FINAL REMEDIAL INVESTIGATION REPORT
PEMACO SUPERFUND SITE

5050 E. SLAUSON AVENUE
MAYWOOD, CALIFORNIA

NOVEMBER 2003

RI Report, Tables, and Figures

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MAYWOOD, CALIFORNIA

Prepared for
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San Francisco, California

U.S. Army Corps of Engineers – Omaha District
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November 2003

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EXECUTIVE SUMMARY

Background

T N & Associates, Inc. (TN&A) has prepared this report to document field activities and results associated with a Remedial Investigation (RI) conducted between January 2001 and April 2002 for the Pemaco Superfund Site located in Maywood, California. This work has been accomplished under contracts issued to TN&A by the U.S. Army Corps of Engineers Rapid Response, at the request of the United States Environmental Protection Agency (USEPA), Region IX.

The Pemaco Superfund Site is comprised of 1.4 acres located in a mixed industrial and residential neighborhood in Maywood, Los Angeles County, California. Pemaco, Inc. formally operated as a custom chemical blender between the 1950's and 1991. A wide variety of chemicals were used on-site including chlorinated and aromatic solvents, flammable liquids, oils and specialty chemicals. These chemicals were stored in drums, aboveground storage tanks and over 30 underground storage tanks. The site was abandoned by its owner in 1991. The stored chemicals, drums, ASTs and USTs were removed by 1998 under guidance and funding from the USEPA. Environmental assessments performed between 1990 and 1999 have identified soil and groundwater contamination that originated from the use and storage of chemicals at the property. A soil vapor extraction (SVE) system was installed by USEPA Emergency Removal staff in 1998 and operated until 1999, when it was shut down because of community concerns with the thermal oxidation unit that was used as a part of the SVE.

The site was listed on the National Priorities List (NPL) on January 19th, 1999. A full-scale Remedial Investigation (RI) was performed between January 2001 and November 2001. Groundwater monitoring and pilot scale activities for the evaluation of remedial technologies are currently in progress for the Pemaco site. Remediation of groundwater beneath the site will likely be ongoing for several years into the future.

The City of Maywood, in conjunction with the Trust for Public Land, is planning to use the Pemaco property along with adjacent properties to build a public recreational park. This project is termed the Maywood Riverfront Park project. Future remedial activities of the Pemaco site and adjacent sites will be integrated with the existence of this park.

Objectives and Scope of RI

The objectives of the RI were to:

1. Define the nature and extent of contamination (waste types, concentrations, distributions, etc.) associated with past uses of the Pemaco property;
2. Identify Federal/State applicable or relevant and appropriate requirements (ARARs) pertinent to management and clean up of the site; and
3. Conduct a baseline risk assessment to quantify potential threats that may exist to human health, relative to contamination resulting from the Pemaco site.

The RI activities included extensive sampling of soil, soil vapor, indoor/outdoor air and groundwater on the Pemaco property and surrounding area. Over 1,500 environmental

samples were collected for the RI. These samples were analyzed by various analytical methods to determine various physical and chemical attributes.

Contaminants of Potential Concern (COPCs) and Associated Source Areas

Analytical results of the environmental samples collected during the RI indicate that chemical concentrations originating from the past industrial practices at the Pemaco property have impacted soil and groundwater at the site, as well as offsite. In addition, impacts to groundwater were discovered below adjacent industrial properties and below nearby residential properties. Fifty-six contaminants of potential concern (COPCs) have been identified based on the comparison of analytical results to ARARs. COPCs include various species of metals, solvents/non-halogenated volatile organic compounds (NHVOCs), semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs).

A general breakdown of environmental media and/or "zones" and the relative types and distribution of COPCs in each are as follows:

Media or Zone	Number of COPCs Present	Types of COPCs	Depth	Extent
Ambient Air*	11	VOCs	Breathing zone (samples collected approx. 6 feet above ground surface)	Onsite and offsite (VOCs detected at every sample location in the general vicinity)
Soil Vapor	12	VOCs	5 feet to 15 feet bgs	Onsite, adjacent industrial properties and adjacent residential areas
Surface and Near Surface Soil	11	SVOCs and Metals	6 inches to 2.5 feet bgs	Onsite and adjacent industrial properties
Upper Vadose Zone	21 (DAF 20)	NHVOCs, VOCs, SVOCs and Metals**	2.5 feet to 35 feet bgs	Onsite and adjacent industrial properties
Lower Vadose Zone	11 (DAF 1)	VOCs and Metals**	35 feet to 65 feet bgs	Onsite and adjacent industrial properties
Perched Groundwater	32	NHVOCs, VOCs, SVOCs and Metals**	25 feet to 35 feet bgs	Onsite, adjacent industrial properties and adjacent residential area (Mixed VOC plume extends up to 200 feet southwest of site)
Exposition Groundwater Zones ('A', 'B', 'C' and 'D')	20	NHVOCs, VOCs and Metals**	65 feet to 110 feet bgs	Onsite, adjacent industrial properties and adjacent residential area (VOC plume, primarily trichloroethene, extends ~1,300 feet southwest of site)

bgs = below ground surface
DAF = Dilution attenuation factors for USEPA Region IX Preliminary Remediation Goals
" * " = Data indicates that many of the VOCs found in breathing zone air could be due to background conditions of the Los Angeles basin.
" ** " = Metal concentrations are likely background levels

In addition to the COPCs that originated from past industrial uses at Pemaco, there are also areas where significant impacts from past industrial activities at an adjacent industrial property (W.W. Henry Property) have also occurred. Contamination from the W.W. Henry

property was encountered at several sampling locations performed during the RI activities to delineate the Pemaco sourced impacts. The following table summarizes each specific "hot spot" area where significant quantities of COPCs were identified in the various media/zones and states the likely sources:

Areas of Significant Impact	Impacted Media/Zone*	Approximate Impacted Depths (feet bgs)	Main COPCs	Likely Sources of Impact
Perimeter of Pemaco property and adjacent LAJR property	Surficial Soils	0 to 2.5	PAHs	Anthropogenic background (vehicle exhaust, structural fires, etc.)
			Metals	Natural-occurring background
Northeast Portion of the Pemaco Property	Upper and Lower Vadose Zone Soils Perched Groundwater Exposition Groundwater	5 to 90	Chlorinated VOCs (Mainly PCE, 1,1,1-TCA and DCE)	Former ASTs or Drum Storage Areas (Pemaco)
Southern Portion of Pemaco, 59th Place and Walker Ave. and 59th Place and District Blvd. Intersections	Upper and Lower Vadose Zone Soils Perched Groundwater Exposition Groundwater	5 to 95	Chlorinated VOCs (mainly TCE)	Former USTs or Drum Storage Area (Pemaco)
South-central to south portion of Pemaco	Upper Vadose Zone Soils Perched Groundwater	15 to 30	Non-chlorinated VOCs (mainly BTEX)	Former USTs (Pemaco)
Area in the immediate vicinity of well B-15, west-central portion of Pemaco bordering LAJR	Perched Groundwater	25 to 30	Non-chlorinated VOCs (kerosene range hydrocarbons, including free product)	Former ASTs (Pemaco) or spill along LAJR
North-east portion of W.W. Henry property (near B-31)	Upper Vadose Zone Soils Perched Groundwater	5 to 25	Chlorinated VOCs (mainly PCE)	Product piping connecting rail spur to USTs (W.W. Henry)
East-central portion of W.W. Henry property and 59th Place west of B-27	Upper and Lower Vadose Zone Soils Perched Groundwater Exposition Groundwater	15 to 90 (including large volumes of free product in the perched zone)	Non-chlorinated VOCs (mainly hexane, toluene and benzene)	Former USTs (W.W. Henry)
West portion of W.W. Henry property	Upper Vadose Zone Soils Perched Groundwater Lower Vadose Zone Soils (?) Exposition Groundwater (?)	5 to >30 (?)	Chlorinated VOCs (mainly 1,1,1-TCA, PCE, 1,1-DCE and 1,1-DCA)	Former Mixing Patio (W.W. Henry)

* = Ambient air not included, see below for discussion.
? = Vertical extent of contamination unknown.

COPCs in Ambient Air and Soil Vapor

Three rounds of soil vapor sampling and two rounds of indoor residential and outdoor air sampling were performed as part of the RI. The first soil vapor sampling event was performed for contaminant delineation purposes and the second two events were performed for vapor intrusion modeling purposes to accompany the residential indoor and outdoor air sampling data collected from the neighborhood adjacent to Pemaco. A total of 86 soil vapor samples were collected at a depth of 5 feet bgs, and 16 samples were collected from 15 feet bgs. A total of 18 indoor residential air samples and 13 outdoor air samples were collected. Indoor air sampling of residences within 1 block of the Pemaco property indicated that COPCs present in soil vapor are not contributing to indoor air contamination above background levels that are found in outdoor air throughout the Maywood area. There are only two residences where the data collected from soil vapor and indoor air samples indicated that the chemical concentrations in soil vapor could be contributing to the indoor air chemical concentrations. These residences are located near the free product plume originating from the W.W. Henry property (adjacent to Pemaco). However, this assertion may be preliminary and requires further investigation to be substantiated. The levels found in soil vapor underlying the residential lots are not high enough to support a vapor intrusion pathway according to the latest literature on the subject. More soil vapor, indoor air and outdoor air sampling events are planned for the residential area near Pemaco in 2003.

COPCs in Surface and Near-Surface Soil

A total of 75 surface (0.5 feet bgs) and 75 near-surface (2.5 feet bgs) soil samples were collected on, and immediately adjacent to the Pemaco property. Samples were analyzed for SVOCs and metals. Analytical results indicate widespread concentrations of SVOCs and limited concentrations of metals exceeding PRGs in both soil zones.

Polyaromatic hydrocarbons (PAHs) were the most prevalent SVOCs detected above Region IX PRGs for residential soil among both surface and near surface samples with concentrations ranging from 62 µg/kg to 38,000 µg/kg. Although there was no indication of historical use of PAHs at Pemaco or adjacent industrial properties, the compounds were detected throughout the Pemaco site. A possible source of the PAH concentrations could be from creosote treated railroad ties located along the Los Angeles Junction Railroad property (LAJR) and the associated spurs branching off each property, or from the warehouse fire that occurred on the Pemaco site in 1993. However, PAHs were also detected in areas that are far from the railway. It is likely that PAHs can be found in shallow soil throughout the Maywood area due to vehicle exhaust, fires and paving activities that have occurred over the years. These concentrations appear to be only surficial phenomena.

Arsenic, iron, lead and manganese are the only metals detected at concentrations exceeding PRGs in surface and near-surface soils. Iron is the only metal that is detected at concentrations somewhat consistently above the PRG of 23,000 mg/kg (27 out of the 150 samples). It should be noted that the mean value for iron concentrations in California soils is approximately 37,000 mg/kg according to published technical literature. The mean iron concentration for the Pemaco surface and near-surface soil samples is 19,300 mg/kg. The mean value for iron concentrations in Pemaco vadose zone soils 20,462 mg/kg. The range of iron concentrations in Pemaco soils is well within naturally occurring background levels. The other metals concentrations exceeding PRGs (arsenic, lead and manganese) were detected in very limited numbers (5 out of 150 samples) and at sporadic aerial distributions.

It is unlikely that the elevated metal concentrations are a result any significant contaminant source related to Pemaco.

As concentrations of SVOCs and metals in surface and near surface soils indicate, the majority of surficial soil contamination appears to lie along the periphery of the Pemaco site. This would be consistent with the fact that clean fill was placed over much of the site during previous removal actions in 1997-1998 when the former warehouse foundation and USTs were removed from the central portion of the site and replaced with the clean fill.

COPCs in Upper and Lower Vadose Zone Soils

A total of 616 samples were collected from vadose zone soils between 2.5 and 70 feet bgs.

Five primary areas of contamination have been identified in the upper vadose zone (between 2.5 and 35 feet bgs), these are:

1. Below the north-central part of Pemaco site and extending approximately 80 feet offsite (to the west) between 25 and 35 feet bgs, primarily comprised of chlorinated VOCs;
2. A small area below the central part of the Pemaco site around 15 feet bgs, primarily comprised of toluene, ethylbenzene and xylenes;
3. A small area below and adjacent to the central-west part of the Pemaco site (below the rail tracks) around 5 feet bgs, primarily comprised of SVOCs;
4. Below the south part of Pemaco site and extending approximately 200 feet offsite (to the west/southwest) between 25 and 35 feet bgs, primarily comprised of chlorinated VOCs; and
5. An offsite area resulting from releases at the adjacent former W.W. Henry-owned property, consisting primarily of benzene, toluene, and hexane.

Two areas of contamination have been identified in the lower vadose zone (between 35 and 70 feet bgs). One area is located below the south part of the Pemaco site and offsite to the south/southwest and is comprised of chlorinated VOCs. The other area is related to the W.W. Henry free product plume and was detected along 59th Place adjacent to the W.W. Henry property. The extent of the W. W. Henry contamination was not fully evaluated, as it is not part of the Pemaco RI/FS scope.

COPCs in Groundwater

A total of 42 groundwater monitoring wells have been installed in the perched groundwater zone, and 36 wells in the various Exposition groundwater zones. Five sampling and monitoring events have been conducted using this well network. These sampling and monitoring events have completely delineated contaminant “plumes” originating from the Pemaco property. Plumes have been identified in the perched groundwater zone (25 to 35 feet bg) and in the upper Exposition Groundwater Zones, which exist as individual semi-confined/confined sand zones typically found between 65 and 95 feet bg.

Perched Groundwater

PCE, TCE and vinyl chloride are the most prevalent compounds in the perched groundwater zone. “Hot spot” areas of these plumes have had groundwater concentrations exceeding

1,000 µg/L. The dissolved-phase portions of these perched plumes extend offsite and have migrated beneath adjacent properties extending up to 250 feet to the south and up to 200 feet southwest of the Pemaco property. The southwest extent of the plume has migrated beneath one adjacent residential lot. Contaminant plumes originating from the Pemaco property have also co-mingled with other chlorinated and non-chlorinated contaminant plumes that have resulted from historical industrial uses of neighboring properties (former W.W. Henry and Lubricating Oil Services properties).

Exposition Groundwater Zones

The Exposition Groundwater Zones include five distinct saturated sand zones located between 65 to 175 feet bgs. These zones are separated by fine-grained (silt/clay) intervals and vary in thickness. For the purposes of this RI, these zones shall be identifeid as Zones 'A' through 'E' (from shallowest to deepest). The most extensive groundwater contaminant plumes in the Pemaco area are found in the upper Exposition Groundwater Zones (Exposition 'A' and 'B' Zones) and are primarily comprised of TCE and its daughter products. The largest plume is approximately 1,300 feet long and 750 feet wide and is within the Exposition 'B' Zone. The dissolved-phase portion of this plume extends towards the southwest of the Pemaco property and underlies a two-block area that is used for residential housing. The "hot spot' area of this plume is directly below the southernmost portion of the Pemaco property and contains TCE concentrations exceeding 20,000 µg/L. These high concentrations fall off quickly to levels below 100 µg/L approximately 300 away from the site and fall below 10 µg/L approximately 500 feet away from the site. It should be noted that while the lateral extent of this plume is somewhat large, the vertical extent is limited to the saturated thickness of the 'B' Zone sand, which ranges from 1.5 to 10 feet thick and is typically found between 80 and 90 feet bg.

During the data review stages of the RI activities, data gaps were identified regarding concentration distributions and gradient directions in the lower Exposition 'C' and 'D' Zones in the immediate Pemaco site vicinity. In July and August of 2003, additional groundwater monitoring wells were installed in the Exposition 'C' and 'D' Zones in the immediate site vicinity adjacent to the postulated TCE release areas. Screening data collected from these wells in August 2003 and definitive data collected in October 2003 indicated that the only elevated TCE concentrations detected in these new deep wells were from the 'D' Zone well located directly adjacent to the postulated source area. These concentrations were detected at 38 and 120 µg/L. No elevated TCE concetrations were detected in any of the surrounding wells which are located approximately 150 feet down and cross gradient to the postulated source area.

A technical memorandum detailing the field activities and results of this additional investigation are provided as an appendix to this document.

<u>Migration and Fate of COPCs</u>

The large volume and widespread spatial distribution of physical and chemical data generated during RI activities allows for accurate assessment of contaminant extent and transport/migration pathways at Pemaco. However, due to the uncertain timing of individual chemical releases, irregular/complex stratigraphy/hydrogeology, and the relative lack of long-term monitoring data, only estimates can be made regarding contaminant fate/migration. Additional groundwater sampling events over time will allow for the determination of whether

dissolved-phase contaminants are continuing to migrate further downgradient in the various groundwater zones, or if groundwater "plumes" are stable.

Risk Assessment

A baseline risk assessement was performed to quantify potential risks to human health that may be associated with chemicals in soil, soil vapor and groundwater at and adjacent to the Pemaco site. The risk assessment considered current, proposed and possible land uses. A summary of carcinogenic risks and non-carcinogenic hazards calculated as part of the risk assessment as follows:

Receptor	Media	Total Carcinogenic Risk		Total Noncarcinogenic Hazard Quotient	
		RME (1)	CT (2)	RME(1)	CT(2)
Current Onsite					
Trespasser	Surface soil	4.5E-06	4.3E-07	1.0E-02	2.2E-03
Future Onsite					
Park User	Surface soil	7.9E-05	1.9E-05	3.1E-01	1.2E-01
Excavation Worker	Surface and subsurface soil	6.9E-06	8.5E-07	1.2E-01	2.5E-02
Resident	Surface soil, groundwater and vapor intrusion	1.6E-01	4.5E-02	1.8E+03	7.5E+02
Current Offsite					
Resident	Indoor and Outdoor air	9.2E-05	2.3E-05	1.1E+01	7.1E+00
	Outdoor air background	3.7E-05	NA	4.4E+00	NA
	Modeled vapor intrusion	1.6E-05	3.1E-6	1.0E-02	5.5E-03

(1) Reasonable maximum exposure parameters

(2) Central tendency exposure parameters

Ongoing and Future Work

A Feasibility Study (FS) to evaluate remedial alternatives for soil and groundwater at the Pemaco Superfund Site is currently under review as part of the public comment period. It is anticipated that the Final FS will be completed in early 2004, and that a Proposed Plan and Record of Decision will be prepared shortly thereafter.

A quarterly groundwater sampling and monitoring program has been implemented and more soil vapor and ambient air sampling (indoor/outdoor) will be performed in the residential neighborhood adjacent to Pemaco.

Design and implementation of the remedial alternative that is eventually selected for the site will require integration and coordination with planners and developers of the Maywood Riverfront Park Project.

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FIGURES (continued)

FIGURES (continued)

APPENDICES

APPENDICES (continued)

ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirements
AST	Aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	Below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CA	Corrective action
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CLP	Contract laboratory program
CLPAS	Contract Laboratory Program Analytical Services
COPC	Chemicals of potential concern
CPT	Cone Penetrometer Test
CSM	Conceptual site model
DCA	Dichloroethane
DCE	Dichloroethene
DNAPL	Dense non-aqueous phase liquid
DOT	Department of Transportation
DPT	Direct push technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
DTSC	Department of Toxic Substances Control
E&E	Ecology & Environment
ESI	Expanded Site Investigation
FASP	Field Analytical Support Program
FHP	Free hydrcarbon product
FTL	Field Team Leader
GC/MS	Gas chromatograph/mass spectrometer
HRS	Hazardous ranking system
ICP	Inductively coupled plasma
ICS	Interferrence check samples
IDW	Investigation-derived waste
IS	Internal Standards
LCS	Laboratory control sample
LAJR	Los Angeles Junction Railway
LOS	Lubricating Oil Services
LQG	Large quantity generator
LUST	Leaking underground storage tank
MDL	Method detection limit
MEK	Methyl Ethyl Ketone
MIBK	Methyl Isobutyl Ketone
MRP	Maywood Riverfront Park
MS	Matrix spike

ACRONYMS (continued)

MSD	Matrix spike duplicate
MSL	Mean sea level
NHVOC	Non-Halogenated Volatile Organic Compound
NIST	National institute of standards and testing
NCR	Non-conformance report
NPL	National Priorities List
NSB	Near surface soil boring
NTU	Nephelometric turbidity unit
OERR	Office of Emergency and Remedial Response
PAH	Polyaromatic hydrocarbons
PA/SI	Preliminary assessment/site investigation
PCE	Tetrachloroethene
PE	Performance evaluation
PID	Photoionization detector
PM	Project Manager
PPE	Personal protective equipment
PRG	Preliminary remediation goal
PRT	Post run tubing
PVC	Polyvinyl chloride
QA	Quality assurance
QA/QC	Quality assurance/quality control
QC	Quality control
RAP	Regional analytical program
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting limit
RPD	Relative percent difference
RSCC	Regional Sample Control Coordinator (or Center)
RSD	Relative standard deviation
RWQCB	Regional Water Quality Control Board
SAP	Sampling and analysis plan
SC	Sample Coordinator
SOP	Standard operating practice
SRM	Standard Reference Materials
SSH	Site safety and health
SSHO	Site safety and health officer
SSHP	Site safety and health plan
SSB	Subsurface soil boring
SSL	Soil screening level
START	Superfund technical assistance and removal team
SVE	Soil vapor extraction
SVOC	Semi-volatile organic compound
TCA	Trichloroethane

ACRONYMS (continued)

TCE	Trichloroethene
TCL	Target Compound List
TN&A	T N & Associates, Inc.
TPH	Total petroleum hydrocarbons
TRPH	Total recoverable petroleum hydrocarbons
USACE	United States Army Corps of Engineers – Rapid Response
USEPA	United State Environmental Protection Agency
UST	Underground storage tank
VOA	Volatile organic analysis
VOC	Volatile organic compound

1.0 INTRODUCTION

The Pemaco Superfund Site is comprised of 1.4 acres located in a mixed industrial and residential neighborhood in Maywood, Los Angeles County, California. Pemaco, Inc. formally operated as a custom chemical blender between the 1950's and 1991. A wide variety of chemicals were used on-site including chlorinated and aromatic solvents, flammable liquids, oils and specialty chemicals.

Operations ceased at Pemaco during 1991. Between 1991 and 1994, approximately four hundred 55-gallon drums and three aboveground storage tanks were removed from the site by order of the Los Angeles District Attorney's office. A substantial fire in 1993 destroyed much of the main warehouse building. In 1994, United States Environmental Protection Agency (USEPA) Region IX Emergency Response conducted a removal assessment at Pemaco at the request of Los Angeles County. As a part of this assessment, USEPA removed six 55-gallon drums, installed fencing, and secured underground storage tank (UST) fill pipes with locking well caps.

In June of 1995, Bechtel completed a preliminary assessment/site investigation at Pemaco, which led to the listing of Pemaco into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) under the I.D. number CAD980737092. Ecology & Environment's (E&E) Superfund Technical Assistance Response Team (START) completed an expanded site investigation (ESI) in 1997, which included an evaluation of Hazardous Ranking System (HRS) Factors. Based on these factors, Pemaco was added to the Superfund National Priorities List (NPL) in January 1999.

CET Environmental Services, Inc. (CET) completed removal activities at Pemaco between August 1997 and March 1998 under the direction of Region IX's Emergency Removal Office (E&E, 1998a, 1998b). Work included excavation and removal of USTs, building demolition, environmental sampling, and the design, installation, and operation of a soil vapor extraction (SVE) system. The SVE system operated between March 1998 and March 1999 (E&E, 1999). By the end of August 1998, the SVE system had operated for 3,230 hours (134.6 days), and removed and treated approximately 90,000 pounds of hydrocarbons and solvents from vadose zone soils at the site. The system was turned off on March 3, 1999 due to community concern regarding the possibility of dioxin releases from the thermal oxidation unit. Public concern of dioxin releases was only speculative; no effluent vapor samples were analyzed for concentrations of dioxin.

Environmental cleanup activities at the site will likely continue for several years into the future. The City of Maywood in conjunction with the Trust for Public Land (TPL) is planning on building the Maywood Riverfront Park as part of a 51-mile greenway along the Los Angeles River. Future remedial activities will be integrated with the existence of the park.

1.1 PURPOSE OF REPORT

This report was prepared for the United States Environmental Protection Agency (USEPA) by T N & Associates, Inc. (TNA) to document field activities and results associated with a Remedial Investigation (RI) conducted between January 2001 and April 2002 for the Pemaco Superfund Site located in Maywood, California. Work in support of this RI was accomplished under Contract No. DACA45-97-D-0015, Delivery Order 017, issued to TN&A by the U.S.

Army Corps of Engineers (USACE) Rapid Response, at the request of Region IX of the USEPA. Technical contacts for the Pemaco Superfund Site are:

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1.2 ORGANIZATION OF THE REPORT

This report is divided into nine major sections. A brief overview of these sections is tabulated below.

Executive Summary: Provides an overview of the investigation and findings.

Section 1: Describes the administrative and regulatory framework for the work conducted and the purpose of the RI Report. Also describes the organization of the report.

Section 2: Provides a physical description and site history; summarizes previous investigations/removal actions conducted at the site; presents operational/land use history of adjacent properties.

Section 3: Summarizes Pemaco RI field activities.

Section 4: Describes regional setting and site-specific geology and hydrogeology of the Pemaco site.

Section 5: Discusses the nature and extent of contamination per media based on results of the RI.

Section 6: Tabulates the contaminants of potential concern present on- and off-site.

Section 7: Discusses contaminant characteristics and their potential routes of migration.

Section 8: Describes risk assessment methodology and risk characterization of Pemaco site for current and future use.

Section 9: Summarizes nature and extent of contamination, fate and transport of site contaminants, and risk characterization.

1.2.1 Field Events

The following table summarizes each field activity performed by TN&A for the Pemaco RI as of the date of this report. Corresponding technical memorandums describing details of individual activities/sampling events are attached as Appendices to this report and will be referenced and summarized in the text as appropriate. Where technical memorandums were not prepared, field events will be discussed in detail within the RI Report.

