# FIRST FIVE-YEAR REVIEW REPORT

## FOR
## DEL AMO WASTE PITS OPERABLE UNIT
## LOS ANGELES, CALIFORNIA

**September 2005**


**United States Environmental Protection Agency**
**Region 9**
**75 Hawthorne Street**
**San Francisco, California 94105**


**Approved by:**

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# Acronyms

| | |
|---|---|
| µg/L | micrograms per liter |
| BACT | Best Available Control Technology |
| bgs | below ground surface |
| BTU | British thermal unit |
| CCR | California Code of Regulations |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| CFR | Code of Federal Regulations |
| CHSC | California Health and Safety Code |
| DTSC | Department of Toxic Substances Control |
| ESD | Explanation of Significant Differences |
| FFS | focused feasibility study |
| GCL | geosynthetic clay liner |
| HDPE | high-density polyethylene |
| IBT | *In-situ* bioventing technology |
| LBF | lower Bellflower aquitard |
| LNAPL | light non-aqueous-phase liquid |
| LUC | land-use covenant |
| MBF | middle Bellflower aquitard |
| MBFB | middle Bellflower B sand |
| MBFC | milled Bellflower C sand |
| MCL | maximum contaminant level |
| NAPL | non-aqueous-phase liquid |
| O&M | operations and maintenance |
| OM&M | operations, monitoring, and maintenance |
| OU | Operable Unit |
| PID | photoionization detector |

| | |
|---|---|
| ppm | parts per million |
| ppmv | parts per million by volume |
| PRG | preliminary remediation goal |
| RCRA | Resource Conservation and Recovery Act |
| RI/FS | remedial investigation/feasibility study |
| ROD | Record of Decision |
| SCAQMD | South Coast Air Quality Management District |
| SVE | soil vapor extraction |
| SVOC | semivolatile organic compounds |
| TBC | to-be-considered |
| TCE | trichloroethylene |
| UBF | upper Bellflower aquitard |
| USEPA | United States Environmental Protection Agency |
| VFPE | very flexible polyethylene |
| VOC | volatile organic compound |

# Five-Year Review Summary Form

## SITE IDENTIFICATION

**Site name:** Del Amo Waste Pits Operable Unit

**EPA ID:** 0936 **CERCLIS ID :** CAD029544731

**Region:** 9 **State:** CA **City/County:** Los Angeles / Los Angeles

## SITE STATUS

**NPL status:** ■ Final ☐ Deleted Other (specify) _____

**Remediation status** (choose all that apply): ■ Operating Complete

**Multiple OUs?** ■ YES ☐ NO **Construction completion date:** Construction not complete.

Has site been put into reuse? ☐ YES ■ NO

## REVIEW STATUS

**Reviewing agency:** ■ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

**Author name:** Dante Rodriguez

**Author title:** Remedial Project Manager **Author affiliation:** EPA Region 9

**Review period:** March through June 2005

**Date(s) of site inspection:** April 15, 2005

**Type of review:** ■ Statutory

☐ Policy ☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only

☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead

☐ Regional Discretion)

**Review number:** ■ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify)

**Triggering action:**

■ Actual RA On-site Construction at the Waste Pits OU

☐ Actual RA

☐ Previous Five-Year Review Report

☐ Construction Completion

Other (specify) _____

**Triggering action date:** May 27, 1999

**Due date (five years after triggering action date):** May 27, 2004

## Issues and Recommendations:

### Issue

Operation of the cap gas collection and treatment system should be optimized.

### Recommendation

As presented in Section 6.1, the operating time of the cap gas collection and treatment system should be reduced from 4 to 2 hours daily, such that the equivalent of one pore volume is removed daily. While this would likely result in an increase in VOC concentrations in the system influent, past monitoring data suggest that the efficiency of the system improves with increased VOC concentrations in the system influent. A reduction in operating time would therefore optimize the system and reduce costs associated with system operation.

It is recommended that the system continue to be monitored biweekly to ensure that effluent concentrations do not exceed 5 ppmv. The frequency of system monitoring should be re-evaluated following a period of evaluation and assessment of the revised operating conditions.

### Issue

Remedial design for an SVE/IBT system is currently being performed. Some potential ARARs were identified in a screening level review by USEPA's contractor, but USEPA has not made an ARARs determination for the bioventing treatment technology.

### Recommendation

EPA should follow-up with evaluating the ARARs that would apply to the SVE/IBT that have not been previously identified in the Waste Pits ROD or ESD.

### Issue

The following remedial action objectives identified for the Waste Pits OU have not been achieved:

- Protect future groundwater users from constituents that may leach out of the waste pits in the future.
- Protect future groundwater users from downward advective and dispersive transport of constituents already in the soils below the waste pits and above the water table.
- Protect future groundwater users from constituents already in the soil below the waste pits and above the water table in the event that the water table rises into the contaminated soil.

These remedial action objectives have not been achieved because the aboveground components of the SVE system have not been constructed or operated.

## Recommendation

The SVE/IBT system that is being designed should be installed to reduce impacts to groundwater and to achieve the remedial action objectives for the Waste Pits OU.

## Protectiveness Statement:

The remedy at the Waste Pits OU is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled. It is protective in the short term as no current exposures are occurring due to the LUCs. Once the SVE/IBT system is operating as designed, the remedy will be fully protective.

# Executive Summary

A five-year review of the Del Amo Waste Pits Operable Unit (Waste Pits OU) at the Del Amo Superfund Site (site) in Los Angeles, California was completed between March and September 2005. The five-year review was required by statute and performed because hazardous substances, pollutants, or contaminants remain at the site above levels that do not allow for unrestricted use and unlimited exposure ("UU/UE"). This five-year review for the Waste Pits OU was triggered by the initiation of implementation of portions of the selected remedy, which occurred on May 27, 1999 (Parsons et al., 2000).

The site is located in Los Angeles, California in a narrow strip of the city known as the Harbor Gateway and encompasses approximately 280 acres. The portion of the site that is the subject of this five-year review—the Waste Pits OU—is approximately 4 acres and covers two parcels (#7351-034-077 and #7351-034-078). The Waste Pits OU is located at the southern end of the site, immediately north of Del Amo Boulevard.

Six unlined pits (Pits 2-A through 2-F) and three unlined ponds (Pits 1-A through 1-C) are located within the Waste Pits OU. These pits formerly received waste from styrene, butadiene, and synthetic rubber plants that operated at the site. These plants supported the production of synthetic rubber during World War II. The 2-series waste pits received an aluminum chloride complex containing petroleum hydrocarbons. The 2-series waste pits also received heavy impurities and tars, including sulfur tars from the styrene purification process. Materials disposed of at the 1-series waste pits include acid sludge, kaolin clay, lime slurry, and petroleum hydrocarbons (Dames & Moore 1996).

The results of environmental investigations performed within the Waste Pits OU indicate that waste material and adjacent soil and soil gas at the Waste Pits OU is contaminated with volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). Benzene, a VOC and known human carcinogen, is the hazardous substance detected most frequently and at the greatest concentrations at the Waste Pits OU. Of the SVOCs, naphthalene has been detected at the greatest concentrations and at the greatest frequency in waste material and soil. An estimated 15,600 and 17,100 cubic yards of waste material and heavily-contaminated soil, respectively, remain in place at the Waste Pits OU (USEPA 1997a). Groundwater beneath and downgradient of the former waste pits is also impacted as a result of former uses of the pits. VOCs and SVOCs (particularly benzene, ethylbenzene, naphthalene, and phenol) are also the prime constituents in groundwater near the Waste Pits OU. Groundwater is addressed as part of the Operable Unit #3, "Dual Site Groundwater Operable Unit."

A remedy was determined to be warranted for the Waste Pits OU to address the potential risk caused to human receptors by constituents in the waste pits and surrounding soil (if these media were disturbed in the future) and to reduce the impact of constituents to groundwater. The remedy for the Waste Pits OU was selected in the Record of Decision for Del Amo Waste Pits Operable Unit (Waste Pits ROD), issued by the United States Environmental Protection Agency (USEPA) in September 1997 (USEPA 1997a). Components of the selected remedy include installation of a Resource Conservation and

Recovery Act-equivalent cap; installation and operation of a soil vapor extraction system (SVE); implementation and enforcement of deed restrictions; installation of surface water controls; installation of security fencing around above-ground treatment units; and long-term operation, monitoring and maintenance.

Portions of the selected remedy have been implemented. The Resource Conservation and Recovery Act-equivalent cap, surface and subsurface water controls, and security fencing were installed between May 1999 and February 2000. Operation, monitoring, and maintenance of these components of the remedy have been performed since installation in accordance with the *Operations, Monitoring, and Maintenance Manual for the Del Amo Waste Pits Operable Unit* (OM&M Manual) (Parsons et al. 1999a). Land-use covenants (LUCs) addressing the environmental deed restrictions for the two parcels composing the Waste Pits OU were recorded in September 2000 and May 2005. The LUCs outline the restrictions associated with the site, consisting of prohibiting use of the site as a hospital, school, day care, or for residential purposes and prohibiting disturbance to the cap, SVE system, or groundwater monitoring wells without notification to and approval by USEPA.

While SVE wells were installed prior to construction of the cap, the SVE aboveground treatment components are currently being designed and have not yet been installed. As a result of community concerns regarding the vapor treatment technology originally designed (thermal oxidation), other remedial technologies have been evaluated for use in the SVE system's vapor treatment component. As a result of these evaluations, remedial design activities are currently underway for one of the evaluated technologies (soil vapor extraction with *in-situ* bioventing technology). Current designs utilize carbon absorption, with off-site disposal (and carbon regeneration), to treat the effluent stream.

The cap, cap gas collection and treatment system, drainage channels, catch basins, and fence are functioning as intended in the Waste Pits ROD. The cap provides a barrier between receptors and contamination present in soil and soil gas at the site. The cap also serves as a barrier to infiltration, which could otherwise flow through the waste pits and vadose zone and transport constituents in soil and soil gas to underlying groundwater. The vegetation on the cap is fully established, resulting in negligible erosion from the cap. The fence surrounding the aboveground cap gas collection and treatment equipment is locked and secure.

An evaluation of monitoring and analytical data was performed as part of the five-year review and resulted in the following conclusions:

- Effluent concentrations from the cap gas collection and treatment system rarely exceeded the concentration limit identified in the OM&M Manual (5 parts per million by volume).
- Monitoring data for SVE perimeter wells indicate that contaminated soil vapors are not migrating at elevated concentrations beyond the boundaries of the Waste Pits OU. Laboratory analyses for samples collected at perimeter wells in November 2003 indicate a maximum VOC concentration of 3.7 parts per million by volume.
- While benzene concentrations in the soil continue to exceed clean-up goals, analytical data from 2000 and 2003 suggest that benzene concentrations are decreasing over time as a result of biodegradation. Of the wells for which data are available for both 2000 and

2003, 75 percent of the wells indicated some decrease in benzene concentration over time.

- Analytical data also indicate that benzene concentrations increased with depth at five of the 13 cluster wells, suggesting that VOCs in groundwater may be off-gassing to the vadose zone in those locations.
- Groundwater analytical data indicate that benzene concentrations are stable at the Waste Pits OU.
- Minimal settlement has been recorded at the survey monuments located on the cap. Elevation differences ranging from -0.10 to 0.08 were recorded over a five-year period (2000 to 2005). This settlement is not expected to affect the integrity of the cap.

Applicable or relevant and appropriate requirements (ARAR) established in the Waste Pits ROD and in an Explanation of Significant Differences were evaluated during the five-year review. There have been minimal changes to the ARAR and to-be-considered criteria since the Waste Pits ROD or the Explanation of Significant Differences that would affect the protectiveness of the remedy in place. It was determined that the established ARARs do not require revision to ensure the protectiveness of current remedial actions or to comply with state or federal requirements.

The assumptions made in the human health risk assessment and during remedy selection were evaluated to determine if they remain valid. Based on observations made during the site inspection, observations made during routine inspections performed by the operations and maintenance contractor, and the current and anticipated future uses of the Waste Pits OU, the assumptions made during the human health risk assessment remain valid. During selection of the remedy, it was assumed that the conclusions of an ecological scoping-level assessment performed in 1988 remained valid. USEPA has concluded that actual or potential exposure to ecological receptors on the site is negligible (USEPA 2005a). Through the five-year review, several issues were identified that should be addressed. These issues are optimization of the cap gas collection and treatment system and evaluation of ARARs for bioventing technology. Recommendations for addressing these issues are provided.

The remedy at the Waste Pits OU is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

# 1.0 Introduction

The United States Environmental Protection Agency (USEPA) conducted a five-year review of the remedial actions implemented at the Del Amo Waste Pits Operable Unit (Waste Pits OU) of the Del Amo Superfund Site (site) in Los Angeles, California. This review was conducted between March and June 2005.

The five-year review evaluates whether the remedy at the Waste Pits OU is protective of human health and the environment. This review is required by federal statute. USEPA must implement five-year reviews consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). CERCLA Section 121(c), as amended, states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

Consequently, this five-year review report has been completed because hazardous substances, pollutants, or constituents remain at the Waste Pits OU above levels that allow for unrestricted use and unlimited exposure.

The site consists of three operable units: the Soil and NAPL (non-aqueous phase liquid) Operable Unit (OU#1), the Waste Pits Operable Unit (OU#2), and the Dual-Site Groundwater Operable Unit (OU#3) for Montrose Chemical and Del Amo Superfund Sites. The scope of the five-year review documented in this report is limited to the Waste Pits OU, for which the remedy was identified in the Record of Decision for Del Amo Waste Pits Operable Unit (Waste Pits ROD) issued by the USEPA on September 5, 1997 (USEPA 1997a). Table 1-1 presents a summary of the status of the other OUs at the site.

The remedy presented in the Waste Pits ROD includes:

- Installation of a Resource Conservation and Recovery Act (RCRA)-equivalent cap over the Waste Pits.
- Installation and operation of a soil vapor extraction (SVE) system.
- Installation of surface water controls.
- Installation of security fencing around the above-ground treatment equipment.
- Implementation of deed restrictions.
- Long-term operations and maintenance (O&M).

TABLE 1-1
Operable Units at the Del Amo Superfund Site
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| OU | Description | Status of Remedy Selection and Implementation | Evaluated in this Five-Year Review? |
|---|---|---|---|
| **Waste Pits OU 2** | Addresses constituents in the vadose zone in a four-acre area at southern end of the site. | The ROD was issued in 1997. Portions of the remedy have been implemented. | **Yes** |
| **Groundwater OU 3** | Addresses groundwater located at the Montrose Chemical and Del Amo Superfund sites. Includes remediation of the dissolved phase, and hydraulic containment surrounding NAPL and other contamination sources. | ROD for Dual Site Groundwater Operable Unit, Montrose Chemical and Del Amo Superfund Sites (Groundwater ROD) issued by USEPA in March 1999 (USEPA 1999a). The remedial action selected by this ROD has not yet been implemented. Work is in the remedial design stage. | No |
| **Soil and NAPL OU 1** | Addresses soil and NAPL in areas of the site that are not already addressed in the Waste Pits ROD. | A remedy has not been selected. This OU is currently in the RI/FS stage. | No |

The selected remedy is intended to address contaminated soil and soil gas and reduce the impact from contaminated soil gas in the vadose zone to groundwater. This is the first five-year review for the Waste Pits OU and was triggered by the initiation of implementation of portions of the selected remedy, which occurred on May 27, 1999 (Parsons et al. 2000). This report evaluates the remedy objectives as stated in the ROD and the progress since the implementation of portions of the selected remedy.

This report is organized into sections that describe the history and setting of the Waste Pits OU, remedial action decision and implementation, and an evaluation the remedial action. These sections are:

- Section 2.0 discusses chronology of events at the Waste Pits OU.
- Section 3.0 discusses physical characteristics, land use, the history of contamination, basis for taking action, and initial response.
- Section 4.0 presents the remedial action implemented at the Waste Pits OU, current status of the remedy, and treatment system O&M activities and cost.
- Section 5.0 outlines activities performed during the five-year review process.
- Section 6.0 presents technical assessment of the remedial action implemented at the Waste Pits OU.
- Section 7.0 discusses Issues and recommendations for the Waste Pits OU.
- Section 8.0 provides a protectiveness statement for the Waste Pits OU.
- Section 9.0 presents identification of the schedule for the next five-year review.
- Section 10.0 provides list of works cited during the preparation of this document.

# 2.0 Site Chronology

Table 2-1 provides a chronology of events that have occurred at the Waste Pits OU.

