300	20	NA
BENZ[a]ANTHRACENE	15	0	0	15	0.092	10	NA
BIS(2-CHLOROETHOXY)METHANE	15	0	NA	NA	NA	10	NA
BIS(2-CHLOROETHYL) ETHER	15	0	0	15	0.0098	10	NA
BIS(2-CHLOROISOPROPYL) ETHER	15	0	0	15	0.27	10	NA
BIS(2-ETHYLHEXYL) PHTHALATE	15	4	1	14	4.8	98	1.0E+08
CHRYSENE	15	0	0	11	9.2	10	NA
DI-N-BUTYL PHTHALATE	15	0	NA	NA	NA	20	NA
DI-N-OCTYL PHTHALATE	15	3	0	0	730	0.000050	0.000050
DIBENZOFURAN	15	0	0	0	24	10	NA
DIBENZ[a,h]ANTHRACENE	15	0	0	15	0.0082	20	NA
DIETHYL PHTHALATE	15	0	0	0	29000	10	NA
DIMETHYL PHTHALATE	15	0	0	0	370000	10	NA
DIPHENYLMETHANONE	1	1	NA	NA	NA	840	NA
FLUORANTHENE	15	0	0	0	1600	10	NA
FLUORENE	15	0	0	0	240	10	NA
HEXACHLOROBENZENE	15	0	0	15	0.042	10	NA
HEXACHLOROBUTADIENE	42	0	0	42	0.86	10	NA
HEXACHLOROCYCLOPENTADIENE	15	0	0	0	260	40	NA
HEXACHLOROETHANE	15	0	0	11	4.8	10	NA
INDENO[1,2,3-cd]PYRENE	15	0	0	15	0.092	20	NA
ISOPHORONE	15	0	0	0	71	10	NA
N-NITROSO-DI-N-PROPYLAMINE	15	0	0	15	0.0096	10	NA
N-NITROSDIPHENYLAMINE	15	0	0	0	14	10	NA
NAPHTHALENE	54	12	4	11	240	64000	266
NITROBENZENE	15	0	0	11	3.4	40	NA
PENTACHLOROPHENOL	15	1	1	14	0.66	4.2	10
PHENANTHRENE	21	6	NA	NA	NA	180000	10313
PHENOL	27	12	0	0	22000	600	22548136
PYRENE	15	0	0	0	180	10	NA
PESTICIDES							
4,4'-DDD	28	0	0	14	0.28	10	NA
4,4'-DDE	28	0	0	15	0.2	10	NA
4,4'-DDT	28	0	0	16	0.2	10	NA
ALDRIN	28	0	0	28	0.004	10	NA
ALPHA-BHC	27	0	0	27	0.011	2.5	NA
ALPHA-CHLORDANE	15	0	NA	NA	NA	25	NA
BETA-BHC	27	1	0	25	0.037	0.000050	NA
CHLORDANE	12	0	0	12	0.052	10	NA
DELTA-BHC	27	3	NA	NA	NA	0.10	0.11
DIELDRIN	28	0	0	28	0.0042	10	NA
ENDOSULFAN I	27	0	0	0	220	2.5	NA
ENDOSULFAN II	27	0	NA	NA	NA	5	NA
ENDOSULFAN SULFATE	27	0	NA	NA	NA	5	NA
ENDRIN	28	0	0	0	11	10	NA
ENDRIN ALDEHYDE	11	0	NA	NA	NA	0.25	NA
ENDRIN KETONE	15	0	NA	NA	NA	5.0	NA
GAMMA-BHC (LINDANE)	29	0	0	17	0.052	10	NA
GAMMA-CHLORDANE	10	0	NA	NA	NA	25	NA
HEPTACHLOR	28	0	0	28	0.015	10	NA
HEPTACHLOR EPOXIDE	28	0	0	28	0.0074	10	NA
METHOXYCHLOR	28	0	0	0	180	25	NA
TOXAPHENE	28	0	0	28	0.051	50	NA
PCBs							
PCB-1018	28	0	0	28	0.0087	25	NA
PCB-1221	28	0	0	28	0.0087	25	NA
PCB-1232	28	0	0	28	0.0087	25	NA
PCB-1242	28	0	0	28	0.0087	25	NA
PCB-1248	28	0	0	28	0.0087	50	NA
PCB-1254	28	0	0	28	0.0087	50	NA
PCB-1260	28	0	0	28	0.0087	50	NA