FIELD EVENT – Description	Time Period	Corresponding Technical Memorandums	Corresp. RI Section
Pre-RI/FS Baseline Sampling – • 9 wells sampled in perched zone • MW-1 through MW-4 sampled in Exposition groundwater zones • Sampled dormant SVE system • Every groundwater well sampled had concentrations of selected COCs above regulatory levels	October 2000	*Draft Summary of Groundwater and SVE System Sampling Events, October 2000* (TN&A, 2000)	Sections 3.5 and 3.6
Hydropunch/CPT Investigation – • 149 surface and near-surface soil samples collected from 76 borings (DPT) • 74 vadose zone soil borings advanced • 152 upper vadose zone soil samples collected • 138 lower vadose zone soil samples collected • 28 groundwater grab samples collected from boring advanced in perched groundwater zone • 13 groundwater grab samples collected from CPT borings advanced in Upper Exposition groundwater zones • 18 monitoring wells (MW-5 through MW-13) installed within Exposition • 16 monitoring wells (B-17 through B-32) installed within perched groundwater	February – April 2001	Technical Memorandum: *Results of In-situ Groundwater Sampling in the Perched Zone and Upper Exposition* Aquifer, *February and November 2001, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, CA (TN&A, 2002a)*	Sections 3.5, 3.6, 5.4, and 5.5
Soil Vapor Investigation – • Soil vapor samples collected from 66 borings (DPT)	February 2001		Sections 3.2 and 5.1
1st Quarterly Groundwater Monitoring Event – • All monitoring wells within the perched groundwater zone and the Exposition groundwater zones were gauged • Groundwater samples collected from monitoring wells B-1 through B-32 (with some exceptions); SV-1 through SV-5; and MW-1 through MW-13	May – June 2001	Technical Memorandum: *Results of Groundwater Monitoring Activities, May 2001 through April 2002, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, CA (TN&A, 2002b)*	Sections 3.5, 3.6, 5.4 and 5.5

FIELD EVENT – Description	Time Period	Corresponding Technical Memorandums	Corresp. RI Section
Groundwater, Soil Vapor & Ambient Air Sampling – • Soil vapor sampling performed by Levine-Fricke as part of separate investigation for the W.W. Henry property; TN&A collected 7 soil vapor split samples • TN&A additionally collected 7 in-situ groundwater samples and 8 ambient air samples (indoor and outdoor) within the residential area surrounding Pemaco	July 2001	Technical Memorandum: *Results of the July 2001 Soil Gas, Indoor/Outdoor Air and Groundwater Sampling Completed in the Residential Neighborhood Adjacent to the Pemaco Superfund Site and Former WW Henry Properties, 5920 Alamo Avenue and 5050 E. Slauson Ave., Maywood, CA (TN&A, 2002c)*	Sections 3.2, 3.5, 5.1, and 5.4
2nd Quarterly Groundwater Monitoring – • All monitoring wells within the perched groundwater zone and the Exposition groundwater zones were gauged • Groundwater samples collected from monitoring wells B-1 through B-32 (with some exceptions); SV-1 through SV-5; and MW-1 through MW-13	September – October 2001	Technical Memorandum: *Results of Groundwater Monitoring Activities, May 2001 through April 2002, Pemaco Superfund Site, 5050 E. Slauson Ave., Maywood, CA (TN&A, 2002b)*	Sections 3.5, 3.6, 5.4 and 5.5
Data Gap Assessment – • 14 soil borings advanced • 70 soil samples were collected from the vadose zone • 7 monitoring wells (B-33 through B-39) were installed within the perched groundwater zone • 6 monitoring wells (MW-14 through MW-19) and one recovery well (RW-1) were installed within Exposition groundwater zones • 6 in-situ CPT groundwater samples were collected	November 2001	Technical Memorandum: *Groundwater Sampling in the Perched Zone and Upper Exposition* Aquifer, *February and November 2001, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, CA (TN&A, 2002a)*	Sections 3.4, 3.5, and 3.6
Aquifer Test – • Recovery well RW-1 was continuously pumped one gpm for 52 hours • Thirteen surrounding observation wells were monitored with pressure transducers set to data loggers • Groundwater samples collected from MW-14, MW-17, MW-18 and MW-19	November/ December 2001	Technical Memorandum: *Aquifer Testing, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, CA (TN&A, 2002d)*	Section 4.5.2.3
3rd Quarterly Groundwater Monitoring – • All monitoring wells within the perched groundwater zone and the Exposition groundwater zones were gauged • Groundwater samples collected from monitoring wells B-1 through B-39 (with some exceptions); SV-1 through SV-5; and MW-1 through MW-14 and MW-18	January 2002	Technical Memorandum: *Results of Groundwater Monitoring Activities, May 2001 through April 2002, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, CA (TN&A, 2002b)*	Sections 3.5, 3.6, 5.4 and 5.5

FIELD EVENT – Description	Time Period	Corresponding Technical Memorandums	Corresp. RI Section
Soil Vapor and Ambient Air Sampling – • 28 soil vapor samples collected at 14 locations (5 feet below ground surface (bgs) and 15 feet bgs) • 22 indoor/outdoor air samples collected in residential area adjacent to Pemaco site	March 2002	Technical Memorandum: *Results of Soil Gas and Indoor/Outdoor Air Sampling – March 2002, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, CA (TN&A, 2002e)*	Sections 3.2 and 5.1
4th Quarterly Groundwater Monitoring – • All monitoring wells within the perched groundwater zone and the Exposition groundwater zones were gauged • Groundwater samples collected from monitoring wells B-1 through B-39 (with some exceptions); SV-1 through SV-5; and MW-1 through MW-14 and MW-17	April 2002	Technical Memorandum: *Results of Groundwater Monitoring Activities, May 2001 through April 2002, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, CA (TN&A, 2002b)*	Sections 3.5, 3.6, 5.4 and 5.5
Baseline Risk Assessment –	September 2002	Technical Memorandum: *Baseline Risk Assessment, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, CA (TN&A, 2002f)*	Section 8.0

1.3 GENERAL NOMENCLATURE OF ENVIRONMENTAL MEDIA

The following nomenclature is used to describe the site's subsurface features and will be referred to throughout this document:

- **Surface soil** – Soil occurring at the surface to a depth of 6 inches below ground surface (bgs).
- **Near-surface soil** – Soil occurring between depths of 6 inches and 2.5 feet bgs.
- **"Upper" vadose zone soil/sediments** – Soil between 2.5 feet bgs and the top of the fine-grained interval that occurs at 35 feet bgs, on average (based on boring logs).
- **Perched groundwater** – The saturated zone that is present above the fine-grained unit (at 35 feet bgs). The perched groundwater zone generally occurs between 25 feet and 35 feet bgs, though the depth to water varies based on seasonal rainfall amounts.
- **Perching clay** – Clay/silt lithosome that occurs between the depths of 28 feet to 40 feet bgs (35' bg on average). The perching clay serves as an aquitard that slows the infiltration of groundwater, which forms the perched groundwater zone

- **"Lower" vadose zone soil** – The interval between the base of the perched groundwater (about 35 feet bgs) and the top of the underlying saturated zone (about 65 feet bgs).

- **Lakewood Formation** –For purposes of this investigation, the Lakewood Formation boundaries will include those strata and lithosomes between 35 feet bgs (top of fine-grained unit) and 200 feet bgs.

- **Lakewood Formation Aquifers and Groundwater Zones** – Regional aquifers within the Lakewood Formation include the Exposition Aquifer and the Gage/Gardena Aquifer. Based on regional data, the Exposition Aquifer is present at depths between 80 ft and 200 ft bgs. The Exposition Aquifer, within the study area, is not a viable aquifer, because the groundwater yield does not produce economically significant quantities of water to local production wells. However, there are five distinct saturated zones present between 65 and 180 feet beneath the site and surrounding area that are stratigraphically equivalent with the more regional Exposition Aquifer. These zones are identified as Exposition Groundwater Zones 'A' through 'E' for the purposes of this project. The presence of the Gage/Gardena Aquifer has not been confirmed beneath the site, but is assumed to exist between 180 and 200 feet bgs. The Exposition 'E' Zone referenced above may be part of the Gage/Gardena Aquifer, but for the purposes of this report all saturated zones between 65 and 180 feet bgs will be referred to as Exposition Groundwater Zones.

- **San Pedro Formation** – For purposes of this investigation, the top of the San Pedro Formation will be placed at the base of the Gage/Gardena Aquifer, extrapolated to be at approximately 200 feet bgs. The base of the San Pedro Formation is likely below 1000 feet bgs in the area.

- **San Pedro Formation Aquifers** - Regional aquifers within the San Pedro Formation include the Hollydale, Jefferson, Lynwood, and Silverado Aquifers. Regional data suggest that the Jefferson and Lynwood are present in the area of the Pemaco Site. The shallower Hollydale aquifer may or may not be present below the site; regional cross-sections of the area show that sand units of the Hollydale aquifer may "pinch-out" and not be present (State of California, 1961).

2.0 SITE BACKGROUND

2.1 PEMACO PROPERTY

The following sections describe current site conditions, site operational and land use history, and previous environmental investigations.

2.1.1 Site Description

The Pemaco site is comprised of 1.4 acres located within a mixed industrial and residential neighborhood in the City of Maywood, California. Maywood is located in Eastern Los Angeles County. Figure 1 illustrates the general geographical area of the Pemaco site.

The site is currently a vacant dirt lot, with the exception of two temporary office/storage containers and a cement pad that parallels the Los Angeles River on the eastern-most side of the property (Figure 2).

The City of Maywood is proposing to build a 7.3-acre public recreational park in the City of Maywood adjacent to and west of the Los Angeles River just south of East Slauson Avenue. The Maywood River Park would be one segment of a proposed 51-mile greenway along the Los Angeles River. The proposed park would include the Pemaco, W.W. Henry, Catellus, Lubricating Oil, LA Junction Railroad Right-of-Way, and Precision Arrow properties.

2.1.2 Site Operational and Land Use History

The Pemaco property was used as a chemical blending facility and chemical distributor from the 1950's until 1991 (E&E, 1998a). Marie B. Richardson was the owner of Pemaco, Inc. until 1984, at which time Lux International purchased the property. Lux International operated a chemical blending facility until 1991 when they went out of business. No other use of the property is documented since 1991.

Historically, the Pemaco facility consisted of a 22,000-square foot warehouse in the northern portion of the property, and 31 underground storage tanks (USTs) and at least 6 aboveground storage tanks (ASTs) in the south part of the property. Figure 2A illustrates the approximate locations of the former environmental features. Large quantities of chemicals were stored in the ASTs and USTs, which ranged in size from 500 to 20,000 gallons, as well as 55-gallon drums stored around the site. A wide variety of chemicals were used on-site including chlorinated and aromatic solvents, flammable liquids, oils and specialty chemicals. Most of the chemicals brought to the site were delivered via railcar from a rail spur that branched out from the Los Angeles Junction Railway Property (LAJR) property west of the site (Figure 2A).

2.1.3 Previous Environmental Investigations

Numerous soil and groundwater investigations have been completed at the property to assess the extent of contamination at the Pemaco site and surrounding area. The first soil assessment of the property was completed in 1990 by the Pemaco facility owner. The owner abandoned the site sometime after 1991 and environmental activities at the site became the

responsibility of the USEPA under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

Operations ceased at Pemaco during 1991. Between 1991 and 1994, approximately four hundred 55-gallon drums and three aboveground storage tanks were removed from the site by order of the Los Angeles District Attorney's office. A substantial fire in 1993 destroyed much of the main warehouse building. In 1994, USEPA Region IX Emergency Response conducted a removal assessment at Pemaco at the request of Los Angeles County. As a part of this assessment, USEPA removed six 55-gallon drums, installed fencing, and secured UST fill pipes with locking well caps.

In June of 1995, Bechtel completed a preliminary assessment/site investigation at Pemaco. Pemaco was then entered into CERCLIS in 1995 under the I.D. number CAD980737092. From February through May of 1997, Ecology & Environment's START completed an ESI, which included the collection of additional soil samples, installation of monitoring wells, sampling of new and existing wells, and an evaluation of HRS Factors. Based on HRS factors, Pemaco was eventually added to the Superfund NPL in January 1999.

CET completed removal activities at Pemaco between August 1997 and March 1998 under the direction of Region IX's Emergency Removal Office (E&E, 1998a, 1998b). Work included excavation and removal of USTs, air monitoring, building demolition, surface soil sampling for volatile organic compounds (VOCs), soil vapor monitoring, subsurface soils sampling, groundwater sampling, remedial pilot tests, design and installation of a SVE system, and operation of the SVE. The SVE system operated between March 1998 and March 1999 (E&E, 1999). By the end of August 1998, the SVE system had operated for 3,230 hours (134.6 days), and removed and treated approximately 90,000 pounds of hydrocarbons and solvents from vadose zone soils at the site. The system was turned off on March 3, 1999 due to community concern regarding the possibility of dioxin releases from the thermal oxidation unit. The USEPA collected air samples from the outflow of the SVE unit and determined that the thermal oxidation unit was safe. The outflow sampling did not, however, specifically analyze for dioxin concentrations.

The aforementioned environmental investigations are more thoroughly discussed in the following sections subdivided by environmental media. A chronological account of previous events at the Pemaco Site can be found in Table 2.1.3. Note that many of the environmental samples with concentrations of chemicals described below were collected/analyzed prior to remediation/removal activities described in Section 2.1.4.

2.1.3.1 Previous Soil Investigations and Findings

Surface Soil

Approximately 120 shallow near surface borings (NSB) were sampled in May 1997 during the ESI at a depth of 5 feet bgs (E&E, 1998a). E&E extensively sampled shallow soils in the former drum storage area on the east side of the property near the Los Angeles River, and from various locations around the former ASTs and USTs on the west side of the property near the railroad tracks (Figure 2A). 4-Methyl-2-pentanone and PCE were detected in the northeast section of the former drum storage area. Acetone, ethylbenzene, trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), and 2-butanone were detected in samples south of the former ASTs.

Additional surface soil samples were collected by E&E in October 1997 as a follow-up to the UST excavations and building demolition (E&E, 1998a). The purpose of the sampling was to better characterize the disturbed and undisturbed surface soils at the site and for use in the design of the SVE system. Several VOCs were detected above method detection limits, with PCE and 1,1,1–TCA most prevalent and detected at the highest concentrations. None of the data exceeded USEPA Region IX Preliminary Remediation Goals (PRGs) or USEPA Soil Screening Levels (SSLs) and there was no apparent pattern of VOC contamination (USEPA, 2000b).

Subsurface Soil

A total of 59 subsurface soil samples from five locations were collected between the depths of 10 and 100 feet bgs in May 1997 during the ESI (E&E, 1998a). The soil borings with the most extensive contamination include subsurface soil boring SSB-3 located in the southwest corner of the property and SSB-4 located in the southeast corner of the former drum storage area (Figure 2A). TCE was detected above the method detection limit in all samples of SSB-3 between 15 and 90 ft bgs. TCE was detected above the method detection limit in all samples of SSB-4 between 50 and 85 ft bgs. Other chemicals detected in subsurface borings include acetone, 1,1-dichloroethane (DCA), and 1,2-dichloroethene (1,2-DCE).

A total of 55 subsurface soil samples were collected by E&E in November of 1997 during the subsurface investigation section of removal activities and for use in the design of the SVE system (E&E, 1998b). These samples were taken from 22 on and off-site locations using a Geoprobe® to a maximum depth of 22 ft bgs. Methylene chloride was detected in the former warehouse area above SSLs, which protect groundwater from contaminants in soil. Acetone, 2-butanone, ethylbenzene, toluene, and xylene were detected in the former UST area above SSLs. Ethylbenzene and xylene detected in the former UST area also exceeded residential PRGs.

2.1.3.2 Previous Soil Vapor Investigations and Findings

Eleven soil vapor samples were collected by E&E in November 1997 during the subsurface investigation section of removal activities for use in the design of the SVE system (E&E, 1998b). A total of eleven soil vapor samples were collected during the investigation concurrent with field screening data acquisition (36 data points; 22 points from 10' to 15' bgs; 14 points from 18' to 25' bgs). Sample locations were collected along the eastern and western perimeters of the former underground storage tanks (5 samples), within the footprint of the former warehouse (4 samples), and two off-site locations; locations were selected with bias, based primarily on field screening data.

PCE and 1,1,1-TCA were detected in 4 of the 5 samples taken from the former UST area (Figure 2A). Other compounds detected in the former UST area include benzene, toluene, ethylbenzene, and xylene. Compounds detected in the former warehouse area include methylene chloride, PCE, 1,1,1-TCA, 1,1-dichloroethane, 1,1-dichloroethene, and toluene. Low detections of benzene, methylene chloride, toluene, 1,1,1-TCA, TCE and xylenes were found in the two off-site soil vapor samples. Sample location SVP-8, collected at 23' bgs near the former ASTs on the east site of the former warehouse, had detections for 10 compounds above the method detection limits and had the highest contaminant concentrations of all soil vapor samples.

2.1.3.3 Previous Groundwater Investigations and Findings

The first groundwater monitoring wells installed at the Pemaco Site were the converted borings B-1 through B-16 installed by ALT in 1990 on behalf of Pemaco. Fourteen of these wells still exist at the site: B-1, B-3 through B-8 and B-10 through B-16 (Figure 2B). These wells are screened in the perched groundwater zone underlying the site vicinity from approximately 25 to 35 feet bgs. Although ALT collected and analyzed groundwater data from these wells, the data was never submitted to regulatory authorities. The USEPA subsequently requested that E&E sample the wells as part of the ESI performed during May 1997. No analytical data for these wells were reported before May 1997 at which time Ecology and Environment, Inc., for the USEPA, sampled them as part of the ESI performed. Twelve of these perched groundwater wells (B-1, B-2, B-4 through B-8, B-10 through B-12, B-14 and B-15) were sampled and analyzed as part of the ESI (E&E, 1998a). Results indicated that various VOCs were present in every well sampled. The highest VOC concentrations were TCE (180 μg/L in B-12), vinyl chloride (290 μg/L in B-08) and 1,2-DCE (350 μg/L in B-01). These elevated chlorinated VOC concentrations were found mainly in the drum storage area. However, several of the samples from the former UST areas were analyzed using elevated detection limits and did not accurately characterize the groundwater concentrations. Also, benzene, toluene, ethylbenzene, and xylene components were not part of the reported analyte list for the perched groundwater samples.

Wells B-2, B-6 and B-9 were found to contain floating free product when they were sampled in May 1997. This free product was analyzed and results indicated that it was comprised of 20% to 30% gasoline range hydrocarbons.

In addition to the sampling of the perched groundwater wells, four additional wells (MW-1 through MW-4) were installed during the ESI. These wells were screened in the upper Lakewood Formation (60 to 100 feet bgs) and sampled for VOCs in May and November 1997. No VOC concentrations were detected above detection limits in upgradient well MW-1 located 15 feet northwest of the site between the site boundary and the train tracks. On site well MW-2, located in the southeastern portion of the site, had elevated TCE (1,090 μg/l), cis-1, 2-DCE (7.59 μg/l) and vinyl chloride (3.88 μg/L) concentrations. Well MW-3, located approximately 35 feet downgradient to the south-southeast of the site, had elevated 1,1-DCE, cis-1,2-DCE, PCE and TCE concentrations ranging from 5.46 μg/l (PCE) to 9,600 μg/l (TCE). Well MW-4, located approximately 45 feet downgradient to the southeast of the site, had elevated 1,1-DCE, cis-1, 2-DCE, PCE and TCE concentrations ranging from 4.53 μg/l (PCE) to 11,000 μg/l (TCE).

No water sampling occurred at the Pemaco Site between November 1997 and October 2000.

In October 2000, after the operation of the SVE system (installed in 1998 and shut down in 1999), a preliminary investigation was performed by TN&A to assess existing site contamination. Nine perched zone wells (B-1, B-3 through B-5, B-10, B-13, B-15, SV-1, and SV-5) and Upper Lakewood Formation wells MW-1 through MW-4 were sampled and analyzed for VOCs, semi-volatile organic compounds (SVOCs) and non-halogenated volatile organic compounds (NHVOCs). In addition, 43 soil gas samples were collected from vertical and horizontal wells from the decommissioned SVE and analyzed for VOCs.

Results for the October 2000 groundwater event can be referenced in the *Draft Summary of Groundwater and SVE System Sampling Events October 2000* (TN&A, 2000). Results

indicated that every well sampled had concentrations of selected COCs that were above regulatory levels.

2.2 ADJACENT PROPERTIES

The following sections summarize the historical uses and environmental assessments that were performed on the individual properties surrounding the Pemaco site. All of the properties are slated to be a part of the Maywood Riverfront Park. Figure 3 illustrates each property in relation to the Pemaco site. A summary table of environmental activities at each property is included where appropriate below.

2.2.1 W.W. Henry/Armstrong

The Pemaco site is bordered to the west by the 1.5-acre W.W. Henry/Armstrong property (5920 Alamo Avenue). A building that formerly occupied the central and western portions of the Site housed offices, a computer room, adhesive mixing and blending operations, raw material storage, packaging, and warehousing areas. The remaining eastern portion of the site was mainly asphalt-paved parking space. A railroad spur runs along the northern boundary of the site.

Currently, the site is an empty dirt lot with no structures, except for an operating soil vapor extraction system. There are currently three perched groundwater wells (B-30, B-31, and B-39) located on the W.W. Henry site, which were installed as part of the Pemaco RI (Figure 2).

2.2.1.1 Operational and Land Use History

The W.W. Henry/Armstrong property operated as an industrial manufacturing facility from the 1940's until 1997. It was used for the manufacturing of batteries, cosmetics, and more recently, adhesive products used for various construction applications such as floor tile and roofing (Cornerstone, 1998). The W.W. Henry Company/Armstrong World Industries, an adhesives manufacturer, occupied the property from approximately 1980 to 1997 (EKI, 1999). Organic solvents were utilized to manufacture the flooring adhesive products during these operations.

The following chemicals have been used on the property: 1,1,1-TCA, toluene, hexane, naptha, methanol, mineral spirits, acetone, isopropyl alcohol and PCE. These chemicals were stored in three on-site USTs located in a single cluster in the eastern portion of the property and aboveground mixing and storage tanks (4,000-10,000 gallon tanks). Chemicals were delivered to the site via a rail spur that branched off from the Los Angeles Railroad property east of the site. The spur ran along the W.W. Henry property's northern boundary.

2.2.1.2 Previous Environmental Investigations and Results

Numerous environmental assessments have been conducted at the W. W. Henry site. Most notably, there has been a significant amount of free product (toluene/hexane) found to be floating atop the perched groundwater underlying the eastern portion of the site. Also, 1,1,1-TCA and other chlorinated compounds have been found in soil and groundwater in the

western portion of the site. A summary of the environmental investigations conducted at the site is provided in Table 2.2.1.2.

2.2.1.3 Previous Remedial Activities

The USTs and associated underground piping were removed from the W.W. Henry property under support of the Los Angeles County Department of Power and Water (LACDPW) and Los Angeles County Fire Department (LACFD) in 1997. In July 1998, 180 tons of total petroleum hydrocarbon concentrations as gasoline (TPHg-) and toluene-impacted soil was excavated and removed from the former tank excavation area. Excavation dimensions reached 17-ft wide x 34-ft long x 21-ft deep. The excavation was then backfilled with both clean excavated soil and imported fill. A second excavation (6-ft wide x 6-ft long x 19- ft deep) of halogenated volatile organic compounds (HVOC) contaminated soil was removed in November 1998. Confirmation sampling indicated all HVOC-impacted soils were apparently mitigated (CTI, 2001).

In May and June 2000, Armstrong World Industries, Inc. demolished the former W.W. Henry facility. The following year (May 2001), a vapor extraction system was installed on the site to remove toluene from the subsurface. The system is still in operation and plans are underway to expand the system to clean up the 1,1,1-TCA contamination in the western portion of the site.

2.2.2 L.A. Junction Railroad

The 0.8-acre LAJR property, which is owned by Catellus and operated/leased by the LAJR, divides the W.W. Henry property from the Pemaco property (and the Catellus property from the Lubricating Oil property) from north to south (Figure 3). The railway property sections of concern lie south of Slauson Blvd. (through 59th Place) and north of 60th Street.

There are currently six perched groundwater wells (B-14, B-15, B-16, B-20, B-21, and B-24) and two Exposition Groundwater zones wells (MW-1 and MW-19) located on the LAJR site (installed as part of the Pemaco investigation) (Figure 2).

2.2.2.1 Operational and Land Use History

The LAJR property has been historically used as a railway corridor with a main track and several spurs leading to adjacent properties. The railway is still active, but far less rail traffic exists then in the past when more businesses operated in the area. Numerous hazardous materials, including the substances that were delivered to the Pemaco, W.W. Henry, Catellus and Lubricating Oil Services properties have been transported along the railway.

2.2.2.2 Previous Environmental Investigations and Results

The LAJR section of railway located north of 59th Place and south of Slauson Avenue has been thoroughly assessed for environmental contamination during the Pemaco RI (Section 3.0 and 5.0). Metals and PAHs were found in surface and near-surface soils along the railway. Subsurface contamination from the Pemaco and W.W. Henry properties was also identified underlying the railway property.

In the beginning of July 2002, TN&A performed additional assessment activities along the railway property on behalf of the Trust for Public Land (TN&A, 2002g). Surface and near surface soil samples, subsurface soil, soil gas and perched groundwater samples were collected along the railway during this investigation. The surface soil samples collected in the portion of the railway north of 59th Place were only analyzed for chlorinated herbicides (0.5' and 2.5' bgs) due to the previous work done in that area during the Pemaco RI. The surface samples collected along the railway south of 59th Place were analyzed for chlorinated herbicides, SVOCs and metals; the subsurface soils (5' to 30' bgs) and groundwater samples were analyzed for VOCs. Also, samples collected in the area along the railway identified as having PCB contamination (EKI, 2001 and Cape, 2001) were analyzed for PCBs.

Data collected for this environmental assessment of the LAJR property indicate that the property has been impacted by past industrial uses of both the LAJR and adjacent properties (TN&A, 2002g). Impacts also exist from anthropogenic background sources due to the LAJR's location within an urban environment. Surficial soils of the LAJR contain concentrations of COPCs including herbicides, PAHs, PCBs and metals. Subsurface soil, soil vapor and groundwater underlying the property contain concentrations of VOCs. These concentrations of COPCs were screened against applicable or relevant and appropriate requirements (ARARs), which were chosen to be PRGs and MCLs, and it was found that samples collected from the LAJR property exceed certain ARARs in surface soils, groundwater and soil vapor.

2.2.3 Lubricating Oil Services

Pemaco is bordered to the south by the 0.4-acre Lubricating Oil Services (LOS) Property located at 5989 South District Boulevard in Maywood (Figure 3). Two warehouse structures, three ASTs and one brick office building once occupied the property. The site is currently a dirt lot.

There are currently two perched groundwater wells (B-35 and B-36) and one Exposition Groundwater zones well (MW-3) located on the Lubricating Oil Services site installed as part of the Pemaco RI (Figure 2).

2.2.3.1 Operational and Land Use History

The LOS property was used for ink manufacturing from 1929 to 1945 and later operated as a fireworks warehouse (Clipper Fireworks Company) from 1945 to 1957. The site was reportedly owned by Pemaco, Inc. from 1957 through 1989. A building permit indicates that the owner of Pemaco, Inc., Marie Richardson, was the property owner for the LOS property in 1990. The site then became occupied by LOS from 1991 until 1999 when it was used for the re-sale of lubricants for automotive purposes (EKI, 2001).

2.2.3.2 Previous Environmental Investigations and Remediation

Several environmental assessments have been performed at the site. These assessments ultimately led to some shallow remedial excavations and then to site closure by the Los Angeles Regional Water Quality Board (LARWQCB). The largest area of soil contamination that was excavated appeared to be contamination from oil in the southwest portion of the site; other small areas that were visually stained were also excavated. Two of the small-excavated areas located on the LAJR property (adjacent to the LOS Property) were found to

be contaminated with polychlorinated biphenyls (PCB's), PCE, total petroleum hydrocarbons (TPH) and semivolatile organic compounds (SVOCs). After these two small areas were excavated, confirmatory samples indicated that contamination still existed down to 4 feet bgs. The excavations were not extended and the contaminated soil was left in place because the areas were not on the LOS Property.

Table 2.2.3.2 summarizes the previous environmental investigations, results, and removal actions. Methods and results of environmental samples collected on the site as part of the Pemaco RI are discussed in *Section 3.0 Study Area Investigation, Section 4.0. Physical Characteristics* and *Section 5.0 Nature and Extent of Contamination*.

2.2.4 Catellus

The Pemaco site is bordered to the southwest by the 0.7-acre Catellus property (Figure 3). The physical address of the Catellus property is 5201 East 60th Street. The site was occupied with two buildings until 1990 when a fire destroyed the structures. The site is currently a public park with a large grass area and native landscaping.

2.2.4.1 Operational and Land Use History

The Catellus property was occupied by the Safeway Corporation and used for the manufacturing of bleach and household cleaning products from 1937 until 1990 (EKI, 1998). Several types of chemicals were used at the site. The chemicals were delivered to the site via truck and railcar from a spur branching from the LAJR property, located to the east. One of the pre-existing buildings was used as an office building; the other larger building housed the manufacturing facility. There were AST's, a drum storage area and a clarifier as part of the manufacturing facility. One large AST was located near the rail spur in the eastern portion of the property.

2.2.4.2 Previous Environmental Investigations and Results

Environmental assessments have not identified any substantial soil and groundwater contamination resulting from prior site uses. There was some shallow oil-stained soil that was reportedly located near the former AST, however samples from the stained soil indicated that the levels were below clean-up standards for the time. It was recommended that the stained soil be removed, but none of the environmental reports reviewed by TN&A document removal actions. Table 2.2.4.2 summarizes the environmental investigations performed at the Catellus property.

2.2.5 Precision Arrow

The 1.7-acre Precision Arrow property (5010 and 5026 East Slauson Avenue) borders the Pemaco site to the northwest (Figure 3). Two large buildings occupied the site until Spring 2003, at which time they were demolished and the site was graded. There is currently a perched groundwater well (B-32) associated with the Pemaco RI located on the Precision Arrow site (Figure 2).

2.2.5.1 Operational and Land Use History

One of the two buildings on site is occupied by Genesis Transportation Services (west portion, 5010 East Slauson); the other building is occupied by Arrow Industries (east portion, 5026 East Slauson). Genesis Transportation uses the building to store metals and other non-hazardous materials and Arrow Industries uses the property to re-package household appliance products such as appliance installation kits (EKI, 2001). The property was previously used to warehouse hospital equipment and was used by the W.W. Henry Company to store their packaged adhesive products before they were shipped out to the distributors (EKI, 2001).

2.2.5.2 Previous Environmental Investigations and Results

A Phase I site assessment was completed for the Precision Arrow property in 2001. Results of the report indicated that no adverse environmental conditions existed at the property according to a records search and a site reconnaissance. The report did state that subsurface contamination existed at the adjacent W.W. Henry and Pemaco properties. Table 2.2.5.2 summarizes the environmental investigations performed at the Catellus property.

There have not been any environmental samples collected on the Arrow property, except for limited soil and groundwater samples that were collected in the east portion of the site as part of the Pemaco RI (Section 3.0 and 5.0).

3.0 STUDY AREA INVESTIGATION

The study area investigation includes the 1.4-acre former Pemaco site, the adjacent properties discussed above, and the residential neighborhood located southwest of the Pemaco site along the streets listed above (Figure 2). The study area investigation included the sampling of ambient air (both indoor residential homes and outdoor), soil vapor, soil, perched groundwater (25 to 35 feet bgs), and a deeper groundwater. Figure 2B illustrates all sample locations of the various medias of interest. The following sections summarize field activities performed by TN & Associates, Inc. as a part of this Remedial Investigation.

All work performed by TN&A was performed in accordance with the *Final Sampling and Analysis Plan (SAP), Remedial Investigation/Feasibility Study, Pemaco Superfund Site, Maywood, California*, (TN&A, February 2001) or SAP modifications (Appendix 9) issued under Contract No. DACA45-97-D-0015, Delivery Order No. 017, issued to TN&A by the USACE Mobile District, at the request of the USEPA Region IX. The SAP was approved by USEPA Region IX Quality Assurance Group PMD-3 and USACE.