TABLE 2-1
Chronology of Events at the Del Amo Waste Pits
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Date | Event |
|---|---|
| 1943 | Operation of styrene and butadiene plants commenced at Del Amo. |
| 1944 | Operation of synthetic rubber plant commenced at Del Amo. |
| 1945 | Disposal of waste generated during production of synthetic rubber to waste pits began. |
| 1955 | Disposal to Waste Pits 2-A through 2-F terminated. Pits filled. |
| 1969 | Disposal to Waste Pits 1-A, 1-B, and 1-C terminated. Waste pits filled and covered with vegetation. Former waste pits surrounded by a double row of chain-link fence. |
| 1969 to 1972 | Styrene, butadiene, and synthetic rubber plants were gradually shutdown. |
| 1972 | Observations of contamination in soil made in the vicinity of the former waste pits during geotechnical investigations associated with redevelopment activities. |
| 1981 | First environmental investigations performed under the direction of the California Department of Health Services to characterize soil and waste materials at the former waste pits. |
| 1982 to 1984 | Waste material and contaminated soil at Waste Pit 1-A excavated in four phases and disposed off-site. Void subsequently backfilled. |
| 1984 | Initial characterization data documented in *Draft Del Amo Site Investigation Phase 1 Report* (Radian 1984), *Interim Summary of Findings, Del Amo Site Investigation* (Dames & Moore 1984), and *Summary of Soil Data at the Western Waste Industries Del Amo Site, Lot 37* (Hekimian 1984). |
| 1985 to 1991 | Environmental investigations performed to support the early remedial investigation/feasibility study (RI/FS) of the Del Amo Site. Investigations performed under a Memorandum of Agreement between the State of California and the property owner, and subsequently under a State Administrative Order. Order terminated in 1991, at which time USEPA assumed regulatory responsibility for the site. |
| 1990 | Additional investigation performed at Waste Pits 1-B, 1-C, and 2-A through 2-F for purposes of treatability testing, including bench-scale analyses of thermal distillation, bioremediaion, solidification, and soil washing. |
| 1991 | USEPA proposed that Del Amo be added to the National Priority List and divided the site into three operable units – Groundwater, Waste Pits, and Soil and NAPL. |
| 1991 | A baseline risk assessment for the Waste Pits OU performed. |
| 1992 | USEPA, DTSC, Shell Oil Company, and Dow Chemical Company entered into an Administrative Order on Consent to perform an accelerated RI/FS for the Waste Pits OU. |
| 1992 | Treatability studies performed to test the effectiveness of SVE and bioventing in remediating volatile compounds in the vadose zone. |
| 1993 | *Phase 1 Remedial Investigation Report, Del Amo Study Area* (Dames & Moore 1993a) submitted. |

TABLE 2-1
Chronology of Events at the Del Amo Waste Pits
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Date | Event |
|---|---|
| 1994 | USEPA issued a Unilateral Administrative Order to the Shell Oil Company following the discovery of small areas of exposed waste at Waste Pits 2-A and 2-B. (USEPA subsequently issued a Notice of Completion for this Order in 1999.) |
| 1994 | Indoor/outdoor air monitoring performed at the Waste Pits OU and adjacent residences. |
| 1996 | *Final Focused Feasibility Study, Del Amo Waste Pits Area* (Dames & Moore 1996) submitted and approved by USEPA. |
| 1997 | The ROD for the Waste Pits OU issued. The selected remedy included a cap with SVE and treatment (assumed to be through thermal oxidation). |
| 1997 | Pursuant to section 105 of CERCLA, 42 USC § 9605, USEPA placed the site on the National Priorities List. |
| 1998 | Unilateral Administrative Order for Remedial Design issued to perform a remedial design for the remedy specified in the ROD for the Waste Pits OU. |
| 1999 | ROD for the Groundwater OU issued. |
| 1999 | *Prefinal Design Report* (Parsons et al. 1999b) submitted and approved by USEPA. |
| 1999 | *Operations, Monitoring, and Maintenance Manual for the Del Amo Waste Pits Operable Unit* (OM&M Manual) (Parsons et al. 1999a) submitted (for long-term operations, monitoring, and maintenance of the selected remedy at the Waste Pits OU). |
| 1999 | Evaluation of treatment technologies alternative to SVE with thermal oxidation commenced due to community concerns regarding potential generation of dioxin. |
| 1999 | Unilateral Administrative Order for Remedial Action issued to perform a remedial action in accordance with the ROD for the Waste Pits OU. |
| 1999 - 2000 | Components of the selected remedy (cap, SVE wells, cap gas collection and treatment system, drainage channels, and fence) installed, as documented in the *Remedial Action Report* (Parsons et al. 2000). A land-use covenant (LUC) recorded for one of the two parcels that compose the Waste Pits OU. |
| 2000 | Baseline monitoring for cap gas collection and treatment system performed. |
| 2000 to 2005 | Operation, monitoring, and maintenance of the cap, SVE wells, off-gas collection and treatment system, drainage channels, and fence performed in accordance with the OM&M Manual. |
| 2002 | An Explanation of Significant Differences (ESD) issued (USEPA 2002b). ESD specified the ARARs that apply to the use of adsorption treatment technology. |
| 2003 | Field pilot test for resin adsorption for vapor treatment on SVE system performed. |
| 2004 | Adsorption treatment technology with enhanced biodegradation evaluated. |
| 2005 | *Remedial Design Workplan Addendum for SVE* ($C_2$REM 2005a) submitted and approved by USEPA. Work plan proposes a combination of SVE and bioventing for treatment of contaminated soil vapor at the Waste Pits OU. Field design tests for the *in-situ* bioventing technology (IBT) performed. |
| 2005 | LUC recorded for the second of the two parcels that compose the Waste Pits OU. |

# 3.0 Site Background

## 3.1 Physical Characteristics

### 3.1.1 Site Description

The site is located in Los Angeles, California in a narrow strip of the city known as the Harbor Gateway. It is bordered to the west and east by the cities of Torrance and Carson, respectively, and is located approximately 10 miles north of the Pacific Ocean. The site is bounded by 190th Street to the north, Interstate 110 to east, Del Amo Boulevard to the south, and Normandie Avenue to the west. The Waste Pits OU is located at the southern end of the site, immediately north of Del Amo Boulevard. The location of the Waste Pits OU relative to the site is presented on Figure 3-1.

The site encompasses approximately 280 acres. The portion of the site that is the subject of this five-year review—the Waste Pits OU—is approximately 4 acres and covers two parcels. Six unlined pits (Waste Pits 2-A through 2-F) and three unlined ponds (Waste Pits 1-A through 1-C) are located within the Waste Pits OU, as presented on Figure 3-2. In addition, an evaporation pond was formerly located within the Waste Pits OU at a location immediately east of Waste Pit 1-A.

An electrical power transmission right-of-way borders the Waste Pits OU to the north; a Union Pacific right-of-way borders the Waste Pits OU to the south and runs through Waste Pit 1-A. A major underground petroleum and petrochemical pipeline corridor is located within the Waste Pit OU boundaries on the southern side of the property (Parsons et al. 1999b).

### 3.1.2 Surface Features

The site is located on a relatively flat alluvial plain (the Torrance Plain) (Dames & Moore 1990). A multi-layer cap is present at the Waste Pits OU and is covered with a vegetative cover consisting of naturally-occurring shallow rooted grasses. Surface drainage channels are located on the north and south sides of the cap to collect and divert rainfall from the cap. Surface water flows down the channels to catch basins located near the eastern side of the cap, and eventually to the storm sewer.[1] The location of the surface drainage channels and catch basins are presented on Figure 3-2. There are no surface water sources at the Waste Pits OU.

### 3.1.3 Geology

Alluvial deposits, consisting of sands, silts, and clays, extend hundreds of feet below ground surface at the site. Soil in the uppermost 100 feet at the site consists of stratified, heterogeneous, and unconsolidated silty clays, clayey silts, and sandy silts and clays (Dames

[1] From the catch basins, runoff is conveyed through 18- and 24-inch reinforced concrete pipelines that tie into the City of Los Angeles storm drain system at Vermont Avenue (Parsons et al. 1999a). A permit was obtained for this tie-in.

& Moore 1990). A cross-section of the upper 65 feet of soil in the vicinity of the waste pits is presented on Figure 3-3.

### 3.1.4 Hydrogeology

The following formations, summarized in Table 3-1, have been observed in the vicinity of the Waste Pits OU: (1) the upper Bellflower aquitard (UBF), (2) the middle Bellflower sand (MBF), (3) the lower Bellflower aquitard (LBF), and (4) the Gage aquifer. The middle Bellflower sand can be further subdivided into the middle Bellflower B sand (MBFB) and the middle Bellflower C sand (MBFC) units.

The greatest groundwater flow occurs within the MBF and the Gage aquifers, which are more permeable than other formations beneath the site. The water table intersects the MBFB unit near the western margin of the site. East of this demarcation, the UBF unit and the MBFB are considered separate units, while to the west, they are identical (Dames & Moore 1998). With exception of monitoring wells XMW-29 and PZL0021, wells in the vicinity of the Waste Pit OU fall to the east of the demarcation line, where the two aquifers are considered separate units. The Gage-Lynwood aquitard is present beneath the Gage aquifer and separates groundwater from the regional aquifers (the Lynwood and Silverado aquifers) (Dames & Moore 1993a, 1998).

Groundwater is present at the site at approximately 60 feet below ground surface (bgs) (within the UBF unit). Recharge and decreased groundwater extraction in the basin since the late 1970's has caused the groundwater elevation at the site to rise at a rate of approximately one foot per year (Dames & Moore 1998). Groundwater at the Waste Pits OU has a horizontal gradient of approximately 0.0025 foot/foot to the southeast (Dames & Moore 1998). The groundwater flow direction and hydraulic gradient of groundwater in the UBF are highly variable due to mounding. Hydraulic gradients can be as high as 0.0193 foot/foot in the vicinity of the Waste Pits OU. The specific cause of the groundwater mounding and high hydraulic gradients is unknown, but could be from a leaking water main.

TABLE 3-1
Formations Observed at the Waste Pits OU
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Formation | Approximate depth interval (feet bgs) | Notes |
|---|---|---|
| UBF | 0 to 80 | Comprised of mud with sandy zones, discontinuous sands. Low permeability. |
| MBFB | 80 to 100 | Stratified sands, shell beds, mud, continuous sand. |
| MBFC | 100 to 140 | Stratified sands, shell beds, mud, continuous sand. |
| LBF | 140 to 170 | Mud with sandy zones. Low permeability. |
| Gage Aquifer | 170 to 240 | Stratified sands, shelly beds, mud zones. |

Source: Dames & Moore 1993a.

## 3.2 Land Use

All but approximately 10 of the 280 acres that comprise the site have been developed for industrial and commercial uses, including light manufacturing, warehousing, and offices. The site is comprised of 62 separate parcels, not counting transportation corridors and rights-of-ways, with approximately 60 to 65 separate structures. There are five public streets within the site, and three others border the site. Two large freeways run within one block of the site on the north and east sides (Figure 3-1). Approximately 17,600 people live within 1 mile of the site.

The two parcels that comprise the Waste Pits OU are zoned for restricted light industrial uses (City of Los Angeles 2005).[2] While the waste pits have been filled and covered with 2 to 15 feet of soil, the area of the Waste Pits OU remains undeveloped (with exception to the treatment system that has been installed as part of the remedy for the Waste Pits OU).[3] The Waste Pits OU is bound by industrial and commercial development to the north, Vermont Avenue to the east, Del Amo Boulevard and a vacant lot to the south, and a vacant lot used for temporary storage to the west (Figure 3-2). Electrical power transmission easements run along the Waste Pits OU northern boundary, and two major underground petroleum and chemical pipeline corridors run along its southern boundary. Residences are located to the southeast and southwest of the Waste Pits OU.

## 3.3 History of Contamination

The Del Amo synthetic rubber plant consisted of three plancors (separate plants) dedicated to styrene, butadiene, and rubber assembly, formerly operated at the site. Synthetic rubber was produced by manufacturing styrene and butadiene separately, piping them to the rubber plant, and then mixing the two together (Dames & Moore 1990). Chemicals used in the production of styrene include propane, crude benzene, toluene, ethylbenzene, a caustic, hydrochloric acid, and sulfuric acid, among others. Chemicals used in the production of butadiene include butane, and butylenes, among others.

The plants operated from approximately 1943 to 1972. During this period, some of the waste generated during operation of the plants was disposed at the waste pits located in the Waste Pits OU. The waste pits consist of four unlined evaporation ponds (referred to as Waste Pits 1-A, 1-B, and 1-C and the eastern evaporation pond) and six unlined waste pits (referred to as Waste Pits 2-A through 2-F). The 1-series waste pits received aqueous waste, and the 2-series waste pits received semi-viscous to viscous wastes. Materials disposed of at the 1-series waste pits include acid sludge, kaolin clay, lime slurry, and petroleum hydrocarbons. The 2-series waste pits received an aluminum chloride complex containing petroleum hydrocarbons. The 2-series waste pits also received heavy impurities and tars, including sulfur tars from the styrene purification process (Dames & Moore 1996). As presented on Figure 3-2, the 1-series waste pits were larger in extent than the 2-series waste pits. However, the 2-series waste pits were considerably deeper (17 to 22 feet bgs) than the 1-series waste pits (approximately 6 feet bgs) (Dames & Moore 1990).

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[2] The site comprises two parcels with assessor parcel numbers 7351-034-077 and 7351-034-078.

[3] Waste material in Waste Pits 1-B and 1-C is covered with 2 to 4 feet of soil, and Waste Pits 2-A through 2-F are covered with 3 to 15 feet of soil.

Environmental investigations of the waste material, soil, soil gas, and groundwater commenced in 1981, after observations of contamination were made during geotechnical investigations performed in the 1970s (Dames & Moore 1993a). Investigations were performed through 1991 to support the RI/FS for the Waste Pits OU. In addition, indoor and outdoor air monitoring was performed at the Waste Pits OU and adjacent residences in 1994 to support the human health risk assessment. The air data were used to determine if volatile organic compounds (VOCs) were migrating to air (above the waste pits and in and around the residences) at concentrations that would pose a potential risk to current and future receptors. The results of the remedial investigation and baseline risk assessment were presented in the *Final Focused Feasibility Study Report, Del Amo Waste Pits Area in December 1996* (Final FFS Report*)* (Dames & Moore 1996).

## 3.4 Initial Response

The following two initial response actions were taken before the Waste Pits ROD was issued in 1997:

1. Waste material and soil at Waste Pit 1-A was excavated from 1982 through 1984, under State oversight, at depths ranging from 6 to 25 feet bgs. The material was disposed off-site at an appropriate hazardous waste facility. Approximately 8,000 cubic yards of waste and 12,000 cubic yards of contaminated soil were removed (Dames & Moore 1996). The void was backfilled with soil in 1985 following regulatory approval (Dames & Moore 1996). Based on confirmation samples collected from the base of the excavation, contaminated soil likely remains beneath the backfill at Waste Pit 1-A.

2. USEPA issued a Unilateral Administrative Order to the Shell Oil Company following the discovery of small areas of exposed waste at Waste Pits 2-A and 2-B in July 1994. Under this Order, Shell was required to secure the Waste Pits, perform routine inspections of the Waste Pits OU, and address seeps of waste material from the Waste Pits. This Order was carried out until September 1999, at which time USEPA issued a Notice of Completion.

## 3.5 Basis for Taking Action

An RI/FS was initially performed at the Waste Pits OU under the direction of DTSC and later under the direction of the USEPA. The Waste Pits OU was characterized through a series of investigations. The results of previous environmental investigations indicate that waste material and adjacent soil and soil gas at the Waste Pits OU is contaminated with VOCs and semivolatile organic compounds (SVOCs), as a result of former uses of the waste pits. Benzene, a VOC and known human carcinogen, is the hazardous substance detected most frequently and at the greatest concentrations at the Waste Pits OU. Of the SVOCs, naphthalene has been detected at the greatest concentrations and at the greatest frequency in waste material and soil. An estimated 15,600 and 17,100 cubic yards of waste material and heavily-contaminated soil, respectively, remain in place at the Waste Pits OU (USEPA 1997a). Analytical data indicate that the extent of contamination is generally limited to soil and soil gas beneath the footprint of the waste pits; VOCs have been detected at low

concentrations in shallow soil gas surrounding the waste pits,[4] and VOC concentrations in soil decrease with distance from the pits.[5] Soil and soil gas extending from beneath the waste pits to the water table (located at approximately 60 feet bgs) contain elevated concentrations of VOCs.

Groundwater beneath and downgradient of the former waste pits is also impacted. VOCs and SVOCs—in particular benzene, ethylbenzene, naphthalene, and phenol—are the primary constituents in groundwater near the Waste Pits OU. These analytes are mobile, and readily migrate from soil and soil gas to groundwater via infiltration. Benzene is the most prevalent VOC detected in groundwater and is the primary contaminant of concern due to its broad distribution, high concentrations, and known toxicity. Though the concentrations of ethylbenzene at discrete monitoring locations are significantly lower than those of benzene, the distribution is similar. Ethylbenzene was historically used in the same plant production processes as benzene. Similarly, the location of the maximum detected concentration of phenol, the most commonly-detected SVOC in the area, coincides with an area of maximum benzene concentration. Phenol is believed to result from degradation of benzene (Dames & Moore 1998).

The highest concentrations of VOCs and SVOCs were detected in groundwater samples collected from wells upgradient of the waste pits, in particular at wells PZL0020, PZL0019, XMW-29, and PZL0021. The benzene distribution suggests that a benzene plume originates along the southeastern edge of the waste pits in the MBFC aquifer, and that benzene concentrations decrease within short distances downgradient of well SWL0040 (URS 2004).

Data collected during previous investigations suggest that light non-aqueous-phase liquid (LNAPL), composed primarily of benzene, is present within the boundaries of the Waste Pits OU and is in contact with groundwater beneath the site. LNAPL is suspected of being located beneath the groundwater table trapped in sediment pore spaces within the fine-grained sediments of the Bellflower aquitard (Dames & Moore 1998). LNAPL serves as a potential source of soil vapor contamination beneath and surrounding the pits.

The baseline health risk assessment presented in the Final FFS Report (Dames & Moore 1996) concluded that contaminants present at the Waste Pits OU do not pose an unacceptable risk to potential receptors. However, there was a possibility that a release of hazardous substances would occur in the future. Specifically, if the waste pits were disturbed, significant emissions of VOCs could be released to the atmosphere. A remedial action was therefore determined to be warranted to protect potential human receptors from exposure to constituents in the waste pits.

Because analytical data for groundwater samples collected upgradient, downgradient, and at the Waste Pits OU suggested that volatile contaminants are migrating from soil in the Waste Pits OU to groundwater (including groundwater in aquifers that are used as a domestic water supply), remedial action was determined to be warranted. The groundwater flows towards current municipal supply wells, but site-related contamination had not reached those wells.

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[4] Contamination in soil gas extends no more than 70 feet from the edge of the pits at the 4- to 16-foot depth interval (Dames & Moore 1996).

[5] With exception to Waste Pit 2-D, benzene in soil attenuates within 50 feet away from the pits (Parsons et al. 1999b).

A remedial alternative was selected, as presented in the following section, to address the potential risk caused by constituents in the waste pits and surrounding soil and to reduce the impact to groundwater.