Summary Statistics for All Water Samples

Analyte (units µg/L unless otherwise noted)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
METALS							
ANTIMONY	41	26	24	16	16	100	56
ARSENIC	48	23	23	26	0.046	370	135
BARIUM	47	47	0	0	2600	230	127
BERYLLIUM	29	3	3	26	0.018	6.0	3.8
CADMIUM	32	9	2	1	18	29	7.6
CHROMIUM (TOTAL)	40	19	NA	NA	NA	260	54
CHROMIUM (VI)	16	0	NA	NA	NA	25	NA
COBALT	37	13	0	0	2200	132	39
COPPER	39	27	0	0	1400	260	88
LEAD	36	19	16	17	4	1300	60
MERCURY	26	9	0	0	11	2.0	0.62
MOLYBDENUM	28	1	0	0	180	57	38
NICKEL	48	26	0	0	730	268	63
SELENIUM	31	6	0	0	180	147	34
SILVER	37	10	0	0	180	160	37
THALLIUM	33	11	11	22	2.6	140	88
THORIUM	8	4	NA	NA	NA	368	178
TIN	9	9	NA	NA	NA	310	216
VANADIUM	31	10	0	0	280	91	33
ZINC	49	40	0	0	11000	9000	278
OTHER							
CYANIDE	5	3	0	0	730	80	74
FLUORIDE	7	7	NA	NA	NA	10200	7303
IGNITABILITY (F)	3	NA	NA	NA	NA	140	NA
pH (standard units)	13	NA	NA	NA	NA	9.5	7.9

* = maximum concentration shown is maximum detection limit.
NA = not applicable or not available.

Source: ESF (1997).