A summary of analytical results for each sampling event is discussed in Section 5.0 of this report.

3.1 TOPOGRAPHIC SURVEY

Site boundaries, surface topography, on-site cement pads, wellheads, and the Los Angeles River channel boundary were surveyed in November 2000 prior to any RI field activities by Dulin & Boynton Licensed Surveyors, Inc. (Dulin & Boynton) of Signal Hill, California. As additional wells were installed, Dulin & Boynton would mobilize to the site and survey wellheads, including casings, covers, and ground surfaces to a local benchmark. All wells were surveyed utilizing the same bench marker, 5Y9343, for each suite of wells under the NAD 83, California Zone 5 coordinate system. Dulin & Boynton produced a site map with all surveyed surface features in AutoCAD format (Figure 2C).

3.2 SOIL VAPOR AND AIR

February 2001
An initial round of soil vapor samples were collected from 66 on- and off-site locations (SV-01 through SV-45 and SV-SO1 through SV-SO21) in February 2001(Figure 2B). The samples were obtained from 5 feet bgs using a Geoprobe® DPT rig. Soil vapor samples were collected in Tedlar® bags and immediately submitted to the USEPA Region IX Field Analytical Support Program (FASP) laboratory for definitive analyses of VOCs (Method SW-846 8260B). The data retrieved from these screening samples facilitated the location of permanent monitoring wells and created a data set for soil vapor migration modeling for risk assessment purposes.

July/August 2001
In July 2001, soil vapor and indoor/outdoor air samples were collected from the surrounding residential neighborhood located adjacent (southwest) of the Pemaco property. This work was performed as a split-sampling event with another consultant working on behalf of

Armstrong Industries (co-owners of the W.W. Henry Property). The work was mandated by the Los Angeles Regional Water Quality Control Board (LARWQCB) to delineate contamination originating from the WW Henry property (Cleanup and Abatement Order No. 01-406 dated April 11, 2001, revised May 23, 2001). The sampling was performed by LFR Levine Fricke (LFR) in accordance with the LFR *Work Plan for Evaluation of Soil and Groundwater, Former W.W. Henry Property*, *5920 Alamo Avenue, Maywood, California*, dated May 14, 2001 and revised May 23, 2001. The USEPA requested that split samples be taken during the LFR assessment to obtain an independent data set due to the sampling's close proximity to the Pemaco Superfund site.

In addition to the scope of work performed by LFR, TN&A performed additional in-situ groundwater sampling and indoor/outdoor air sampling as directed by the USEPA. This additional work was done to supplement LFR's efforts and to supplement data produced by the on-going RI/FS for the Pemaco Superfund Site.

Both the LFR and TN&A soil vapor and groundwater samples were collected using a Geoprobe® rig fitted with the appropriate tooling (Post-run Tubing System for soil vapor and Screen-Point Sampler for Groundwater). The only differences between sampling methodologies were that the LFR soil vapor samples were collected in glass bulbs and analyzed by an onsite mobile laboratory and the TN&A soil vapor samples were collected in Summa® canisters and analyzed at an offsite fixed laboratory. Summa® canisters were used for all indoor and outdoor air sampling (LFR and TN&A).

On July 30th and July 31st, 2001, LFR and TN&A personnel collected soil vapor samples at seven locations (LFSG 18 through LFSG 24) on residential properties adjacent to the W.W. Henry property. LFR collected soil vapor samples at 5', 10', 15' and 20' bg at each location and TN&A collected a split sample at the 5' soil vapor sample at each location. Perched groundwater sample collection was attempted at each of these locations for VOC analysis by EPA Method 8260B. Three additional perched groundwater locations were sampled by TN&A on August 1st, 2001 (HP-33, HP-34 and HP-35). Figure 2B illustrates these locations.

Indoor/outdoor air samples (labeled by address) were collected utilizing Summa® canisters fitted with 24-hour flow controllers. These 24-hour samples were started on July 30th and collected on July 31st, 2001. TN&A placed Summa canisters inside residences (5000 59th Place, 5100 59th Place, 5114 59th Place, 5130 A 59th Place and 5130 C 59th Place), in one crawl space beneath the residence at 5130 C 59th Place, and outside in the yards of two residences located at 5002 59th Place and 5130A 59th Place. LFR placed Summa® canisters inside residences located at 5000 59th Place, 5100 59th Place and 5130A 59th Place. The canisters were fitted with Teflon tubing so that the intakes were 3' - 5' above floor level to replicate breathing zone air conditions. The canisters were gathered approximately 24 hours after their initial start. The samples were sent to Calscience via courier to be analyzed for VOCs by EPA Method TO-15.

Appendix 2 contains the *Technical Memorandum - Results of July 2001 Soil Gas, Indoor/Outdoor Air and Groundwater Sampling Completed in the Residential Neighborhood Adjacent to the Pemaco Superfund Site and Former WW Henry Properties, 5920 Alamo Avenue and 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002c). The memorandum discusses the field activities and analytical results of this event in more detail. Figures illustrating sample locations and all analytical results are included in the memorandum.

March 2002

Based on elevated acetone concentrations found in the soil vapor samples and ambient/indoor air samples collected in July/August 2001, additional sampling was deemed necessary by the USEPA. The acetone concentrations for ambient/indoor air samples from July 2001 were below USEPA Region IX Preliminary Remediation Goals (PRGs) for acetone in ambient air. However, the levels were above typical background levels found in ambient air for the Southern California area (Grosjean et al, 1996).

On March 19th and 20th, 2002, TN&A personnel collected soil vapor samples at 14 locations in the Pemaco area. Indoor air samples were collected from 12 residential locations and outdoor air samples were collected at 10 locations throughout the local area. Each of these samples was analyzed for volatile organic compounds (VOCs). The following sections detail the sampling activities.

Soil vapor samples were collected from 14 separate locations (Figure 2B). A sample was collected at 5 feet bg and 15 feet bg from each location. This was done in attempt to delineate the source of the soil vapor VOC concentrations found during the July 2001 residential sampling event. The multi-depth samples were collected to ascertain whether the VOC concentrations were sourced from the lateral migration of vapors through utility trenches or if the concentrations were sourced from the vertical migration of vapors from a deeper source, such as off-gassing from contaminated perched groundwater or from a vadose zone soil source.

All soil vapor sampling activities were performed using a Geoprobe® Sampling post-run tubing (PRT) System coupled with an above ground vacuum pump and a negative pressure sampling bell. The samples were each collected in Tedlar® bags, except for one duplicate sample that was collected using an evacuated Summa® canister (SV-2002-1000). Each of the Tedlar® bags were sent to Calscience Environmental Laboratories, Inc. (Calscience) of Garden Grove, California via courier. Each of the samples was analyzed for VOCs by EPA Method TO-15.

On March 19th, 2002, TN&A personnel placed Summa® canisters fitted with 24-hour flow controllers inside residences located at 5000 59th Place, 5014 59th Place, 5024 59th Place, 5100 59th Place, 5110 59th Place, 5112 59th Place, 5130 59th Place, 5119 60th Street, 5039 60th Street and 5021 60th Street. A total of 12 locations were sampled from these residences (three at 5130 59th Place at one each at the other residences). The canisters were fitted with Teflon tubing so that the intakes were 3' - 5' above floor level to replicate breathing zone air conditions. These canisters were collected approximately 24 hours later on March 20th, 2001 and sent to Calscience via courier to be analyzed for VOCs by EPA Method TO-15. These samples were collected to investigate the possibility of VOC concentrations migrating into the neighboring residential houses from soil vapor.

During the 24-hour Summa® canister sampling (both indoor and outdoor) a weather station monitoring device was set up on the Pemaco site. This station monitored and logged wind speed, wind direction, relative humidity, temperature, rainfall and barometric pressure from 9:30 AM on March 19th, 2002 until 3:30 PM on March 20th, 2002. Data was logged every 10 minutes during this time interval. A wind rose diagram (Figure 3 in Appendix 3) was created from the wind speed and direction data and the other data is presented in Graph 1 in Appendix 3. No rainfall was recorded during the sampling event. The dominant wind direction during the sampling event was out of the west-southwest, with a secondary

component out of the north-northeast. There were very little south, southeasterly or easterly wind directions observed during the sampling. Temperature readings ranged from 51 to 79 degrees Fahrenheit.

Appendix 3 contains the *Technical Memorandum - Results of Soil Gas and Indoor/Outdoor Air Sampling – March 2002, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002e). The memorandum discusses the field activities and analytical results of this event in more detail. Figures illustrating sample locations and all analytical results are included in the memorandum.

3.3 SURFACE AND NEAR SURFACE SOIL

In late February and early March 2001, a total of 150 soil samples were collected from 0.5 to 2.5 feet bgs, including field duplicates. Surface (0.5 feet bgs) and near-surface (2.5 feet bgs) soil samples were collected as using a Geoprobe® DPT rig and analyzed for SVOCs (CLP OLM04), metals (Inorganic CLP SOW ILM04), and total dissolved solids (TDS) (EPA Method 160.1).

Sample locations were selected by layering a 25' x 25' grid pattern over the site, adjacent railroad right-of-way, and the former loading area. The grid sampling resulted in 87 individual sampling zones (GP-SS-01 through GP-SS-87), although GP-SS-40, GP-SS-64 through 68, and GP-SS-79 through 83 were not sampled. Within each zone, one surface sample (0.0-0.5') and one near-surface sample (0.5-2.5') was collected with the exception of GP-SS-1, GP-SS-32 through 34, GP-SS-44 through 47, which were only sampled at one depth.

The 25' x 25' grid sampling excluded the area of the site where clean imported fill was previously placed as backfill of the former UST area and former warehouse-building pad. In this imported fill area, 5 composite samples from 20 randomly located areas were analyzed (RAN-01 through RAN-05). The composite samples were taken from 0.5 feet bgs.

With exception to the 5 composite samples collected within the area of imported clean fill, surface and near-surface soil samples were collected as independent, discrete grab samples using a DPT rig and placed in glass jars. Upon collection, soil samples were sealed, chilled immediately to 4°C, and processed for shipment to laboratories contracted through the CLP program.

3.4 SUBSURFACE SOIL

3.4.1 Upper Vadose Zone Soil

February-April 2001
Between February and April 2001, a total of 195 discrete soil samples were collected from 46 on-site and off-site locations (GP-VS-1 through GP-VS-32, GP-VS-WW-1, GP-VS-WW-2, B-17, B-20, and B-21 through B-32) utilizing a Geoprobe® DPT rig (Figure 2B). Samples were collected from three depth intervals – approximately 5 feet bgs, near the capillary fringe (25 feet bgs), and at the top of the perching clay (approximately 35 feet bgs) and analyzed for VOCs (EPA Method SW-846 8260B and CLP OLM04), SVOCs (EPA Method SW-846 8270C and CLP OLM04), NHVOCs (EPA Method SW-846 8015B), and metals (EPA Method SW-

846 6010B and Inorganic CLP SOW ILM04 [including hexavalent chromium (EPA Method 7199)]). Nineteen of the 195 samples were analyzed for total organic carbon (TOC, EPA Method 160.1) and geotechnical parameters (organic carbon content, grain size, permeability, specific gravity, bulk density, moisture content, and porosity). Soil samples collected for VOC and NHVOC analyses were collected first using EnCore™ samplers. Samples were then collected for followed by SVOCs and metals in 8-ounce glass jars after collection of the Encore™ samples. Upon collection, soil samples were sealed, chilled immediately to 4°C, and processed for shipment to the laboratory. Geotechnical samples were collected in 4-inch brass Shelby tubes.

The DPT rig was equipped with a 2-inch diameter by 4-foot long core barrel sampler fitted with an acetate liner. Each boring was continuously cored down to 35 feet and used to construct a detailed boring log for each boring. Appendix 8 contains all lithologic logs produced during RI drilling activities. Sections of the core containing the desired sampling intervals were collected for chemical analyses. Once the coring was completed for borings B-17 through B-32, larger diameter rods (2-5/8") were driven down the same borehole and used to install 1.5-inch diameter PVC wells with 5' long screen intervals fitted with pre-packed sand filters. These wells were completed into permanent monitoring wells of the "perched" groundwater zone. Each monitoring well was subsequently developed by surging and bailing at least 5 well volumes of purge water. All wells were then surveyed by a licensed surveyor.

November 2001
In November 2001, seven borings (B-33 through B-39) were advanced to approximately 35 feet bgs using a Geoprobe® DPT rig and seven borings (MW-14 through MW-19 and RW-01) were advanced to approximately 90 ft bgs utilizing a Hollow Stem Auger (HSA) rig. Fifty-four soil samples were collected within the upper vadose zone at 5 feet bgs, near the capillary fringe (20-30 feet bgs), and at the top of perching clay (approximately 35 feet bgs). Field sampling and analytical methodologies were identical to the February-April 2001 sampling.

These borings were completed as monitoring wells B-33 through B-39, MW-14 through MW-19, RW-01 and subsequently developed and surveyed. Figure 2 illustrates these well locations. Lithologic logs and well construction diagrams are presented in Appendix 8.

3.4.2 Lower Vadose Zone Soil

February-April 2001
Subsurface soil samples were collected in late March and early April 2001 from soil borings advanced at nine off-site locations. These borings were continuously cored to approximately 90 to 100 feet below grade using a HSA rig. The HSA rig was equipped with a 4-inch diameter by 5 feet long core barrel. Soil from the core was used for soil classification purposes in order to construct a detailed boring log for each borehole. Appendix 8 contains all lithologic logs produced during RI drilling activities. These borings were converted to monitoring wells (MW-05 through MW-13) and became part of the system of monitoring wells for the Exposition groundwater zones (Figure 2).

Soil samples were taken at 10-foot intervals beginning at 5 feet bgs and continuing to 65 feet bgs. Thirty-seven soil samples collected within the lower vadose zone were tested for VOCs (EPA Method SW-846 8260B and CLP OLM04), SVOCs (EPA Method SW-846 8270C and CLP OLM04), NHVOCs (EPA Method SW-846 8015B), and metals (EPA Method SW-846 6010B and Inorganic CLP SOW ILM04). Twenty-five soil samples were collected and

analyzed for TOC (EPA Method 160.1) and for geotechnical parameters (organic carbon content, grain size, permeability, specific gravity, bulk density, moisture content, and porosity).

Soil samples collected for VOC and NHVOC analyses were collected first using EnCore™ samplers. Samples were then collected for SVOCs and metals in 8-ounce glass jars after completion of the Encore™ sampling. Upon collection, soil samples were sealed, chilled immediately to 4°C, and processed for shipment to the laboratory. Geotechnical samples were collected in 4-inch brass Shelby tubes.

In late April 2001, four additional soil borings (advanced by a mud-rotary rig) permitted the collection of 5 soil samples (in 4-inch brass Shelby tubes) analyzed for TOC and geotechnical parameters (organic carbon content, grain size, permeability, specific gravity, bulk density, moisture content, and porosity). These borings were converted to monitoring wells (MW-5-135, MW-7-130, MW-10-175, and MW-12-150) and expanded the Exposition Groundwater zones system of monitoring wells. Figure 2 illustrates the well locations.

November 2001
In November 2001, seven borings were advanced with a DPT rig and seven borings were advanced utilizing an HSA rig. Soil samples (26 total within the lower vadose zone) were collected at 10-foot intervals from 5 feet bgs to approximately 65 feet bgs and analyzed for the same chemical properties as the February-April 2001 sampling. Three additional soil samples were collected and analyzed for TOC (EPA Method 160.1) and geotechnical parameters (organic carbon content, grain size, permeability, specific gravity, bulk density, moisture content, and porosity).

The seven borings were completed as monitoring wells MW-14 through MW-19 and recovery well RW-1. Each monitoring well was subsequently developed and surveyed. These wells were integrated into the groundwater monitoring network and also used for a groundwater pump test. Figure 2 illustrates the well locations.

3.5 PERCHED GROUNDWATER

The perched groundwater investigation included water collected from either temporary hydropunch wells, temporary piezometers or permanent wells screened in the perched groundwater zone. Wells installed within the perched groundwater zone (42 total) are typically labeled with ‘B’ and ‘SV’ prefixes (Figure 2).

A quarterly groundwater monitoring program was progressively developed as each new suite of shallow wells were installed and initially sampled. Each monitoring event included gauging, purging and sampling each of the wells to be included in the quarterly monitoring program. A quarterly monitoring program was conducted on a continual basis so that all data quality objectives (DQOs) pertaining to groundwater sampling could be met. The samples were analyzed for the proper constituents of potential concerns (COPCs), which were decided after the initial sampling was completed. The analytical program for quarterly events changed over time as new data was collected and evaluated.

The results of each monitoring event are summarized in *Section 5.0, Nature and Extent of Contamination* of this RI Report, and more thoroughly discussed in Appendix 4, *Technical*

Memorandum – Results of Groundwater Monitoring Activities May 2001 through April 2002, Pemaco Superfund Site, 5050 East Slauson Avenue, Maywood, California (TN&A, 2002b). This memorandum presents all the perched groundwater data produced by monitoring activities of the perched groundwater wells for four separate events and includes hydrographs, groundwater contour maps, groundwater contamination plume maps, "chembox" maps and data tables for all analyses.

October 2000
Groundwater samples were collected using low-flow sampling methods from existing perched zone monitoring wells (B-1 through B-16 and SV-1 through SV-5) in October of 2000 as part of the preliminary investigation for scoping the RI/FS. Samples were analyzed for VOCs (CLP OLM04), SVOCs (CLP OLM04), NHVOCs (Method SW-846 8015B), and TPH-GRO (SW-846 8015B).

Results for the October 2000 preliminary groundwater sampling can be referenced in the *Draft Summary of Groundwater and SVE System Sampling Events, October 2000 (TN&A, 2000).*

February 2001
A Geoprobe® drill rig was utilized to install temporary PVC wells (1-inch) screened just above the perching clay at the desired sample locations. After enough groundwater had accumulated in the temporary screens, sample collection was conducted using a 1"-diameter stainless steel micro-bailer, which was thoroughly decontaminated between each sampling location. Groundwater was transferred from the bailer directly to 40-ml VOA glass vials and analyzed for VOCs by EPA Method SW-846 8260B. The analysis was performed by the USEPA FASP laboratory, which was onsite at the Pemaco property throughout the February 2001 groundwater sampling event. Figure 2B illustrates the sampling locations.

There were a total of 35 locations where groundwater was collected or where collection was attempted (HP-1 through HP-22A and HP-22B through HP-32, and WW-1 and WW-2). Six out of the 35 locations were dry (HP-5, HP-22A, HP-22B, HP-27, HP-30 and HP-31). In addition to the in-situ groundwater samples, pre-existing monitoring wells B-10, B-12, SV-2, SV-3 and SV-4 where sampled using a disposable bailer. This was done to supplement the data set, which was used to determine the locations of additional permanent monitoring wells.

Appendix 1 contains the *Technical Memorandum - Results of In-situ Groundwater Sampling in the Perched Zone and Upper Exposition Groundwater, February and November 2001, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002a). The memorandum discusses the field activities and analytical results of this event in more detail. All figures illustrating sample locations and all analytical results are included in the memorandum.

May 2001
In May 2001, groundwater samples were collected or were attempted to be collected from all pre-existing permanent wells (B-01 to B-16) and newly installed permanent wells (B-17 to B-32) completed within the perched zone as part of the on-going quarterly sampling program at Pemaco (Figure 2). All wells were sampled following low-flow sampling procedures. The perched groundwater samples were analyzed for VOCs (CLP OLM04), SVOCs (CLP OLM04), NHVOCs (Method SW-846 8015B), metals (Inorganic CLP SOW ILM04)[including

hexavalent chromium (CrVI) (EPA Method SW-846 7199)], cyanide (Inorganic CLP SOW ILM04), and natural attenuation parameters, carbon dioxide (CO_2) (SM 4500-CO2D), total organic carbon (TOC) (EPA 415.1), and methane, ethene, and ethane (EPA Method SW-846 RSK-175M). If insufficient sample volume was recovered from any of the wells, the analyses were prioritized and the containers filled in the following order: VOCs, NHVOCs, metals, CrVI, SVOC, cyanide, and natural attenuation parameters (CO_2, TOC, and methane, ethene, and ethane).

During this sampling event, three of the perched wells (B-07, B-14, and B-16) were dry, three contained floating free product (B-28, B-29, and B-15), and one well (B-6) was obstructed. Monitoring wells B-02 and B-09 were destroyed during UST removal in 1997.

July 2001
On July 31st, 2001, groundwater samples from the perched zone (25' – 30' bg), were attempted to be collected at each of the soil vapor sampling locations LFSG-18 through LFSG-24 and HP-33 through HP-35 using a Geoprobe® DPT rig and Screen Point-16 Groundwater Sampling System or temporary 1-inch diamter PVC well. Groundwater samples were collected from all locations except for LFSG-22, LFSG-24, and HP-35 where no perched groundwater was encountered. All groundwater samples collected were analyzed for VOCs by EPA Method 8260.

Figure 2B illustrates the sampling locations. A detailed description of the sampling event is provided in Appendix 2.

September 2001
Quarterly groundwater sampling was conducted in September 2001. All existing perched groundwater wells were sampled or were attempted to be sampled following low-flow sampling procedures. Samples were analyzed for VOCs (EPA Method SW-846 8260B and CLP OLM04) and NHVOCs (EPA Method SW-846 8015B). Selected wells (B-01, B-17, B-18, B21, B-22, B-24, B-27, and B-30) were also analyzed for ferrous iron, sulfate and chloride (EPA Method 300.0), sulfide (EPA Method 376.2), and alkalinity (SM 2320B). Ferrous iron concentrations were measured in the field using HACH DR/820 Colorimeter (Method 8146). If insufficient sample volume was recovered from any of the wells, the analyses were prioritized and the containers filled in the following order: VOCs, NHVOCs, anions, and ferrous iron.

During this sampling event, five wells were dry (B-07, B-11, B-12, B-14 and B-16) and four had free product (B-8, B-15, B-28, and B-29). Monitoring well B-6 was not sampled, as the downhole obstruction (approximately 8 feet bgs) could not be removed. Monitoring wells B-2 and B-9 were destroyed during UST removal in 1997.

January 2002
In January 2002, quarterly groundwater sampling was conducted or attempted at all perched groundwater wells installed to date (including the wells installed in November 2001, B-33 through B-39). All wells were sampled following low-flow sampling procedures. Samples were analyzed for VOCs (Method SW-846 8260B and CLP OLM04) and NHVOCs (EPA Method SW-846 8015B).

During this sampling event, six wells were dry (B-07, B-08, B-11, B-14, B-16, and B-34) and three had free product (B-15, B-28, and B-29). Monitoring well B-6 was not sampled, as the

downhole obstruction (approximately 8 feet bgs) could not be removed. Monitoring wells B-02 and B-09 were destroyed during UST removal in 1997.

April 2002
As part of the quarterly groundwater sampling program for the Pemaco site, groundwater samples were collected from all perched groundwater wells and analyzed for VOCs (Method SW-846 5030/8260B and CLP OLM04) and NHVOCs (EPA Method SW-846 8015B). All wells were sampled following low-flow sampling procedures. During this sampling event, wells B-07, B-08, B-11, B-14, B-16, B-30, and B-34 were dry, wells B-15, B-28, and B-29 contained free floating product, and B-06 was obstructed at 8 feet bgs. Monitoring wells B-02 and B-09 were destroyed during UST removal in 1997.

July 2002 – Present
The Pemaco groundwater monitoring and sampling program is ongoing. Analytical data tables for the July 2002, October 2002, January 2003, and April 2003 quarterly events have been added as an attachment to Appendix 4 of this document. These four sampling events will be documented in an annual technical memorandum to be distributed in mid-year 2004. All subsequent sampling events (July 2003, October 2003, etc.) will be documented as separate quarterly groundwater monitoring reports.

3.6 DEEPER GROUNDWATER (EXPOSITION GROUNDWATER ZONES)

There are several groundwater zones between 65 and 175 feet bgs in the Pemaco area. These zones combined are known as the Exposition Groundwater Zones, the next vertical groundwater zone beneath the perched groundwater zone. Each zone has been given the following nomenclature according to the depths that they generally occur: Exposition 'A' zone – 65 to 75 feet bgs; Exposition 'B' zone – 80 to 90 feet bgs; Exposition 'C' zone – 100 to 105 feet bgs; Exposition 'D' zone – 125 to 145 feet bgs; Exposition 'E' zone – 160 to 175 feet bgs. A total of 36 monitoring wells are installed within the Exposition Groundwater zones (on the Pemaco property and surrounding area), several of which are multi-nested to monitor the different groundwater zones at the same location (Figure 2). The wells screened within these zones have been given identification modifiers according to their total depths rounded to the nearest five feet. For example, well MW-05-85 is approximately 85 feet deep and well MW-05-135 is approximately 135 feet deep.

A quarterly groundwater monitoring program was progressively developed as each new suite of deep wells were installed and initially sampled. Each monitoring event included gauging, purging and sampling each of the wells to be included in the quarterly monitoring program. A quarterly monitoring program was conducted on a continual basis so that all data quality objectives (DQOs) pertaining to groundwater sampling could be met. The samples were analyzed for the proper constituents of potential concerns (COPCs), which were decided after the initial sampling was completed. The analytical program for quarterly events changed over time as new data was collected and evaluated.

The results of each monitoring event are summarized in *Section 5.0, Nature and Extent of Contamination* of this RI Report, and more thoroughly discussed in Appendix 4, *Technical Memorandum – Results of Groundwater Monitoring Activities May 2001 through April 2002, Pemaco Superfund Site, 5050 East Slauson Avenue, Maywood, California* (TN&A, 2002b). This memorandum presents all the groundwater data for Exposition Zones 'A' through 'E' produced by monitoring activities of the Exposition groundwater wells for four separate

events and includes hydrographs, groundwater contour maps, groundwater contamination plume maps, "chembox" maps and data tables for all analyses.

October 2000
Multiple samples were collected from the existing monitoring wells (MW-1, MW-2, MW-3 and MW-4) in the upper Lakewood Formation (Exposition Zones) at different depths within the screened intervals to assess contaminant stratification. Groundwater samples were analyzed for VOCs (Method SW-846 5035/8260B or CLP OLM04), NHVOCs (Method SW-846 8015B), and TPH-GRO (SW-846 8015B).

Results for the October 2000 preliminary groundwater sampling can be referenced in the *Draft Summary of Groundwater and SVE System Sampling Events, October 2000 (TN&A, 2000).*

February 2001
In February 2001, a series of in-situ groundwater samples were collected from the upper Exposition Groundwater zones utilizing a Cone Penetrometer Testing (CPT) rig fitted with a Screen Point-16® groundwater sampling system. There were a total of 14 locations where groundwater was collected or where collection was attempted (CPT-HP-2, CPT-HP-4, CPT-HP-5, CPT-HP-6, CPT-HP-8, CPT-HP-9, CPT-HP-10, CPT-HP-12, CPT-HP-13, CPT-HP-15, CPT-HP-16, CPT-HP-19 and CPT-HP-21). One out of the 14 locations was dry (CPT-HP-2). All groundwater samples collected were analyzed for VOCs by EPA Method SW-846 8260B. The analysis was performed by the onsite FASP laboratory. Figure 2B illustrates the sampling locations. The CPT Hydropunch samples facilitated an extrapolation of the lateral extent of contaminant plumes and the location of permanent monitoring wells within the Exposition Groundwater zones.

Appendix 1 contains the *Technical Memorandum - Results of In-situ Groundwater Sampling in the Perched Zone and Upper Exposition Groundwater Zones, February and November 2001, Pemaco Superfund Site, 5050 East Slauson Avenue, Maywood, California* (TN&A, 2002a). The memorandum discusses the field activities and analytical results of this event in more detail. Figures illustrating sample locations and all analytical results are included in the memorandum.

May 2001
All existing wells (MW-1 through MW-4) and newly installed wells (MW-5 through MW-13, all depths) were sampled utilizing low-flow sampling techniques. Samples were analyzed for VOCs (CLP OLM04), SVOCs (CLP OLM04), NHVOCs (Method SW-846 8015B), metals (Inorganic CLP SOW ILM04)[including hexavalent chromium (CrVI) (EPA Method SW-846 7199)], cyanide (Inorganic CLP SOW ILM04), and natural attenuation parameters, carbon dioxide (CO_2) (SM 4500-CO2D), total organic carbon (TOC) (EPA 415.1), and methane, ethene, and ethane (EPA Method SW-846 RSK-175M).

September/October 2001
Quarterly groundwater sampling was conducted in late September/early October 2001. All existing Exposition Zone groundwater wells were sampled following low-flow sampling procedures. Twenty-two deep groundwater wells (MW-01-80, MW-02-95, MW-03-85, MW-04-85, MW-5-85, MW-5-135, MW-6-85, MW-7-75, MW-7-130, MW-8-70, MW-8-85, MW-9-70, MW-9-85, MW-10-75, MW-10-90, MW-10-110, MW-10-175, MW-11-100, MW-12-70, MW-12-90, MW-12-150, and MW-13-85) in total were sampled. Samples were analyzed for VOCs

(EPA Method SW-846 8260B and CLP OLM04) and NHVOCs (EPA Method SW-846 8015B). In addition, selected wells (MW-01-80, MW-03-85, MW-06-85, MW-08-85, MW-09-85, MW-10-90) were analyzed for ferrous iron, sulfate and chloride (EPA Method 300.0), sulfide (EPA Method 376.2), and alkalinity (SM 2320B). Ferrous iron concentrations were measured in the field using HACH DR/820 Colorimeter (Method 8146).