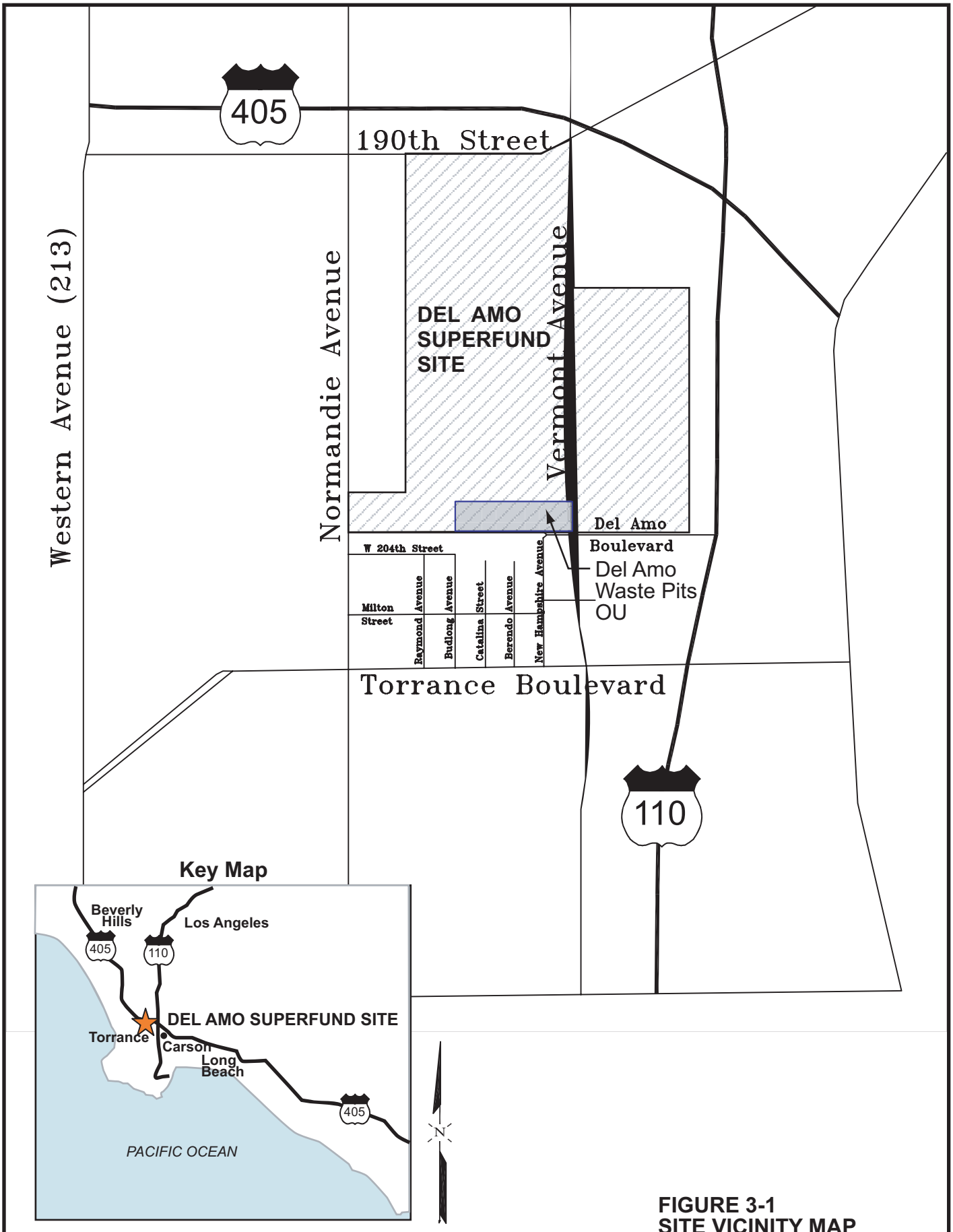
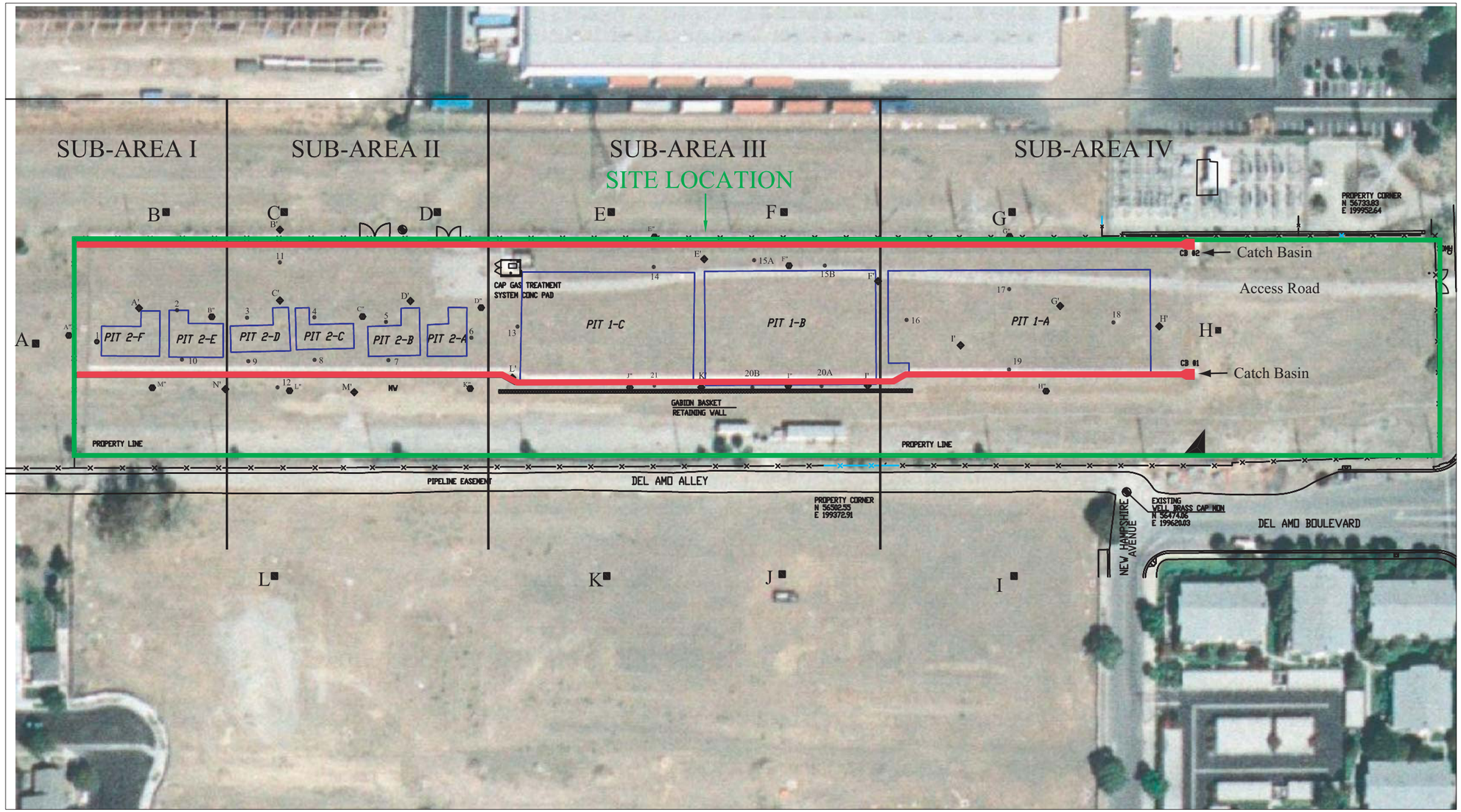



**FIGURE 3-1**
**SITE VICINITY MAP**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA

Source: C2REM 2005




LEGEND

- Soil Vapor Extraction (SVE) Concentration Monitoring Cluster
- Soil Vapor Extraction (SVE) Pressure and Performance Standard Well Location
- Soil Vapor Extraction (SVE) Well Location
- Soil Vapor Extraction (SVE) Perimeter Well Location
- Pit 1-C — Estimated Extent of Former Waste Pit
- Waste Pits OU Boundary
- Sub-Area Delineations
- Surface Water Drainage Channels

SOURCE: C2REM 2005

**FIGURE 3-2**
**SITE LAYOUT**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA

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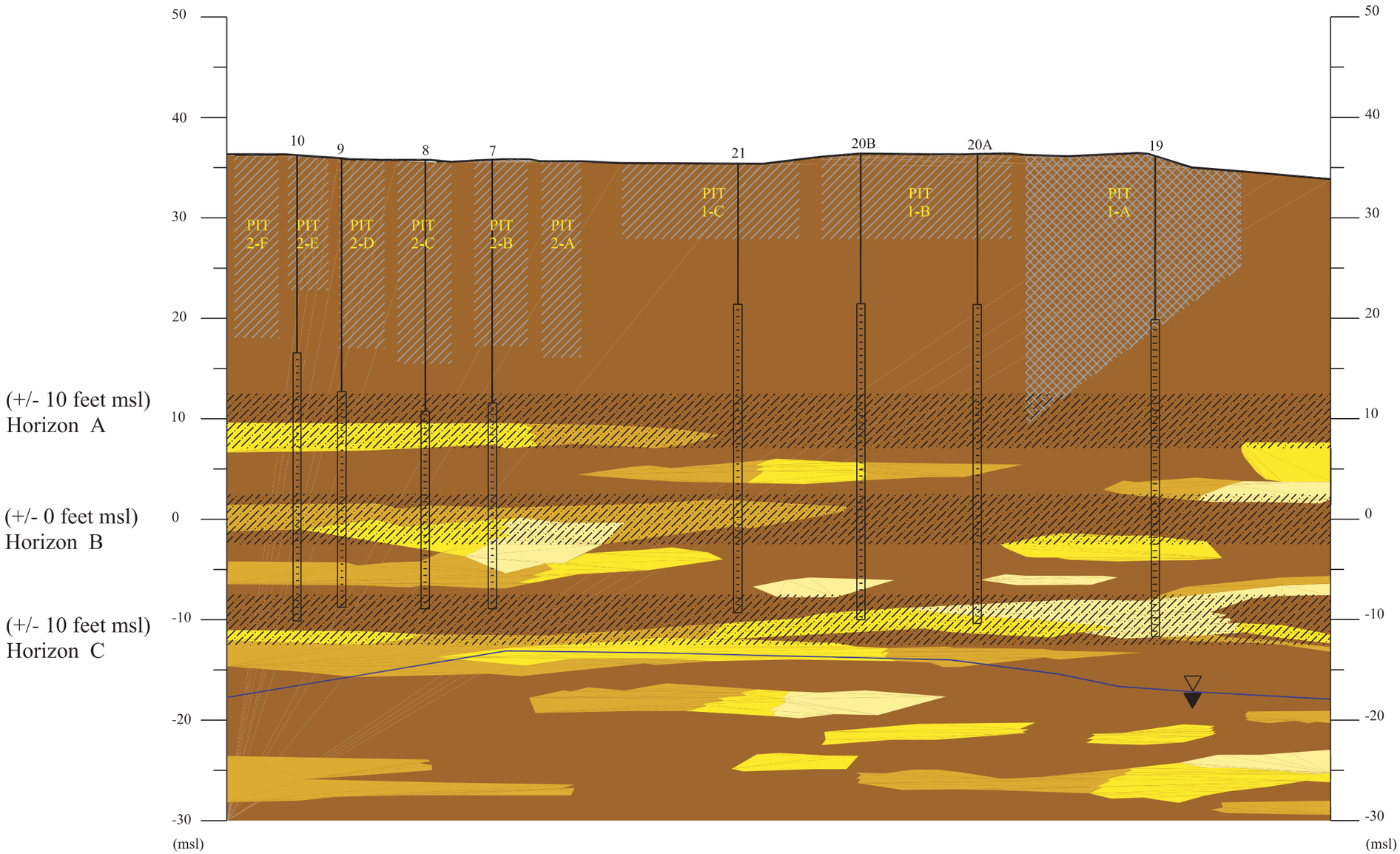
175847.RO.01 _Fig 3-2 Site Layout_7/13/05_ez




| Lithotype | Tip Resistence Range | Estimated Horizontal Hydraulic Conductivity (KH) |
|---|---|---|
| Sand | >275 tsf | >2E+00 ft/day (8E-04 cm/sec) |
| Silty Sand to Sand | 175-275 tsf | 1E-01 to 2E+00 ft/day (4E-05 to 8E-04 cm/sec) |
| Sandy Silt to Silty Sand | 125-175 tsf | 2E-02 to 1E-01 ft/day (9E-06 to 4E-05 cm/sec) |
| Silt | <125 tsf | <E-02 ft/day (9E-06 cm/sec) |

Waste Pit (projected approximately 100 feet south onto cross section)

Pit 1-A Fill (projected approximately 100 feet south onto cross section)

Facies Change

Estimated January 1997 Water Table

Horizon Delineation Zones

**Hydrology Reference:** Preliminary Draft Hydrostratigraphic Model, Dames & Moore, February 4, 1998

**SVE Location Reference:** Final Design Report Drawings - Appendix C, Parsons Engineering Science, et al, April 9, 1999

**Note:** Southern Extraction Wells Projected Between 50 and 75 Feet Onto Hydrostratigraphic Cross Section

SVE Well

Screen Interval

SOURCE: C2REM 2005

**FIGURE 3-3**
**GEOLOGIC CROSS-SECTION**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA



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# 4.0 Remedial Actions

The following section summarizes the remedial actions that have been selected and implemented at the Waste Pits OU. The remedial action selected for the Dual-Site Groundwater OU, as it pertains to groundwater beneath the waste pits, is also summarized but is not evaluated in this five-year review.

## 4.1 Remedy Selection

Based on the evaluation of remedial alternatives presented in the Final FFS Report (Dames & Moore 1996), the USEPA selected a remedy for the Waste Pits OU in the Waste Pits ROD (USEPA 1997a). The ROD was issued by USEPA on September 5, 1997. The remedial action objectives were identified in the Final FFS Report, and included:

1. Protecting nearby residents from migration of gases from the pits, from atmospheric migration of contaminated dust, and other direct contact with the waste.
2. Protecting future groundwater users from constituents that may leach out of the pits in the future.
3. Protecting future groundwater users from downward advective and dispersive transport of constituents already in the soils below the pits and above the water table.
4. Protecting future groundwater users from constituents already in the soil below the pits and above the water table, in the event that the water table rises into the contaminated soil.

The remedy selected for the Waste Pits OU included installing a RCRA-equivalent cap and performing soil vapor extraction beneath the waste and adjacent contaminated soil above the water table. Additional components of the selected remedy included surface water drainage, security fencing around above-ground treatment equipment, deed restrictions, and long-term monitoring and maintenance. This alternative was determined to be the most appropriate alternative to address, on an interim basis, the contribution of the Waste Pits OU to contamination in groundwater.

The interim remedy was made final in the *ROD for Dual Site Groundwater Operable Unit Montrose Chemical and Del Amo Superfund Sites* (Groundwater ROD) issued in March 1999 (USEPA 1999a). The Groundwater ROD established a technical impracticability waiver for the groundwater underlying the Waste Pits, which means that the groundwater beneath the Waste Pits will not be restored to drinking water standards. However, USEPA concluded in the Groundwater ROD that the interim remedy selected in the Waste Pits ROD was appropriate as a final remedy, since it would remove or contain, to the extent practicable, contaminant sources present in the vadose zone beneath and surrounding the Waste Pits which contribute to the groundwater contamination.

### 4.1.1 Remedy for Waste Pits OU

The following sections present a summary of the components of the selected remedy, as identified in the Waste Pits ROD (USEPA 1997a).

#### 4.1.1.1 RCRA-equivalent Cap, Cap Gas Collection and Treatment System, and Associated Monitoring

The selected remedy included construction of a RCRA-equivalent cap over the waste and contaminated soil. The cap was to cover slightly less than 4 acres and be applied over Waste Pits 1-A, 1-B, 1-C, 2-A, 2-B, 2-C, 2-D, 2-E, and 2-F.[6] The cap includes a surface water drainage layer, a low-permeability layer, and a gas collection layer. The objectives of the cap are to prevent: (1) direct human contact with constituents; (2) generation of uncontrolled runoff and wind-blown dust; (3) the emission of constituents into the air; (4) rainwater from washing through the waste pits and carrying constituents into the groundwater; and (5) rainwater from washing through the contaminated vadose zone soils below the pits and carrying constituents into the groundwater. The cap was designed with surface water controls to prevent water from ponding on the surface and to prevent runoff onto adjacent properties.

A cap gas collection and treatment system was included to address VOCs that would collect in soil gas within the cap. The selected remedy included long-term inspection, operation, monitoring, maintenance, and repair of the cap and cap gas collection and treatment system, consistent with the OM&M Manual (Parsons et al. 1999a). The requirements identified in the OM&M Manual are part of the approved remedy for the Waste Pits OU.

The OM&M Manual identifies a criterion of 5 parts per million by volume (ppmv) for VOCs and SVOCs in exhaust from the cap gas collection and treatment system. This criterion was developed to assure compliance with the South Coast Air Quality Management District's (SCAQMD) Rule 1401, which requires that the potential human health risk from carcinogenic compounds be less than $1 \times 10^{-5}$ (Parsons et al. 1999a).

#### 4.1.1.2 Soil Vapor Extraction and Associated Monitoring

A second component of the selected remedy was the design, installation, operation, and long-term monitoring and maintenance of an SVE system, to remove volatile constituents from soil and thus limit migration into groundwater. The objectives of the SVE system are to protect groundwater from: (1) constituents that migrate out of the pits; (2) constituents that migrate out of the vadose soil below the pits; and (3) constituents in the soil below the pits in the event that the water table rises into the contaminated soil.

The depth of the SVE application was to be between the capillary fringe above the water table (located at approximately 60 feet bgs) and just below the bottom of each waste pit (located at depths ranging from 6 to 22 feet bgs). The areal extent of the SVE application was to extend across the waste pits themselves and laterally beyond the boundaries of the waste. It was estimated that the volume of soil within which the SVE system would be

[6] Analytical results for samples collected from borings within the eastern evaporation pond located east of Waste Pit 1-A indicate that soil at the former Eastern Evaporation Pond is not contaminated (Dames & Moore 1993a). USEPA consequently concluded that no remedial action is warranted at the former Eastern Evaporation Pond (USEPA 1997a).

applied is approximately 317,000 cubic yards. The SVE was not to be applied to the waste itself.

Thermal oxidation was selected in the remedial design as the vapor treatment component of the SVE system. Thermal oxidation was selected over other treatment options based on: (1) being a proven technology, (2) having a higher destruction removal efficiency, (3) capacity to treat the required flow needed, and (4) overall cost effectiveness (Parsons et al. 1999b).