Table 3-3
Summary Statistics for All of the Pits

Analyte (units mg/kg unless otherwise not)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
TPH							
OIL & GREASE, EPA 413.2	4	4	NA	NA	NA	9060	NA
TPH, EPA 3510/8015	16	12	NA	NA	NA	520000	1.5E+09
TRPH, EPA 418.1	56	45	NA	NA	NA	970000	124850
VOCs							
1-METHYLETHENYL BENZENE	3	3	NA	NA	NA	180	5.4E+40
1-METHYLPROPYL BENZENE	1	1	NA	NA	NA	41	NA
2-METHYLPROPYL BENZENE	1	1	NA	NA	NA	5.3	NA
1,1,1-TRICHLOROETHANE	29	0	0	3	0.45	2.0	NA
1,1,2,2-TETRACHLOROETHANE	29	0	0	1	0.65	2.0	NA
1,1,2-TRICHLOROETHANE	29	0	0	0	900	2.0	NA
1,1-DICHLOROETHANE	11	0	0	6	0.037	5.0	NA
1,1-DICHLOROETHENE	47	0	0	NA	NA	70	NA
1,2,3,5-TETRAMETHYLBENZENE	1	1	NA	NA	NA	2.0	NA
1,2-DICHLOROETHANE	29	0	0	3	0.25	2.0	NA
1,2-DICHLOROETHENE (TOTAL)	22	0	0	0	35	0.60	NA
1,2-DICHLOROPROPANE	29	0	0	3	0.31	2.0	NA
1,4-DIETHYLBENZENE	1	1	NA	NA	NA	490	NA
1-ETHENYL-4-ETHYLBENZENE	1	1	NA	NA	NA	31	NA
1-PROPENYLBENZENE	1	1	NA	NA	NA	100	NA
2-BUTANONE	25	11	0	0	7100	4.3	1.4
2-CHLOROETHYL VINYL ETHER	11	0	NA	NA	NA	2.0	NA
2-HEXANONE	25	1	NA	NA	NA	0.0034	NA
4-METHYL-2-PENTANONE	25	0	0	0	770	5.8	NA
ACETONE	25	17	0	0	2100	1.0	NA
BENZENE	30	8	1	1	0.63	3.5	0.27
3-BROMODICHLOROMETHANE	29	0	0	1	0.63	2.0	NA
BROMOFORM	29	0	0	0	56	2.0	NA
BROMOMETHANE	29	0	0	0	6.6	5.0	NA
CARBON DISULFIDE	25	1	0	0	7.5	1.3	0.31
CARBON TETRACHLORIDE	29	0	0	3	0.23	5.0	NA
CHLOROBENZENE	29	0	0	0	65	2.0	NA
CHLORODIBROMOMETHANE	33	0	0	0	5.3	2.1	NA
CHLOROETHANE	29	0	0	0	1100	5.0	NA
CHLOROFORM	29	0	0	2	0.25	2.0	NA
CHLOROMETHANE	29	0	0	1	1.2	5.0	NA
CIS-1,2-DICHLOROETHENE	29	0	0	0	31	2.0	NA
CIS-1,2-DICHLOROPROPENE	7	0	NA	NA	NA	0.050	NA
CIS-1,3-DICHLOROPROPENE	4	0	NA	NA	NA	2.0	NA
DIETHYLBENZENES	25	0	NA	NA	NA	63	NA
DIMETHYLINDAN	1	1	NA	NA	NA	1.1	NA
ETHYLBENZENE	1	13	2	0	230	670	64
ETHYLMETHYLBENZENE ISOMERS	32	1	NA	NA	NA	11	NA
INDAN	1	1	NA	NA	NA	2.2	NA
INDENE	1	1	NA	NA	NA	10	NA
METHYLENE CHLORIDE	1	1	NA	NA	NA	7.8	0.061
METHYLINDAN	29	5	0	1	NA	1.1	NA
METHYLNAPHTHALENE	1	1	NA	NA	NA	0.88	NA
OCTAHYDROINDENE	1	1	NA	NA	NA	0.26	NA
PROPYLBENZENE	1	1	NA	NA	NA	7.7	NA
STYRENE	28	6	1	0	680	720	NA
TETRACHLOROETHENE	29	0	0	0	5.4	2.0	NA
TETRAMETHYLBENZENE	1	1	NA	NA	NA	2.3	NA
TOLUENE	31	13	0	0	790	6.4	0.67
TRANS-1,2-DICHLOROETHENE	7	0	0	0	78	2.0	NA
TRANS-1,3-DICHLOROPROPENE	29	0	0	3	0.25	2.0	NA
TRICHLOROETHENE	29	0	0	0	3.2	2.0	NA
TRICHLOROFLUOROMETHANE	29	0	0	0	380	5.0	NA
VINYL ACETATE	11	0	0	0	780	5.0	NA
VINYL CHLORIDE	25	0	0	0	0.016	5.0	NA
XYLENES (TOTAL)	29	9	0	0	320	0.45	0.32
SVOCs							
1,1'-(1,2-ETHENEDIYL)BISBENZENE	1	1	NA	NA	NA	2800	NA
1,1'-BIPHENYL	2	2	1	0	350	1200	NA
1,2,4-TRICHLOROBENZENE	31	0	0	1	570	1100	NA
1,2-DICHLOROBENZENE	39	0	0	1	700	1100	NA