November 2001

Seven of the 11 additional wells installed in November 2001 as part of an aquifer pump test were sampled by lowering a disposable bailer into the wells immediately after well development was completed. This was done as a screening exercise to anticipate concentrations of the large volume of purge water produced during the aquifer pump test completed in December 2001. The samples from wells MW-14-80, MW-14-90, MW-17-70, MW-17-85, MW-17-95, MW-19-70, MW-19-90 were analyzed for VOCs by EPA Method 8260B.

In addition, a round of in-situ CPT groundwater sampling was performed in November 2001 to delineate an apparent acetone and isopropyl alcohol plume detected during the first sampling event (May-June 2001). In-situ groundwater samples were collected from the Exposition 'B' Zone at six locations on November 27th and 28th, 2001. Four of the locations (CPT-27, CPT-28, CPT-30 and CPT-31) were located down-gradient of the wells MW-10-90 and MW-12-90 and two locations (CPT-34 and CPT-35) were located up/cross-gradient of the Pemaco property (Figure 2). Each of the samples were analyzed for VOCs by EPA Method 8260 and for NHVOCs by EPA Method 8015.

A more detailed description of the November 2001 CPT groundwater sampling event, as well as the analtyical results for this investigation, are provided in Appendix 1, *Technical Memorandum – Results of In-situ Groundwater Sampling in the Perched Zone and Upper Exposition Groundwater Zones, February and November 2001, Pemaco Superfund Site, 5050 East Slauson Avenue, Maywood, California* (TN&A, 2000a).

January 2002

In January 2002, quarterly groundwater sampling was conducted at the following Exposition groundwater wells: MW-01-80, MW-02-95, MW-03-85, MW-04-85, MW-05-85, MW-05-135, MW-06-85, MW-07-75, MW-07-130, MW-08-70, MW-08-85, MW-09-70, MW-09-85, MW-10-75, MW-10-90, MW-10-110, MW-10-175, MW-11-100, MW-12-70, MW-12-90, MW-12-150, MW-13-85, MW-14-80, MW-14-90, MW-18-70 and MW-18-85. All wells were sampled following low-flow sampling procedures. Samples were analyzed for VOCs (Method SW-846 8260B and CLP OLM04) and NHVOCs (EPA Method SW-846 8015B).

April 2002

As part of the quarterly groundwater sampling program for the Pemaco site, groundwater samples were collected from Exposition wells MW-01-80, MW-02-95, MW-03-85, MW-04-85, MW-05-85, MW-05-135, MW-06-85, MW-07-75, MW-07-130, MW-08-70, MW-08-85, MW-09-70, MW-09-85, MW-10-75, MW-10-90, MW-10-110, MW-10-175, MW-11-100, MW-12-70, MW-12-90, MW-12-150, MW-13-85, MW-14-80, MW-17-70 and MW-17-85. Samples were collected using low-flow sampling procedures and analyzed for VOCs (Method SW-846 5030/8260B and CLP OLM04) and NHVOCs (EPA Method SW-846 8015B).

July 2002 – Present

The Pemaco groundwater monitoring and sampling program is ongoing. Analytical data tables for the July 2002, October 2002, January 2003, and April 2003 quarterly events have been added as an attachment to Appendix 4 of this document. These four sampling events will be documented in an annual technical memorandum to be distributed in mid-year 2004. All subsequent sampling events (July 2003, October 2003, etc.) will be documented as separate quarterly groundwater monitoring reports.

It should be noted that additional groundwater wells (MW-20-70, MW-20-85, MW-21-80, MW-21-90, MW-22-75, MW-22-90, MW-23-110, MW-23-145, MW-24-110, MW-24-140, MW-25-110, and MW-25-130) were installed within the Exposition 'A', 'B', 'C', and 'D' Zones during the Summer and Fall of 2003. These wells were added to the Pemaco groundwater monitoring program to further assess the vertical extent of chlorinated VOC concentrations in the immediate release area in the south portion of the Pemaco property and to further define the northern and western extent of VOC concentrations in the 'A' and 'B' Zones. A technical memorandum detailing the field activities of this additional investigation are provided as Appendix 13.

4.0 PHYSICAL CHARACTERISTICS OF STUDY AREA

4.1 SURFACE FEATURES

With exception to a cement pad that parallels the Los Angeles River channel, the Pemaco property is currently a dirt lot with limited vegetation. Two temporary containers, one of which serves as an on-site field office and one of which serves as an equipment storage facility, are the only site structures. The entire site is fenced. Surface topography on-site slopes downhill in a westerly to southwesterly direction away from the LA River channel. Figure 2C illustrates the surface topography of the Pemaco site and adjacent properties.

4.2 DEMOGRAPHY AND LAND USE

The Pemaco site is comprised of 1.4 acres located within a mixed industrial and residential neighborhood in the City of Maywood, California. Maywood is located in Eastern Los Angeles County. The demographics for the City of Maywood include a Hispanic-majority (96%) population with a median age of 24. Maywood is the most densely populated city in California, with 30,000 people living in 1.14 square miles. Land use in Maywood and in the area surrounding the Pemaco site varies from light industrial to commercial to residential (Figure 2).

4.2.1 Nearby Residential Areas

Urban areas of medium density are commingled with commercially developed properties west and northwest of the Pemaco site. To the southwest, diagonally across 59th Street and Walker Avenue, the area is zoned residential and consists primarily of low-to-moderate income single-story homes on lots that are 50 feet by 100 feet. Heliotrope Elementary School is located approximately 0.5-miles due west of Pemaco. Figure 2 illustrates the locations of the residential areas adjacent to Pemaco.

4.2.2 Nearby Industrial Areas

An industrial area bounds the Pemaco property to the north. This industrial area includes the area north of Slauson Ave. along District Blvd (Dunn and Edwards, Joes Plastics, Steel Grinding, Amro Industries, etc.).

Immediately west of the Pemaco site is a 50-foot-wide railroad right-of-way, currently operated by Los Angeles Junction Railroad. One of the rail spurs adjacent to the west-central part of the Pemaco property was the area were Pemaco operations would load/receive products. On the west side of the rail tracks are two industrial properties, one of which, the W.W. Henry Property has had several reported releases.

East of the facility is the Los Angeles River channel. The river has been converted into a “flood control” channel and is concrete-lined. The channel is approximately 500 feet wide and approximately 35 feet deep. For most of the year, the channel has only minor water flow in the very central part of the channel. However, during and immediately following storm events

the channel can sometimes reach near its flow capacity. A heavy industrial area within the City of Bell is located on the East side of the river channel.

Figure 2 illustrates the locations of the industrial areas and the portion of the Los Angeles River Channel adjacent to Pemaco.

4.2.3 Proposed Maywood Riverfront Park

The City of Maywood is proposing to build a 7.3-acre public recreational park in the City of Maywood adjacent to and west of the Los Angeles River just south of East Slauson Avenue (Figure 3). This site is a critical link in the assemblage of several parcels along the LA River. The parcels will eventually form a riverside park and are part of the larger LA River Greenway program and the LA River Master Plan.

The Maywood River Park would be one segment of a proposed 51-mile greenway along the Los Angeles River. The proposed park would include the Pemaco, W.W. Henry, Catellus, Lubricating Oil, LA Junction Railroad Right-of-Way, and Precision Arrow properties. TN&A was contracted by the City of Maywood to perform a risk assessment for the proposed Maywood Riverfront Park Property (MRPP). The objective of this study is to assess any potential health risks for the future recreational users of the MRPP and the future excavation workers that may work at the MRPP. This health risk assessment was performed to identify areas within the MRPP where residual chemicals in soil from historic property uses could cause potential impact human health.

Results of the MRPP Risk Assessment are summarized in Section 8.0 of this document and are more thoroughly discussed in the *Draft Environmental Impact Report, Maywood Riverfront Park Project* (Willdan, 2002).

4.3 METEOROLOGY

The Pemaco site is located within the Central Groundwater Basin of the Los Angeles-Orange County Coastal Plain. The Los Angeles Coastal Plain is bounded on the north and east by the Santa Monica Mountains and the Puente Hills; on the south by the San Joaquin Hills; and on the west by the Pacific Ocean. The major drainages in the basin are the Los Angeles, the San Gabriel, and the Santa Ana Rivers, all of which have headwaters outside of the basin.

Climate in the Los Angeles-Orange County Coastal Plain is Mediterranean; characterized by warm summers, cool winters, and markedly seasonal rainfall. Summer daytime temperatures average 70° to 80° F while winter temperatures average 50° to 60° F, December through March. Nearly all rain falls from late autumn to early spring; virtually no precipitation falls during the summer. The average rainfall in Los Angeles is approximately 14 inches. Potential evapotranspiration in the coastal plain exceeds precipitation on an annual basis, and under natural conditions, the lower reaches of the rivers that drain the basin are dry in the summer. The above data was averaged for the years 1957 through 2000.

4.4 SITE GEOLOGY/STRATIGRAPHY

Geologic cross sections (Figures 4 and 5A-5F) illustrate site geology and hydrogeology as encountered in continuously cored borings drilled during RI activities. Lithologic logs (Appendix 8) were prepared during CPT in-situ groundwater testing and during traditional soil logging. CPT lithologic logs classify soils based on soil behavior types whereas traditional soil logging classifies soils based on the United Soil Classification System (USCS) (Campanella and Robertson, 1988). Figure A-8 of Appendix 8 illustrates a comparison of logs prepared by the CPT classification system and logs prepared utilizing the USCS.

The following is a simplified description of the stratigraphy and lithologic units underlying the site vicinity. The titles given to the lithologic units discussed below will be used throughout the document as they relate to drilling and sampling activities and analytical results. Table 4.4 summarizes site stratigraphy and may be used in conjunction with the discussion of each soil zone below.

4.4.1 Surface Soil

Surface soils in the area are comprised primarily of heterogeneous fill material. Surficial fill in the area varies in thickness from 2 feet to 6 feet and is typically comprised of dark yellowish brown silty sands and local gravelly sands or clayey gravels.

4.4.2 Subsurface Soil

Subsurface soils in the site area are described below and are designated as all non-saturated intervals below 2' bg.

4.4.2.1 Upper Vadose Zone and Perching Clay

Upper Vadose Zone
Typical depth of the upper vadose zone is between 2 feet bgs to 25 feet bgs. These native soils are predominately light olive gray to dark yellowish brown laminated to moderately bedded fine silty sands (1 foot- to 20 feet-thick) interbedded with pale yellowish brown to light olive gray lenses of laminated to poorly bedded poorly graded sands and fine poorly graded sands with silt from 2 inch- to 6 foot-thick. Local discontinuous lenses of olive gray sandy silt and lean clay lenses ranging from 3 inch- to 4 foot- thick are also present within upper vadose zone.

Perching Clay
Typical depth of the perching clay is between 28 feet bgs to 40 feet bgs. The top of this unit is comprised of silty lean and fat clays ranging from 1 foot- to 15 foot-thick, which are underlain and interbedded with olive gray to moderate yellowish brown clayey and sandy silts ranging from 1 foot to 8 feet in thickness. Figure 6A illustrates the elevation contours of the top of the perching clay. The perching clay and associated clayey silts comprise the fine-grained lithosome that ranges from 10 feet to 20 feet in total thickness. Local unsaturated silty sand and sands with silt lenses are found within the lithosome.

Table 4.4.2A summarizes the geotechnical analyses for the upper vadose zone and perching clay soils (approximately 5 to 40 feet bgs). Geotechnical analyses include water content

(ASTM D2216), wet/dry density (ASTM D2937), total porosity, and sieve/hydrometer analyses (ASTM C117 and ASTM D422).

4.4.2.2 Lower Vadose Zone

Descriptions of the Lower Vadose Zone are provided below and include the unsaturated Lower Vadose Zone Sand and all the fine-grained intervals below 40' bg.

Lower Vadose Zone Sand
The lower vadose zone sand is typically found between 40 feet bgs to 50 feet bgs. It is predominately fine- to medium-grained, unsaturated, poorly graded sands and gravelly well-graded sands derived from granitic source rocks. The zone typically coarsens downward with poorly bedded gravelly basal units. The lower vadose zone sands are usually 1 foot- to 14 foot-thick with local intervals of silty sands and poorly graded sands with silt from 6 inch- to 3 foot-thick. The local interbeds of silt lenses from 6 inch- to 4 foot- thick are within this unit as well. The lower vadose zone sand appears to be continuous throughout the area as it was encountered in every boring completed in the site vicinity except in the area adjacent to MW-12 where it appears to pinch out locally. The thickest local sequences are found along District Blvd. and in the area underlying 60th Street between Walker Ave. and District Boulevard. Fine silty sands comprise the unit in locations where the interval is less than 3' thick.

Lower Vadose Zone Fine-Grained Unit
Typical depth of the lower vadose zone fine-grained unit is between 50 feet bgs to 65 feet bgs. It is comprised of sandy and clayey silts ranging from 7 foot- to 20 foot-thick interbedded with lean and fat clays ranging from 6 inch- to 5 foot-thick. Local discontinuous lenses of unsaturated poorly graded sands and silty sands are present from 0.5 foot- to 2 foot-thick within this interval. The thickest areas of the unit are predominately silt. Localized abundant organic material can also be found throughout the interval.

Table 4.4.2B summarizes the geotechnical analyses for the lower vadose zone soils (approximately 35.5 to 65 feet bgs). Geotechnical analyses include water content (ASTM D2216), wet/dry density (ASTM D2937), total porosity, and sieve/hydrometer analyses (ASTM C117 and ASTM D422).

Lakewood Formation
'A' – 'B' Fine-Grained Unit
This zone separates the 'A' and 'B' Exposition groundwater zones and is typically found between 70 feet bgs to 80 feet bgs. It is comprised of light olive gray fat and lean moderate to very stiff clays with local interbeds of dark greenish gray clayey silt with sand. Local mottling of the gray clays with dark yellowish orange and medium yellow brown clays may distinguish this unit. This aquitard interval ranges from 5 foot- to 10 foot-thick and is continuous where both 'A' and 'B' Exposition groundwater zones are present.

'B' – 'C' Fine-Grained
This unit is typically found between 90 feet bgs to 100 feet bgs. It is predominately comprised of olive gray to dark greenish gray fat and lean clays from 8 foot- to 10 foot-thick with local interbeds of sandy silts and silt with clay from 1 foot- to 5 foot-thick. Total thickness of the unit ranges from 7 feet to 12 feet.

'C' – 'D' Fine-Grained
This unit is typically found between 105 feet bgs to 125 feet bgs. It is comprised of lean and fat clays from 3 foot- to 6 foot-thick interbedded with sandy and clayey silts from 4 foot- to 12 foot-thick. Total unit thickness ranges from 18 feet to 30 feet.

'D' – 'E' Fine-Grained
This unit is typically found between 145 feet bgs to 160 feet bgs. It is predominately comprised of clayey silt with local interbeds of lean clays. Thickness ranges from 12 feet to 18 feet. Local saturated silty sand lenses to 2 feet thick are located within the interval.

Tables 4.4.2C and 4.4.2D summarizes the geotechnical analyses for the Lakewood Formation soils (approximately 70 to 165 feet bgs). Geotechnical analyses include water content (ASTM D2216), wet/dry density (ASTM D2937), total porosity, and sieve/hydrometer analyses (ASTM C117 and ASTM D422).

Lower Exposition Fine-Grained Unit
The top of this unit is typically found at 175 feet bgs. It is comprised of clay with silt finely laminated with silt. Local lenses of medium-grained saturated poorly graded sands to 6 inches thick are found within this unit. The depth to bottom and total thickness of this unit is unknown in the site vicinity.

4.4.2.3 Saturated Zones

Perched Zone
The perched saturated interval comprises a few inches to 4 feet of the "perched zone" lithosome (perching clay described above in Section 4.4.2.1). Typical depth of the perched zone is between 25 feet bgs to 30 feet bgs. This wet to saturated zone is comprised of locally laminated fine silty sands ranging from 6 inch- to 4 foot-thick. Locally, the perched zone is comprised of two perched intervals of sandy silts or silt with sand separated by a 1 foot- to 3 foot-thick "perching" clay. The perched zone is absent in some areas where it is replaced by "high points" of the underlying "perching" clay. Groundwater flow direction and hydraulic communication between different localities of the perched zone is dependent upon the geometry of the underlying perching clay (Figure 6A). The degree of saturation in the perched zone also is dependent on the amount of meteorological re-charge from year to year. Locally, the perched zone is dried out and acts as a vadose zone. The perched zone can be characterized by low transmissivities and very limited yield. This is not a viable aquifer.

Exposition 'A' Zone
This is the first saturated zone encountered below the perched zone. The 'A' Zone is typically found between 65 feet bgs to 75 feet bgs. It is comprised of light olive gray to dark greenish gray fine silty and poorly graded sands locally interbedded with well-graded sands with silt. The thickness of this zone is highly variable ranging from 3 inch- to 10 foot-thick. The thickest 'A' zone intervals are comprised of interbedded poorly graded silty sands and well-graded sands. The thinnest intervals of the 'A' zone are a series of 1 inch- to 3 inch-thick saturated silty sands interbedded with silts and clays from 0.5 to 1 foot-thick. Overall, the 'A' zone can be characterized as a series of semi-discontinuous saturated sand lenses.

Exposition 'B' Zone

The 'B' zone is the second saturated zone below the perching layer and is typically found between 80 feet bgs to 90 feet bgs. It is comprised of fine silty sands, poorly graded sands and poorly graded sands with silt ranging from 1.5 to 10-feet thick. The fine-grained silty sands are typically light olive gray mottled with moderate yellowish brown or moderate olive brown. Some of the thicker portions of the unit have interbeds of silt/clay to 4 feet thick. The 'B' zone is continuous throughout the site vicinity, except in the area along District Blvd., south of 60th Street, where it pinches out.

A secondary saturated silty sand lens located between 90 and 92 feet bgs was consistently observed during the coring of borings MW-16 through MW-18 and RW-01located in the southernmost portion of the Pemaco site (Figure 2). This secondary lens is isolated from the 'B' Zone described above by an overlying interval of fat clay from 1 to 3 feet thick. Well MW-17-95 was screened solely in this zone for aquifer test purposes. This zone was informally named the 'B_2' Zone. The 'B_2' lens was not encountered in any of the offsite borings that were cored below 90 feet bgs.

Exposition 'C' Zone
The 'C' Zone is typically found between 100 feet bgs and 105 feet bgs. It is comprised of saturated dark greenish gray fine silty sands, poorly graded sands and poorly graded sands with silt ranging from 2 foot- to 6 foot-thick. It appears to be continuous throughout the site vicinity within the 95 feet to 110 feet depth interval.

Exposition 'D' Zone
The 'D' Zone is typically found between 125 feet bgs to 145 feet bgs. It is comprised of interbedded fine silty sands, poorly graded sands and poorly graded sands with silt, well-graded sands and gravelly sands and local well-graded sandy gravel intervals. Total thickness ranges from 6 feet to 15 feet. This zone is the thickest and highest yielding of all the Exposition lithosomes encountered in the site vicinity.

Exposition 'E' Zone
The 'E' Zone is typically found between 160 feet bgs to 175 feet bgs and is comprised of alternating saturated intervals of 1 foot-thick fine silty sands and well-graded sands.

4.5 HYDROGEOLOGY

4.5.1 Regional Hydrogeology

The Los Angeles--Orange County coastal plain is a structural basin formed by folding of the consolidated sedimentary, igneous, and metamorphic rocks that underlie the basin at great depths. Primary geologic/hydrogeologic units in the area, from youngest to oldest include:

- *Recent Alluvium* – Primarily unconsolidated braided-river and floodplain deposits. These deposits comprise the uppermost 30 to 40 feet of soil/sediment in the immediate area (Figure 5A).

- *Pleistocene Lakewood Formation*, including the Exposition and Gage/Gardena Aquifers – Also consisting of braided river and floodplain deposits. In the Pemaco area, sediments of the Lakewood Formation generally comprise the stratigraphic interval between about 35 feet bgs and 200 feet bgs (Figures 5B – 5F). However, the

stratigraphic equivalent of the Exposition Aquifer in the Pemaco area is a series of thin saturated sand lenses interbedded with thicker fine-grained lithosomes (silts and clays). This zone is not used for groundwater production near Pemaco due to its low yielding quality.

- *Lower Pleistocene San Pedro Formation*, including the Hollydale, Jefferson, Lynwood and Silverado Aquifers – A variety of lithosomes deposited in both marine and non-marine environments. In the Pemaco area of the Central Groundwater Basin, the stratigraphic top of the San Pedro Formation is generally placed at the base of the Gage/Gardena Aquifer (basal Lakewood Fm.), estimated to occur at about 200 feet bgs. The uppermost unit of the San Pedro Formation is a 50- to 75-foot thick fine-grained lithosome, generally regarded as an aquitard. The Hollydale and Jefferson aquifers are the upper aquifers in the San Pedro Formation, and may be present below the Pemaco Site, with the top of the uppermost coarse-grained unit occurring somewhere between 250 feet and 325 feet bgs.

The aquifers mentioned above are all used for both municipal and industrial purposes in various parts of the Central Basin. In the Pemaco area, screened/perforated intervals in nearby production wells begin in the San Pedro Formation Aquifers, usually at depths of 350 feet bgs or deeper. The closest active well is approximately ½ mile south of the site, one of the two wells owned and operated by Mutual Maywood Water Company. The most-shallow production well within 1 mile of the site is screened starting at 350 feet bgs, within the uppermost aquifer of the San Pedro Formation (the Jefferson Aquifer). In general, the groundwater flow direction in the aquifers is southwest, towards the coast.

4.5.2 Hydrogeology of Study Area

There are two distinct hydrogeologic units within the study area: a perched groundwater zone and the more regional Exposition Groundwater Zones. The perched groundwater zone is typically found between 25 feet bgs and 40 feet bgs within the study area. The Exposition Groundwater Zones, within the study area, are comprised of five distinct saturated zones separated by silt/clay intervals that are typically found between 65 feet bgs and 175 feet bgs. Forty-one monitoring wells are currently installed within the perched groundwater zone and 35 monitoring wells are installed in the five Exposition Zones as a part of the Pemaco RI (as of April 2002).

Groundwater depth levels were taken with an electronic sounder during each quarterly monitoring event. Groundwater levels were also taken in April 2001 during well development events. Gauging occurred weekly during May 2001 and monthly between June and December 2001 for the Exposition Aquifer wells to determine if a hydraulic connection exists between the Exposition Aquifer (particularly lower zones ‘D’ and ‘E’, see Figures 5B – 5F) and the two active Maywood production wells.

The following sections summarize each hydrogeologic unit in more detail as well as the findings of the groundwater gauging data for each groundwater zone.

4.5.2.1 Perched Groundwater

Groundwater in the perched zone occurs in intercalated lenses of poorly graded sand, silty sand, and sandy silt, which lie on top of the perching clay and are locally overlain by finer-grained units. These saturated lenses are located at different depths ranging from 20 feet and 40 feet bgs and 5 inches to 5 feet thick. The geometry of the perched zone is controlled by the highly irregular and undulating top surface of the underlying, laterally extensive perching clay. Measurements of depths to groundwater in the perched zone in the Pemaco site vicinity ranged from 18.48 feet bgs (B-31, April 2001) to 39.31 feet bgs (B-17, May 2001) since measurements began in September 2000. Groundwater fluctuations of greater than five feet have been observed since routine gauging started. Hydrographs for the perched zone are presented in Appendix 4.

The complex hydrogeology of the perched zone causes highly variable groundwater gradients. The over-all general component of apparent groundwater flow in the perched zone is towards the southwest, but there are many localized areas that indicate that the apparent groundwater flow is in multiple directions. Figure 6B illustrates the most recently produced gradient map of the perched zone (April 2002). Due to the irregular nature of the perched groundwater zone, no gradient was calculated. Groundwater gradient maps for each of the monitoring events (May 2001 through April 2002) are presented in Appendix 4, Technical *Memorandum – Results of Groundwater Monitoring Activities May 2001 through April 2002, Pemaco Superfund Site, 5050 East Slauson Avenue, Maywood, California* (TN&A, 2002).

4.5.2.2 'Exposition' Zones 'A' through 'E'

The Exposition Groundwater Zones include five distinct saturated zones that are separated by silt/clay intervals. These five units have been informally named from top to bottom, the Exposition 'A' through 'E' Zones. The 'A' Zone is typically found between 65 and 75 feet bgs. It is comprised of fine silty and poorly graded sands locally interbedded with well-graded sands. The thickness of this zone is highly variable ranging from 3" to 10 feet thick. This interval can be characterized as a series of semi-continuous saturated sand lenses. The 'B' zone is typically found between 80 and 90 feet bgs. It is comprised of fine silty sands, poorly graded sands and poorly graded sands with silt ranging from 1.5 to 10 feet thick. The 'B' Zone is more uniform and laterally continuous than the 'A' Zone. These two zones are the predominant zones of concern and together are informally named the Upper Exposition Groundwater Zone.

Potentiometric surface measurements in the semi-confined Exposition 'A' Zone ranged from 53.43 feet bg (MW-07-75, May 2001) to 64.27 feet bg (MW-15-70, January 2002) since measurements began. Groundwater fluctuations of up to seven feet have been observed in the 'A' Zone since measurements began in May 2001. Figure 7A illustrates the 'A' Zone groundwater gradient during the April 2002 monitoring event. Gradients ranged from 0.0043 to 0.011 feet per foot (ft/ft) from May 2001 to April 2002. Apparent groundwater flow directions have been consistently towards the southwest and south-southwest.

Potentiometric surface measurements in the confined Exposition 'B' Zone ranged from 57.71 feet bg (MW-13-85, May 2001) to 72.40 feet bg (MW-14-90, January 2002) since measurements began. Groundwater fluctuations of more then four feet have been observed

in the 'B' Zone since measurements began in May 2001. Figure 7B illustrates the 'B' Zone groundwater gradients for the April 2002 monitoring event. Gradients ranged from 0.0063 to 0.0092 ft/ft from May 2001 to April 2002. Apparent groundwater flow directions have been consistently towards the southwest.

The remaining three zones, 'C', 'D', and 'E' are typically found from 95 to 110 feet bgs, 125 to 145 feet bgs, and 160 to 175 feet bgs, respectively. The 'C' zone is comprised of saturated fine silty sands, poorly graded sands and poorly graded sands with silt ranging from 2 to 6 feet-thick. It appears to be continuous throughout the site vicinity within the 95 to 110 feet depth interval. The 'D' Zone is typically comprised of interbedded fine silty sands, poorly graded sands and poorly graded sands with silt, well-graded sands and gravelly sands, and local well-graded sandy gravel intervals. Total thickness ranges from 6 to 15 feet. This zone is the thickest and highest-yielding of all the Exposition lithosomes encountered in the site vicinity. The 'E' Zone is typically comprised of alternating saturated intervals of 1 foot-thick fine silty sands and well-graded sands. Due to the limited number of monitoring wells screened within the Exposition 'C' through 'E' Zones , no gradient data is available for these zones.

More detailed descriptions of the Exposition 'A' through 'E' Zones' groundwater elevations and gradients may be referenced in Appendix 4, *Technical Memorandum – Results of Groundwater Monitoring Activities May 2001 through April 2002, Pemaco Superfund Site, 5050 East Slauson Avenue, Maywood, California* (TN&A, 2002). This Appendix includes hydrographs, "chem-box" maps, groundwater gradient maps and contaminant plume maps for the Exposition Zones, along with summary tables of all analytical data and water level data to date.

Additional groundwater wells (MW-20-70, MW-20-85, MW-21-80, MW-21-90, MW-22-75, MW-22-90, MW-23-110, MW-23-145, MW-24-110, MW-24-140, MW-25-110, and MW-25-130) were installed in the Exposition 'A', 'B', 'C', and 'D' Zones during the Summer and Fall of 2003 to further assess the vertical extent of chlorinated VOC concentrations in the immediate release area in the south portion of the Pemaco property and to further define the northern and western extent of VOC concentrations in the 'A' and 'B' Zones. In general, the results from this investigation indicated that the chlorinated VOC concentrations located in the 'A' and 'B' Zones have had very limited vertical migration to impact the deeper Exposition 'C' and 'D' Zones underlying the source area. The new 'A' and 'B' Zone data indicated that low (<100 µg/L) VOC concentrations exist in the 'A' and 'B' Zones underlying the northern and central portions of the Pemaco property, but do not extend westwardly beneath the W.W. Henry property. A technical memorandum detailing the field activities and gauging results of this additional investigation are provided as an appendix to this document.