The Waste Pits ROD identified methods for calculating performance standards for the SVE system. The performance standards were based on not allowing the waste pits contamination to cause any further groundwater contamination beyond 0.5 percent of the existing groundwater contaminant concentrations. During the design phase, remediation and contingency goals were established for each sub-area in accordance with this requirement. The remediation and contingency goals are presented in Table 4-1. Monitoring data was to be collected following 3 to 6 months of system operation and compared to these goals to evaluate system performance (Parsons et al. 1999a).

TABLE 4-1
Remediation and Contingency Goals for Benzene in Soil Gas
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| | Sub-Area I | Sub-Area II | Sub-Area III | Sub-Area IV |
|---|---|---|---|---|
| **Remediation Goal (ppmv)** | 510 | 2,000 | 840 | 78 |
| **Contingency Goal (ppmv)** [a] | 4,300 | 17,000 | 7,200 | 700 |

[a] The contingency standard is defined as an upward constituent concentration gradient with an upper concentration limit of less than 60 percent of the constituent equilibrium concentration in groundwater (Parsons et al. 1999a).
Sub-Area I includes Waste Pits 2-E and 2-F, Sub-Area II includes Waste Pits 2-A through 2-D, Sub-Area III includes Waste Pits 1-B and 1-C, and Sub-Area IV includes Waste Pit 1-A (Figure 3-2).

The SVE system was to be monitored through soil and soil gas monitoring, in accordance with the OM&M Manual (Parsons et al. 1999a). The OM&M Manual defines activities required for the long-term operation, inspection, monitoring, maintenance, and repairs of the SVE system.

#### 4.1.1.3 Surface Water Drainage

The selected remedy included the installation of two concrete channels located on the north and south margin of the waste pits cap to collect surface runoff and water coming from the drainage layer and convey it to two catch basins located at the eastern end of the cap. The channels were designed to accommodate capacity flows resulting from a 50-year/24-hour storm event (Parsons et al. 1999b). The surface water drainage structures are inspected and maintained in accordance with the OM&M Manual (Parsons et al. 1999a).

#### 4.1.1.4 Security Fencing

The selected remedy included installation of security fencing surrounding the SVE and cap gas collection-treatment systems. Fencing was to be inspected and maintained in accordance with the OM&M Manual (Parsons et al. 1999a).

#### 4.1.1.5 Deed Restrictions

To prevent inappropriate future land use or development, the remedy also required deed restrictions, prohibiting future residential use of the Waste Pits OU and prohibiting any future use that could impact the integrity of the cap.

### 4.1.2 Remedy for Dual-Site Groundwater OU

The remedy for groundwater is not evaluated in this five-year review. However, the Dual Site Groundwater OU ROD included groundwater beneath the Waste Pits OU. Because the remedial action objectives for the Waste Pits OU involve the protection of groundwater, the remedy for the Dual Site Groundwater OU is relevant to the five-year review of the Waste Pits OU.

The remedy for groundwater at the Montrose Chemical and Del Amo Superfund Sites included containment of benzene, chlorobenzene, and trichloroethylene (TCE) plumes (both dissolved phase and NAPL) for an indefinite period within a containment zone and reduction of dissolved-phase contaminant concentrations outside of the containment zone. The dissolved-phase benzene, chlorobenzene, and TCE plumes inside the containment zones were to be contained through a combination of groundwater extraction and treatment, and monitored intrinsic biodegradation. Groundwater within the containment zone is subject to a technical impracticability waiver. The areas that are subject to the technical impracticability waiver are presented on Figure 4-1. Due to the presence of LNAPL (benzene) beneath the waste pits, groundwater in the UBF, MBFB, and MBFC units at the Waste Pits OU is within the containment zone and is therefore subject to the technical impracticability waiver.

Constituent concentrations in groundwater outside of the containment zone were to be reduced to *in-situ* groundwater standards through groundwater extraction and treatment. The in-situ standards are lower of the state or federal maximum contaminant limits (MCLs) or, when MCLs have not been identified for a particular analyte, USEPA preliminary remediation goals (PRGs).

### 4.1.3 Post-ROD

After the Waste Pits ROD was signed, USEPA issued a Unilateral Administrative Order on May 5, 1998 (USEPA 1998) that directed Shell Oil Company and Dow Chemical Company to perform a remedial design for the Waste Pits OU remedy. During the remedial design, a range of vapor treatment technologies were evaluated in response to community concerns regarding thermal oxidation. A pilot test was performed to evaluate the effectiveness of adsorption technology with on-site regeneration as an alternative to thermal treatment. Because this technology was not included in the Waste Pits ROD, ARARs related to this technology had not been fully evaluated. Consequently, an ESD (USEPA 2002b) was issued on August 13, 2002 to add ARARs for the adsorption technology to the Administrative Record for the Waste Pits OU (USEPA 2002a).

## 4.2 Remedy Implementation

Remedial design of the selected remedy commenced following issuance of the Waste Pits ROD in 1997, in compliance with the requirements of the Administrative Order for Remedial Design issued in 1998. The *Prefinal Design Report* (Parsons et al. 1999b) was issued in February 1999 and finalized in April 1999. Implementation of the selected remedy commenced on May 27, 1999 in accordance with the Administrative Order for Remedial Action.

### 4.2.1 Phase 1 Remedy Implementation

A RCRA-equivalent cap and an off-gas collection and treatment system were installed as part of Phase 1 of the remedy implementation between May 1999 and February 2000. These components of the remedy were implemented in accordance with the *Prefinal Design Report* (Parsons et al. 1999b) and the *Construction Quality Assurance Plan* (Parsons et al. 1999c). Other remedy components installed during Phase 1 include surface water controls and security fencing. The following section describes the implementation of these remedy components. The final inspection of the remedy was performed on February 10, 2000. On this date, USEPA determined that Phase 1 of the remedy implementation was constructed in accordance with the Waste Pits ROD (Parsons et al. 2000).

#### 4.2.1.1 RCRA-Equivalent Cap

From bottom to top, the subsurface cap consists of: (1) a compacted soil foundation layer, (2) a 6-inch gas collection sand layer with high-density polyethylene (HDPE) collection piping, (3) an impermeable geosynthetic clay liner (GCL), (4) a 40-mil impermeable very flexible polyethylene (VFPE) geomembrane, (5) a non-woven geosynthetic drainage layer, (6) a 3-foot layer of cover soil, and (7) a topsoil layer vegetated with native grasses. A cross-section of the cap is presented on Figure 4-2. A vertical gabion retaining wall was installed along the southern side of the cap to prevent erosion from the cap to the area south of the cap (Figure 3-2).

The cap was constructed with few obstacles. However, shallow tarry waste was encountered in the subsurface during installation of anchor trenches for the cap. This waste was consistent with the waste present in the Waste Pits. The waste was subsequently deposited within one of the Waste Pits, beneath the cap.

#### 4.2.1.2 Cap Gas Collection and Treatment System

Soil gas is collected within the RCRA-equivalent cap through a 4-inch-diameter perforated HDPE pipe in the 6-inch cohesionless sand layer (immediately above the soil foundation). Following construction of the cap, the above-ground components of the cap gas collection and treatment system were installed (at the location presented on Figure 3-2). Soil gas is extracted with a 5-horsepower regenerative extraction blower and treated by a carbon treatment system consisting of a vapor-liquid separator and two carbon canisters in series. Approximately two pore volumes are extracted from the sand layer daily. Following treatment, approximately 90 percent of the soil gas is returned to the sand layer. Ten percent of the soil gas is exhausted to the atmosphere.

#### 4.2.1.3 Surface Water Drainage

Following construction of the cap, the concrete drainage channels were installed on the north and south sides of the cap at the locations presented on Figure 3-2. Surface grading was performed (to a maximum grade of 2 percent) to direct surface runoff into the drainage channels and storm drains. Catch basins were installed at the eastern end of the cap.

#### 4.2.1.4 Security Fencing

New sections were added to existing sections to complete a 6-foot chain-link security fence around the perimeter of the Waste Pits OU, and an 8-foot security fence with barbed wire and vinyl slats was installed around the gas treatment system pad (Figure 3-2) (Parsons et al. 2000).

### 4.2.2 Soil Vapor Extraction System

Phase 2 of the Waste Pits OU remedy, the SVE system, has not yet been installed. However, SVE wells and associated monitoring wells were installed prior to construction of the cap.[7] The locations of the wells are presented on Figure 3-2. Since completion of Phase 1, various remedial technologies have been evaluated to determine the technology that would best address VOCs in soil gas at the Waste Pits OU. A summary of the evaluations and studies performed since 2000 is presented in Section 6.3.

### 4.2.3 Institutional Controls

An LUC (Land Use Control) that prohibits unrestricted land uses and identifies environmental restrictions was recorded with the Los Angeles County Recorder's Office for the western parcel (APN 7351-034-077) of the Waste Pits OU on September 27, 2000 [8] (Signed by Del Amo et al. 2000). This parcel is owned by Triton Diagnostics, a subsidiary of Shell Oil Company (the Covenantor). Waste Pits 1-B, 1-C, 2-A through 2-F, and the 62 most westerly feet of Waste Pit 1-A are located within this parcel. A similar LUC was recorded for the eastern parcel (APN 7351-034-078) on May 27, 2005.[9] The eastern parcel is owned by Del Almo Landfill, LLC (the Covenantor). The remaining portions of Waste Pit 1-A and the former eastern evaporation pond are located within this parcel.

Copies of the LUCs were obtained through a title search and are provided in Appendix A. The LUCs are signed by the covenantors, DTSC, and USEPA as the third-party beneficiary. The LUCs:

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[7] Ninety-two wells have been installed throughout the Waste Pits OU. Twelve perimeter wells were installed to measure soil vapors laterally around the edge of the cap; 27 SVE wells were installed for future soil vapor extraction to determine the lateral distribution of contamination and to monitor pressure response; 13 cluster wells with three screen intervals each were installed to assess soil gas concentrations across the vertical profile; and 14 performance and pressure response wells were installed for purposes of monitoring the response from the vacuum created by soil vapor extraction.

[8] The western parcel encompasses Lot 36, the most westerly 62 feet of Lot 37, portions of Lot 13, and Rosemead Street. These lots are part of Tract 4671 of the City of Los Angeles, as shown in pages 30 and 31 of Book 56 of Maps stored in the office of the County Recorder for the County of Los Angeles. The LUC does not include a 100-foot strip of land along the northern border of Lot 36 that was acquired by the Los Angeles Department of Water and Power. This strip of land is located north of the northern fence line and data for perimeter wells on that property indicate low concentrations of VOCs are present.

[9] The eastern parcel encompasses Lot 37 of Tract 4671 of the City of Los Angeles and portions of adjoining Vermont Avenue but excludes the westerly most 62 feet of the lot and the northerly most 100-feet of land acquired by the Los Angeles Department of Water and Power. This strip of land is located north of the northern fence line and data for perimeter wells in that property indicate low concentrations of VOCs are present.

- Provide a legal description of the capped portion of the property.
- Restrict the use of the property and will run with the land.
- Identify the hazardous substances that are located on-site, as well as the affected media.
- State the restrictions associated with the site, including prohibiting use of the site as a hospital, school, day care, or for residential purposes and prohibiting disturbance to the cap, SVE system, or groundwater monitoring wells without notification to and approval by USEPA.
- Provide a description that must be included on all future deeds, leases, assignments, or other transfers for the property that communicates the restrictions associated with the property to future property owners or tenants.
- Identify provisions for site access and enforcement by DTSC and USEPA.
- Identify the right of entry for the entity responsible for performing operation and maintenance of the remedial system.

### 4.2.4 Groundwater

This five-year review does not address the Dual Site Groundwater OU directly. The remedial action for the Dual Site Groundwater OU has not yet been implemented. The remedy for the Dual Site Groundwater OU will address groundwater beneath the Waste Pits OU as well as within the overall "joint site" as defined by the Dual Site Groundwater Operable Unit ROD. As stated in Section 4.1.2, groundwater beneath the waste pits is subject to a technical impracticability waiver. Dissolved-phase constituents beneath the waste pits will be contained through hydraulic extraction and treatment and monitored intrinsic biodegradation. The remedial design for the selected remedy is underway and is expected to be complete in 2006. Following completion of the remedial design, construction of the well field and groundwater extraction and treatment system will commence. In the interim, groundwater monitoring is being performed in the vicinity of the Waste Pits. The results of recent groundwater monitoring in the vicinity of the Waste Pits OU are evaluated in Section 5.3.

The Groundwater ROD issued in 1999 pertains to dissolved-phase constituents and did not specifically address the recovery or migration of NAPL. A feasibility study is currently being performed to evaluate alternatives to address LNAPL at the Del Amo site.

## 4.3 Operation and Maintenance

Operation, maintenance, and routine monitoring of the Phase 1 components of the Waste Pits OU remedy have been performed since 2000 in accordance with the OM&M Manual (Parsons et al. 1999a). Table 4-2 presents a summary of the OM&M events for the Waste Pits OU. The table also presents any deviations

TABLE 4-2
Summary of Operations, Maintenance, and Monitoring Activities
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Event | Frequency Identified in OM&M Manual | Deviations from OM&M Manual | Notes |
|---|---|---|---|
| Cover Systems Inspection | Quarterly, after heavy rainfall, after seismic events, and after fires | Inspected monthly for first year of operation. | Monthly monitoring was performed for the first year of operation to identify any significant changes in cover system soil grade. Frequency revered to quarterly thereafter. |
| Cap Gas Collection and Treatment System Inspection | Quarterly | Inspected monthly for first quarter of operation.<br>Blower motor inspection frequency increased to bimonthly in January 2002. | Monitoring frequency increased to bimonthly in 2002 due to a blower motor failure in 2001. |
| Cap Gas Collection and Treatment System Monitoring | Periodic based on carbon use life cycle | System monitored bimonthly. | Results of monitoring used to assess the need for carbon canister change-out. |
| Cap Gas Confirmation Sampling | Annually | Discontinued annual sampling after second year. The next sampling events are scheduled for 2005 and 2010. | Based on the strong correlation value between field and laboratory analyzed data recorded during the second annual confirmation sampling event, a third annual confirmation sampling event was deemed unnecessary by the O&M contractor and USEPA ($C_2$REM 2002a; USEPA 2002c). The frequency of confirmation sampling decreased from annual to once every 5 years. |
| Surface Water Drainage Systems Inspection | Quarterly and after heavy rainfall | Inspected monthly for first quarter of operation. | |
| Subsurface Drainage Systems Inspection | Quarterly and after heavy rainfall | Inspected monthly for first quarter of operation. | |
| Security Fences Inspection | Quarterly and after seismic event | Inspected monthly for first quarter of operation. | |
| Access Road Inspection | Quarterly, after a seismic event, and after heavy rainfall | Inspected monthly for first quarter of operation. | |
| Settlement Monitoring | Monthly for first year, annually for years 2 through 5; after seismic event | Data was not collected during month of August 2000. | |
| SVE Perimeter Well Monitoring | Quarterly | Not regularly conducted from 2000 – 2003 after initial baseline monitoring.<br>Monitoring conducted quarterly since second quarter 2003. | Quarterly monitoring was determined to not be warranted between 2001 and 2003 because the SVE system was not operational.<br>USEPA requested that quarterly monitoring commence prior to startup of an SVE system (USEPA 2003). |
| Repairs | As required | | |

from the events and frequency of events specified in the OM&M Manual and the rationale for such deviation.

### 4.3.1 Cap Gas Collection and Treatment System

System startup and baseline monitoring of the off-gas collection and treatment system was performed in March 2000. Samples were collected from the system inlet and outlet and at the outlet of each of two carbon canisters that comprise the system. Samples collected during the first 5 days of system operation were submitted to a laboratory for analysis of VOCs and petroleum hydrocarbons and were also field monitored using a photoionization detector (PID) to determine the correlation between data recorded in the field and in the lab. The correlation analysis indicated a strong positive linear relationship between field and lab-derived data. The correlation coefficient was 0.72. The results of the field analysis were at or above the laboratory analysis results in 95 percent of the samples, indicating a more conservative result for the field analyses ($C_2$REM 2000a).

The following paragraphs summarize the results of monitoring that has been performed on the cap gas collection and treatment system since 2000.

#### 4.3.1.1 2000 Operation, Maintenance, and Monitoring

The *2000 Operations, Maintenance, & Monitoring Annual Report* ($C_2$REM 2002b) documents the results of the first year of operation (March 2000 through March 2001) of the cap gas collection and treatment system, as well as the results of inspections performed through March 2001. The effluent concentrations did not exceed the concentration limit identified in the OM&M Manual (5 parts per million [ppm]) during the year.[10] The system used up five changes of carbon canisters during the period ($C_2$REM 2002b).

#### 4.3.1.2 2001 Operation, Maintenance, and Monitoring

The second year of system operation (April 2001 through January 2002) was documented in the *2001 Operations, Maintenance, & Monitoring Annual Report* ($C_2$REM 2002a). Data from annual cap gas confirmation sampling were evaluated to determine the correlation between field- and lab-derived data following a year of system operation. A correlation coefficient of 0.94 was calculated, suggesting that the field-derived data closely model the laboratory data. The effluent concentrations did not meet or exceed 5 ppm during the period. Carbon canisters were replaced once during the period ($C_2$REM 2002a).

#### 4.3.1.3 2002 Operation, Maintenance, and Monitoring

The third year of system operation (January 2002 through January 2003) was documented in the *2002 Operations, Maintenance, & Monitoring Annual Report* ($C_2$REM 2003). The effluent concentration exceeded 5 ppm once during the period. An effluent concentration of 6.6 ppm was recorded on December 20, 2002. The carbon canisters were consequently replaced on January 3, 2003 ($C_2$REM 2003).

[10] An elevated concentration (6.8 ppmv) was detected once during the first year of operation, but is suspected of being erroneous due to a malfunction of the PID ($C_2$REM 2002a).

#### 4.3.1.4 2003 Operation, Maintenance, and Monitoring

The fourth year of system operation (January 2003 through December 2003) was documented in the *2003 Operations, Maintenance, & Monitoring Annual Report* ($C_2$REM 2004a). The effluent concentration exceeded 5 ppm three times during the period. Effluent concentrations of 5.2, 5.5, and 11.5 ppm were recorded on March 27, 2003, May 8, 2003, and June 12, 2003, respectively. The carbon canisters were replaced after the two latter effluent concentrations were detected (on May 9, 2003 and June 16, 2003, respectively), consistent with the protocol for carbon canister replacement approved by the USEPA (see below). The carbon canisters were replaced on four occasions during 2003 ($C_2$REM 2004a).