Summary Statistics for All of the Pits

Analyte (units mg/kg unless otherwise not)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
1,3-DICHLOROBENZENE	39	0	0	1	500	1100	NA
1,4-DICHLOROBENZENE	39	0	0	5	3.6	1100	NA
1-ETHENYL-2-METHYLBENZENE	1	1	NA	NA	NA	770	NA
1-METHYLETHENYLBENZENE	1	1	NA	NA	NA	1200	NA
1-METHYLNAPHTHALENE	1	1	NA	NA	NA	18	NA
1-METHYLPROPYLBENZENE	1	1	NA	NA	NA	370	NA
2,4,6-TRICHLOROPHENOL	31	0	0	0	6500	2000	NA
2,4,6-TRICHLOROPHENOL	31	0	0	2	40	1700	NA
2,4-DICHLOROPHENOL	31	0	0	2	200	1100	NA
2,4-DIMETHYLPHENOL	31	0	0	1	1300	2600	NA
2,4-DINITROPHENOL	31	0	0	2	130	8500	NA
2,4-DINITROTOLUENE	31	0	NA	NA	NA	1200	NA
2,6-DINITROTOLUENE	31	0	0	24	0.65	1100	NA
2-BUTOXYETHANOL	1	1	NA	NA	NA	13	NA
2-CHLORONAPHTHALENE	31	0	0	2	110	1100	NA
2-CHLOROPHENOL	31	0	0	2	91	2800	NA
2-ETHYL-1,1'-BIPHENYL	1	1	NA	NA	NA	580	NA
2-METHYL-1,1'-BIPHENYL	1	1	NA	NA	NA	490	NA
2-METHYLNAPHTHALENE	32	13	NA	NA	NA	24	NA
2-METHYLPHENOL	31	0	0	0	3300	2000	NA
2-NITROANILINE	31	0	0	17	3.9	10000	NA
2-NITROPHENOL	31	0	NA	NA	NA	1100	NA
3,3'-DICHLOROBENZIDINE	31	0	0	28	0.89	5500	NA
3-NITROANILINE	31	0	NA	NA	NA	10000	NA
4,6-DINITRO-2-METHYLPHENOL	31	0	NA	NA	NA	4800	NA
4-BROMOPHENYL PHENYL ETHER	31	0	NA	NA	NA	1700	NA
4-CHLORO-3-METHYLPHENOL	31	0	NA	NA	NA	1100	NA
4-CHLOROANILINE	31	0	0	2	260	2000	NA
4-CHLOROPHENYL PHENYL ETHER	31	0	NA	NA	NA	1100	NA
4-METHYLPHENOL	31	0	0	2	330	2000	NA
4-NITROANILINE	31	0	NA	NA	NA	10000	NA
4-NITROPHENOL	31	0	NA	NA	NA	5500	NA
ACENAPHTHENE	31	3	0	2	110	2.3	NA
ACENAPHTHYLENE	31	0	NA	NA	NA	1100	NA
ANILINE	11	0	0	1	19	1700	NA
ANTHRACENE	33	5	1	3	5.7	180	47
AZOBEZENE	1	0	0	1	4	1700	NA
BENZALDEHYDE	1	1	0	0	6500	12	NA
BENZIDINE	11	3	3	8	0.0019	99	NA
BENZOIC ACID	31	0	0	0	100000	10000	NA
BENZO[APYRENE	31	1	1	27	0.061	1.2	NA
BENZO[B]FLUORANTHENE	31	0	0	24	0.61	2200	NA
BENZO[G,H]PERYLENE	31	0	NA	NA	NA	1700	NA
BENZO[K]FLUORANTHENE	31	0	0	3	6.1	2200	NA
BENZYL ALCOHOL	31	0	0	0	20000	10000	NA
BENZYL BUTYL PHTHALATE	31	1	0	1	930	0.63	NA
BENZ[AN]ANTHRACENE	31	0	0	24	0.81	1800	NA
BIS(2-CHLOROETHOXY)METHANE	31	0	NA	NA	NA	1100	NA
BIS(2-CHLOROETHYL) ETHER	31	0	0	31	0.043	1200	NA
BIS(2-CHLOROISOPROPYL) ETHER	31	0	0	7	2.5	1200	NA
BIS(2-ETHYLHEXYL) PHTHALATE	30	19	1	1	32	200	63
CHRYSENE	31	5	0	2	6.1	2.8	NA
DI-N-BUTYL PHTHALATE	31	17	NA	NA	NA	4.3	NA
DI-N-OCTYL PHTHALATE	31	0	0	1	1300	5500	NA
DIBENZOFURAN	31	0	0	2	140	2000	NA
DIBENZ[1,2]ANTHRACENE	31	2	2	26	0.061	1.7	NA
DIETHYL PHTHALATE	31	0	0	0	52000	1100	NA
DIMETHYL PHTHALATE	31	0	0	0	100000	1100	NA
FLUORANTHENE	31	3	0	0	2600	1100	36
FLUORENE	31	3	0	2	90	1.1	NA
HEXACHLOROBENZENE	31	0	0	26	0.28	1100	NA
HEXACHLOROBUTADIENE	31	0	0	2	5.7	1100	NA
HEXACHLOROCYCLOPENTADIENE	31	0	0	2	450	5500	NA
HEXACHLOROETHANE	31	0	0	2	32	2200	NA
INDENO[1,2,3-CD]PYRENE	31	0	0	28	0.61	2200	NA
ISOPHORONE	31	0	0	1	470	1100	NA
N-NITROSO-DI-N-PROPYLAMINE	31	0	0	28	0.063	2400	NA
N-NITROSODIPHENYLAMINE	31	0	0	2	91	2200	NA
NAPHTHALENE	36	13	0	2	240	110	NA