4.5.2.3 Site-Specific Hydraulic Parameters

A series of groundwater slug, pumping, and recovery tests were performed at the Pemaco site between December 12th and 24th, 2001. Types of tests performed included:

- Background/diurnal logging of "static" groundwater levels in the 'A' and 'B' Zones
- Slug testing of five 'A' Zone wells;
- Step drawdown pump testing of the 'B' Zone while monitoring 'A' Zone and 'B' Zone wells;

- Constant rate pump testing (72 hrs) of the 'B' Zone while monitoring 'A' and 'B' Zone wells;
- Post-pumping recovery monitoring of all wells monitored during pumping test; and
- "Stress" pumping of the 'B' Zone to determine maximum sustainable pumping rates.

Results of data analysis are:

- Sustainable pumping rates from the 'A' zone are approximately 0.5 gallons per minute (gpm) and approximately 1.0 gpm from the 'B' zone.
- Calculated hydraulic conductivity (K) values for the 'A' zone range from 8.3 E-04 to 2.3 E-03 feet per minute (ft/min).
- Calculated hydraulic conductivity (K) values for the 'B_1' zone range from 1.1 E-03 to 1.1 E-01 ft/min.
- Calculated hydraulic conductivity (K) values for the 'B_2' zone average 6.6 E-03 ft/min.
- Pump test data indicated that the 'A' and 'B' Zones are hydraulically connected in a way consistent with a composite/leaky confined aquifer.
- Calculated linear velocities for the 'A' Zone average 7 feet per year (ft/yr) and linear velocities for the 'B' Zone average 203 ft/yr.

A summary of hydraulic property calculations is presented in Table 4.5. See Appendix 5 for a detailed description of the aquifer test and data analysis methods, calculations, best-fit curve graphs and raw data.

4.5.2.4 Regional Hydraulic Parameters

The Maywood Mutual Water Company operates several groundwater production wells located in the Maywood area. There are two locations within a mile down-gradient of the Pemaco site that are actively used to produce drinking water. One of the locations is approximately 0.4 miles south of Pemaco (top of screen interval = 640 feet bg) and the other location is approximately 0.8 miles southwest of Pemaco (top of screen interval = 350 feet bg). The pumps in these wells are turned on in the beginning of May and turned off in the end of October annually. Weekly gauging of the Exposition Groundwater Zone wells installed for the Pemaco RI was done during the month of May 2001 and the wells were gauged monthly from June 2001 through November 2001 and then continued quarterly along with the sampling events. This was done to identify if there is a hydraulic connection between the Exposition Zones located in the Pemaco area and the Maywood Mutual Water Company wells. Hydrographs 2A through 2C, located in Appendix 4, illustrate the changes in water levels for the Pemaco wells and identify when the production wells are turned on and off.

These hydrographs indicate that the potentiometric surfaces for the lower Exposition Zones ('C' and 'D') are reduced when the Maywood Mutual Water Company wells are turned on in May and increase when the wells are turned off in October. This indicates that there may be a hydraulic connection between the lower Exposition Zones and the underlying San Pedro Aquifers that are used for groundwater production. However, water level data for other monitoring wells in the Los Angeles Basin (http://well.water.ca.gov) show the same general trend, which may indicate that the fluctuations are from seasonal effects. A site-specific aquifer test would need to be completed to ascertain the hydraulic communication between the lower Exposition Zones and the deeper aquifers used for groundwater. It should be noted that lower Exposition Zones 'E' and 'D' have not been impacted by VOCs according to

the analytical data for the areas tested down-gradient of the Pemaco site. The hydrograph data does not support a hydraulic connection between the San Pedro Aquifers and the 'A' and 'B' Zones of the Exposition Aquifer, which are known to be impacted by Pemaco related contamination.

5.0 NATURE AND EXTENT OF CONTAMINATION

The following sections (5.1 – 5.5) describe the nature and extent of contamination provided by the analytical data for each environmental media including: ambient air, soil vapor, surface and near surface soil, subsurface soil, perched groundwater, and Exposition Aquifer groundwater. The most prevalent analytes detected within each environmental media will be distinguished and the vertical and lateral extent of each contaminant of concern will be delinated where appropriate. Laboratory and QA/QC results are presented in Appendix 10 (Analytical Data and QA/QC Evaluation Results) of this report.

The RI activities for the Pemaco Superfund Site were performed at multiple locations: within the Pemaco site boundaries; at adjacent properties (W.W. Henry, Catellus, LAJR and Lubricting Oil Services); and in the residential area located southwest of Pemaco (Figure 3). During sampling activities performed to delineate contamination from sources related to former operations at the Pemaco facility, several areas of non-Pemaco related contamination were encountered. In certain areas, non-Pemaco related contamination has co-mingled with Pemaco related contamination and in other areas, non-Pemaco related contamination exists as a separate entity (see Section 5.6 below).

5.1 SOIL VAPOR AND AIR

Three soil vapor sampling events and two indoor/outdoor air samplling events have occurred during the Pemaco RI/FS activities between January 2001 and April 2002. The February 2001 soil vapor event was done for contaminant delineation and to collect onsite data for risk assessment purposes. The July 2001 and March 2002 events were performed to assess the potential of soil vapor concentrations to migrate into the residential homes located between 59th Place and 60th Street in the site vicinity. Figure 8 illustrates all the sampling locations associated with the three events.

February 2001
A total of 66 soil vapor samples were collected at 5 feet bgs in February 2001. Samples were analyzed by EPA Method SW-846 8260B utilizing an on-site FASP laboratory. Analytical results of this event indicated elevated concentrations of VOCs in 37 of the 66 soil vapor samples collected. Detected analytes were as follows: 1,1,1-trichloroethane (1,1, 1-TCA), 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), chloroform, cis-1, 2-dichloroethene (cis-1, 2-DCE), cyclohexane, ethylbenzene, p/m xylenes, tetrachloroethene (PCE), and trichloroethene (TCE).

PCE, TCE, and DCE were the most frequently detected analytes during this sampling event. The concentration range for each of these analytes is as follows: PCE (500 to 140,000 ug/m^3), TCE (500 to 11,000 ug/m^3), and 1,1-DCE (1,000 to 36,000 ug/m^3). The highest reported concentration of any analyte was 150,000 ug/m^3 for 1,1,1-TCA detected in the southwest corner of the W.W. Henry property. Concentration ranges of the remaining detected analytes are as follows: 1,1-DCA (1,000 to 8,000 ug/m^3), chloroform (1,000 ug/m^3), cis-1,2-DCE (1,000 to 26,000 ug/m^3), cyclohexane (3,000 to 23,000 ug/m^3), ethylbenzene (500 ug/m^3), and p/m xylenes (2,000 ug/m^3).

The majority of detected concentrations on the Pemaco site were located in the northern portion of the property. This area coincides with former AST and drum storage locations.

Other "hot spot" locations on the Pemaco property were in the west central portion where the rail spur connected with the property and in the extreme southern portion of the Pemaco property near former USTs and a former drum storage area. This small drum storage area in the extreme southwest corner of the site is likely the main TCE release point associated with the large groundwater plume discussed in subsequent sections. Figure 3A illustrates the locations of all the former environmental features.

Locations with elevated VOC concentrations other than on the Pemaco property were found in the southwest portion of the W.W. Henry site, which coincides with a former mixing patio (Figure 3A) and in the northeast portion of the W.W. Henry site where the railway spur enters the property. It should be noted that the detections on the W.W. Henry property appear to be related to W.W. Henry sourced contamination and not from former Pemaco activities. Two other smaller bodies of contamination were detected on the LAJR property adjacent to the Lubricating Oil Services property (1,000 ug/m^3 of PCE at SV-40) and in the center of the former Catellus property (1,000 ug/m^3 of chloroform at SV-SO20). These concentrations appear to be isolated and not associated with the releases at Pemaco or W.W. Henry.

Figures 8A, 8B, 8C and 8D illustrate the spatial distribution of analytes detected during the February 2001 soil vapor event. As the figures illustrate, it appears that there are several isolated releases that occurred in the site area, with co-mingling of their associated plumes found along the LAJR property north of W.W. Henry and possibly in the northwest portion of the 59th Place and Walker Avenue intersection. A tabulated summary of analytical results for soil vapor in the vicinity of Pemaco can be found in Table 5.1.

For risk assessment purposes, detected analytes were screened against Region IX PRGs for ambient air multiplied by 100. This is a conservative screening method that takes into account the dilution factor that occurs when soil vapors migrate into ambient air. Six of the ten detected analytes (all but 1,1-DCA, cyclohexane, ethylbenzene, and p/m xylenes) exceeded their applicable PRGs x 100.

It should be noted that method detection limits of FASP laboratories are typically higher than traditional fixed-base laboratories. In particular, the method reporting limit for ketones (acetone, 4-methyl-2-pentanone, etc.) was 10,000 ug/m^3 during the February 2001 soil vapor sampling event, whereas, the method reporting limit for non-diluted samples in the July 2001 soil vapor sampling event (discussed below) was 1 ug/m^3. These elevated detection limits explain why no acetone concentrations were detected during the February 2001 event, yet acetone was very prevalent in the July 2001 event, which led to the follow-up March 2002 event.

July/August 2001

Appendix 2 contains the *Technical Memorandum – Results of the July 2001 Soil Gas, Indoor/Outdoor Air and Groundwater Sampling Completed in the Residential Neighborhood Adjacent to the Pemaco Superfund Site and Former WW Henry Properties, 5920 Alamo Avenue and 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002c). The memorandum contains all tables and figures associated with this sampling event. A brief summary of analytical results of soil vapor and ambient air sampled during this event is presented below.

Environmental samples (a total of 7 soil vapor and 8 indoor/outdoor air samples) were collected from eight residences within the surrounding neighborhood adjacent (southwest) of

the Pemaco property. Soil vapor and ambient air samples were analyzed for VOCs by EPA Method SW-846 8260B and EPA TO-15, respectively. Twenty-four different analytes were detected in the soil vapor and air samples collected during the July 2001 event. Only ten out of the 24 detected analytes were present in both the soil gas samples and the indoor/outdoor air samples. These analytes are as follows: acetone, 2-butanone, chloromethane, methylene chloride, MTBE, toluene, 1,2,4-trimethylbenzene, vinyl acetate, o-xylene and m,p-xylenes.

The highest detected concentration in each soil vapor sample was acetone (280 parts per billion per volume (ppbv) to 1,300 ppbv; 665 ug/m^3 to 3,088 ug/m^3). Upon comparison of soil vapor results to Pemaco ARARs for soil vapor, two VOCs, chloroform and benzene, fallout from the list of detected VOCs. Chloroform was detected in four samples at concentrations above the ARAR for chloroform of 8.4 ug/m^3 with concentrations ranging from 15 to 73 ug/m^3. Benzene was detected above its ARAR of 25 ug/m^3 in one sample (LFSG 23) at a concentration of 25.5 ug/m^3. The location of these benzene and chloroform '"hits"' are consistent with locations of high acetone concentrations (5100 59th Place, 5112 59th Place and 5130 59th Place; residential properties closest to the Pemaco and W.W. Henry properties).

Analysis of ambient air samples indicated that, like soil vapor samples, the highest detected concentration in each sample was acetone. Acetone concentrations in these samples ranged from 11 ppbv to 50 ppbv (26 to 116 ug/m^3). For comparison, detected concentrations of other VOCs, including bromomethane, 2-butanone, chloromethane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, dichlorodifluoromethane, methylene chloride, 4-methyl-2-pentanone, MTBE, toluene, trichlorofluoromethane, 1,2,4-trimethylbenzene, vinyl acetate and xylenes, ranged from 0.75 ppbv to 5.6 ppbv (2.1 to 17.7 ug/m^3). However, concentrations of 1,3-dichlorobenzene, 1,4-dichlorobenzene, chloromethane, and MTBE exceeded ambient air PRGs (3.3 ug/m^3, 0.31 ug/m^3,1.1 ug/m^3, and 3.7 ug/m^3, respectively) in six air samples/locations. Concentration ranges of each analyte are as follows: 1,3-dichlorobenzene (6.01 ug/m^3 in 2 locations), 1,4-dichlorobenzene (6.01 ug/m^3 at 1 location), chloromethane (2.06 to 6.2 ug/m^3), and MTBE (7.2 to 14.4 ug/m^3). The air samples with the highest concentrations of both acetone and the three analytes which exceeded ambient air PRGs were located indoor at 5112 59th Place and indoor and outdoor at 5130 59th Place.

Results of the LFR-collected samples are presented in the *Addendum to Soil, Soil Gas, Groundwater and Ambient Air Evaluation, Former W.W. Henry Property, 5920 Alamo Avenue, Maywood, California*, written by LFR and dated November 1, 2001. These data are not presented in this RI report.

March 2002

Appendix 3 contains the *Technical Memorandum – Results of Soil Gas and Indoor/Outdoor Air Sampling – March 2002, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002e). The memorandum contains all tables and figures associated with this sampling event. A brief summary of analytical results of soil vapor and ambient air sampled during this event is presented below.

Soil vapor samples were collected from 14 locations at 5 and 15 feet bg from the Pemaco, W.W. Henry and former Catellus properties, and several residential lots adjacent to these properties; 12 indoor air samples were collected from residences in the neighborhood adjacent to Pemaco; and 10 outdoor air locations were sampled throughout the general Pemaco area including samples collected several blocks away from Pemaco. This additional

investigation was a follow-up to the elevated acetone concetrations detected during the July 2001 event.

Soil Vapor Concentrations
Each of the soil vapor and air samples collected had detectable VOC concentrations. Trace (<10 ug/m^3) to moderate (<1,000 ug/m^3) VOC concentrations were detected at nine of the 14 soil vapor locations and high (>1,000 ug/m^3) VOC concentrations were detected at four of the 14 locations. Acetone, isopropanol and PCE were the most consistently detected VOCs with elevated concentrations in soil vapor.

The highest concentrations were detected from the following locations: southern portion of Pemaco; north-central portion of Catellus; LAJR property adjacent to Pemaco; near the free product plume originating from the W.W. Henry property; and near the west end of the W.W. Henry property. Each of the former industrial properties appears to be contributing to soil vapor contamination found underlying the adjacent residential neighborhood. Soil vapor VOC concentrations were consistently detected at higher levels in the 15 feet bg samples than the 5 feet bg soil vapor samples (except for the Catellus property sample) indicating that the concentrations are likely from impacted groundwater.

Indoor/Outdoor Air Concentrations and Migration of Soil Vapor
VOC concentrations exceeding PRGs for ambient air were detected at all of the 12 indoor air and 10 outdoor air locations. The most consistently detected VOCs at concentrations exceeding PRGs were 1,2,4-TMB, benzene, chloromethane and MTBE. These compounds were also commonly found in soil vapor samples. The compounds 1,4-dichlorobenzene, chloroform, dichlorodifluoromethane and hexabutadiene were also detected at levels exceeding PRGs in indoor air. However, these exceedences were sporadic and do not have associated elevated concentrations in the co-located soil vapor sample, except for chloroform at 5114 59th Place (see below). Acetone and isopropanol were commonly detected in the indoor, outdoor and soil vapor samples, but none of these concentrations exceeded PRGs. Table 6 summarizes the data for the co-located samples (soil vapor and indoor/outdoor air samples that were collected from the same property).

VOCs that were consistently found in both soil vapor and indoor air samples collected at the same properties include 1,2,4-TMB, acetone, benzene, chloromethane, ethylbenzene, isopropanol, MEK, MTBE, toluene and xylenes. However, the concentrations of these VOCs that were detected in indoor air were also detected at similar concentrations in outdoor air samples collected throughout the area, including the outdoor air sample collected several blocks away from the Pemaco area.

The only instances were the sampling results indicate that soil vapor migration is possibly elevating indoor air concentrations above the outdoor background ranges are:

- The residence at 5112/5114 59th Place where chloroform, hexane and cyclohexane were found in soil vapor and also detected in the associated indoor air sample. None of these compounds were detected in any of the outdoor air samples.

- The acetone concentrations detected in the corner market (5100 59th Place) and in the residence at 5112/5114 59th Place were slightly above the outdoor

acetone concentration ranges. Elevated acetone concentrations were detected in soil vapor at both of these locations.

The concentration distributions indicate that the only VOCs that exceed PRGs in indoor air (except for chloroform in the 5112/5114 residence) are found at similar concentrations in outdoor air, or are from indoor uses of household chemicals and appliances. Furthermore, the distribution of VOC concentrations found in the outdoor air samples indicate that the elevated acetone concentrations are from a more regional phenomenon and not related to soil vapor migration originating from the Pemaco, W.W. Henry or former Catellus properties. The outdoor air concentration distributions of acetone, isopropanol, 1,2,4-TMB, benzene, chloromethane, MEK, and MTBE are generally uniform throughout the area west of the Los Angeles River. VOC concentrations detected in the immediate Pemaco area were also found at similar concentrations in the sample collected $2^1/_2$ blocks east of Pemaco and there was no significant eastward wind direction observed. If the Pemaco, W.W. Henry and former Catellus properties were the source of the VOC concentrations found in the outdoor air samples, then you would expect to see high concentrations at these locations and much lower diluted concentrations at the more distant sampling locations. The sampling results are not consistent with this premise.

Comparison of March 2002 and July 2001 Results
There were four soil vapor and eight indoor/outdoor air locations that were sampled during both the July 2001 and March 2002 sampling events.

The soil vapor results for the two sampling events were generally consistent. The most notable differences were the decreases in acetone, MEK and toluene concentrations and the increases in PCE and xylenes from July 2001 to March 2002. These changes may be attributed in part to the operation of a soil vapor extraction system, which has operated at the W.W. Henry property between May 2001 and the present.

The indoor/outdoor air sampling results of this investigation were generally consistent with the sampling results of the July 2001 indoor/outdoor air results for the locations that were sampled during both events. The only notable differences are the consistent increase in toluene concentrations from July 2001 to March 2002; the detections of benzene during the March 2002 event that were not detected in July 2001; the trace levels of bromomethane detected in indoor air in July 2001 were not detected during the March 2002 event; and PCE detected in March 2002 from the location on the corner of Alamo and 59th Place (Ambient West) was not detected during the July 2001 event.

One of the objectives for the March 2002 sampling event was to evaluate the differences in indoor air concentrations during open-house (Summer) vs. closed house (Winter) conditions. However, it should be noted that even though the March 2002 event occurred in winter, the weather conditions were rather mild and almost Summer-like (day time temperatures reached 79 degrees Fahrenheit) and therefore it is likely that.the March 2002 event was also an open-house type event.

The concentration differences found between the July 2001 and March 2002 events could possibly be attributed to seasonal/meteorological differences (temperature, barometric pressure, wind speed/direction, etc.). However, no meteorological monitoring occurred during the July 2001 and therefore, no concentration variances from meteorological effects can be substantiated.

5.2 SURFACE AND NEAR-SURFACE SOIL

A total of 75 surface (0.5 feet bgs) and 75 near-surface (2.5 feet bgs) soil samples were collected and analyzed for SVOCs (CLP OLM04) and metals (Inorganic CLP ILM04) in February and March 2001. Analytical results of this sampling event indicate concentrations of SVOCs and metals (mainly iron) in both soil zones that exceed USEPA PRGs were found along the LAJR property and the Pemaco property. These elevated concentrations could be associated with the historical use of railcars and the presence of the train tracks. However, the concentrations may also be contributed to naturally-occurring and anthropogenic background levels in the soil.

Arsenic, iron, lead and manganese are the only metals detected at concentrations exceeding PRGs in surface and near-surface soils. Iron is the only metal that is detected at concentrations somewhat consistently above the PRG of 23,000 mg/kg (27 out of the 150 samples) and could be related to the presence if the rail tracks. However, it should be noted that the mean value for iron concentrations in California soils is approximately 37,000 mg/kg (Bradford et al. 1996). The mean iron concentration for the Pemaco surface and near-surface soil samples is 19,300 mg/kg. The mean value for iron concentrations in Pemaco vadose zone soils 20,462 mg/kg. The range of iron concentrations in Pemaco soils is well within naturally occurring background levels. Please see the Baseline Risk Assessment (Appendix 6) for a more detailed discussion and data analyses of background metal concentrations compared to site values. The other metal concentrations exceeding PRGs (arsenic, lead and manganese) were detected in very limited numbers (5 out of 150 samples) and at sporadic aerial distributions. It is unlikely that these elevated metal concentrations are a result of any significant contaminant source related to the Pemaco property.

Polyaromatic hydrocarbons (PAHs) were the most prevalent SVOCs detected above Region IX PRGs for residential soil among both surface and near surface samples with concentrations ranging from 62 µg/kg to 38,000 µg/kg. Although there was no indication of historical use of PAHs at Pemaco or adjacent industrial properties, the compounds were detected throughout the Pemaco site. Previous investigations at the W.W. Henry property (EKI, 1999) and the Lubricating Oil Services property (EKI, 2001 and ALT, 1991) have also detected PAHs in surficial soils. A possible source of the PAH concentrations could be from creosote treated railroad ties located along the LAJR and the associated spurs branching off each property. However, PAHs were also detected in areas that are far from the railway. It is likely that PAHs can be found in shallow soil throughout the Maywood area due to vehicle exhaust, fires and paving activities that have occurred over the years. These concentrations appear to be only surficial phenomena.

As the SVOC and metals concentrations in surface and near surface soils indicate, the majority of surficial soil contamination appears to lie along the periphery of the Pemaco site. This would be consistent with the fact that clean fill was placed over much of the site during previous removal actions of the former warehouse foundation, UST excavation and soil removal within the central portion of the site.

Statistical summaries of surface and near surface zone soils are included as Tables 5.2A and 5.2B, respectively. These tables include the minimum and maximum value for each analyte, the location of the minimum and maximum concentrations, and the frequency of detected values by analyte. For a complete summation of analytical results, please reference Tables 5.2C and 5.2D (surface soil) and Tables 5.2F and 5.2G (near surface soil). Table 5.2E

includes a summary of field QA/QC results for surface and near surface soils. Analytical results of the surface and near surface soils are summarized below per analyte group.

5.2.1 Surface Soil

Analytical data indicated that three (iron, lead, and manganese) of the 24 target analytes for metals by CLP Method ILM04 and seven of 55 analytes for SVOCs by CLP Method OLM04 were detected in one or more samples above Region IX PRGs for residential soil.

Of the metals, iron reported the highest concentrations (up to 73,230 mg/kg) with 15 samples exceeding the iron PRG of 23,000 mg/kg. The majority of iron exceedances were located along the LAJR corridor, although there were three samples collected from the Pemaco property (one along the eastern property boundary, one along the western property boundary, and one in the northwest corner), which exceeded the PRG. There were six samples with lead concentrations exceeding the PRG and one sample with a manganese concentration exceeding the PRG. The samples exceeding the lead PRG were collected along the LAJR property and the sample exceeding the manganese PRG was collected in the northwest corner of the Pemaco property adjacent to the LAJR property.

Seven SVOCs were detected in concentrations exceeding residential soil PRGs in surface soil samples including: benzo(a) anthracene (620 to 22,000 µg/kg), benzo(a) pyrene (62 to 33,000 µg/kg), benzo(b) fluoranthene (650 to 38,000 µg/kg), benzo(k) fluoranthene (440 to 28,000 µg/kg), chrysene (only one exceedance, 24,000 µg/kg), dibenzo(a,h) anthracene (66 to 5,300 µg/kg), and indeno(1,2,3-cd) pyrene (640 to 19,000 µg/kg). The highest concentrations of SVOCs in surface soils were detected in the sample collected at grid GP-SS-14 located along the southeast property boundary.

Figures 9A and 9B illustrate metals and SVOCs that exceeded Region IX Residential Soil PRGs in surface soils.

5.2.2 Near-Surface Soil

Analytical data indicated that three (lead, iron and arsenic) of the 24 target analytes for metals by CLP Method ILM04 and 6 of 55 analytes for SVOCs by CLP Method OLM04 were detected in one or more samples above Region IX PRGs for residential soil.

Similar to surface soil results, iron was the most prevalent metal to exceed PRGs in near-surface soils with concentrations ranging from 23,000 to 71,500 mg/kg in 12 of the samples. The majority of iron exceedances were located along the LAJR corridor. However, there were three locations sampled on the Pemaco property (two along the eastern property boundary and one along the northern property boundary), which exceeded the iron PRG. Arsenic was found at concentrations exceeding the non-cancer endpoint PRG (22 mg/kg) in two near-surface samples at 40.4 mg/kg and 24.1 mg/kg. Both of these samples were collected in the southern portion of the LAJR property. Lead was found at only one location, GP-SS-70, along the railroad track at a concentration of 211 mg/kg, exceeding the updated PRG of 150 mg/kg.

With exception to chrysene, the same SVOCs that exceeded PRGs in surface soils exceeded PRGs in near surface soils. Concentrations of these analytes are as follows: benzo(a) anthracene (630 to 950 µg/kg), benzo(a) pyrene (62 to 1,100 µg/kg), benzo(b) fluoranthene (650 to 1,000 µg/kg), benzo(k) fluoranthene (390 to 760 µg/kg), dibenzo(a,h) anthracene (62 to 130 µg/kg), and indeno(1,2,3-cd) pyrene (650 to 670 µg/kg). The majority of SVOC '"hits"' were located along the eastern, western and northern property boundaries (center of property contains clean fill material from UST excavations). SVOC concentrations were also detected along the southern two-thirds of the LAJR corridor.

Figures 10A and 10B illustrate metals and SVOCs that exceeded Region IX residential soil PRGs in near surface soils.

5.3 SUBSURFACE SOIL

5.3.1 Upper Vadose Zone

Between February and April 2001, 152 discrete soil samples were collected from 46 on-site and off-site locations from three depth intervals – approximately 5 feet bgs, near the capillary fringe (25 feet bgs), and at the top of the perching clay (approximately 35 feet bgs). Soil samples were analyzed for VOCs (EPA Method SW-846 8260B and CLP OLM04), SVOCs (EPA Method SW-846 8270C and CLP OLM04), NHVOCs (EPA Method SW-846 8015B), and metals (EPA Method SW-846 6010B and Inorganic CLP SOW ILM04 [including hexavalent chromium (EPA Method 7199)]).

In November 2001, 21 additional soil samples were collected at the same depth intervals from seven soil borings. Upper vadose soil samples were analyzed for VOCs (EPA Method SW-846 8260B and CLP OLM04), SVOCs (EPA Method SW-846 8270C and CLP OLM04), NHVOCs (EPA Method SW-846 8015B), metals (EPA Method 6010B and Inorganic CLP SOW ILM04), and TOC (EPA Method 160.1).

Upper Vadose Zone sample locations are shown on Figures 2 and 2B. It should be noted that locations denoted as GP-VS and HP on all site figures are interchangeable. For example, boring HP-06 is equivalent to GP-VS-06.

5.3.1.1 Results Discussion

Analytical results of upper vadose zone soils (approximately 5 to 35 feet bgs) indicate concentrations of eleven VOCs, seven SVOCs, two metals and one NHVOC that exceed Region IX DAF 20 PRGs. The USEPA Region IX has established PRGs that are used to screen sub-surface soil as a threat to groundwater. These are termed Dilution Attenuation Factor (DAF) PRGs. The DAF20 PRGs are used when the contaminated soil is not directly adjacent to a drinking water source and dilution of the contaminant is occurring before it reaches the drinking water source. The DAF 20 PRGs were used to screen Pemaco upper vadose soil and lower vadose soil to 50 feet bgs because the soil is more than 100 feet above any potential drinking water source. Figure 11A illustrates the sampling locations and analyte concentrations exceeding the DAF 20 PRGs in the Upper Vadose Zone.

A statistical summary of upper vadose zone soils is included as Table 5.3A. This table includes the minimum and maximum value for each analyte, the location of the minimum and maximum concentrations, and the frequency of detected values by analyte. For a complete summation of analytical results, please refer to Tables 5.3B and 5.3C. Analytical results of the upper vadose zone soils are summarized below per analyte group.

Metals
All 24 metal target analytes were detected above method detection limits, although only arsenic and total chromium were detected above DAF 20 PRGs. Arsenic concentrations exceeded the DAF 20 PRG for arsenic (29 mg/kg) at only one location (MW-13, 34.5-35 feet bgs) located off-site just south of the former Lubricating Oil Services property. Chromium concentrations exceeded the DAF 20 PRG for chromium of 38 mg/kg at four locations (MW-7, MW-13, MW-10, and GP-VS-18) in concentrations ranging from 40.2 to 48.4 mg/kg. Although the elevated chromium concentrations were detected at all four locations between 32 and 35 feet bgs, distribution laterally was random (borings MW-7, MW-10, and MW-13 are located off-site south to southwest of Pemaco; GP-VS-18 is located on-site in the southwest corner of the Pemaco site). The distance of these borings from the Pemaco site and the sporadic distribution of the detected concentrations suggest that they are likely background levels and not from a Pemaco release.

NHVOCs
Trace to low concentrations of NHVOCs were detected in the southwest portion of the Pemaco site. Detected NHVOCs include: 1,4-dioxane, acetone, isopropanol, methanol, methyl ethyl ketone (MEK), and methyl isobutyl ketone (MIBK). Acetone was the only NHVOC that exceeded its PRG of 16 mg/kg. The acetone exceedances were reported from samples collected between 25 and 25.5 feet bgs from borings located in the southwest corner of Pemaco (RW-01 and MW-16).