#### 4.3.1.5 2004 Operation, Maintenance, and Monitoring

The fifth year of system operation (January 2004 through December 2004) was documented in the *2004 Operations, Maintenance, & Monitoring Annual Report* ($C_2$REM 2005b). The effluent concentration exceeded 5 ppm two times during the period. An effluent concentration of 5.3 ppm was recorded on August 20, 2004 and December 9, 2004. The carbon canisters were replaced on two occasions during 2004 (on June 4, 2004 and August 24, 2004) ($C_2$REM 2005b).

#### 4.3.1.6 2005 Operation, Maintenance, and Monitoring

The results of operation, maintenance, and monitoring performed during 2005 have not been formally documented. However, annual cap gas confirmation sampling was performed on June 2, 2005 ($C_2$REM 2005c). Samples were submitted to a laboratory and were analyzed for VOCs using USEPA Method TO-15. In addition, field monitoring of the cap gas collection and treatment system was performed using a PID calibrated to benzene.

#### 4.3.1.7 Changes to Operation and Monitoring of Cap Gas Collection and Treatment System

The protocol for changing out the carbon canisters has been revised since installation of the cap gas collection and treatment system. Originally, the canisters were to be replaced when the efficiency of the system decreased to 60 percent (or 40 percent breakthrough). However, following an evaluation of data collected during routine monitoring of the system, and in an effort to optimize operation of the system, an alternate protocol for performing canister change out was developed and approved by the USEPA. A graphical presentation of the revised protocol is presented on Figure 4-3. When the observed influent concentration and lead carbon canister efficiency result fall within Zone 2 presented on Figure 4-3 for two consecutive monitoring events or fall within Zone 3 on Figure 4-3 during one monitoring event, both canisters are replaced ($C_2$REM 2003a). This revised protocol was developed and implemented in 2002. The protocol was revised in 2003 to give consideration to the effluent concentration (i.e., carbon canisters should be replaced when the effluent concentration exceeds 5 ppm and/or when the influent concentration and efficiency data fall within Zones 2 or 3 on Figure 4-3) ($C_2$REM 2004a).

#### 4.3.1.8 Vapor-liquid Separator

The purpose of the vapor-liquid separator was to remove any moisture or condensate created from the temperature and pressure differential from the inlet ambient air and collection pipe (Parsons et al. 1999a). Moisture and condensate have not been observed in the vapor-liquid separator during the 5 years of system operation ($C_2$REM 2005d).

### 4.3.2 Soil Vapor Monitoring

Baseline soil vapor monitoring data was performed in April 2000, as documented in *SVE Baseline Monitoring Results & Low Flow SVE Evaluation Report* ($C_2$REM 2000b). In accordance with that report, and because the SVE system is not yet in operation, subsequent monitoring was not performed at the SVE wells. However, in 2003 the USEPA requested that quarterly monitoring of the SVE wells along the perimeter of the Waste Pits OU be performed (USEPA 2003). Quarterly monitoring of the SVE perimeter wells commenced in second quarter 2003. Additionally, a follow-up full-scale monitoring event was conducted in November 2003 ($C_2$REM 2004b). Data collected during the baseline and follow-up monitoring events and during quarterly monitoring is evaluated in Section 5.3 and presented in Table 5-2.

### 4.3.3 Settlement Monitoring

Eight survey monuments are located within the footprint of the cap to monitor ground movement and settlement over time. The monuments were surveyed during 2000 (baseline), 2001, 2002, 2003, and 2005. Very little settlement was observed between the baseline and subsequent monitoring. A recommendation was consequently made to reduce the settlement monitoring frequency to every five years ($C_2$REM 2005b). Data collected during the baseline and most recent settlement monitoring events are evaluated in Section 5.3.

### 4.3.4 Irregularities and Unscheduled Maintenance Activities

Table 4-3 presents a summary of isolated occurrences that required unscheduled maintenance and/or repairs, as reported in annual OM&M reports. The issues identified (i.e., burrowing caused by animals, soil erosion, and equipment malfunction) have been remedied, as indicated in the table.

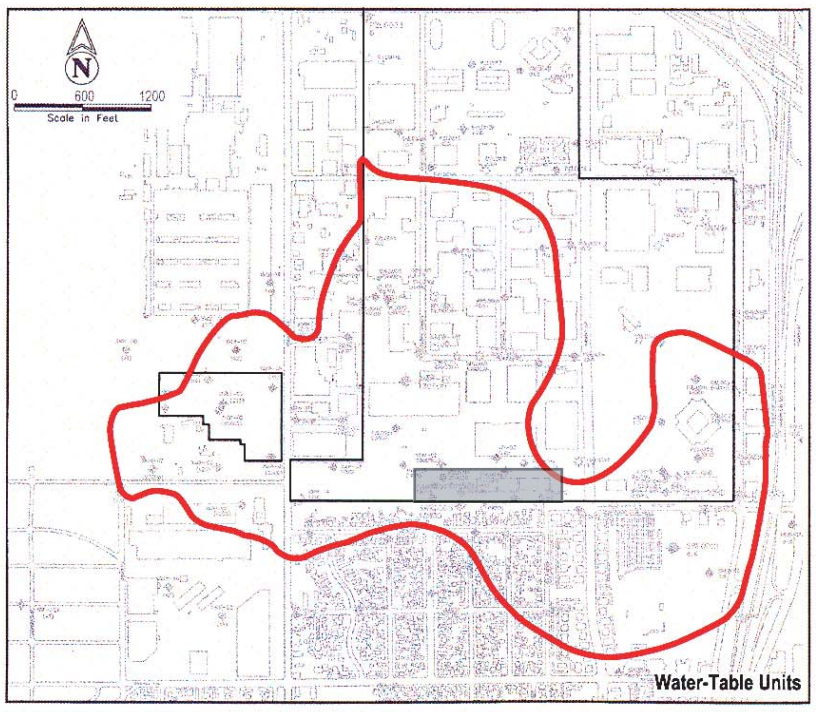
### 4.3.5 Operations, Maintenance, and Monitoring Costs

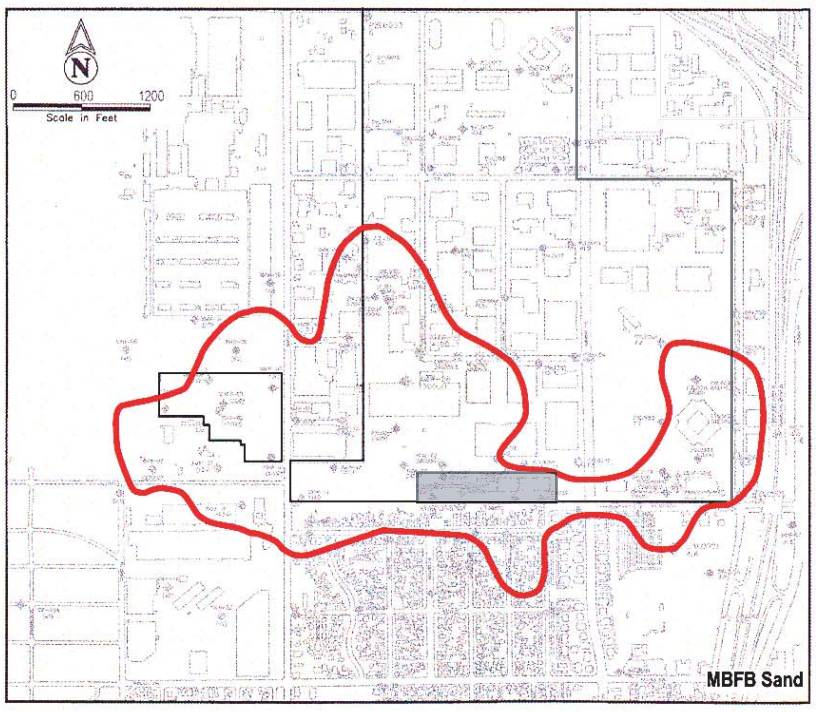
During development of the selected remedy, it was estimated that annual inspections, and annual OM&M costs would amount to $61,500 for a duration of 30 years [11] (Dames & Moore 1996). Based on information provided by the O&M contractor at the Waste Pits OU, the annual cost for OM&M of the components of the remedy that have been implemented is $250,000 ($C_2$REM 2005d). Actual costs for OM&M were not available for this five-year review.

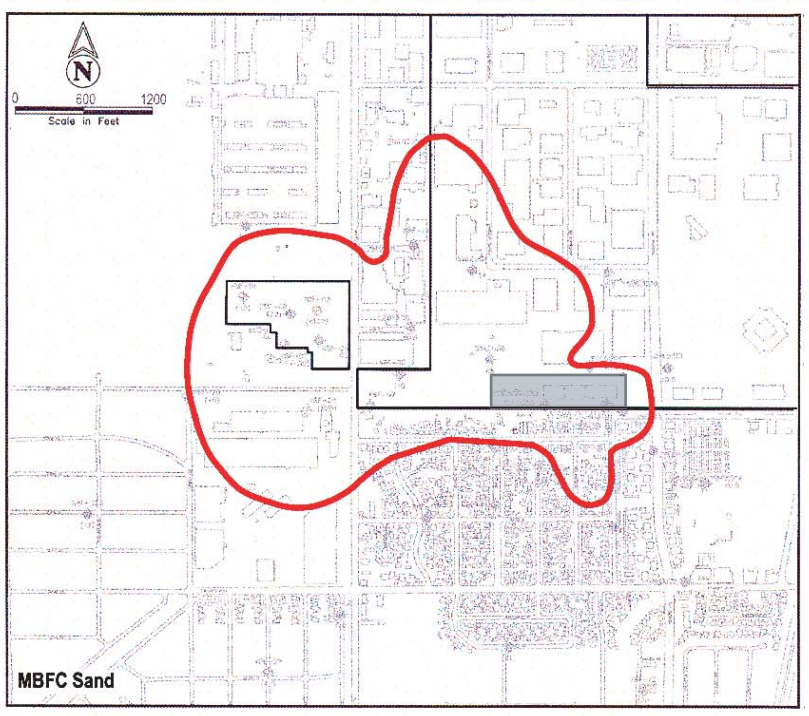
[11] Excluding estimated annual costs for operation, maintenance, and monitoring of the SVE system ($180,000) and groundwater monitoring ($30,000).

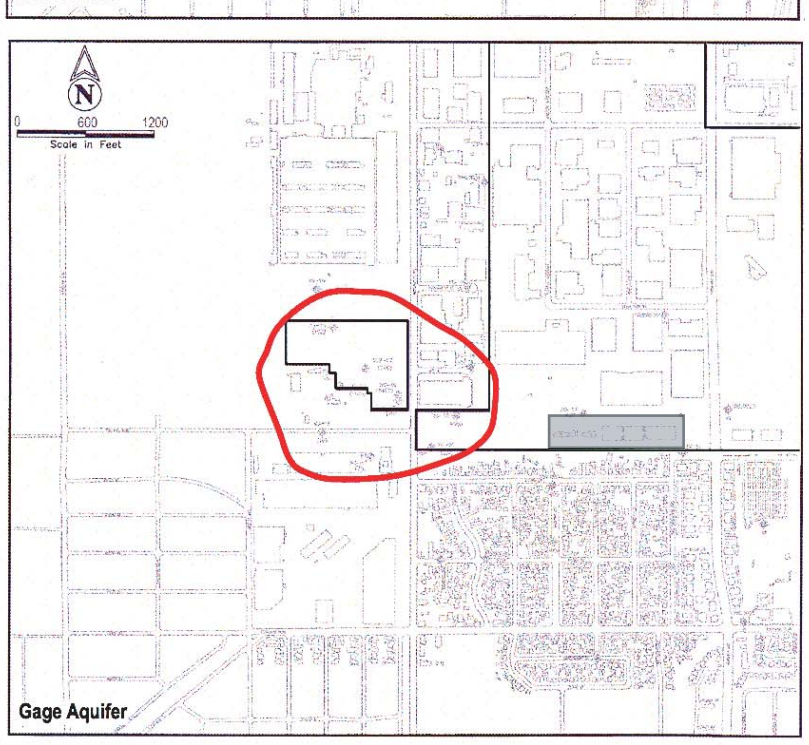
TABLE 4-3
Irregularities and Unscheduled Maintenance Activities
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Observation | Date | Explanation/notes | How Addressed/Maintenance Action |
|---|---|---|---|
| Underground tunnels in proximity to the cap | Periodically throughout last 5 years | Caused by of burrowing animals (gophers) | Bemus Landscaping, Inc. was contracted to eliminate rodent population. |
| Cap gas blower motor not operating | Intermittently between June 19, 2001 and January 21, 2002 (7 months) | | Blower motor replaced on February 11, 2002. Monitoring frequency of the blower subsequently increased from monthly to biweekly. |
| Recurring soil loss along eastern incline of cover system | May 2002 | Erosion due to inadequate rainfall drainage | Soil replaced on May 24, 2002, and a concrete weir box was constructed at the southern edge of the gravel access road to facilitate water flow. |
| Recurring soil loss in previously-identified problem areas of cover system | First quarter of 2003 | Recurring erosion due to heavy rain | Newly-placed soil was seeded with California native grass. Further mitigation was not required in 2003 or 2004. |



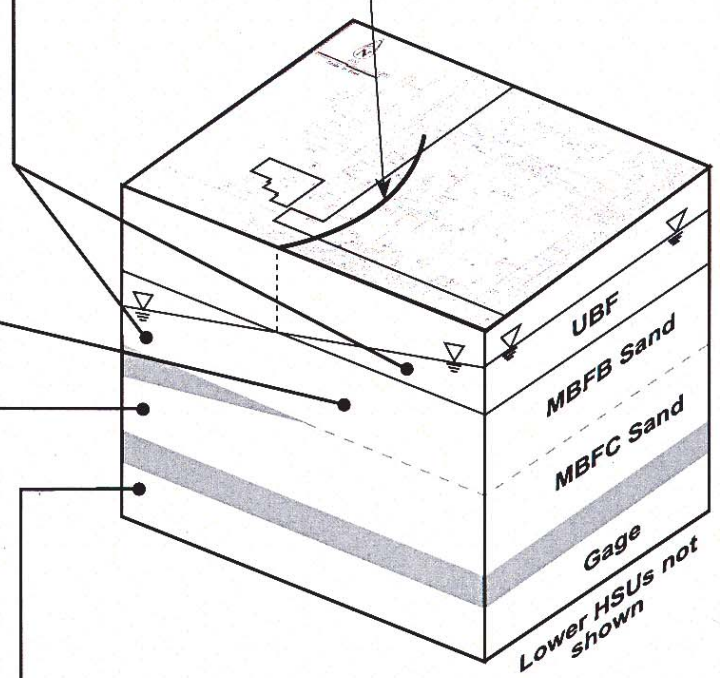

**Water-Table Units (UBF & MBFB)**

**MBFB Sand***

**MBFC Sand**

**Gage**

Approximate location of demarcation line, where Water Table crosses the contact between UBF and MBFB Sand.




* MBFB Sand is a water-table unit west of the demarcation line and is a confined aquifer east of the demarcation line

Waste Pits OU

Source: USEPA 1999

**FIGURE 4-1**
**AREA SUBJECT TO THE TECHNICAL IMPRACTICABILITY WAIVER**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA



CH2MHILL

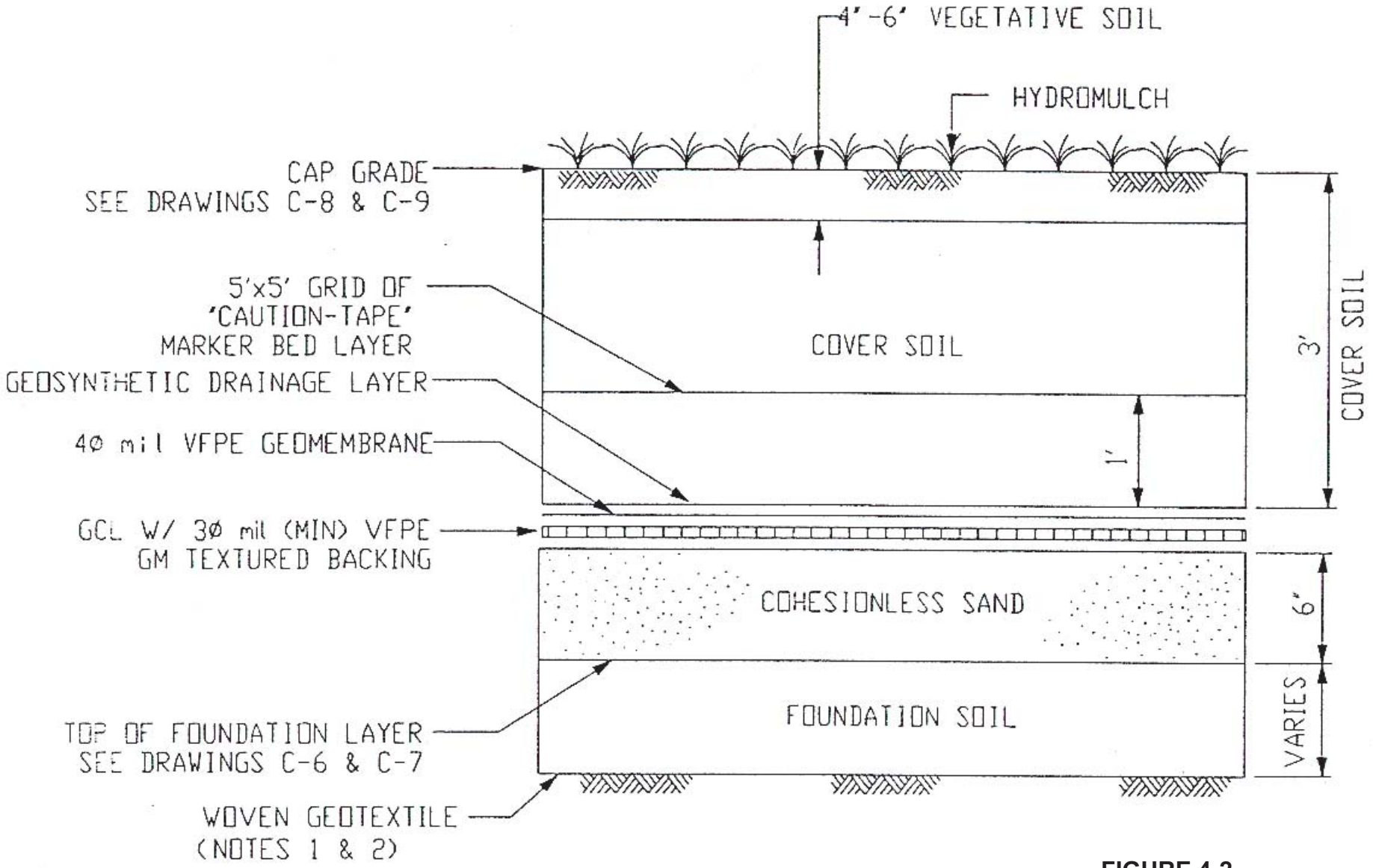
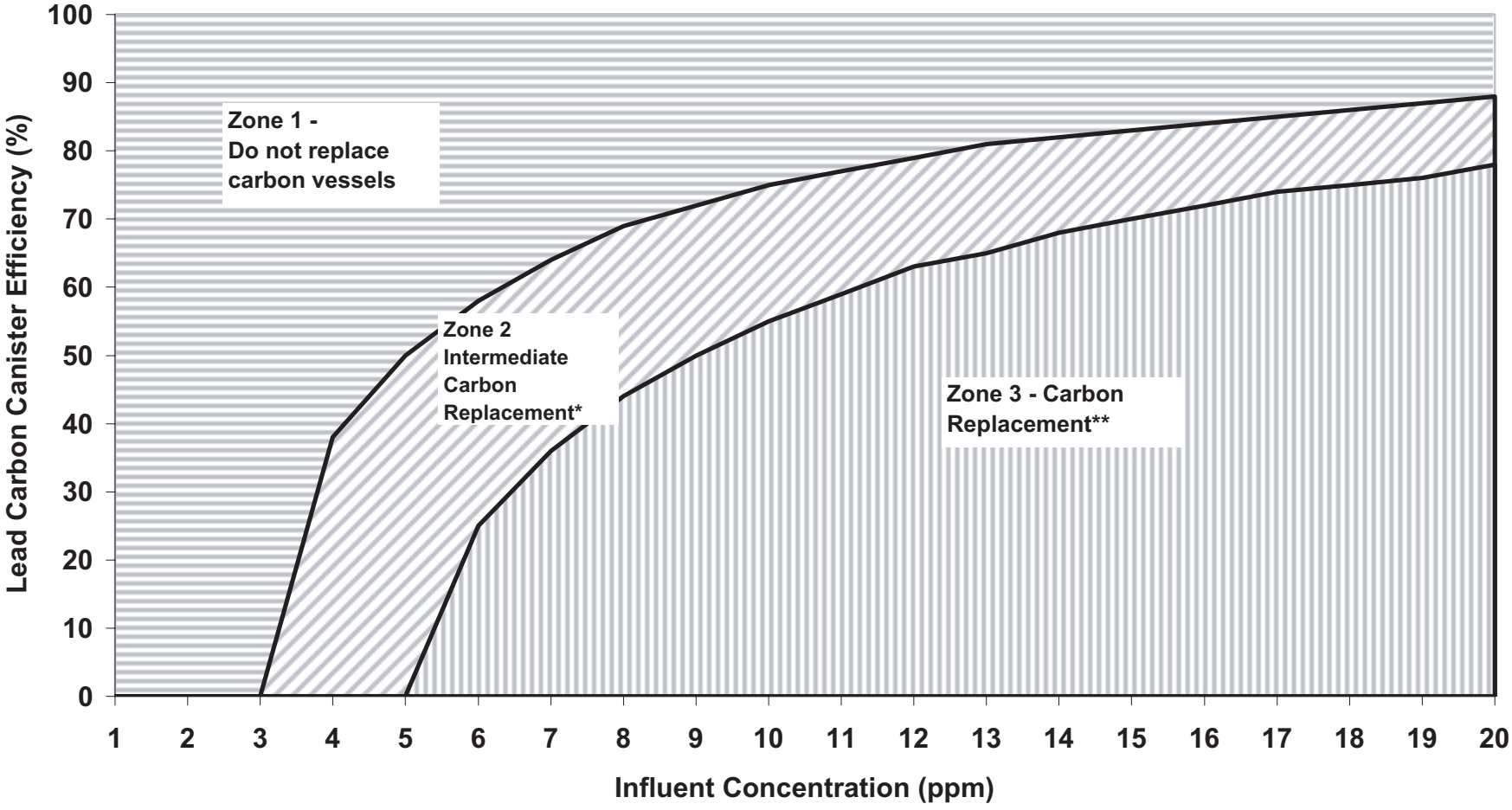



**FIGURE 4-2**
**CROSS-SECTION OF RCRA-EQUIVALENT CAP**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA

Source: Parsons 2000




* Two consecutive monitoring results within this zone indicate carbon vessel replacement

** One monitoring result within this zone indicates carbon vessel replacement

Source: C2REM 2003

**FIGURE 4-3**
**CARBON REPLACEMENT PROTOCOL**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA

CH2MHILL

# 5.0 Five-Year Review Process

The following sections discuss findings from the five-year review process.

Dante Rodriguez, USEPA Remedial Project Manager, led the Waste Pits OU five-year review. CH2M HILL provided technical support to USEPA for the review. The five-year review consisted of: a review of relevant documents, interviews with $C_2$REM (the O&M contractor), and a site inspection.

USEPA placed a notice, in English and Spanish, in local newspapers near the site on August 24 and 25, informing the public that it was conducting the five-year review, and inviting them to submit any thoughts or comments about the Waste Pits OU remedy to date. Following the release of this document, USEPA will produce and distribute a fact sheet to the community near the Waste Pits OU. The fact sheet will summarize the findings of the five-year review and instructions on how to access a copy of the review. The public will be able to submit to USEPA any comments or concerns about the remedy to date.

## 5.1 Document Review

As a part of the five-year review, CH2M HILL conducted a review of numerous documents related to site activities. The documents chosen for review primarily focused on progress since implementation of Phase 1 of the remedy (completed in 2000) but ranged in publication date from 1990 to 2005. Appendix B provides a list of the documents reviewed in compiling this report. One of the documents reviewed was a title search report, compiled by First American with documents obtained from the Los Angeles County Hall of Records.

## 5.2 Data Reviewed

The following section includes a summary and evaluation of data collected during routine monitoring at the Waste Pits OU. Data that were reviewed and evaluated as part of this five-year review include field monitoring data collected at the cap gas collection and treatment system, analytical data for site SVE wells, field monitoring data collected at perimeter wells surrounding the site, analytical data for groundwater monitoring wells, and settlement data.

### 5.2.1 Soil Gas

#### 5.3.1.1 Cap Gas Collection and Treatment System

Biweekly monitoring (once every two weeks) is performed using a photoionizing detector (PID) at four locations on the cap gas collection and treatment system (system influent, effluent of lead carbon canister, effluent of secondary carbon canister, and system effluent). The PID data are used to determine when the carbon canisters require replacement, consistent with the protocol presented in Section 4.3.1. With exception to the exceedances

identified in Section 4.3.1, the effluent standard of 5 ppmv benzene has been achieved over the past five years of operation of the treatment system.

The influent VOC concentrations have fluctuated over time, but significant trends in changes in influent concentrations have not been observed since operation of the cap gas collection and treatment system commenced. VOCs were detected in influent soil gas at concentrations ranging from 0.3 to 17 ppm between March 2000 and December 2004. Analytical and field monitoring data for an influent soil gas sample collected in June 2005 indicated benzene concentrations of 0.16 ppm and 0.9 ppm, respectively ($C_2$REM 2005d).

#### 5.3.1.2 Soil Vapor Extraction and Monitoring Wells

As described in Section 4.3.2, baseline soil vapor monitoring was performed in April 2000, and subsequent quarterly field monitoring of the SVE perimeter wells commenced in second quarter 2003 at the request of the USEPA. In addition, soil gas samples were collected from the perimeter wells in November 2003 and were submitted to a laboratory for analysis of VOCs (by Method TO-15). The results of field monitoring and laboratory analysis performed at the perimeter wells are presented on Table 5-1. (The locations of the perimeter wells are presented on Figure 3-2.)

The data for the perimeter wells, which are screened at depths ranging between 5.7 and 23.6 feet bgs, indicate that contaminated soil vapors are not migrating at elevated concentrations beyond the boundaries of the Waste Pits OU. Results from recent field monitoring indicate a maximum VOC concentration of 9.2 ppm (in August 2004 at perimeter well C in Sub-Area II), and laboratory analyses performed in November 2003 indicate a maximum VOC concentration of 3.7 ppmv (at perimeter well D in Sub-Area II). These concentrations are significantly below the remediation goal of 2,000 ppmv identified for benzene in Sub-Area II (Table 4-1) (Parsons et al. 1999a).

A full-scale monitoring event was performed in November 2003 and included the collection of samples from 23 soil vapor extraction wells, 14 pressure and performance wells, 39 cluster wells, and 12 perimeter wells ($C_2$REM 2004b). The locations of these wells, and the sub-areas in which the wells are located, are presented on Figure 3-2. Samples were submitted to a laboratory for analysis of VOCs. The greatest concentrations of VOCs were detected at wells located in the vicinity of former Waste Pits 2-A through 2-D (Sub-Area II). The lateral and vertical distribution of benzene, the VOC detected at the greatest concentrations and at the greatest frequency in soil gas at the Waste Pits OU, is presented on Figure 5-1 (based on data collected during the 2003 monitoring event). Table 5-2 presents the results of laboratory analysis for benzene for samples collected in 2003. Table 5-2 also presents the results of analyses for benzene performed as part of the baseline monitoring event in 2000. The percent decrease in benzene concentration between 2000 and 2003 is presented for each well. Table 5-2 also identifies the wells that contain benzene at concentrations exceeding the remediation goals for each sub-area.

While benzene concentrations continue to exceed the remediation goals identified for each sub-area at many of the wells, the data suggest that benzene concentrations are decreasing over time as a result of biodegradation. Of the wells for which data are available for both 2000 and 2003, 75 percent of the wells indicated some decrease in benzene concentration over time. Benzene concentrations decreased by more than 90 percent at 42 percent of the wells.

TABLE 5-1
Perimeter Well Analytical Data and Monitoring Results
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Perimeter Well ID | 2001 Baseline PID Results (ppm) | 2nd Quarter 2003 Monitoring PID Results (ppm) | 3rd Quarter 2003 Monitoring PID Results (ppm) | 4th Quarter 2003 Monitoring PID Results (ppm) | 4th Quarter 2003 Monitoring - Lab Analysis by USEPA Method TO-15 for VOCs (ppm) | First Quarter 2004 Monitoring Results PID Results (ppm) | 2nd Quarter 2004 Monitoring PID Results (ppm) | 3rd Quarter 2004 Monitoring PID Results (ppm) | 4th Quarter 2004 Monitoring PID Results (ppm) |
|---|---|---|---|---|---|---|---|---|---|
| A | 15.3 | 1.1 | 1.1 | 1.8 | 0.0451 | 2.3 | 2.6 | 3.2 | 4.3 |
| B | 21.0 | 2.8 | 1.8 | 23.0 [a] | 1.8587 | 2.8 | 2.1 | 2.3 | 5.4 |
| C | 16.1 | 1.7 | 1.2 | 2.6 | 0.2045 | 2.3 | 3.4 | 9.2 | 3.8 |
| D | 57.3 | 0.8 | 0.6 | 1.5 | 3.7221 | 2.5 | 1.8 | 3.4 | 2.3 |
| E | 9.0 | 1.5 | 0.9 | 1.3 | 0.0794 | 1.4 | 0.9 | 4.3 | 3.5 |
| F | 12.2 | 1.9 | 1.3 | 1.4 | 0.04245 | 1.2 | 3.9 | 2.6 | 4.8 |
| G | 13.0 | 2.2 | 1.4 | 1.4 | 0.0153 | 0.9 | 1.7 | 4.4 | 3.1 |
| H | 14.9 | 1.6 | 1.7 | 1.3 | 0.00906 | 1.5 | 3.2 | 2.8 | 2.1 |
| I | 3.1 | 0.7 | 1.6 | NR | 0.00786 | 2.0 | 1.4 | 3.8 | 1.8 |
| J | 3.4 | 0.0 | 1.6 | 35.3 [a] | 0.01072 | 2.2 | 0.7 | 3.1 | 2.0 |
| K | 3.6 | 0.0 | 1.7 | 6.5 | 0.02136 | 2.8 | 1.2 | 1.8 | 2.8 |
| L | 4.4 | 2.0 | 1.4 | 44.3 [a] | 0.0348 | 2.6 | 2.2 | 3.3 | 2.2 |

[a] Elevated concentrations are expected of being erroneous due to significantly lower VOC concentrations that were detected through laboratory analysis (by Method TO-15).
NR = Not Recorded.

TABLE 5-2
Comparison of Analytical Results for Benzene from 2000 and 2003
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| | | **USEPA Method TO-15 (Full-scale Sampling November 2003) & USEPA 8021B (Baseline Sampling May 2000)** | | |
|---|---|---|---|---|
| **Probe** | **Well Type** | **2000 Benzene (ppmv)** | **2003 Benzene (ppmv)** | **Percent decrease in benzene concentration between 2000-2003** |
| **Sub-Area I - Remediation Goal = 510 ppmv** | | | | |
| A | Perimeter | 17 | 0.011 | 100 |
| A DUP | Perimeter | ND | 0.0036 | -- |
| B | Perimeter | 14 | 0.013 | 100 |
| A' | Performance | 10,000 | **18,000** | NA |
| A"1 | Cluster | <0.40 | 7 | NA |
| A"1 DUP | Cluster | NA | 0.27 | -- |
| A"2 | Cluster | <0.39 | 0.0051 | 99 |
| A"3 | Cluster | 14,000 | **9,100** | 35 |
| B" 1 | Cluster | 22,000 | **42,000** | NA |
| B" 2 | Cluster | 17,000 | **10,000** | 41 |
| B" 3 | Cluster | 18,000 | **13,000** | 28 |
| M"1 | Cluster | 18,000 | **13,000** | 28 |
| M"2 | Cluster | 21,000 | **4,600** | 78 |
| M"3 | Cluster | NR | **920** | -- |
| 1 | Extraction | NR | **7,400** | -- |
| 2 | Extraction | NR | **21,000** | -- |
| 10 | Extraction | NR | **19,000** | -- |
| **Sub-Area II - Remediation Goal = 2,000 ppmv** | | | | |
| C | Perimeter | 21 | 0.025 | 100 |
| D | Perimeter | 100 | 3.3 | 97 |
| L | Perimeter | 3 | 0.0046 | 100 |
| B' | Performance | 18 | 0.0016 | 100 |
| C' | Performance | 29,000 | **20,000** | 31 |
| D' | Performance | 30,000 | **30,000** | 0 |
| D' DUP | Performance | NA | **37,000** | -- |
| L' | Performance | 3,400 | **2,800** | 18 |
| M' | Performance | 32,000 | **4,100** | 87 |
| N' | Performance | 22,000 | **13,000** | 41 |

TABLE 5-2
Comparison of Analytical Results for Benzene from 2000 and 2003
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| | | **USEPA Method TO-15 (Full-scale Sampling November 2003) & USEPA 8021B (Baseline Sampling May 2000)** | | |
|---|---|---|---|---|
| **Probe** | **Well Type** | **2000 Benzene (ppmv)** | **2003 Benzene (ppmv)** | **Percent decrease in benzene concentration between 2000-2003** |
| C"1 | Cluster | 9,900 | **9,600** | 3 |
| C"2 | Cluster | 14,000 | **20,000** | -- |
| C"3 | Cluster | 6,100 | **3,200** | 48 |
| C"3 DUP | Cluster | NA | **6,000** | -- |
| D"1 | Cluster | 23,000 | **84,000** | NA |
| D"2 | Cluster | 20,000 | **150,000** | NA |
| D"3 | Cluster | 28,000 | **19,000** | 32 |
| K"1 | Cluster | 7,100 | 57 | 99 |
| K"2 | Cluster | 32,000 | **13,000** | 59 |
| K"3 | Cluster | 31,000 | **47,000** | NA |
| L"1 | Cluster | 30,000 | **32,000** | NA |
| L"1 DUP | Cluster | NA | **45,000** | -- |
| L"2 | Cluster | 35,000 | **43,000** | NA |
| L"3 | Cluster | 17,000 | **2,900** | 83 |
| 3 | Extraction | NR | **19,000** | -- |
| 4 | Extraction | NR | **37,000** | -- |
| 5 | Extraction | NR | **2,400** | -- |
| 6 | Extraction | NR | **8,700** | -- |
| 7 | Extraction | NR | **21,000** | -- |
| 8 | Extraction | NR | **130,000** | -- |
| 9 | Extraction | NR | **100,000** | -- |
| 11 | Extraction | NR | **33,000** | -- |
| 12 | Extraction | NR | **11,000** | -- |
| **Sub-Area III - Remediation Goal = 840 ppmv** | | | | |
| E | Perimeter | 87 | 0.038 | 100 |
| F | Perimeter | 7.5 | 0.001 | 100 |
| J | Perimeter | 4 | 0.00083 | 100 |
| K | Perimeter | 4 | 0.0052 | 100 |
| E' | Performance | 110 | 0.4 | 100 |