Summary Statistics for All of the Pits

Analyte (units mg/kg unless otherwise not)	No. of Samples Tested	No. of Samples with Detected Concentrations	No. of Samples with Detected Concentrations Greater than the PRG	No. of Samples with the Detection Limit Greater than the PRG	Preliminary Remediation Goal (PRG)	Maximum Concentration	Upper 95% Confidence Limit
NITROBENZENE	31	0	0	2	18	5500	NA
PENTACHLOROPHENOL	31	0	0	21	2.5	5500	NA
PHENANTHRENE	34	14	NA	NA	NA	21000	1110
PHENOL	32	2	0	0	36000	0.80	NA
PYRENE	31	8	0	2	100	5.8	NA
PESTICIDES							
4,4'-DDD	13	0	0	0	1.9	1.0	NA
4,4'-DDE	13	0	0	0	1.3	0.50	NA
4,4'-DDT	13	0	0	0	1.3	1.0	NA
ALDRIN	13	0	0	7	0.026	0.50	NA
ALPHA-BHC	12	0	0	4	0.071	0.50	NA
ALPHA-CHLORDANE	4	0	NA	NA	NA	0.13	NA
BETA-BHC	12	0	0	2	0.25	0.50	NA
CHLORDANE	9	0	0	4	0.34	1.0	NA
DELTA-BHC	12	0	NA	NA	NA	1.0	NA
DIELDRIN	13	0	0	7	0.028	0.50	NA
ENDOSULFAN I	12	0	0	0	390	5.0	NA
ENDOSULFAN II	12	0	NA	NA	NA	0.50	NA
ENDOSULFAN SULFATE	12	0	NA	NA	NA	5.0	NA
ENDRIN	13	0	0	0	20	1.0	NA
ENDRIN ALDEHYDE	8	0	NA	NA	NA	1.5	NA
ENDRIN KETONE	4	0	NA	NA	NA	0.025	NA
GAMMA-BHC (LINDANE)	13	0	0	2	0.34	0.50	NA
GAMMA-CHLORDANE	4	0	NA	NA	NA	0.13	NA
HEPTACHLOR	13	0	0	4	0.099	0.50	NA
HEPTACHLOR EPOXIDE	13	0	0	7	0.049	0.50	NA
METHOXYCHLOR	13	0	0	0	330	15	NA
TOXAPHENE	13	0	0	7	0.4	18	NA
PCBs							
PCB-1016	14	0	0	12	0.066	50	NA
PCB-1221	14	0	0	12	0.066	50	NA
PCB-1232	14	0	0	12	0.066	50	NA
PCB-1242	14	0	0	12	0.066	50	NA
PCB-1248	14	0	0	12	0.066	50	NA
PCB-1254	14	0	0	12	0.066	50	NA
PCB-1260	14	0	0	12	0.066	50	NA
METALS							
ANTIMONY	36	21	0	0	31	8.7	4.0
ARSENIC	44	25	25	18	0.38	29	8.8
BARIUM	44	44	0	0	5300	790	226
BERYLLIUM	36	25	24	1	0.14	99	2.5
CADMIUM	45	10	0	0	9	7.8	0.72
CHROMIUM, TOTAL	45	44	1	0	210	660	48
CHROMIUM, VI	8	0	0	1	0.2	0.25	NA
COBALT	31	30	0	0	4600	19	11
COPPER	37	36	0	0	2800	1300	88
LEAD	45	23	3	0	130	640	29
MERCURY	22	5	0	0	23	0.12	0.036
MOLYBDENUM	31	1	0	0	380	1.9	0.48
NICKEL	36	36	0	0	150	39	19
SELENIUM	45	7	0	0	380	75	23
SILVER	44	2	0	0	380	4.2	0.54
THALLIUM	36	0	0	0	5.4	5.0	NA
VANADIUM	35	35	0	0	540	67	44
ZINC	37	37	0	0	23000	430	114
OTHER							
CYANIDE	8	0	0	0	1300	0.10	NA
IGNITABILITY	4	NA	NA	NA	NA	140	120
pH	7	NA	NA	NA	NA	10	NA