SVOCs
Analytical data indicated that 32 of the 79 SVOC target analytes were present in one or more samples above the method detection limits. The most prevalent SVOCs within the upper vadose zone soils were PAHs, the majority of which were located within 5 to 6 feet bgs. As stated in the surface/near surface soil section, there was no indication of historical use of PAHs at the Pemaco facility or the adjacent industrial properties. A possible source of PAH contamination could be from creosote treated railroad ties located along the LAJR and the associated spurs branching off to each property. PAHs may also be prevalent throughout the Maywood area due to vehicle exhaust, fires, and paving activities that have occurred over the years.

SVOCs that exceeded Region IX DAF 20 PRGs were limited to boring GP-VS-09, located along the LAJR property between Slauson Avenue and 59th Place. The following SVOCs exceeded DAF 20 PRGs at this location: benzo(a) anthracene, benzo(a) pyrene, benzo(a) fluoranthene, carbazole, dibenzo(a,h) anthracene, indeno (1,2,3-cd) pyrene, and isophorone ranging from 5,200 to 40,000 µg/kg. With exception to isophorone, which was detected at 34.5-35 feet bgs, all exceedances were detected between 5-5.5 feet bgs. This small area of elevated SVOC concentrations may be associated with the surficial phenomena of PAH contamination (see above). It appears that SVOC contamination in the sub-surface is very limited and is not significant for depths below 5 feet bgs.

VOCs
Thirty-five out of 69 VOC target analytes were detected in one or more samples above method detection limits. VOC concentrations were detected above Region IX DAF 20 PRGs for 11 compounds. These include the following: 1,1-DCE, acetone, benzene, cis-1, 2-DCE, ethylbenzene, methylene chloride, PCE, toluene, TCE, vinyl chloride, and xylenes. Figure 11A illustrates detected analytes above Region IX DAF 20 PRGs. The most prevalent and widespread concentrations consisted of chlorinated VOCs. There are several non-

chlorinated VOC concentrations within the upper vadose zone soils, but the most significant of these non-chlorinated concentrations appear to be from releases at the W.W. Henry property.

In general, the majority of VOC concentrations that exceeded DAF 20 PRGs were detected in samples collected at approximately 25 to 35 feet bgs (Figure 11A). These concentrations migrated from the release points (USTs, ASTs and drum storage areas) downward through the Upper Vadose Zone and then migrated laterally within the perched zone during periods of seasonal saturation and laterally along the top of the perching clay where they "pooled" at low spots in the perching clay (Figure 6A) before migrating deeper. There appear to be four separate areas where VOCs were released to upper vadose zone soils in significant quantities (Figure 11B). These include:

- Southwest corner of the Pemaco property;
- North-central portion of the Pemaco property;
- East-central portion of the W.W. Henry property; and
- Southwest corner of the W.W. Henry property.

The releases of VOCs in the southern portion of Pemaco were likely a result of leaking USTs and/or spills associated with the former loading areas, drum storage areas or former USTs. The release in the northern portion of Pemaco was likely from the former above ground storage tanks and/or former drum storage areas. The W.W. Henry releases were likely associated with the former USTs (east portion) and former "mixing patio" (west portion). More specific VOC distribution is discussed below.

PCE
Concentrations of PCE detected in upper vadose zone soils, which exceeded the DAF 20 PRG of 60 µg/kg, were only detected at one location (GP-VS-06 at 30 feet bgs). This concentration of 2,000 µg/kg was the only significant PCE concentration detected in soils. The only other PCE concentrations in soil above trace levels (>10 µg/kg) were detected in samples from 5 feet bgs at locations in the extreme northeast portion of Pemaco (GP-VS-03 and B-17); at 25 o 35 feet bgs in the middle portion of the LAJR property between Pemaco and W.W. Henry (GP-VS-08); in the northeastern portion of the W.W. Henry property (B-31); and in the southeastern portion of the Precision Arrow property (B-32). These concentrations ranged from 12 µg/kg to 34 µg/kg. It is likely that the detections of PCE on the LAJR, W.W. Henry and Precision Arrow properties are associated with the PCE release that occurred in the northeast portion of the W.W. Henry property where the rail spur enters the property (Meridith/Boli & Associates, Inc., 1997). It is possible, however, that the PCE concentrations on the Precision Arrow and LAJR properties are related to the release from the former ASTs and drum storage area in the north portion of Pemaco. The PCE concentrations underlying the Precision Arrow and LAJR properties may be a co-mingled plume from both the W.W. Henry and Pemaco sources. More characterization would be needed to determine the specific PCE sources affecting the LAJR and Precision Arrow properties.

TCE
Concentrations of TCE detected in upper vadose zone soils, which exceeded the DAF 20 PRG of 60 µg/kg, were detected at 10 locations surrounding the extreme southern portion of the Pemaco property (GP-VS-16, GP-VS-18, GP-VS-21, GP-VS-25, MW-15, MW-16, MW-17, MW-18, MW-19 and RW-01) and at one location on the LAJR property adjacent to the central portion of Pemaco (GP-VS-09). These concentrations ranged from 91 µg/kg to 4,000

µg/kg. Several other sampling locations had trace to low concentrations of TCE (2 µg/kg to 34 µg/kg). The majority of these lower concentrations were detected at locations extending outward from the southern end of the Pemaco property down District Blvd., Walker Avenue and 59th Place (GP-VS-22, GP-VS-23, GP-VS-26, GP-VS-27, GP-VS-29, B-26 and B-36) and appear to be associated with the release in the southernmost portion of Pemaco. The only other detectable TCE concentrations in upper vadose zone soils were detected in samples at locations in the northeast portion of Pemaco (GP-VS-06); in the middle portion of the LAJR property between Pemaco and W.W. Henry (GP-VS-08); and in the western portion of the W.W. Henry property (WW-02). These TCE detections appear to be more isolated and are likely associated with releases of PCE in these areas (see PCE discussion above).

The TCE concentrations detected in the vicinity of the southern portion of the Pemaco property appear to be associated with a large release that occurred in that area, most likely from the former drum storage area (Figure 2A) or from a former UST leak (however no record of TCE being stored in a UST at Pemaco has been found). All of the elevated soil detections exceeding 1,000 µg/kg were detected in the capillary fringe samples (~25' bg) or in the samples collected from the top of the perching clay (30 to 35 feet bg). No significant detections were encountered in any of the shallow samples (<15' bg) indicating that the specific release point has not been encountered during sampling activities (it may have been removed/disturbed during UST removal activities). Due to the density and viscosity of many of the chlorinated solvents such as PCE and TCE, the vertical migration of the liquid product through sandy soils, such is found in the Upper Vadose Zone, tends to be in dendritic patterns that don't spread out laterally until the liquid product encounters a fine grained unit (clay/silt) or encounters a saturated zone where lateral migration in soil occurs via de-sorption of groundwater concentrations (although TCE still migrates vertically through saturated zones because it is heavier than water). This migration pattern in the vadose zone makes pin-pointing the exact release area very difficult after the source has been removed.

The TCE release likely occurred in the extreme southwestern portion of Pemaco near borings GP-VS-18, MW-17, MW-18 and MW-19 (these contained the samples with the highest TCE concentrations). The release likely entered the subsurface in this area, migrated downward through the Upper Vadose Zone, and spread laterally via groundwater transport in the perched zone and along the top of the perching clay before migrating deeper into the Lower Vadose Zone and Exposition Groundwater Zones.

1,1-DCE

There appears to be two separate areas where 1,1-DCE is present in upper vadose zone soils: the north portion of the Pemaco property and the southwest corner of the W.W. Henry property. 1,1-DCE was detected above the DAF 20 PRG (60 µg/kg) at a concentration of 400 µg/kg at 29' bgs in the northern portion of Pemaco (GP-VS-06 at 29 feet bgs) and was also detected at two different depths (25' and 30' bgs) on the W.W. Henry property at boring WWH-2 (southwest corner of property), both concentrations at 200 µg/kg. These concentrations may be from releases of 1,1-DCE or from releases of 1,1,1-TCA, which readily breaks down to 1,1-DCE in environmental media. These soil concentrations appear to be related to de-sorption from groundwater contamination as indicated by their depth. These don't appear to be indicative of the specific release points because more shallow vadose zone "hits" would be expected. These two areas where 1,1-DCE was detected are definitely from two separate releases as indicated by the relatively long distance between the sampling locations and the absence of 1,1-DCE in data points between the two areas.

Acetone
Acetone was only detected at one location at 25' bgs (MW-16 located in the extreme southwest portion of Pemaco) above the DAF 20 PRG for acetone (16,000 µg/kg) at a concentration of 19,000 µg/kg. However, the NHVOC analysis, which also includes acetone, detected levels above the DAF 20 PRG at both the MW-16 and RW-01 locations at 25 feet bgs. These locations were very near each other. There was likely an acetone release in the southern portion of the site from a former UST.

Benzene
Benzene concentrations exceeding the DAF 20 PRG of 30 µg/kg were detected at several locations along 59th Place (B-27, B-28, B-29, GP-VS-31 and MW-06); one location on the W.W. Henry property (B-30); and at one location on the LAJR property (GP-VS-09). These concentrations ranged from 46 µg/kg to 4,100 µg/kg. No benzene concentrations exceeding the DAF 20 PRG were detected on the Pemaco property.

The concentrations detected along 59th Place and on the W.W. Henry property are likely associated with the free product release (toluene and hexane) from the former USTs removed from the east-central portion of the W.W. Henry property. Each of these concentrations were detected at depths within the capillary fringe and are probably from the desorption of groundwater concentrations ("smear-zone effect") associated with the toluene/hexane free product plume in the perched zone located in this area. Sampling of free product from this plume has confirmed that benzene is a significant constituent of this product plume. See Section 5.6 below and Section 5.6.1 of Appendix 4 for more discussion of the W.W. Henry free product plume.

Benzene concentrations were detected at 5' bg and 35' bg at one boring located on the LAJR property (GP-VS-09), however benzene was not detected in the capillary fringe sample (22' bg). The shallow concentration is likely from an isolated release (spill) along the LAJR and the deeper concentration could also be from an isolated spill or could be associated with a release from the W.W. Henry property former USTs. No significant benzene concentrations were detected directly upgradient from this location (Pemaco property).

Toluene
Concentrations exceeding the DAF 20 PRG for toluene (12,000 µg/kg) were detected at only two locations: boring GP-VS-10 (98,000 µg/kg) and GP-VS-16 (31,000 µg/kg), located in the south-central and southern portion of the Pemaco site, respectively. Both of these elevated concentrations were located between 15 and 16 feet bgs. These were the only toluene concentrations detected above the DAF 20 PRGs. Other elevated concentrations below the DAF 20 PRG were detected in the vicinity of these two areas at concentrations ranging from 230 µg/kg to 3,400 µg/kg (GP-VS-13, GP-VS-15, GP-VS-19, MW-15 and MW-16).

The depths and spatial distributions of these concentrations indicate that they likely originated from separate leaks from former underground storage tanks.

Other VOCs
Other analytes detected at concentrations exceeding DAF 20 PRGs in upper vadose zone soils include: cis-1, 2-DCE, ethylbenzene, methylene chloride, vinyl chloride and xylenes.

Concentrations of cis-1,2-DCE and vinyl chloride were detected above the DAF 20 PRGs (400 µg/kg and 10 µg/kg, respectively) at the same locations where elevated concentrations

of other chlorinated compounds (PCE and TCE) were detected. These concentrations ranged from 450 µg/kg to 3,300 µg/kg for 1,2-DCE and from 12 µg/kg to 280 µg/kg for vinyl chloride. These concentrations are the associated daughter products from the de-chlorination of PCE and TCE. Reductive de-chlorination occurs in environmental media (soil and groundwater) to varying degrees depending on the microbial environment. This is known as natural attenuation. The detected concentrations of cis-1,2-DCE and vinyl chloride in soils are from degradation of other chlorinated compounds and not from a direct release.

Ethylbenzene and xylenes were detected at concentrations above the DAF 20 PRGs (13,000 µg/kg and 210,000 µg/kg, respectively) at only one location in the south-central portion of the site (GP-VS-10). The sample collected from this location at 15' bg had a ethylbenzene concentration of 61,000 µg/kg and a xylenes concentration of 430,000 µg/kg. This is the same sample, which had an elevated toluene concentration (see toluene discussion above). This sample did not have a detectable benzene concentration, but this was probably due to the elevated benzene detection limit of 910 µg/kg. If the assumption is correct that this sample had elevated BTEX components, then it is likely that there was a gasoline spill that occurred in this area. This area is within a former UST area, but according to documentation, the only gasoline UST was located in the west-central portion of the site near B-3 and B-5 (Figures 2 and 2A). It is possible that one of the former USTs near GP-VS-10 was used for gasoline, but no documentation exists, or the release was from an isolated spill, such as from a drum or automobile.

Methylene chloride was detected above the DAF 20 PRG of 20 µg/kg at two locations. The 25' bg sample from MW-06 had a methylene chloride concentration of 530 µg/kg and the 24' bg sample from GP-VS-32 had a methylene chloride concentration of 190 µg/kg. These two concentrations were the only concentrations detected above trace levels (<10 µg/kg). It also should be noted that all methylene chloride concentrations detected have been 'J' flagged as estimated values detected below the proper calibration ranges. Methylene chloride is a common laboratory contaminant and since there is no record of methylene chloride use and/or storage at any of the properties; and due to the limited number of detections, these concentrations were not likely form any sort of significant release of methylene chloride at the site. This is further supported by the perched zone groundwater sampling results. No methylene chloride concentrations were consistently detected in any of the perched groundwater wells (see below).

Total Organic Carbon (TOC)

In addition to the above chemical and metal analyses, seventeen soil samples were collected within the upper vadose zone and analyzed for total organic carbon (TOC) by EPA Method 160.1. TOC ranged from 0.05 percent (5-5.5 feet bgs) to 4.98 percent (25-25.5 feet bgs). Tables 4.4.2A through 4.4.2D summarize the TOC results.

5.3.2 Lower Vadose Zone

Lower vadose zone soil samples were collected in late March and early April 2001 from soil borings advanced at 9 on-site and off-site locations. Soil samples were collected at 10-foot intervals beginning at 5 feet bgs and continuing to 65 feet bgs. Lower vadose zone soil samples were analyzed for VOCs (EPA Method SW-846 8260B and CLP OLM04), SVOCs (EPA Method SW-846 8270C and CLP OLM04), NHVOCs (EPA Method SW-846 8015B), and metals (EPA Method SW-846 6010B and Inorganic CLP SOW ILM04).

In November 2001, soil samples were collected at 10-foot intervals from 5 feet bgs to approximately 65 feet bgs. Lower vadose soil samples were collected and analyzed for VOCs (Method SW-846 8260B and CLP OLM04), SVOCs (EPA Method SW-846 8270C and CLP OLM04), NHVOCs (EPA Method SW-846 8015B), metals (EPA Method 6010B and Inorganic CLP SOW ILM04) and TOC (EPA Method 160.1).

Upper Vadose Zone sample locations are shown on Figure 2 and 2B. It should be noted that locations denoted as GP-VS and HP (as illustrated on site figures) are interchangeable. For example, boring HP-06 is equivalent to GP-VS-06.

5.3.2.1 Results Discussion

Analytical results of lower vadose zone soils (approximately 35 to 65 feet bgs) indicate concentrations of one metal and six VOCs that exceed Region IX DAF 20 PRGs. Due to the first saturated zone present between approximately 60 to 65 feet bgs and the potential future use of the Exposition Zones as a viable water source, lower vadose soils present at 50 feet bgs or greater were also compared to DAF 1 PRGs. The DAF1 PRGs assume that the contaminated soil source is directly adjacent to a drinking water source, such as a regional aquifer, and no dilution is occurring along the migration pathway between the source soil and the drinking water source. The concentrations of six metals and five VOCs exceeded DAF 1 PRGs.

Metals
All 24 metal target analytes were detected above method detection limits, although only total chromium was detected above DAF 20 PRGs. Total chromium concentrations exceeded the DAF 20 PRG of 38 mg/kg at one location (MW-19, 65-65.5 feet bgs) at 39.3 mg/kg. Comparing lower vadose zone soil concentrations at depths below 50 feet bgs with DAF 1 PRGs, the following metals were found to exceed the DAF 1 levels: antimony (0.9 to 1.7 mg/kg), arsenic (0.95 to 24.8 mg/kg), barium (30.6 to 337 mg/kg), cadmium (0.35 to 0.52 mg/kg), total chromium (8.7 to 39.3 mg/kg), and nickel (6.7 to 35.3 mg/kg). The DAF 1 PRGS for these metals are 0.3 mg/kg, 1 mg/kg, 82 mg/kg, 0.4 mg/kg, 2 mg/kg and 7 mg/kg respectively. Total chromium exceeded the DAF 1 PRG for chromium (2 mg/kg) at every boring where samples were collected below 50 feet. With exception to antimony, all other metals were detected at concentrations exceeding their applicable DAF 1 PRGs (1 mg/kg, 82 mg/kg, 0.4 mg/kg, 7 mg/kg, respectively) at all borings sampled below 50 feet except for two locations. Antimony was only detected above its DAF 1 PRG of 0.3 mg/kg at 10 of the 39 locations sampled below 50 feet bgs. The relatively even spatial distribution of metal concentrations within lower vadose zone soils suggests that these metals are likely background and not from a Pemaco release.

A statistical summary of lower vadose zone soils is included as Table 5.3D. This table includes the minimum and maximum value for each analyte, the location of the minimum and maximum concentrations, and the frequency of detected values by analyte. For a complete summation of analytical results, please reference Table 5.3C (summary of field QA/QC results) and Table 5.3E.

NHVOCs
Trace to low concentrations of NHVOCs were detected in the southern portion of the Pemaco site. Detected analytes were limited to acenonitrile and acrylonitrile. Acrylonitrile (MW-17, 45-45.5) was only detected once. Acenonitrile was detected at five sample locations (three

boring locations, five separate depths). No NHVOC concentrations exceeded DAF 20 PRGs or DAF 1 PRGs (for soils greater than 50 feet bgs).

SVOCs

Analytical data indicated that 3 (atrazine, bis(2-Ethylhexyl)phthalate, and pyrene) of the 65 SVOC target analytes were present in one or more samples above the method detection limits. Pyrene (MW-12, 54.4-55) was only detected once. The distribution of atrazine and bis(2-Ethylhexyl)phthalate detected concentrations (8 total) was random. No SVOC concentrations exceeded DAF 20 or DAF 1 PRGs (for soils greater than 50 feet bgs).

VOCs

Twenty out of 48 VOC target analytes were detected in one or more samples above method detection limits. Six of the 28 detected VOCs exceeded Region IX DAF 20 PRGs including: benzene, cis-1, 2-DCE, 1,2-DCA, methylene chloride, TCE, and vinyl chloride. Figure 12A illustrates analytes detected above Region IX DAF 20 PRGs for lower vadose zone soils.

There appear to be two separate areas where VOCs were released to lower vadose zone soils (Figure 12B). These “hot spot” areas are in the southwest corner of the Pemaco property where a large release of chlorinated VOCs (mainly TCE) has occurred and in the southern boundary of the W.W. Henry property that is impacted by the large release of non-chlorinated VOCs that occurred on that property. The release of VOCs at Pemaco was likely a result of leaking drums associated with the former loading area, former drum storage area and/or a leak from the former UST area located in the southwest corner of the site (Figure 2A). The RI data indicates that these releases migrated vertically through the Upper Vadose Zone and spread out laterally in the Perched Zone and along the top of the Perching Clay before migrating deeper into the Lower Vadose Zone. The other area where elevated concentrations of VOCs were found vertically throughout the Lower Vadose Zone was at the MW-06 location adjacent to the W.W. Henry property in 59th Place. Benzene was the main VOC detected at this location. This boring was located within the perched free product plume associated with the east-central portion of the W.W. Henry property. A conductor casing (0 to 35’ bg) was used to install this boring.

More specific VOC distribution is discussed below:

TCE and cis-1,2-DCE were the most prevalent VOCs detected in lower vadose zone soils that exceeded their applicable DAF 20 PRGs (60 µg/kg and 400 µg/kg, respectively). These compounds were detected primarily on-site in the southwest corner of the Pemaco facility. Migration of contaminants down to the Exposition ‘A’ groundwater zone in this area has been confirmed by the consistent vertical presence (35’ to 65’ bg) of chlorinated compounds throughout the Lower Vadose Zone down to the Exposition ‘A’ Zone. Concentrations exceeding the DAF 20 PRGs ranged from 150 to 2,100 µg/kg for TCE and from 450 to 730 µg/kg for cis-1,2-DCE in borings located in the southwest corner of Pemaco, along 59th Place, and along the LA JR property (Figure 12A). However, the maximum concentrations of each analyte were detected on-site from borings located in the southwest corner of Pemaco. Likewise, methylene chloride and 1,2-DCA concentrations were only detected above DAF 20 PRGs within the southwest corner of Pemaco at concentrations of 450 µg/kg (MW-18, 55-55.5 feet bgs) and 400 µg/kg (MW-17, 55-55.5 feet bgs), respectively.

Benzene was the only analyte with concentrations above PRGs not found on-site. All benzene concentrations exceeding the PRG of benzene (30 µg/kg) were detected in samples

collected from boring MW-06 between the depths of 45 to 65 feet bgs. Benzene concentrations ranged from 190 to 520 µg/kg at this location. This area of benzene is likely to have originated from a release associated with the former USTs in the east-central portion of the former W.W. Henry property.

Vinyl chloride exceeded DAF 20 PRGs (10 µg/kg) in only one location. This was found along the west-central boundary of the Pemaco site (GP-VS-32, 39.5-40 feet bgs) at a concentration of 22 µg/kg. No concentrations of vinyl chloride were detected deeper than 40 feet bgs. Vinyl chloride is one of the end daughter products in the degradation process of PCE and TCE. The vinyl chloride within the lower vadose zone is probably due to the degradation of PCE and TCE and not from a release of vinyl chloride.

Upon comparison of lower vadose zone VOC concentrations greater than 50 feet bgs with the more conservative DAF 1 PRGs, all VOCs discussed above reported concentrations exceeding DAF 1 PRGs with exception to vinyl chloride. Concentration ranges exceeding DAF 1 PRGs for each VOC is as follows: 1,2-DCA (400 µg/kg), benzene (2 to 520 µg/kg), cis-1, 2-DCE (140 to 730 µg/kg), methylene chloride (2 to 450 µg/kg), and TCE (11 to 1,400 µg/kg). This comparison indicates that additional off-site impacts exist at borings MW-5 (11 µg/kg of TCE at 55' bg), MW-8 (2 µg/kg of methylene chloride at 65' bg), MW-11 (6 µg/kg of methylene chloride and 2 µg/kg of benzene at 65' bg) and MW-13 (2 µg/kg of benzene at 65' bg). However, each of these trace concentrations were estimated values below calibration ranges and could be from laboratory or sampling cross-contamination.

Total Organic Carbon
In addition to the metal and chemical analyses described above, a total of 23 soil samples were collected within the lower vadose zone soils and analyzed for TOC (EPA Method 160.1). TOC percentages ranged from 0.19 (45-45.5 feet bgs) to 8.60 (45-45.5 feet bgs).

5.4 PERCHED GROUNDWATER

February 2001
Appendix 1 contains the *Technical Memorandum – Results of In-situ Groundwater Sampling in the Perched Zone and Upper Exposition Aquifer, February and November 2001, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002a). The memorandum contains all tables and figures associated with this sampling event. A brief summary of analytical results of groundwater sampled within the perched groundwater zone is presented below.

VOCs were detected in all twenty-nine in-situ groundwater samples and in all five samples collected from pre-existing monitoring wells during the February 2001 sampling event. Trace (<1 µg/L) to high (>1,000 µg/L) concentrations of both petroleum hydrocarbons and chlorinated compounds were detected in the groundwater samples. The predominant petroleum hydrocarbons detected were benzene and toluene and the predominant chlorinated compounds detected were trichloroethene (TCE) and cis-1, 2-dichloroethene. Acetone was also commonly found in many of the samples at elevated concentrations.

July 2001
Appendix 2 contains the *Technical Memorandum – Results of the July 2001 Soil Gas, Indoor/Outdoor Air and Groundwater Sampling Completed in the Residential Neighborhood*

Adjacent to the Pemaco Superfund Site and Former WW Henry Properties, 5920 Alamo Avenue and 5050 E. Slauson Avenue, Maywood, California (TN&A, 2002c). The memorandum contains all tables and figures associated with this sampling event. A brief summary of analytical results of groundwater sampled during this event is presented below.

Seven groundwater samples were collected (LFSG-18 through LFSG-21, LFSG-23, HP-33 and HP-34) during the July 2001 sampling event. VOCs were detected at five of these seven samples (LFSG-18 through LFSG-21 and LFSG-23). The highest VOC concentration was cyclohexane at 720 micrograms per liter (µg/L) detected in sample LFSG-21. All other analytes were detected at concentrations ranging from 0.1 µg/L to 21 µg/L. These detected VOCs included: 1,1-dichloroethane (1,1-DCA), cis-1,2-dichloroethene (cis-1,2-DCE), benzene, trichloroethene (TCE), Methylcyclohexane, 4-methyl-2-pentanone, toluene, ethylbenzene, xylenes and isopropylbenzene.

In addition to the field samples collected, two trip blanks, a rinsate blank and a field sample duplicate were provided to the laboratory for quality assurance/quality control (QA/QC) purposes. It should be noted that acetone and methylene chloride concentrations were present in method blanks, storage blanks, trip blanks and equipment blanks. Therefore, the results for these two analytes were qualified as non-detect with elevated detection limits for the field sample results.

Eleven different VOCs were detected in five of the perched groundwater samples collected during the July 2001 event. Out of these eleven VOCs, only three (ethylbenzene, toluene and xylenes) were detected in both soil gas and indoor/outdoor air samples collected from the same property.

Quarterly Groundwater Monitoring, May 2001 through April 2002

A quarterly groundwater monitoring program was developed using an iterative approach as each new suite of shallow wells were installed and initially sampled (Section 3.5). Each monitoring event included gauging, purging and sampling each of the wells to be included in the quarterly monitoring program. A quarterly monitoring program was conducted on a continual basis so that all data quality objectives (DQOs) pertaining to groundwater sampling could be met. The samples were analyzed for the proper constituents of potential concern (COPCs), which were decided after the initial sampling was completed. The analytical program for quarterly events changed over time as new data was collected and evaluated.

Appendix 4 contains the *Technical Memorandum – Results of Groundwater Monitoring Activities May 2001 through April 2002, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002b). The technical memorandum includes all tables and figures associated with the quarterly sampling events. Analytical results of the four quarterly events (May 2001, September 2001, January 2002 and April 2002) are briefly summarized below per analyte group.

Metals

Metal concentrations were found in each of the perched zone wells sampled. Twenty-five of the 27 perched wells sampled had detectable metal concentrations exceeding regulatory screening levels (USEPA Region IX PRGs or California MCLs). Figure 13A illustrates the metal concentrations exceeding PRGs or MCLs for the perched groundwater zone. Metal concentrations exceeding screening levels were of aluminum, arsenic, total chromium, hexavalent chromium, iron, lead, manganese, selenium and thallium. Maximum total

chromium, lead, manganese, selenium and thallium concentrations were all less than 10 times (within the same order of magnitude) of the screening levels. Maximum aluminum, hexavalent chromium and iron concentrations were within one order of magnitude of the screening levels. The only maximum detected metal concentration that was more than one order of magnitude higher than the screening levels was of arsenic. The maximum arsenic concentration detected (101 µg/L) in a filtered sample is only one order of magnitude above the arsenic MCL (50 µg/L), but is four orders of magnitude above the cancer end-point PRG for arsenic (0.045 µg/L). The majority of concentrations exceeding these screening levels were collected from the perched wells located on the Pemaco site, except for hexavalent chromium which appears in more offsite wells than in onsite wells.

It should be noted that the detected metal concentrations are greatly reduced when the samples are filtered. Many of the PRG and MCL values that are exceeded by the non-filtered sample results are not exceeded by the filtered sample results. Water clarity in the perched zone is generally poor with high concentrations of settleable and suspended solids. Metal concentrations in groundwater are often elevated by the presence of these solid particles.

NHVOCs

The only NHVOCs that have been detected in the perched zone above regulatory screening levels (PRGs) are the compounds 1,4-dioxane, acrylonitrile, acetonitrile and methyl isobutyl ketone (MIBK). Figure 13A (May 2001) and Figure 13B (April 2002) illustrate all NHVOCs detected within the perched groundwater zone above USEPA PRGs or California MCLs.

Samples from wells B-01, B-03, B-04, B-05, B-33, SV-1, SV-02 and SV-05 have had detectable 1,4-dioxane concentrations above the PRG of 0.0061 mg/L. The 1,4-dioxane concentrations are consistently detected in samples from the wells located in the central portion of the Pemaco site. No offsite wells have had any detectable 1,4-dioxane concentrations, except for one detection of the compound in well B-33 during the April 2002 event. It should be noted that all the concentrations except for the B-01 samples have been estimated values below the 0.25 mg/L detection limit. During the July 2002 sampling event, samples from selected wells were analyzed for 1,4-dioxane using EPA Method 8270C which allowed for a lower detection limit (<0.01 mg/L). The results are pending as of the date of this document and will be presented in a future technical memorandum.