TABLE 5-2
Comparison of Analytical Results for Benzene from 2000 and 2003
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| | | **USEPA Method TO-15 (Full-scale Sampling November 2003) & USEPA 8021B (Baseline Sampling May 2000)** | | |
|---|---|---|---|---|
| **Probe** | **Well Type** | **2000 Benzene (ppmv)** | **2003 Benzene (ppmv)** | **Percent decrease in benzene concentration between 2000-2003** |
| F' | Performance | 180 | 0.31 | 100 |
| J' | Performance | 81 | 5.5 | 93 |
| K' | Performance | 140 | 34 | 76 |
| E" 1 | Cluster | 18 | 1.1 | 94 |
| E" 2 | Cluster | 830 | 55 | 93 |
| E" 3 | Cluster | 12,000 | **7,700** | 36 |
| F"1 | Cluster | 300 | 3.1 | 99 |
| F"2 | Cluster | 530 | 44 | 92 |
| F"3 | Cluster | 4,500 | **14,000** | NA |
| I"1 | Cluster | 4,300 | **3,000** | 30 |
| I"2 | Cluster | 1,100 | **10,000** | NA |
| I"3 | Cluster | 850 | **6,600** | NA |
| J"1 | Cluster | 130 | 19 | 85 |
| J"2 | Cluster | 3,600 | **5,500** | NA |
| J"3 | Cluster | 110 | 0.32 | 100 |
| 13 | Extraction | NR | **4,800** | -- |
| 13 DUP | Extraction | NR | **1,800** | -- |
| 14 | Extraction | NR | **11,000** | -- |
| 15A | Extraction | NR | **8,900** | -- |
| 15B | Extraction | NR | **11,000** | -- |
| 20A | Extraction | NR | **12,000** | -- |
| 20B | Extraction | NR | **1,800** | -- |
| 21 | Extraction | NR | 590 | -- |
| 21 DUP | Extraction | NR | 610 | -- |
| **Sub-Area IV - Remediation Goal = 78 ppmv** | | | | |
| G | Perimeter | 9.4 | ND | -- |
| H | Perimeter | 9.1 | ND | -- |
| I | Perimeter | 3.4 | ND | -- |
| G' | Performance | 5.5 | 39 | NA |

TABLE 5-2
Comparison of Analytical Results for Benzene from 2000 and 2003
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Probe | Well Type | USEPA Method TO-15 (Full-scale Sampling November 2003) & USEPA 8021B (Baseline Sampling May 2000) | | |
|---|---|---|---|---|
| | | 2000 Benzene (ppmv) | 2003 Benzene (ppmv) | Percent decrease in benzene concentration between 2000-2003 |
| H' | Performance | 210 | 0.018 | 100 |
| H' DUP | Performance | NA | 0.016 | -- |
| I' | Performance | 3,800 | **3,400** | 11 |
| G" 1 | Cluster | 12 | 0.012 | 100 |
| G" 2 | Cluster | 100 | 0.81 | 99 |
| G" 3 | Cluster | 220 | **410** | NA |
| H" 1 | Cluster | 84 | 1.5 | 98 |
| H" 2 | Cluster | 43 | 0.0014 | 100 |
| H" 3 | Cluster | 30 | ND | -- |
| 16 | Extraction | NR | **10,000** | -- |
| 17 | Extraction | NR | **1,400** | -- |
| 18 | Extraction | NR | **91** | -- |
| 18 DUP | Extraction | NR | **120** | -- |
| 19 | Extraction | NR | **2,600** | -- |

Notes:
-- = Percent decrease could not be calculated because data were not available for both the 2000 and 2003 sampling events.
NA = not applicable. A decrease in benzene concentration was not detected between 2000 and 2003.
NR = not recorded.
2003 concentrations that exceed the corresponding remediation goal are indicated in bold text.
DUP = duplicate sample.

In general, oxygen levels decrease and carbon dioxide levels increase when a substrate (e.g., benzene) is degraded under aerobic conditions. The oxygen and carbon dioxide levels recorded at the wells in 2000 and 2003 support the conclusion that biodegradation is occurring in the vadose zone. Oxygen levels were found to be inversely proportional to benzene and carbon dioxide concentrations ($C_2$REM 2004b).

The analytical data collected at perimeter wells in 2003 indicate benzene concentrations appreciably lower than those recorded in 2000 and less than the remediation goals. Seven of the 14 performance wells, 14 of the 39 cluster wells, and three of the 23 extraction wells contained benzene at concentrations less than the remediation goals. Benzene concentrations increased with depth at five of the 13 cluster wells (cluster wells A", K", E", F", and G") and at select wells (e.g., F"3, I"3, and K"3) (Table 5-2).

An increasing portion of the vadose zone along the capillary fringe is expected to be impacted by LNAPL as the water table rises in the vicinity of the Waste Pits OU. As presented in Section 3.1, the water table has risen at a rate of approximately 1 foot per year since the late 1970s. The water table is currently at approximately 60 feet bgs, just below the bottom of the screen interval of the SVE extraction wells (48.4 to 56.1 feet bgs).

#### 5.3.1.3 Groundwater

The groundwater cleanup at the Del Amo site is primarily governed by the Dual Site Groundwater Operable Unit ROD (USEPA 1999a). Accordingly, it is not appropriate for this five-year review to evaluate the protectiveness of the groundwater remedy (Dual-Site Groundwater OU remedy is not in place as of this five-year review).

However, one of the four major components of the Waste Pits ROD is to provide source control to limit continuing migration of contaminant mass to groundwater. The EPA selected soil vapor extraction in the vadose zone under the waste pits to reduce contaminant mass and to provide a buffer for contaminant mass that may be released from the pits waste in the future.

The Dual Site Groundwater Operable Unit ROD addresses all groundwater contamination within the Montrose Chemical and Del Amo Sites. One element of the Dual-Site Groundwater ROD is a separate phase of remedy selection for non-aqueous phase liquid (NAPL) recovery and source control at NAPL sources within the two Superfund sites. As one of many sources addressed, the Dual Site Groundwater Operable Unit ROD requires that the source control component of the Waste Pits ROD be followed.

As the SVE component of the Waste Pits remedy has not been implemented as of the date of this five-year review, it is premature to evaluate whether this component of the remedy is effective and protective. USEPA may decide to make this evaluation either in a subsequent Waste Pits OU five-year review.

A basic assessment of current conditions near the waste pits as of the time of this review is provided.

A review of time-series dissolved phase concentration data suggests that benzene concentrations have been relatively stable (URS 2004) in vicinity of the waste pits since the time of the Waste Pits ROD. Data also verify that the groundwater in close proximity to the waste pits remains highly contaminated and would pose an extreme health threat if consumed. This is not unexpected because NAPL in the subsurface continues to dissolve, and the SVE system under the waste pits has not yet been installed.

Figure 5-2 presents the locations of wells in the vicinity of the Waste Pits OU for each of the four hydrostratigraphic units. The figure indicates the predominant groundwater flow direction, which is to the south/southeast in the water table units, more southeast in the Middle Bellflower "C" Sand, and east/southeast in the Gage Aquifer.

Groundwater concentrations in the water table zone in close proximity to the pits have dissolved phase benzene concentrations up to 500,000 µg/L (ppb). Wells in this vicinity include PZL0020, PZL0019, XMW-29, PZL0021, PZL0024, and PZL008 among others. Because the hydraulic gradient in this zone is relatively flat and subject to historical perturbations in flow direction, those wells in closest proximity to the pits either to the north

or the south are most-likely indicative of waste pits contamination. There are also additional historical sources of dissolved phase contamination at the Del Amo plant site northwest of the waste pits, which may be adding to the waste pits area contamination.

Dissolved benzene phase concentrations in the Middle Bellflower C Sand (MBFC) aquifer continue to remain extremely high, with levels up to 40,000 µg/L (SWL0040). The benzene distribution in the MBFC confirms that a benzene plume originates along the southeastern edge of the Waste Pits OU. The concentrations are highest at well SWL0040 and decrease within a short distance downgradient of the waste pits.

Benzene was most recently not detected in the Gage Aquifer in the immediate vicinity of the waste pits (XG-11 and XG-17) and is present at concentrations up to 3.9 µg/l (XG-9) downgradient of the waste pits. Benzene is present in the overlying units which may have cascaded into the Gage Aquifer.

Overall the groundwater contaminant concentrations under the waste pits have remained stable and very high relative to health-based standards; however, there has been some variability in concentrations at certain wells during the five-year review interval. None of these variations is considered conclusive with respect to the contaminant mass from the waste pits.

Figures 5-3 through 5-5 present time-series plots for monitoring wells that have decreasing or increasing trends in benzene concentrations. The wells not shown on Figures 5-3 through 5-5 exhibited either stable or highly variable concentrations.

In the UBF, decreasing trends in benzene concentrations were identified at wells SWL0021, SWL0051, and SWL0044, as presented on Figure 5-3. In the MBFB, elevated concentrations of benzene were reported during the January 2004 sampling event at wells PZL0021 (200,000 µg/L), SWL0048 (190,000 µg/L), XMW-29 (580,000 µg/L), and SWL0041 (22,000 µg/L). Increasing trends were identified at wells PZL0021 and XMW-29 (Figure 5-4). In the MBFC Sand, decreasing trends were observed at wells SWL0055 and XBF-13 (Figure 5-4) only. In the Gage Aquifer, benzene concentrations have decreased at wells XG-005 and XG-09 and have increased at well SWL0034 (Figure 5-5).

#### 5.3.1.4 Settlement

Very little settlement has been recorded at the survey monuments located on the cap. Table 5-3 presents the elevation data recorded at the nine survey monuments in 2000 and 2005 respectively, and the elevation differential between these two monitoring events. Elevation differences ranged from -0.10 to 0.08 for this time period. This degree of settlement is not expected to affect the integrity of the cap.

TABLE 5-3
Settlement Monitoring Data
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| | BASELINE COORDINATES (1/27/00) | | | MONITORING DATE (1/10/05) | | | |
|---|---|---|---|---|---|---|---|
| ID No | Northing | Easting | Elevation (feet above MSL) | Northing | Easting | Elevation (feet above MSL) | Elevation Difference (feet) |
| S-1 | 56646.97 | 199287.31 | 39.76 | 56646.95 | 199287.29 | 39.84 | +0.08 |
| S-2 | 56646.99 | 199102.66 | 40.60 | 56646.97 | 199102.62 | 40.67 | +0.07 |
| S-3 | 56631.70 | 198929.44 | 14.42 | 56631.70 | 198929.41 | 41.42 | 0.00 |
| S-4 | 56631.66 | 198876.96 | 41.55 | 56631.64 | 198876.94 | 41.45 | -0.10 |
| S-5 | 56631.73 | 198807.17 | 42.47 | 56631.72 | 198807.13 | 42.42 | -0.05 |
| S-6 | 56631.72 | 198760.02 | 43.05 | 56631.74 | 198759.96 | 42.98 | -0.07 |
| S-7 | 56631.85 | 198722.09 | 43.40 | 56631.86 | 198722.09 | 43.41 | +0.01 |
| S-8 | 56631.59 | 198688.12 | 43.72 | 56631.60 | 198688.09 | 43.74 | +0.02 |
| Monument 1 | 56740.04 | 198884.47 | 36.44 | 56740.04 | 198884.47 | 36.44 | 0.00 |

## 5.3 Site Inspection

Representatives of $C_2$REM, the United States Army Corps of Engineers, and CH2M HILL performed a site inspection on April 15, 2005. A summary of the inspection findings is presented below. The site inspection checklist and photos taken during the inspection are provided in Appendices C and D, respectively.

Conditions during the inspection were warm and dry, with elevated temperatures (approximately 70 degrees Fahrenheit). All inspected areas were secured with adequate fencing and signage. The cap appeared to be in good condition, with a fully-established vegetative cover. Indications of settlement, erosion, or burrowing were not observed within the vegetative cover during the site inspection. In addition, there was no indication of erosion in the surface drainage channels that border the northern and southern edges of the cap or in the catch basins at the eastern end of the cap. The gabion wall along the southern side of the cap appeared to be in good condition. The access road that runs along the northern portion of the Waste Pits OU also appeared to be in good condition.

The cap gas collection and treatment system was operating during the site visit and appeared to be in good condition based on visual observation. The system operates for approximately 4 hours each day (10:00 a.m. to 2:00 p.m.). The vapor/liquid separator, carbon canisters, and blower were observed to be structurally intact during the inspection and were surrounded by secondary fencing. The aboveground piping appeared to be in good condition. The aboveground piping is replaced as necessary when it exhibits deterioration caused by sun exposure.

While the aboveground components of the SVE system have not yet been installed, extraction and monitoring wells have been installed within the footprint of the cap and surrounding the cap. The wells appeared to be in good condition. Indications of air releases from the wells were not observed while the blower was operating. The representatives from $C_2$REM indicated that a boot had been installed around each well to seal the well to the cap liner and that pressure tests had been performed around each well following well installation to ensure that no leaks were occurring through the cap.

Overall, the components of the remedy that have been installed are functioning as designed and appear are well-maintained.

## 5.4 Interviews

An interview was conducted with staff of $C_2$REM on April 15, 2005. $C_2$REM is an environmental management company hired by Shell Oil Company to operate and maintain the remedy at the site. An interview summary form is provided in Appendix C. The following $C_2$REM employees were interviewed:

- Ed Bourke, Principal
- Jack Keener, Project Manager
- Stefan Klemm, Senior Project Engineer
- Christine Neidel, Project Engineer
- Ryan Carroll, Field Technician

The $C_2$REM staff oversee and perform OM&M of the cap and associated gas collection and treatment system, fencing, surface drainage channels, and the access road. The staff indicated that the cap gas collection and treatment system operates automatically (by timer) every day. The carbon canisters are replaced as necessary (approximately four times per year) and in accordance with the carbon change-out protocol approved by the USEPA (presented in Section 4.3.1). $C_2$REM staff indicated that data collected from site wells indicate that contaminant concentrations are generally decreasing in the vadose zone. In addition, the data indicate that constituents are not migrating off-site.

The staff suggested the following possible optimizations to the system:

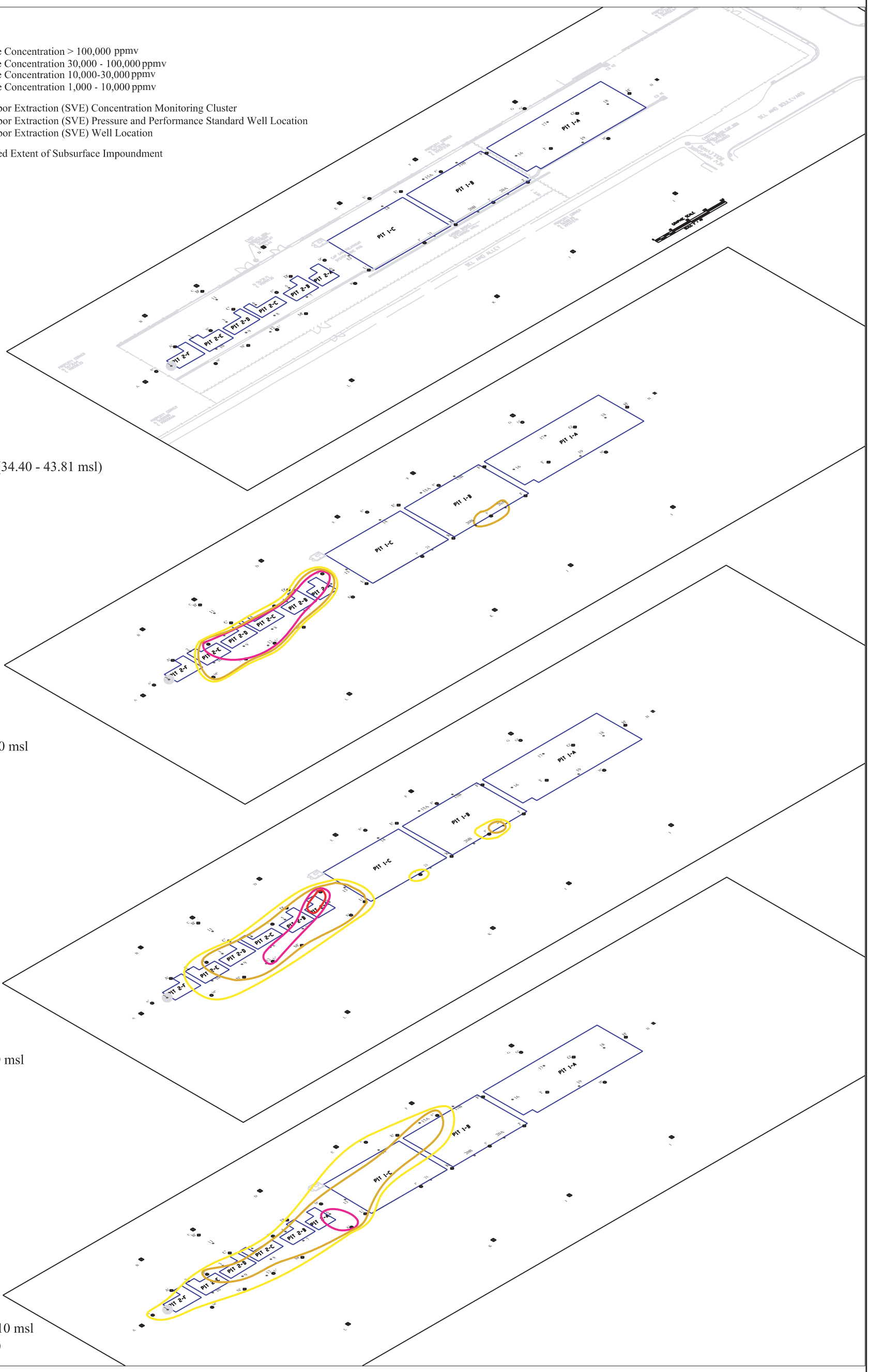
- Reduce the volume of air that is purged from the vadose zone daily (to increase the efficiency of the treatment system).
- Reduce the frequency of site visits and monitoring of the cap gas collection and treatment system.
- Reduce the frequency of settlement monitoring ($C_2$REM has previously recommended this remedial process optimization in the 2004 OM&M Report [$C_2$REM 2005b]).