* = maximum concentration shown is maximum detection limit
NA = not applicable or not available.

Source: ESI (1997).

TABLE 3-4
SAMPLES FROM PIT A WITH CONCENTRATIONS EXCEEDING THE PRGs

Area	Sample Location	Analyte	Result, mg/kg	Depth, ft.	TTLc, mg/kg	10 X STLc, mg/kg	20 X TCLP, mg/kg
P-A	II 66	BENZIDINE	14	10	NA	NA	NA
P-A	II 66	BENZIDINE	1.6	20	NA	NA	NA
P-A	II 66	DiBENZ[a,h]ANTHRACENE	1.7	5	NA	NA	NA
P-A	Radian B-2A	ARSENIC	20	5	500	50	100
P-A	Radian B-2	ARSENIC	21	21	500	50	100
P-A	Radian B-2A	ARSENIC	24	20	500	50	100
P-A	Radian B-2	ARSENIC	12	15	500	50	100
P-A	Radian B-2A	ARSENIC	7.1	15	500	50	100
P-A	Radian B-2A	BERYLLIUM	0.65	5	75	7.5	NA
P-A	Radian B-2	BERYLLIUM	1.2	21	75	7.5	NA
P-A	Radian B-2A	BERYLLIUM	1.2	20	75	7.5	NA
P-A	Radian B-2	BERYLLIUM	0.82	15	75	7.5	NA
P-A	Radian B-2A	BERYLLIUM	0.89	15	75	7.5	NA
P-A	Radian B-2A	CHROMIUM (TOTAL)	680	5	2500	50	100
P-A	Radian B-2A	LEAD	640	5	1000	50	100
Source: ESE (1997a)							

TABLE 3-5

SAMPLES FROM PIT B WITH CONCENTRATIONS EXCEEDING THE PRGs

Area	Sample Location	Analyte	Result, mg/kg	Depth, ft.	TTLc, mg/kg	10 X STLC, mg/kg	20 X TCLP, mg/kg
P-B	Radian B-3	ARSENIC	6.5	3	500	50	100
P-B	Radian B-3	ARSENIC	10	20	500	50	100
P-B	Radian B-3	BERYLLIUM	0.44	3	75	7.5	NA
P-B	Radian B-3	BERYLLIUM	0.5	15	75	7.5	NA
P-B	Radian B-3	BERYLLIUM	0.51	20	75	7.5	NA
P-B	Radian B-3	LEAD	180	20	1000	50	100
Source: ESE (1997a)							

TABLE 3-6

SAMPLES FROM PIT C WITH CONCENTRATIONS EXCEEDING THE PRGs

Area	Sample Location	Analyte	Result, mg/kg	Depth, ft.	TTLc, mg/kg	10 X STLc, mg/kg	20 X TCLP, mg/kg
P-C	Radian B-11	ARSENIC	8.1	3	500	50	100
P-C	Radian B-11	ARSENIC	8.3	7	500	50	100
P-C	Radian B-11	ARSENIC	13	10	500	50	100
P-C	Radian B-11	BERYLLIUM	0.56	3	75	7.5	NA
P-C	Radian B-11	BERYLLIUM	0.72	7	75	7.5	NA
P-C	Radian B-11	BERYLLIUM	0.71	10	75	7.5	NA

Source: ESE (1997a)