Acrylonitrile concentrations have been detected above the PRG of 0.000039 mg/L in wells B-01, SV-02 and SV-05. Each of these concentrations has been detected at estimated values below the detection limit (0.25 mg/L). Initially positive detections were reported for groundwater samples collected in wells B-21 and B-27 during September-October 2001 and April 2002 sampling events. However, these results were qualified as non-detected during the data validation process due to QA/QC issues. The detailed laboratory QA/QC evaluation has confirmed that the acrylonitrile detections were from matrix interferences due to the elevated concentrations of other compounds, such as TCE. From the four sampling events, acrylonitrile has not been detected in any of the offsite wells. All the other detections have been one-time occurrences, except for two detections in SV-02.

Acetonitrile concentrations have only been detected during the September-October 2001 sampling event (wells B-03, B-05, B-13 and SV-01). Each of these concentrations were estimated values below the 0.25 mg/L detection limit. Concentrations above the PRG of 0.10 mg/L were found in well B-13 during this sampling event. This compound has not been detected during any other sampling event.

SVOCs

The SVOCs bis(2-Ethylhexyl)phthalate and naphthalene were the only detected SVOCs exceeding regulatory levels (PRGs) in the perched zone (Figures 4B and 4C). Figure 13A illustrates the SVOCs within the perched groundwater exceeding PRGs for the perched zone. Concentrations of bis(2-Ethylhexyl)phthalate were detected in wells B-01, B-04, B-10, B-26 and SV-04; and naphthalene concentrations were detected in wells B-04, B-05, B-20, SV-01 and SV-04. The detected bis(2-Ethylhexyl)phthalate concentrations appear to have a somewhat random distribution that are not consistent with a release. The detected naphthalene concentrations were all from samples collected from onsite wells in the south-central portion of the Pemaco site, except for a trace detection (1 µg/L) in well B-20, which is located just down-gradient from the south-central portion of the site. The distribution of these concentrations is consistent with a release from one of the former USTs or associated piping.

VOCs

Several chlorinated and non-chlorinated VOCs were detected in the perched zone above USEPA PRGs and State of California MCLs for drinking water. The most prevalent and widespread concentrations are of chlorinated VOCs. There are several non-chlorinated VOCs in the perched groundwater zone, but the most significant of these non-chlorinated concentrations appear to be from releases at the W.W. Henry property. Figure 13A (May 2001) and Figure 13B (April 2002) illustrate all VOCs detected within the perched groundwater zone above the selected Pemaco ARARs (USEPA PRGs or California MCLs). The chlorinated compounds PCE, TCE and vinyl chloride cover the most extensive areas and are the most significant in terms of environmental impact from historical uses of the Pemaco property. The following paragraphs discuss the distributions of these three chemicals in the perched zone.

There appears to be three separate areas where PCE was released (Figure 14A) including the north-central portion of the Pemaco property, the northeast portion of the W.W. Henry property and in District Blvd (approximately half a block south of the Pemaco property). The highest concentrations (>500 µg/L) are found in the north-central portion of the Pemaco property in the vicinity of wells B-01 and SV-2. This area coincides with the former above ground storage tanks and drum storage areas. The northern extent of this plume is approximately where the northern Pemaco property boundary lies. The western extent of this plume appears to co-mingle with another separate PCE plume that probably originated from the W.W. Henry property. This is indicated by the increase in concentrations (>200 µg/L) going from northeast to southwest across the Pemaco and Railway properties onto the W.W. Henry property. This W.W. Henry hot spot also coincides with a documented release of PCE in soil adjacent to the former rail spur that ran along the northern boundary of the W.W. Henry property. In 1997, a surface soil sample was collected on the W.W. Henry property approximately 40’ southwest of the present location of B-31. This sample contained 3,700 µg/kg of PCE (Meridith/Boli & Associates, Inc., 1997). The third identified perched zone PCE plume is located in a small area around well B-25. The PCE concentrations in well B-25 are typically 20 µg/L and there are only trace concentrations (<1.0 µg/L) in the surrounding wells (B-24, B-25, B-34). This small plume is likely to have originated from a release on the former Lubricating Oil Services property.

TCE is the most prevalent VOC in the perched zone. The perched TCE plume extends throughout most of the Pemaco site and adjacent areas (Figure 14B). The highest

concentrations (>100 µg/L) are found in the extreme southern portion of the Pemaco site and to the south and southwest of the Pemaco site. The "hot spot" of the perched TCE plume appears to be limited to an area between the 59th Place and Walker Avenue intersection, and the portion of District Blvd. north of B-25. This plume may have originated from the former loading dock located in the extreme southwest of the Pemaco property or from spills that could have occurred along the railway. A second area of elevated concentrations (>50 µg/L) coincides with the north-central portion of the Pemaco site in the SV-2 and B-01 areas. This TCE plume may be associated with the dechlorination of the PCE plume in that area.

The perched TCE plume does not extend beyond the northern boundary of the Pemaco property. To the south, it is limited to approximately halfway down District Blvd. and Walker Avenue between 59th Place and 60th Street. The southwest extent of the plume extends into the adjacent residential neighborhood approximately 100' southwest of the 59th Place and Walker Avenue intersection. In-situ groundwater samples were collected from selected residential lots in July 2001 (TN&A, *Technical Memorandum – Results of the July 2001 Soil Gas, Indoor/Outdoor Air and Groundwater Completed in the Residential Neighborhood Adjacent to the Pemaco Superfund Site and Former W.W. Henry Property, 5920 Alamo Avenue and 5050 E. Slauson Avenue, Maywood, California*, March 21, 2002). These results were used to delineate the TCE plume in the residential area. The TCE plume is truncated to the west by the floating free product plume originating from the W.W. Henry property.

Vinyl chloride is one of the end daughter products in the degradation process of PCE and TCE. The vinyl chloride plume in the perched zone (Figure 14C) is probably due to the degradation of PCE and TCE (and subsequently DCE) and not from a release of vinyl chloride. The "hot spot" (>100 µg/L) of the vinyl chloride plume appears to be in a small area near B-21. This well has elevated levels of toluene, which may be aiding in the degradation process of TCE and PCE causing the elevated vinyl chloride concentrations. The vinyl chloride plume does not extend offsite southward like the TCE plume does. It terminates west of the Pemaco site at the free product plume originating from the W.W. Henry property.

5.5 EXPOSITION GROUNDWATER ZONES

February 2001
Appendix 1 contains the *Technical Memorandum – Results of In-situ Groundwater Sampling in the Perched Zone and Upper Exposition Groundwater Zones, February and November 2001, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002a). The memorandum contains all tables and figures associated with this sampling event. A brief summary of analytical results of groundwater sampled within the Exposition groundwater zones is presented below.

Thirteen in-situ groundwater samples from the Upper Exposition Zones were collected and analyzed for VOCs by EPA Method 8260 in February 2001. VOCs were detected in 11 of the 13 samples. The only analytes detected in these samples were TCE, acetone and chloroform at concentrations ranging from 0.5 µg/L to 990 µg/L. The highest concentrations were found in the samples collected nearest to the southern end of the Pemaco property.

November 2001

Aquifer Test Screening Samples
Seven of the 11 additional wells installed in November 2001 as part of an aquifer pump test were sampled by lowering a disposable bailer into the wells immediately after well development was completed. This was done as a screening exercise to anticipate concentrations of the large volume of purge water produced during the aquifer pump test completed in December 2001. The samples from wells MW-14-80, MW-14-90, MW-17-70, MW-17-85, MW-17-95, MW-19-70, MW-19-90 were analyzed for VOCs by EPA Method 8260B by Calscience Analytical Laboratories. Results for this screening data are available in Appendix 4, *Technical Memorandum – Results of Groundwater Monitoring Activities May 2001 through April 2002, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002b).

CPT Investigation
During the first sampling event (May-June 2001), several of the newly installed Exposition wells (especially the 'B' Zone wells) had elevated acetone and isopropyl alcohol concentrations. Due to these high concentrations appearing in the down-gradient wells, it was assumed that a large acetone and isopropyl alcohol plume existed that was not fully delineated. Due to the documented historical uses and storage of these two chemicals on the Pemaco and other adjacent industrial sites (W.W. Henry property, Catellus property, Dunn-Edwards property), it was plausible that a large plume could exist. A second round of in-situ CPT groundwater sampling was performed in November 2001 to delineate this apparent plume. A summary of the field activities and sampling results are provided in Appendix 1, *Technical Memorandum – Results of In-situ Groundwater Sampling in the Perched Zone and Upper Exposition Groundwater Zones, February and November 2001, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002a).

The additional CPT investigation results showed only trace acetone concentrations (4 to 12 ug/L) that were likely due to the ambient sampling conditions. All the other samples were non-detect for acetone. The only other detected VOCs in the down-gradient samples collected during the November 2001 CPT sampling were TCE in sample CPT-27 at 2.1 ug/L; ethyl acetate in sample CPT-28 at 830 ug/L and 1-propanol at 40 ug/L. Up-gradient sample CPT-35 was non-detect for all analytes. The cross-gradient sample (CPT-34), located adjacent to the Dunn-Edwards Property contained detectable concentrations of benzene, 1,2-DCA, 1,1-DCE, cis-1,2-DCE, TCE and vinyl chloride ranging from 0.63 to 71 ug/L. These concentrations are likely sourced from the Dunn-Edwards property.

During the time of the CPT investigation, the results of the September-October 2001 sampling event were received and it was found that the acetone and isopropyl alcohol concentrations had decreased by an order of magnitude from the May-June 2001 sampling results in each of the newly installed wells. This anomalous decrease caused other possible reasons for the concentrations to be researched. It was found through discussions with drilling companies and well construction materials manufacturers that food-grade isopropyl alcohol is used for the time release coatings of bentonite pellets. This coating occasionally contains acetone as an impurity according to the sources consulted. These time-release pellets were used to seal the saturated annulus space between the well casings and the borehole walls for the Exposition wells.

During the November 2001 well installation activities for the aquifer test wells (MW-14-80 through MW-19-85 and RW-01-85), TN&A personnel placed several of the coated bentonite pellets in a certified clean glass jar filled with laboratory grade de-ionized water. The pellets were allowed to soak in the container for approximately four hours, then a sample was collected from the water in the glass jar. The sample was analyzed for VOCs by EPA Method 8260 and the results indicated that acetone was detected in this water at 310 ug/L (benzene and chloroform were also detected at 5.1 ug/L and 4.5 ug/L). This test validated the hypothesis that the elevated acetone levels were caused by the coated bentonite pellets.

Quarterly Groundwater Monitoring, May 2001 through April 2002
A quarterly groundwater monitoring program was developed using an iterative approach as each new suite of deep wells were installed and initially sampled (Section 3.6). Each monitoring event included gauging, purging and sampling each of the wells to be included in the quarterly monitoring program. A quarterly monitoring program was conducted on a continual basis so that all data quality objectives (DQOs) pertaining to groundwater sampling could be met. The samples were analyzed for the proper constituents of potential concerns (COPCs), which were decided after the initial sampling was completed. The analytical program for quarterly events changed over time as new data was collected and evaluated.

Appendix 4 contains the *Technical Memorandum – Results of Groundwater Monitoring Activities May 2001 through April 2002, Pemaco Superfund Site, 5050 E. Slauson Avenue, Maywood, California* (TN&A, 2002b). The technical memorandum includes all tables and figures associated with these sampling events. Analytical results of the four quarterly events (May 2001, September 2001, January 2002 and April 2002) are briefly summarized below per zone, per analyte group.

5.5.1 'A' Zone

VOCs
Groundwater concentrations of chlorinated VOCs are the most prevalent and widespread compounds in the 'A' Zone. Detections of hexane and cyclohexane are the only non-chlorinated compounds that are consistently detected in the Exposition 'A' Zone (wells MW-03-85, MW-04-85, MW-05-85, MW-17-70). However, these compounds were not detected above the PRGs for hexane and cyclohexane of 350 µg/L and 35,000 µg/L, respectively. The compounds PCE, TCE and their associated daughter products (1,1-DCE, cis-1,2-DCE, trans-1,2-DCE and vinyl chloride) are the only chlorinated compounds that are widespread and consistently detected in the 'A' Zone above regulatory levels. Chloroform has been consistently detected over the PRG of 0.16 µg/L, but it only appears in well (MW-05-85). Figure 15A (May 2001) and Figure 15B (April 2002) illustrate the VOCs exceeding PRGs and/or MCLs for the Exposition groundwater zones.

TCE is the prevalent compound in the 'A' zone indicated by its high concentrations (>20,000 µg/L) and large spatial area. PCE is consistently detected in the 'A' zone, but the concentrations are relatively low (<10 µg/L) compared to the TCE concentrations (>20,000 µg/L). The "hot spot" concentrations (>10,000 µg/L) of the Exposition 'A' Zone TCE plume is limited to the southernmost portion of the Pemaco property and extends southward to the south side of 59th Place and westward to the 59th Place and Walker Avenue intersection (Figure 16A). This "hot spot" area is consistent from a release in the southernmost portion of the Pemaco site possibly from the former loading dock, former drum storage area or one of

the southernmost former USTs. The farthest that the dissolved-phase fringes of the plume extend offsite is southward where it terminates before 60th Place. The 'A' Zone TCE plume does not appear to extend in the southwest direction consistent with its gradient. This is likely due to the irregular geometry and discontinuous nature of the 'A' Zone sand lenses.

NHVOCs
There were only two NHVOCs detected in the 'A' Zone that exceeded PRG screening levels, these were acetone and acrylonitrile (Figures 15A and 15B). Acetone was detected above the tap water PRG of 0.610 mg/L in only two wells (MW-10-75 and MW-12-70). These concentrations above PRGs were only detected during the first sampling event following the installation of these wells and are attributable to the well construction materials (see discussion below). Furthermore, these two wells are the furthest down-gradient wells from the Pemaco property. This spatial distribution of the acetone detected concentrations support the premise that these concentrations are anomalous.

Acrylonitrile was detected in MW-09-70 above the PRG of 0.000039 mg/L. This detection has been repeated in the same well during multiple sampling events. Laboratory reported detections of acrylonitirle in MW-03-85, MW-05-85, and MW-17-70, however, due to QA/QC issues these detections were qualified as false during the data validation process. Majority of acrylonitrile detections resulted from matrix interferences (see the discussion of acrylonitrile results in the perched zone section above).

SVOCs
There were no SVOCs detected above California MCLs or PRGs in the Exposition 'A' Zone.

Metals
Metal concentrations in the Exposition 'A' Zone exceeded ARARs for hexavalent chromium in MW-03-85, MW-04-85 and MW-05-85 (0.2 to 0.4 µg/L); and thallium in MW-03-85 (7.4 µg/L). Figure 15A illustrates these concentrations and locations.

The spatial distributions of these concentrations appear to coincide with chlorinated VOC plume "hot spot" and could possibly be associated with a release. However, since the detected concentrations are trace levels barely exceeding detection limits, it is more likely that these are background concentrations.

5.5.2 'B' Zone

VOCs
The groundwater concentrations of VOCs are similar to the concentrations found in the 'A' Zone with TCE concentrations being the most prevalent and widespread compound. The dissolved-phase fringes of the TCE plume extend over a much greater area in the 'B' Zone than in the 'A' Zone. Less prevalent concentrations which are consistently detected in the 'B" Zone include: hexane in wells MW-02-90, MW-03-85, MW-06-85 and MW-17-85; cyclohexane in wells MW-02-90, MW-03-85, MW-04-85. MW-05-85, MW-06-85, MW-10-90, MW-12-90, MW-14-80 and MW-17-85;and benzene in wells MW-06-85 and MW-10-90. Benzene concentrations above MCLs and PRGs are consistently present in well MW-06-85, which is located in the free product area adjacent to the W.W. Henry property. Figure 15A (May 2001) and Figure 15B (April 2002) illustrates the VOCs exceeding PRGs and/or MCLs for the Exposition groundwater zones.

The "hot spot" concentrations (>10,000 µg/L) of the Exposition 'B' Zone TCE plume mirrors the 'A' Zone "hot spot" area (Figure 16B). The farthest that the dissolved-phase fringes of the 'B' Zone TCE plume extend offsite is southwestward where it terminates near the Alamo Avenue and 60th Place intersection. The total size of this elliptical plume is estimated to be 1,290 feet long and 750 feet wide in map view. The geometry of the 'B' Zone TCE plume appears to be consistent with the southwest groundwater gradient indicated by the groundwater measurements in the 'B' Zone wells. The estimated surface area of the 'B' Zone TCE plume is approximately 17.5 acres (760,000 sq. ft.). This larger plume size is further indication that the 'B' Zone sand lenses are more uniform and continuous than the 'A' Zone sands.

The consistent detections of elevated benzene, hexane and cyclohexane concentrations in samples from well MW-06-85 indicate that the non-chlorinated contamination, which is prevalent in the perched zone underlying the eastern portion of the W.W. Henry property (free product area), has migrated down to the Exposition groundwater zones. Further evidence of this migration is indicated by the benzene concentrations found in each of the soil samples collected from 25 to 65 feet bg from the MW-06 boring.

NHVOCs
There were only two NHVOCs detected in the 'B' Zone that exceeded PRG screening levels, these were acetone and acrylonitrile (Figures 15A and 15B). The same discussion applies for these two compounds as discussed in the Exposition 'A' Zone section above.

SVOCs
There were no SVOCs detected above California MCLs or PRGs in the Exposition 'B' Zone during the May-June 2001, September-October 2001, January 2002 and April 2002 sampling events.

Metals
Metal concentrations in samples from the Exposition 'B' Zone exceeded the selected ARARs (MCLs or PRGs) for aluminum in MW-02-95; arsenic in MW-13-85; hexavalent chromium in MW-03-85, MW-04-85 and MW-05-85; manganese in MW-09-85 and MW-12-90; and thallium in MW-03-85. Figure 15A illustrates the metals exceeding ARARs for the Exposition groundwater zones.

The hexavalent chromium concentrations appear to coincide with chlorinated VOC plume "hot spot" and could possibly be associated with a release. However, all of the detected hexavalent chromium concentrations are very low (<1 ug/L) and could also constitute background levels. The spatial distribution and limited occurrences of elevated arsenic, aluminum, manganese and thallium concentrations indicate that these are likely high natural background levels.

5.5.3 'C', 'D' and 'E' Zones

Note: Please see Appendix 13 for additional information on the 'C' and 'D' Zones as a supplement to the text below.

Exposition 'C' Zone

VOCs
There are only two wells screened in the Exposition 'C' Zone (MW-10-110 and MW-11-100). These wells are located over 800 feet down-gradient to the south (MW-11-100) and southwest (MW-10-110) of the Pemaco site. No VOCs exceeding MCLs or PRGs have been detected in samples from well MW-11-100. The only VOCs that have been consistently detected at concentrations at or exceeding detection levels are TCE and benzene in samples from MW-10-110. These concentrations are detected at trace levels and may represent the dissolved-phase fringes of the TCE plume from the Pemaco site and the benzene plume from the W.W. Henry property. The trace benzene detections may also be a result of the ambient sampling conditions. This well is in an area of high traffic and the benzene concentrations could be a product of vehicle exhaust that occurred during sampling events (thereby cross-contaminating the sample at the surface). Outdoor air samples collected in the Pemaco area in March 2002 (see Section 5.1 above) confirmed the ambient presence of benzene.

It should be noted that TCE and cis-1,2-DCE concentrations in samples from well MW-10-110 have showed an increasing trend. This may be due to migration of the outermost plume fringe, seasonal fluctuations or sampling and analysis inconsistencies.

NHVOCs
The only NHVOCs detected in the 'C' Zone that exceeded PRG screening levels was acetone, which exceeded the PRG of 0.61 mg/L during the May-June 2001 sampling. This one exceedence can be attributed to the well construction materials (see discussion above in Section 5.5).

SVOCs
There were no SVOCs detected above California MCLs or PRGs in the Exposition 'C' Zone during the May-June 2001, September-October 2001, January 2002 and April 2002 sampling events.

Metals
Metal concentrations in samples from the Exposition 'C' Zone exceeded the selected ARARs for arsenic in MW-10-110 (52.7 µg/L) and for hexavalent chromium in MW-11-100 (2.1 µg/L).

The fact that these wells are located over 800 feet away from the Pemaco property and contain little or no VOC contamination indicate that these arsenic and hexavalent chromium concentrations are likely background levels and not from a Pemaco release.

Average arsenic concentrations in groundwater in the Los Angeles area range from 5 to 10 µg/L (Saracino Kirby, Inc. *Arsenic Occurrence and Conjunctive Management in California, Prepared the Association of California Water Agencies,* September 2000) and average hexavalent chromium concentrations found in a Los Angeles area water production well

network is 6 µg/L (Burbank Water and Power, *A Report on Chromium in Burbank's Groundwater*, September 26, 2000).

Exposition 'D' and 'E' Zones

VOCs
There are three wells screened in the Exposition 'D' Zone (MW-05-135, MW-07-130 and MW-12-150) and only one well screened in the Exposition 'E' Zone (MW-10-170). No VOCs exceeding MCLs or PRGs have been detected in samples from any of these wells. The only VOCs detected in these wells have been at very trace levels (<7 µg/L), except for acetone during the first sampling event (49 µg/L). The only VOC that has been detected during more than one sampling event in the same well was cis-1,2-DCE in well MW-07-130 during the September 2001 and April 2002 events (both <1.0 µg/L).

The trace concentrations that appear in samples from MW-07-130 could be related to the Pemaco plume, however, more temporal data needs to be collected for confirmation. The other wells (MW-05-130, MW-12-150 and MW-10-170) appear to be clean down-gradient "guard" wells for these lower zones.

NHVOCs
The only NHVOC detected in the 'D' and 'E' Zones that exceeded PRG screening levels was one detection of acrylonitrile in MW-10-175 (0.19 mg/L) during the May-June 2001 sampling. This detection was likely a product of matrix interferences and has not been confirmed in other sampling events. The only other NHVOC detected in the 'D' or 'E' Zone wells was ethyl acetate in MW-05-135 and MW-07-130 during the January 2002 event. These concentrations were also estimated values detected below the reporting limits and were never detected in subsequent sampling events.

SVOCs
There were no SVOCs detected above California MCLs or PRGs in the Exposition 'D' and 'E' Zones during the May-June 2001, September-October 2001, January 2002 and April 2002 sampling events. The only detected SVOC concentration detected was bis(2-Ethylhexyl)phthalate in well MW-05-135 during the May-June 2001 event. This concentration was never confirmed in subsequent sampling events.

Metals
Metal concentrations in samples from the Exposition 'D' and 'E' Zones exceeded ARARs only for hexavalent chromium in wells MW-05-135, MW-07-130, MW-10-175 and MW-12-150. Arsenic was found at levels from 3 to 5 µg/L exceeding the PRG, but not the MCL, which is the selected ARAR.

As discussed above for the Upper Exposition groundwater zones, it is likely that these metal concentrations are background levels. The spatial distributions of these concentrations are not consistent with a release. Each of these arsenic and hexavalent chromium concentrations are at very similar levels (2 to 6 µg/L). There are no "hot spot" type relationships.

5.5.4 Anions in Upper Exposition Groundwater Zones

In May 2001, groundwater samples were selected from a subset of wells in the Expostion 'A' and 'B' zones and analyzed for certain anions and other general chemistry parameters. Screening-level analytical results for sulfide indicated elevated concentrations in several wells. The highest concentrations where noted in MW-9-85 (9.5 mg/L), a downgradient well located on 60th Street.

Sulfide can be generated from redox reactions involving the reduction of sulfate. Sulfate-reducing zones are typical in groundwater plumes of chlorinated VOCs, especially where reducing conditions exist and background concentrations of sulfate are moderate to high, such as in the Exposition 'A' and 'B' Zones in the Pemaco area.

It is postulated that the elevated concentrations of sulfide in downgradient 'A' and 'B' Zone wells are the result sulfate reduction. A more comprehensive sampling and analysis program has been designed to evaluate general chemical parameters of groundwater in these zones to determine the nature of sulfide concentrations in the 'A and 'B' zones. A technical memorandum will be prepared as an addendum to this RI report to discuss the results of the sampling and analysis.

5.6 NON-PEMACO RELATED CHEMICAL CONCENTRATIONS

Former industrial properties, adjacent to Pemaco, have had historical uses that have impacted soil and groundwater. According to the chemical distribution data collected during the RI activities, it is evident that soil and groundwater contamination exist from sources other than the Pemaco property. The most evident non-Pemaco source of contamination is the W.W. Henry property and to a lesser extent, the LAJR, Lubricating Oil Services and Catellus properties. The above sections have described the spatial distributions of all detected chemical concentrations by media and zone and have differentiated between Pemaco and non-Pemaco related contaminant distributions wherever applicable. However, it is necessary to separately identify all non-Pemaco related concentrations for future litigation and remediation purposes. Table 5.6 identifies all non-Pemaco related chemical concentrations that were encountered during the RI/FS activities. Table 5.6 does not address soil vapor and perched groundwater contamination found beneath the residential areas between 59th Place and 60th Street, as it appears that each of the former industrial properties has contributed to these concentrations (See Section 5.1 and Appendices 2 and 3).

6.0 CONTAMINANTS OF POTENTIAL CONCERN

Chemical and metal concentrations found in environmental media during the RI were screened against Applicable or Relevant and Appropriate Requirements (ARARs). Contaminants filtered during this process (exceeding project ARARs) are considered contaminants of potential concern (COPCs). The ARARs chosen were USEPA PRGs for ambient air, soil vapor, and soil concentrations and State of California MCLs for groundwater concentrations. These are concentration levels of chemicals that are considered to be protective of human health by the USEPA Region IX (PRGs) and the California Department of Health Services (MCLs). It should be noted that PRGs and MCLs only account for the protection of human health and do not take into consideration ecological impacts. ARARs and the COPCs for each media are discussed below.

Ambient air results collected on the Pemaco property and throughout the adjacent residential neighborhood were screened against USEPA Region IX PRGs for chemical concentraitons in ambient air. Ambient air sampling canisters (SUMMA canisters) were situated in areas thought to be representative of breathing zones. Table 6.1 lists the COPCs for ambient air as well as the maximum concentration detected and its location.

Soil vapor results collected in the vicinity of the Pemaco property (as well as on-site) were screened against the USEPA Region IX PRG for chemical concentrations in ambient air multiplied by an attenuation factor of 100. This screening procedure is typically used to evaluate whether further investigation of ambient air should be evaluated. Dilution factors would be much greater for the soil vapor concentrations migrating to outdoor air. This is a very conservative approach and was done as a preliminary measure to identify COPCs. Table 6.2 lists the COPCs for soil vapor as well as the maximum concentration detected and its location.

For the USEPA Region IX soil PRGs there are two types of land uses: residential and industrial. The residential PRGs are much more conservative (lower concentrations). Residential PRGs assume that the amount of time that one is being exposed to a certain chemical is much greater because that exposure is occurring at home rather than if that exposure is occurring at work (assuming a normal 40-hour work week). Surface and near surface soils were screened against the more conservative residential soil PRGs due to the close proximity of site soils to a residential neighborhood as well as the future use of the property as a community park. Table 6.3A lists the COPCs for surface and near surface soils as well as the maximum concentration detected and its location.

There are also USEPA Region IX PRGs that are used to screen subsurface soil as a threat to groundwater. These are termed Dilution Attenuation Factor (DAF) PRGs and there are two types. The DAF1 PRGs assume that the contaminated soil source is directly adjacent to a drinking water source, such as a regional aquifer, and no dilution is occurring along the migration pathway between the source soil and the drinking water source. The DAF20 PRGs are used when the contaminated soil is not directly adjacent to a drinking water source and dilution of the contaminant is occurring before it reaches the drinking water source. The DAF20 PRGs were used to screen Pemaco upper vadose soil and lower vadose soil to 50 feet bgs because the soil is more than 100 feet above any potential drinking water source. Lower vadose soils below 50 feet bgs were screened against DAF 1 PRGs as these soils are in direct contact with the Upper Exposition groundwater zones. Although the Exposition

Groundwater Zones are not a viable aquifer, a possible hydraulic connection between the Exposition groundwater zones and the surrounding municipal supply wells could exist. Table 6.3B, 6.3C, and 6.3D lists the COPCs for upper and lower vadose zone soils as well as the maximum concentration detected and its location.

The chemical concentrations found in perched groundwater and the Exposition groundwater zones were conservatively screened against California MCLs for drinking water (even though these zones are not feasible sources of drinking water). These MCL levels are primarily risk-based levels similar to PRGs were it is assumed that a person will drink water with the specified chemical concentrations. MCLs also take into account laboratory detection limits, treatibility and the cost of treatment. For chemicals which do not have an associated MCL, the USEPA Region IX PRG for tap water is used as the ARAR. Tables 6.4A and 6.4B list the COPCs for the perched groundwater zone and Exposition groundwater zones, respectively, as well as the maximum concentration detected and its location.

A summary table with key chemical characteristics and attributes of Pemaco COPCs has been prepared and is included as Appendix 12.

7.0 CONTAMINANT FATE AND TRANSPORT

7.1 POTENTIAL ROUTES OF CHEMICAL MIGRATION

The following is a list of potential contaminant transport pathways at Pemaco:

- Contaminants in soil vapor migrating laterally and/or vertically in vadose zone soil, including:
  - Soil vapor migrating upward in vadose zone soil and being released at the surface;
  - Soil vapor migrating in the vadose zone and condensing into pore water existing in either the unsaturated zone or capillary fringe;
  - Soil vapor migrating in utility conduits (e.g. sewer line trench backfill);
- Volatilization of contaminants exisitng as "free product" (perched zone), dissolved or adsorbed phase, then migrating as soil vapor in one of the manners described above;
- Adsorbed-phase contaminants in the vadose zone partitioning into the dissolved phase (leaching) and migrating/infiltrating downward, either readsorbing onto soil particles or mixing with groundwater;
- "Free product" migrating under the influence of gravity and/or groundwater flow (i.e. in the perched zone, primarily the W.W. Henry "plume," but also the isolated product plume near monitoring well B-15);
- Dissolved-phase contaminants in groundwater, migrating due to advective, dispersive and chemical processes.

These pathways are shown schematically on the conceptual site model, included as Figure 17. Figures 8 through 16 illustrate the distribution of COPCs, and, in general, represent how and where the COPCs have migrated throughout various environmental media over time, up to the present.

7.2 CONTAMINANT CHARACTERISTICS AND PERSISTENCE

As described in Section 6 and associated tables of that section (Tables 6.1 through 6.4B), there are numerous COPCs (a total of 57) present within the various environmental media at Pemaco. The following is a list of the number of COPCs per environmental "zone" (based on the presence of each exceeding the selected ARAR):

Media or Zone	Number of COPCs Present
Ambient Air	11
Soil Vapor	12
Surface and Near Surface Soil	11
Upper Vadose Zone	21
Lower Vadose Zone	11 (DAF 1)
Perched Groundwater	28
Exposition Groundwater Zones	20

The COPCs vary widely in their respective chemical characteristics and behavior/fate in the environment. For example, some of the NHVOCs present (e.g. acetone) have infinite solubility in water, whereas most metals are quite insoluble. Special attention will need to be given to this variability in the evaluation of remedial alternatives for the site.

A summary table with key chemical characteristics and attributes has been prepared and is included as Appendix 12. Also, the reader is referred to the following internet websites that include chemical data bases and user-friendly "search" functions:

http://www1.nature.nps.gov/toxic/
www.chemfinder.com
www.chemexper.com
www.atsdr.cdc.gov

7.3 CONTAMINANT MIGRATION

The large volume and widespread spatial distribution of physical and chemical data generated during RI activities allows for accurate assessment of contaminant transport/migration pathways at Pemaco. However, due to the uncertain timing of individual chemical releases and the relative lack of long-term monitoring data, only estimates can be made regarding contaminant fate/migration. Contaminant fate and transport modeling is not an applicable tool for the site due to the highly irregular/complex hydrostratigraphy (e.g. myriad discontinuous fine sand lenses/stringers) and the large number of different chemicals (i.e. 57 COPCs).

Figures 8 through 16 illustrate the distribution of COPCs, and, in general, represent how and where the COPCs have migrated throughout various environmental media over time, up to the present. Additional groundwater sampling events over time will allow for the determination of whether dissolved-phase contaminants are continuing to migrate further downgradient in the various groundwater zones, or if groundwater "plumes" are stable.

8.0 Baseline Risk Assessment

A baseline risk assessement was performed to quantify potential risks to human health that may be associated with chemicals in soil, soil vapor and groundwater at and adjacent to the Pemaco site. A summary of the risk assessment assumptions, methods and results is presented below. The complete risk assessment report with details regarding exposure parameters, toxicity values, parameters used, calculations, results, references, etc., is included as Appendix 6.

8.1 EXPOSURE ASSESSMENT

As discussed previously in this document, the Pemaco property will be combined with several other former industrial properties and redeveloped as the Maywood Riverfront Park. The plan for the park includes a playground area, playing fields, basketball courts, native plants landscaping, picnic areas, restrooms, and a parking area. Although not specifically included in the current plan, addition of a swimming pool in the future is a possibility. While the planned future land use is as a park, residential use of the property cannot be excluded, because the site is adjacent to a residential community and the City of Maywood may rezone the property for residential development in the future.

Currently the Pemaco site is fenced and access is limited. The only current onsite use of the Pemaco site is by local gangs of adolescents who trespass on the site.

Based on current, proposed, and possible land uses, one current land-use scenario and three potential future land-use scenarios were developed to evaluate potential onsite exposure of human receptors. In addition, one current offsite exposure scenario was developed to evaluate potential risks to residents presently living in the vicinity of the Pemaco site. Each of the five exposure scenarios, both current and future, and their respective pathways are listed below.

1. The current trespasser scenario evaluates exposure to surface soils by the ingestion, dermal, and inhalation pathways.
2. The future park user scenario evaluates exposure to surface soil by the ingestion, dermal, and inhalation pathways.
3. The future excavation worker scenario evaluates exposure to surface and subsurface soils (to 15 feet bgs) by the ingestion, dermal, and inhalation pathways.
4. The future onsite residential scenario evaluates exposure to surface soils and to groundwater within the Exposition ‘A’ and ‘B’ Zones by the ingestion, dermal, and inhalation pathways. Vapor intrusion by volatile chemicals detected in onsite shallow soil gas was also evaluated for the future onsite residential scenario.
5. The current offsite residential scenario evaluates risks posed by potential inhalation exposure to chemicals volatilizing from the onsite subsurface soil and perched groundwater or volatilizing from perched groundwater plumes that are migrating offsite. There are currently no water supply wells in the Exposition ‘A’ and ‘B’ groundwater zones; therefore, exposure to groundwater in these zones was not evaluated.

Based on the extensive database available for the Pemaco site, fate and transport modeling were not required. The onsite risks to human health were evaluated, therefore, on the basis of the measured concentrations of chemicals in the surface soil, subsurface soil, soil gas, and groundwater in the perched zone and Exposition 'A' and 'B' Zones. Offsite risks were evaluated on the basis of measured concentrations of chemicals in indoor and outdoor air samples and soil gas samples collected on the Pemaco site and nearby residential locations.

Two general types of "receptors" were selected as representative examples of the general population. A "reasonable maximum exposure (RME) receptor" was designed to represent people who may have high exposures to COCs. A "central tendency (CT) receptor" was designed to represent people who may have what are considered to be average exposures to COCs. The results of these two cases provide a realistic range of general exposures to COCs and, consequently, a range of human health risks associated with those general exposures. Using the predicted distributions of various concentrations in each media zone, the RME receptor was assumed to be exposed to the 95th percentile concentration of each COC and the CT receptor was assumed to be exposed to the median concentration.

RME and CT exposure parameters were developed for all five exposure scenarios as bulleted below.

- The trespasser scenario was developed using exposure parameters representative of the frequency and duration of adolescent gangs per consultation with the City of Maywood, local police, and church groups.

- For the future park user scenario, outdoor athletic activities are likely to be the most intensive use of the park. Because the residential neighborhood near Pemaco is predominately Latin American and soccer in an intrinsic part of the Latin American culture, playing soccer was selected as an activity representative of the RME conditions. Because the Pemaco site is adjacent to a residential community, residential exposure duration parameters were applied. It was also assumed that the park would be accessible to small children.

- Trespassers and park users are expected to have contact only with the surface soil. In contrast, an excavation worker scenario was evaluated for potential risks due to exposure to subsurface soils up to a depth of 15 feet. Although an excavation worker may only spend a few days or weeks on the Pemaco site, exposure over a career was evaluated. This reflects the potential that an excavation worker in a metropolitan area such as Los Angeles may frequently excavate on properties that are being redeveloped after previous industrial uses.

- Potential future onsite residents were assumed to have contact with the surface soil and to use groundwater from the Exposition groundwater zones for all domestic needs. Default residential parameters were used.

- The current offsite resident exposure scenario was developed to assess inhalation exposure to chemicals volatilized from subsurface soils and perched groundwater plumes. Residential inhalation exposure parameters were used to evaluate data from indoor and outdoor air samples. This exposure pathway was also evaluated using the Johnson and Ettinger model to predict potential exposures due to vapor intrusion by volatile chemicals found in shallow soil gas samples.

8.2 TOXICITY ASSESSMENT

The COCs evaluated in the risk assessment were selected using the following criteria:

- Those chemicals detected in greater than 5 percent of the samples analyzed and detected at a maximum concentration that exceeded one-tenth of the USEPA Region IX PRGs were retained as COCs.

- The concentrations of inorganic chemicals in the soil were also screened against the 95 percent upper tolerance limit (95 % UTL) of the background data for California soils (Bradford et al., 1996).

- The exposure point concentration evaluated was either the maximum detected concentration or the 95 percent upper confidence limit (95 % UCL) calculated based on the statistical distribution of the sample concentration values.

Toxicity values (cancer slope factors and references doses) were selected from the following sources. Preference was given to values available on USEPA's Integrated Risk Information System (IRIS) accessible at http://www.epa.gov/IRIS (USEPA, 2002). If no toxicity values were available on IRIS the Health Assessment Summary Tables (HEAST) was searched (USEPA, 1997). If information was not available from these two sources, values used by USEPA Region IX to develop the PRG values were used to assess risks at the Pemaco site (USEPA, 2000). California EPA toxicity values more than 4-fold more conservative than corresponding USEPA values were used to evaluate risks at the Pemaco site (CalEPA, 1996).

8.3 RISK CHARACTERIZATION

The only current onsite use of the Pemaco site is by local gangs of adolescents who trespass on the site. Current offsite risks posed by potential inhalation exposure to volatile chemicals in the neighborhood adjacent to the Pemaco site were also evaluated.

Future onsite land-use scenarios include a park user, an excavation worker and residents. The park user scenario represents the most likely future land use as the property is slated for development into the Maywood Riverfront Park. The excavation worker scenario was evaluated to determine if exposure to contaminants in subsurface soil would raise human health concerns (especially during redevelopment activities). Although the planned future land use is as a park, residential use of the property cannot be excluded, because the site is adjacent to a residential community and the City of Maywood may rezone the property for residential development in the future. While actual domestic use of untreated groundwater from the Exposition groundwater zones is unlikely due to the availability of a municipal water supply in the community and due to restrictions on development of private groundwater wells by the Regional Water Quality Control Board (RWQCB), the residential scenario included the use of groundwater to provide a conservative evaluation of all possible risks to human health.

Generally accepted USEPA screening levels for carcinogenic health risks are between 10^{-6} and 10^{-4} and for non-carcinogenic health risks a hazard quotients less than 1.0 is considered to be acceptable. The total estimated carcinogenic risk and noncarcinogenic hazards for each of the five receptor scenarios calculated as part of the Pemaco risk assessment are tabulated below for both RME and CT parameters. The specific chemical risk drivers

associated with each media are discussed in the paragraphs that follow and are summarized in the table provided Section 9.3.

Under current land-use conditions, when the only use of the site is by occasional trespassers, the estimated carcinogenic risks using RME parameters falls at the lower end of the USEPA target risk range of 1E-06 to 1E-04. The carcinogenic risk was primarily due to potential exposure to benzo(a)pyrene and dibenzo(a,h)anthracene by the ingestion and dermal exposure routes. Using CT parameters, the carcinogenic risk for the Trespasser was below the target range. The total noncarcinogenic hazard index was well below the target level of 1.0, thus indicating that noncarcinogenic adverse effects to human health would be unlikely.

The estimated carcinogenic risks using the future park user scenario with either the RME or CT parameters falls in the middle of the USEPA target risk range (see above table). The carcinogenic risk was primarily due to potential exposure to benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene by the ingestion and dermal exposure routes. The total noncarcinogenic hazard index was well below the target level of 1.0, thus indicating that noncarcinogenic adverse effects to human health would be unlikely.

The estimated carcinogenic risks using the future excavation worker scenario with RME parameters falls in the lower end of the USEPA target risk range and falls below the target range using CT parameters (see above table). The carcinogenic risk was primarily due to potential exposure to arsenic, benzo(a)pyrene, and dibenzo(a,h)anthracene by the ingestion exposure route. The total noncarcinogenic hazard index was well below the target level of 1.0, thus indicating that noncarcinogenic adverse effects to human health would be unlikely.

The estimated carcinogenic risks using the future onsite resident exposure scenario, with either RME or CT parameters, falls well above the upper end of the USEPA target risk range (see above table). The estimated carcinogenic risks were primarily due exposure to contaminants in the Exposition groundwater zones. The estimated carcinogenic risks were greatest for inhalation exposure, but also exceeded the upper end of the USEPA target risk range due to ingestion and dermal exposure. The carcinogenic risk was primarily due to potential exposure to arsenic, benzene, chloroform, TCE, and vinyl chloride. The total noncarcinogenic hazard index also greatly exceeded the target level of 1.0, thus indicating that noncarcinogenic adverse effects to human health would be possible. The elevated noncarcinogenic hazard index was primarily due to potential exposure to acetone, arsenic, benzene, chloroform, cis-1,2-dichloroethene, manganese, TCE, and vinyl chloride.

The estimated carcinogenic risks based on measured indoor and outdoor air concentrations, using the current offsite resident exposure scenario falls within the target risk range using either RME or CT exposure parameters (see above table). The carcinogenic risk was primarily due to potential exposure to chloroform, benzene, methyl tert-butyl ether, and tetrachloroethene. The total noncarcinogenic hazard index also exceeded the target level of 1.0 with either RME or CT parameters, thus indicating that noncarcinogenic adverse effects to human health would be possible. The elevated noncarcinogenic hazard index was primarily due to potential exposure to chloroform, 1,2,4-trimethylbenzene, and benzene. Risk estimates, based on background air sample data, also resulted in carcinogenic estimates within the USEPA target risk range and the noncarcinogenic hazard quotient also exceeded the target level of 1.0 using RME parameters. Thus, the site-related risks may lie within the

level of background risk, but more background data is needed to establish an adequate statistical basis for comparison.

Estimates of carcinogenic risk based on vapor intrusion modeling from maximum observed shallow soil gas concentrations also gave estimates of cancer risk within the USEPA target range, but the noncancer hazard estimate was well below the threshold level of 1.0. The greatest potential cancer risk was due to exposure to trichloroethene. The indoor air vapor intrusion pathway is of minimal concern at the Pemaco site, based on the results of the Johnson-Ettinger model (USEPA, 2000c).

These estimation results are interpreted in relation to the Superfund site remediation goals in the NCP. The cancer risk remediation goals are an excess lifetime cancer risk (ELCR) range from 10^{-6} to 10^{-4}. Results for ELCR below 10^{-6} suggest that the increased risk of developing cancer in a lifetime due to exposure to the COCs is very small and that no further remedial action is required. Results for ELCR that fall in the range of 10^{-6} to 10^{-4} suggest that additional investigation may be needed to further evaluate the risks. Results for ELCR in excess of 10^{-4} indicate that increased cancer risk due to exposure to the COC may warrant some type of remedial action.

Risk-based values, or remediation goal options, were developed during the Pemaco risk assessment for all risk drivers summarized by receptor above. These goals are calculated by rearranging the equations used to calculate each COCs hazard quotient or incremental cancer risk so that the equations can be used to solve for a concentration that will result in target hazard indexes of 1.0 or target cancer risk of 1E-06.

9.0 SUMMARY AND CONCLUSIONS

Analytical results of the environmental samples collected during the Pemaco RI indicate that chemical concentrations originating from the past industrial practices at the Pemaco property and other adjacent industrial properties have impacted soil and groundwater underlying these properties and underlying the adjacent residential properties. Sixty contaminants of potential concern (COPCs) have been identified based on the comparison of analytical results to ARARs. COPCs include various species of metals, NHVOCs, SVOCs, and VOCs.

A general breakdown of environmental media and/or "zones" and the relative types and distribution of COPCs in each is as follows:

Table 9.0 – General Breakdown of COPC Distributions in Environmental Media Pemaco Superfund Site

Media or Zone	Number of COPCs Present	Types of COPCs	Depth	Extent
Ambient Air*	11	VOCs	Breathing zone	Onsite and offsite (VOCs detected at every sample location in the general vicinity)
Soil Vapor	12	VOCs	5 feet to 15 feet bgs	Onsite, adjacent industrial properties and adjacent residential areas
Surface and Near Surface Soil	11	SVOCs and Metals	6 inches to 2.5 feet bgs	Onsite and adjacent industrial properties
Upper Vadose Zone	21 (DAF 20)	NHVOCs, VOCs, SVOCs and Metals**	2.5 feet to 35 feet bgs	Onsite and adjacent industrial properties
Lower Vadose Zone	11 (DAF 1)	VOCs and Metals**	35 feet to 65 feet bgs	Onsite and adjacent industrial properties
Perched Groundwater	32	NHVOCs, VOCs, SVOCs and Metals**	25 feet to 35 feet bgs	Onsite, adjacent industrial properties and adjacent residential area (Mixed VOC plume extends 200 feet to southwest of site)
Exposition Groundwater Zones ('A', 'B', 'C' and 'D')	22	NHVOCs, VOCs and Metals**	65 feet to 110 feet bgs	Onsite, adjacent industrial properties and adjacent residential area (VOC plume, primarily trichloroethene, extends ~1,300 feet southwest of site)

bgs = below ground surface
DAF = Dilution attenuation factors for USEPA Region IX Preliminary Remediation Goals
" * " = Data indicates that many of the VOCs found in breathing zone air could be due to background conditions of the Los Angeles basin.
" ** " = Metal concentrations s are likely background levels

These COPC concentrations, which have been found in various environmental media underlying the Pemaco property and surrounding areas, have been delineated by the RI activities and shown to be the result of the use and storage of hazardous materials on the Pemaco property, LAJR property and W.W. Henry property and also from anthropogenic and naturally-occurring background sources. Some of the chemical concentrations sourced from

past industrial activities have migrated offsite through soil vapor and groundwater beneath the adjacent residential neighborhood.

The chemical concentration data and distribution data have been used to calculate potential health risks to the current and future users of the property. These risk calculations have indicated that a potential health risk exists to future residential users of the property who may come into contact with surface soil and/or groundwater. A feasibility study is currently in progress to assess the optimum remediation method(s) to be used to reduce the chemical concentrations in soil and groundwater to acceptable levels.

9.1 NATURE AND EXTENT OF CONTAMINATION

The following table summarizes the "hot spot" areas where significant quantities of COPC concentrations were identified in soil and/or groundwater during the RI activities and lists the affected media/zones and likely sources.

Table 9.1 – Areas of Significant Impact of Environmental Media and Likely Sources Pemaco Superfund Site

Areas of Significant Impact	Impacted Media/Zone*	Approximate Impacted Depths (feet bgs)	Main COPCs	Likely Sources of Impact
Perimeter of Pemaco property and adjacent LAJR property	Surficial Soils	0 to 2.5	PAHs,	Anthropogenic background (vehicle exhaust, structural fires, etc.)
			Metals	Natural-occurring background
Northeast Portion of the Pemaco Property	Upper and Lower Vadose Zone Soils Perched Groundwater Exposition Groundwater	5 to 90	Chlorinated VOCs (Mainly PCE, 1,1,1-TCA and DCE)	Former ASTs or Drum Storage Areas (Pemaco)
Southern Portion of Pemaco, 59th Place and Walker Ave. and 59th Place and District Blvd. Intersections	Upper and Lower Vadose Zone Soils Perched Groundwater Exposition Groundwater	5 to 95	Chlorinated VOCs (mainly TCE)	Former USTs or Drum Storage Area (Pemaco)
South-central to south portion of Pemaco	Upper Vadose Zone Soils Perched Groundwater	15 to 30	Non-chlorinated VOCs (mainly BTEX)	Former USTs (Pemaco)
Area in the immediate vicinity of well B-15, west-central portion of Pemaco bordering LAJR	Perched Groundwater	25 to 30	Non-chlorinated VOCs (kerosene range hydrocarbons, including free product)	Former ASTs (Pemaco) or spill along LAJR

Areas of Significant Impact	Impacted Media/Zone*	Approximate Impacted Depths (feet bgs)	Main COPCs	Likely Sources of Impact
North-east portion of W.W. Henry property (near B-31)	Upper Vadose Zone Soils Perched Groundwater	5 to 25	Chlorinated VOCs (mainly PCE)	Product piping connecting rail spur to USTs (W.W. Henry)
East-central portion of W.W. Henry property and 59th Place west of B-27	Upper and Lower Vadose Zone Soils Perched Groundwater Exposition Groundwater	15 to 90 (including large volumes of free product in the perched zone)	Non-chlorinated VOCs (mainly hexane, toluene and benzene)	Former USTs (W.W. Henry)
West portion of W.W. Henry property	Upper Vadose Zone Soils Perched Groundwater	5 to >30 (?)	Chlorinated VOCs (mainly 1,1,1-TCA, PCE, 1,1-DCE and 1,1-DCA)	Former Mixing Patio (W.W. Henry)

* = Ambient air not included, see below for discussion.
? = Vertical extent of contamination unknown.

COPCs in Ambient Air and Soil Vapor

Three rounds of soil vapor sampling and 2 rounds of residential/ambient air sampling were performed as part of the RI. A total of 86 soil vapor samples were collected at a depth of 5 feet bgs, and 16 samples were collected from 15 feet bgs. A total of 12 residential air samples and 18 ambient air samples were collected. Indoor air sampling of residences within 1 block of the Pemaco property indicated that COPCs present in soil vapor are not contributing to indoor air contamination above background levels that are found in outdoor air throughout the Maywood area. There are only two residences where the data collected from soil vapor and indoor air samples indicated that the chemical concentrations in soil vapor could be contributing to the indoor air chemical concentrations. These residences are located near the free product plume originating from the W.W. Henry property (adjacent to Pemaco). However, this assertion may be preliminary and requires further investigation to be substantiated. The levels found in soil vapor underlying the residential lots are not high enough to create a vapor intrusion pathway according to the latest literature on the subject (USEPA, 2000). More air sampling events are scheduled for 2003.

COPCs in Surface and Near-Surface Soil

A total of 75 surface (0.5 feet bgs) and 75 near-surface (2.5 feet bgs) soil samples were collected on, and immediately adjacent to the Pemaco property. Samples were analyzed for SVOCs and metals. Analytical results indicate elevated concentrations of SVOCs and metals in both soil zones. It is unlikely that the elevated metal concentrations are a result of previous activities on the Pemaco site and are probably due to naturally occurring background levels.

Polyaromatic hydrocarbons (PAHs) were the most prevalent SVOCs detected above Region IX PRGs for residential soil among both surface and near surface samples with concentrations ranging from 62 µg/kg to 38,000 µg/kg. Although there was no indication of historical use of PAHs at Pemaco or adjacent industrial properties, the compounds were

detected throughout the Pemaco site. A possible source of the PAH concentrations could be from creosote treated railroad ties located along the LAJR and the associated spurs branching off each property, or from the warehouse fire that occurred on the Pemaco site in 1993. However, PAHs were also detected in areas that are far from the railway during previous environmental assessments of adjacent properties (EKI, 1999, EKI, 2001 and ALT, 1991). It is likely that PAHs can be found in shallow soil throughout the Maywood area due to vehicle exhaust, fires and paving activities that have occurred over the years. These concentrations appear to be only surficial phenomena.

As concentrations of SVOC and metals in surface and near surface soils indicate, the majority of surficial soil contamination appears to lie along the periphery of the Pemaco site. This would be consistent with the fact that clean fill was placed over much of the site during previous removal actions of the former warehouse foundation, UST excavation and soil removal within the central portion of the site.

COPCs in Upper and Lower Vadose Zone Soils

A total of 616 samples were collected from vadose zone soils between 2.5 and 70 feet bgs.

Five primary areas of contamination have been identified in the upper vadose zone (between 2.5 and 35 feet bgs), these are:

1. Below the central part of Pemaco site and extending approximately 80 feet offsite (to the west) between 25 and 35 feet bgs, primarily comprised of chlorinated VOCs;
2. A small area below the central part of Pemaco around 15 feet bgs, primarily comprised of toluene, ethylbenzene and xylenes;
3. A small area below and adjacent to the central-west part of the Pemaco site (below the rail tracks) around 5 feet bgs, primarily comprised of SVOCs;
4. Below the south part of Pemaco site and extending approximately 200 feet offsite (to the west/southwest) between 25 and 35 feet bgs, primarily comprised of chlorinated VOCs; and
5. An offsite area resulting from releases at the adjacent former W.W. Henry-owned property, consisting primarily of benzene, toluene, and hexane.

Two areas of contamination have been identified in the lower vadose zone (between 35 and 70 feet bgs). One area is located below the south part of the Pemaco site and offsite to the south/southwest and is comprised of chlorinated VOCs. The other area is related to the W.W. Henry free product plume and was detected along 59th Place adjacent to the W.W. Henry property. The extent of this contamination was not fully evaluated, as it was not part of the Pemaco RI/FS scope.

COPCs in Groundwater

A total of 42 groundwater monitoring wells have been installed in the perched groundwater zone, and 36 wells in the various Exposition groundwater zones. Five sampling and monitoring events have been conducted using this well network. These sampling and monitoring events have completely delineated contaminant “plumes” originating from the Pemaco property. Plumes have been identified in the perched groundwater zone (25 to 35 feet bg) and in the upper Exposition Groundwater Zones, which exist as individual semi-

confined/confined sand zones typically found between 65 and 95 feet bg. The following sections summarize the nature and extent of contamination by groundwater zone.

Perched Groundwater

PCE, TCE and vinyl chloride are the most prevalent compounds in the perched groundwater zone. "Hot spot" areas of these plumes have had groundwater concentrations exceeding 1,000 µg/L. The dissolved-phase portions of these perched plumes extend offsite and have migrated beneath adjacent properties extending up to 250 feet to the south and up to 200 feet southwest of the Pemaco property. The southwest extent of the plume has migrated beneath one adjacent residential lot. Contaminant plumes originating from the Pemaco property have also co-mingled with other chlorinated and non-chlorinated contaminant plumes that have resulted from historical industrial uses of neighboring properties (former W.W. Henry and Lubricating Oil Services properties). The most significant of these non-Pemaco related plumes is the large free product plume (toluene/hexane) originating from the northeastern portion of the W.W. Henry property and extending to an undetermined extent to the west and to the south of well B-29.

Exposition Groundwater Zones

The most extensive contaminant plumes are found in the upper portions of the Exposition Groundwater Zones (Exposition 'A' and 'B' Zones) and are primarily comprised of TCE and its daughter products. The plume of largest lateral extent is approximately 1,300 feet long and 750 feet wide within the Exposition 'B' Zone. The dissolved-phase portion of this plume extends towards the southwest of the Pemaco property and underlies a two-block area that is used for residential housing. The "hot spot' area of this plume is directly below the southernmost portion of the Pemaco property and contains TCE concentrations exceeding 20,000 µg/L. These high concentrations fall off quickly to levels below 100 µg/L approximately 300 away from the site and fall below 10 µg/L approximately 500 feet away from the site. It should be noted that while the lateral extent of this plume is somewhat large, the vertical extent is limited to the saturated thickness of the 'B' Zone sand, which ranges from 1.5 to 10 feet thick and is typically found between 75 and 85 feet bg.

9.2 FATE AND TRANSPORT

The large volume and widespread spatial distribution of physical and chemical data generated during RI activities allows for accurate assessment of contaminant extent and transport/migration pathways at Pemaco. However, due to the uncertain timing of individual chemical releases, irregular/complex stratigraphy/hydrogeology, and the relative lack of long-term monitoring data, only rough estimates can be made regarding contaminant fate/migration. Additional groundwater sampling events over time will allow for the determination of whether dissolved-phase contaminants are continuing to migrate further downgradient in the various groundwater zones, or if groundwater "plumes" are stable.

9.3 RISK ASSESSMENT

A baseline risk assessement was performed to quantify potential risks to human health that may be associated with chemicals in soil, soil vapor and groundwater at and adjacent to the Pemaco site. The risk assessment considered current, proposed and possible land uses. A

summary of carcinogenic risks and non-carcinogenic hazards calculated as part of the risk assessment as follows:

Receptor	Media	Total Carcinogenic Risk		Total Noncarcinogenic Hazard Quotient	
		RME (1)	CT (2)	RME(1)	CT(2)
Current Onsite					
Trespasser	Surface soil	4.5E-06	4.3E-07	1.0E-02	2.2E-03
Future Onsite					
Park User	Surface soil	7.9E-05	1.9E-05	3.1E-01	1.2E-01
Excavation Worker	Surface and subsurface soil	6.9E-06	8.5E-07	1.2E-01	2.5E-02
Resident	Surface soil, groundwater and vapor intrusion	1.6E-01	4.5E-02	1.8E+03	7.5E+02
Current Offsite					
Resident	Indoor and Outdoor air	9.2E-05	2.3E-05	1.1E+01	7.1E+00
	Outdoor air background	3.7E-05	NA	4.4E+00	NA
	Modeled vapor intrusion	1.6E-05	3.1E-6	1.0E-02	5.5E-03

(1) Reasonable maximum exposure parameters

(2) Central tendency exposure parameters

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