LEGEND

Benzene Concentration > 100,000 ppmv
Benzene Concentration 30,000 - 100,000 ppmv
Benzene Concentration 10,000-30,000 ppmv
Benzene Concentration 1,000 - 10,000 ppmv

Soil Vapor Extraction (SVE) Concentration Monitoring Cluster
Soil Vapor Extraction (SVE) Pressure and Performance Standard Well Location
Soil Vapor Extraction (SVE) Well Location

Pit 1-C — Estimated Extent of Subsurface Impoundment




Ground Surface (34.40 - 43.81 msl)

Horizon A
Approximately 10 msl
(+/- 30 feet bgs)

Horizon B
Approximately 0 msl
(+/- 40 feet bgs)

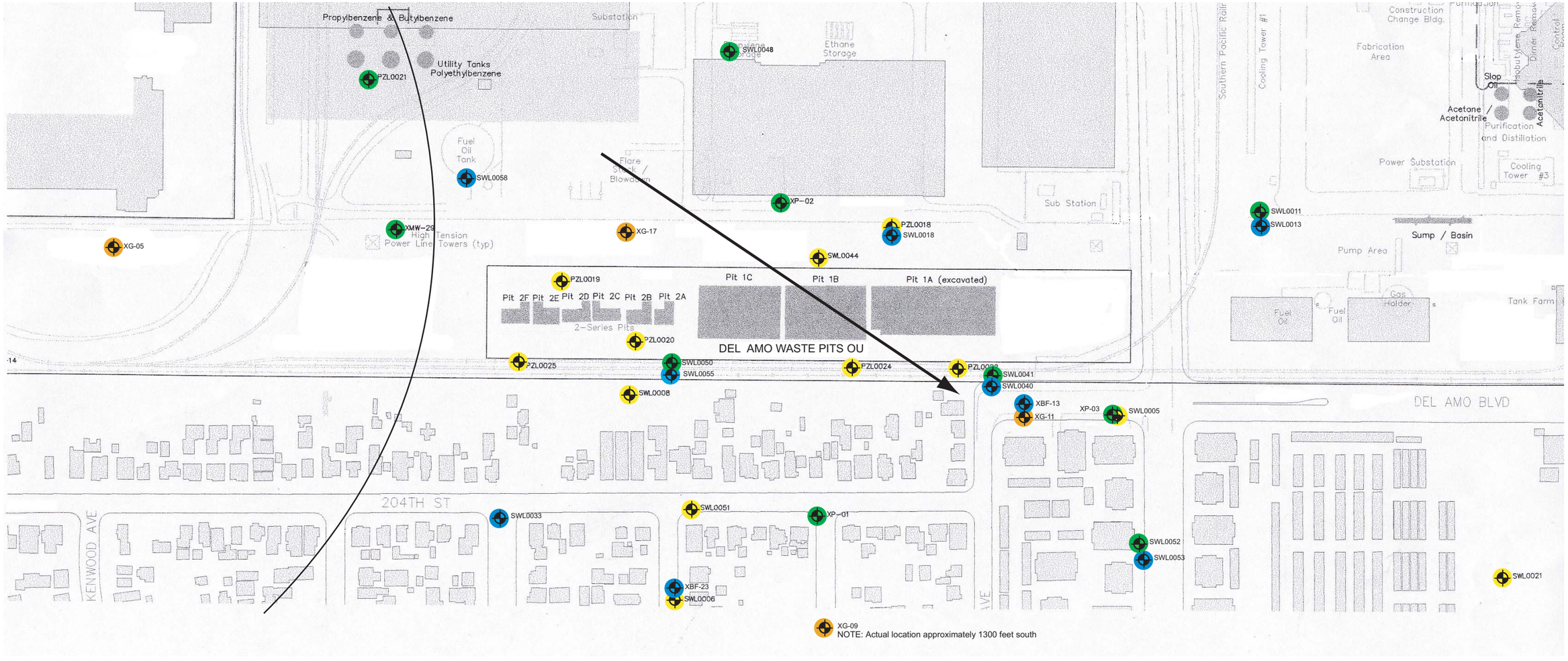
Horizon C
Approximately -10 msl
(+/- 450 feet bgs)

Note:
Groundwater Elevation Ranges between -13.89 to -16.47 msl

Source: C2REM 2004

**FIGURE 5-1**
**BENZENE VAPOR CONCENTRATIONS BY HORIZON**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA

CH2MHILL




Inferred intersection of water table surface with top of middle Bellflower B sand. The overlying upper Belflower aquitard is unsaturated west of the inferred intersection.

Direction of prevailing groundwater flow. NOTE: Flow direction in the UBF is highly variable. The flow direction in the UBF may not be accurately depicted in this figure.

UBF Monitoring location

MBFB Monitoring location

MBFC Monitoring location

Gage Aquifer Monitoring location

N

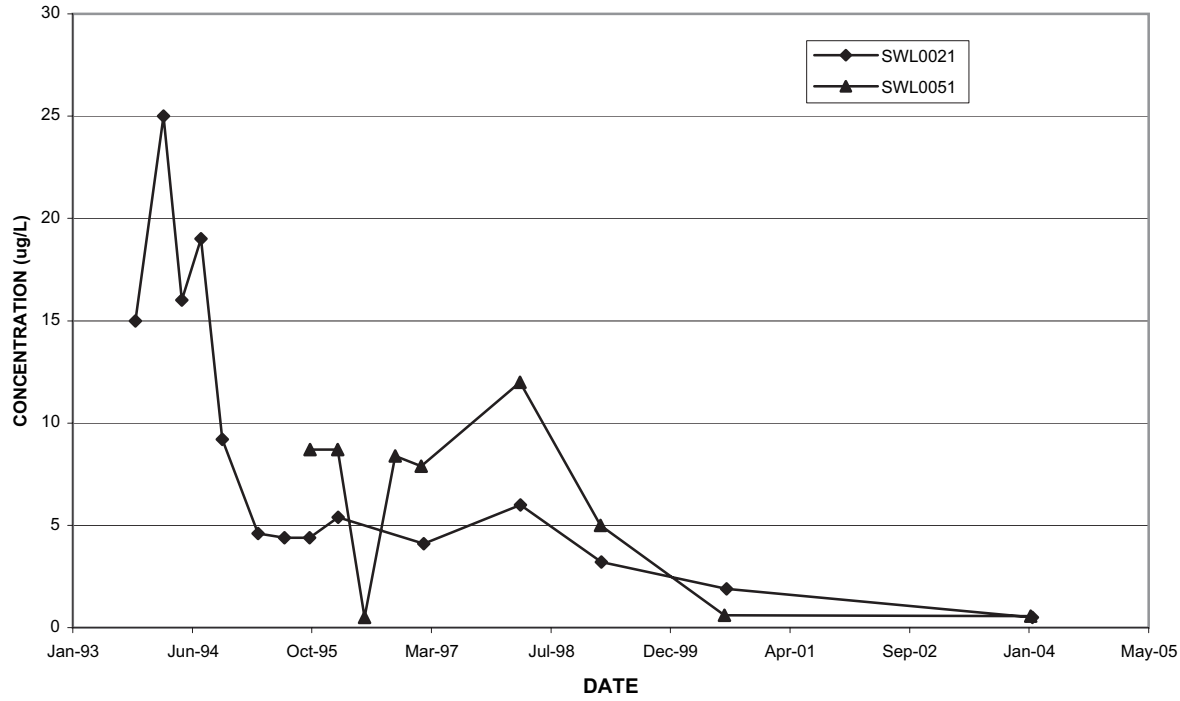
0 200 400

SOURCE: Dames & Moore 1998

175847.RO.01 _Fig 5-2 Geo X-section_7/13/05_ez_sfo

**FIGURE 5-2**
**MONITORING WELL LOCATION AND PREVAILING GROUNDWATER FLOW DIRECTION**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA

CH2MHILL



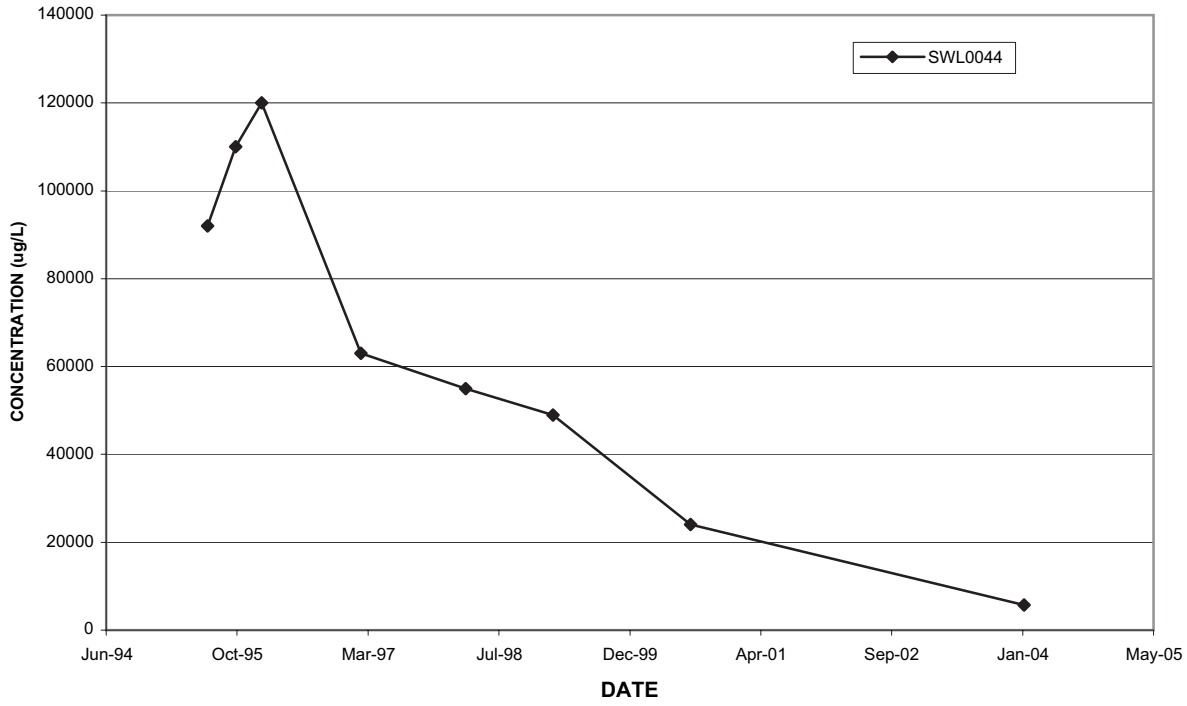
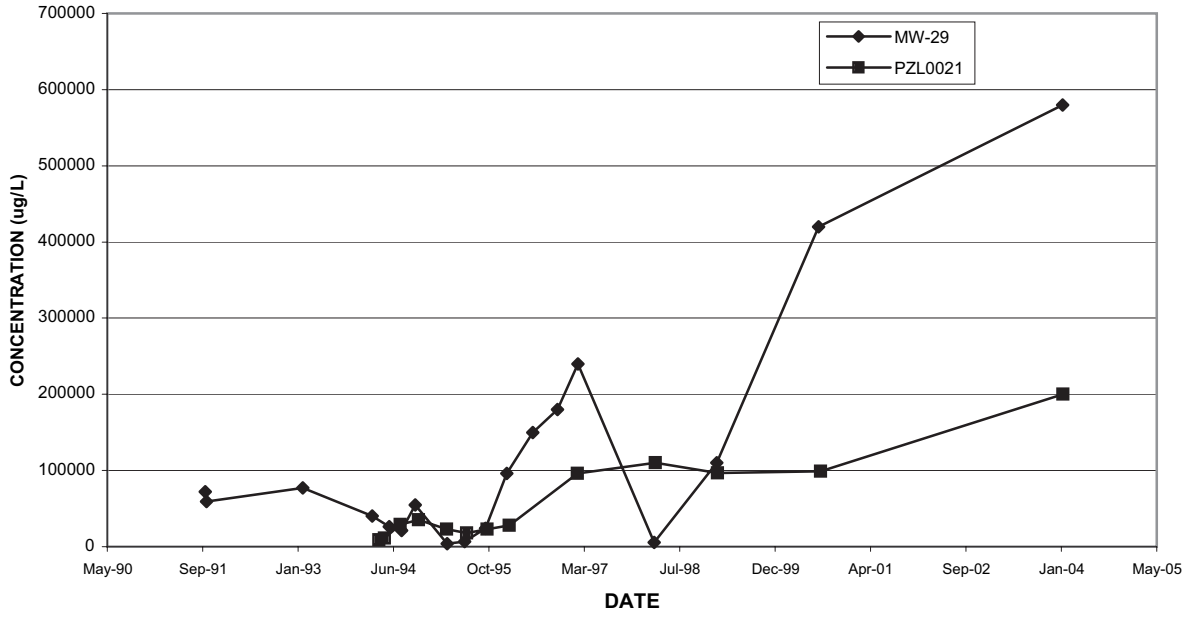




**FIGURE 5-3**
**BENZENE CONCENTRATION TRENDS IN THE UPPER BELLFLOWER UNIT**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA



CH2MHILL

## Middle Bellflower B Unit




## Middle Bellflower C Unit

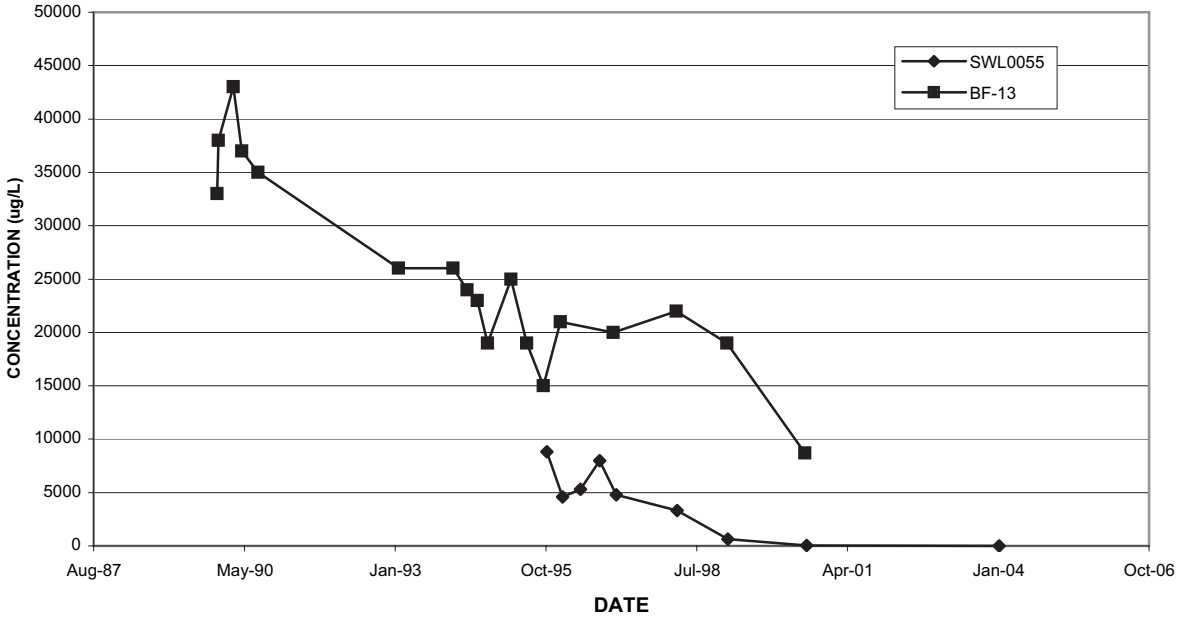



**FIGURE 5-4**
**BENZENE CONCENTRATION TRENDS IN THE MIDDLE BELLFLOWER B UNIT & MIDDLE BELLFLOWER C UNIT**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA



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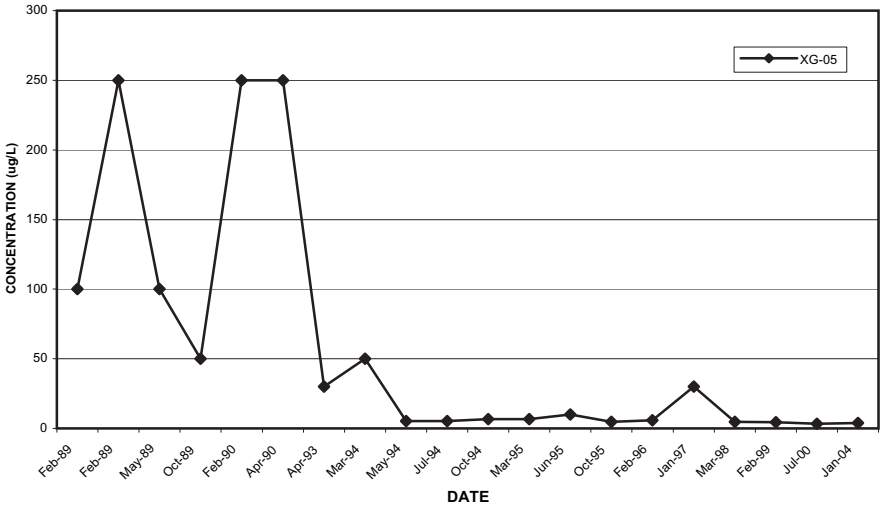
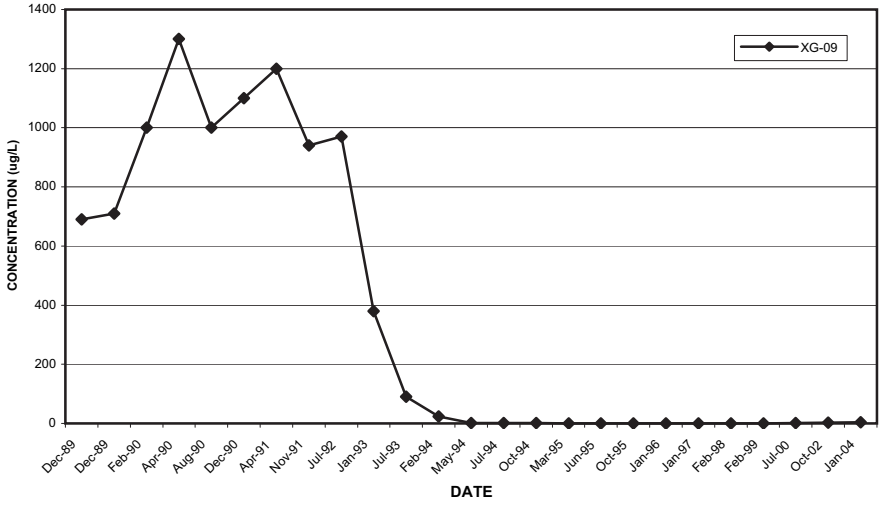


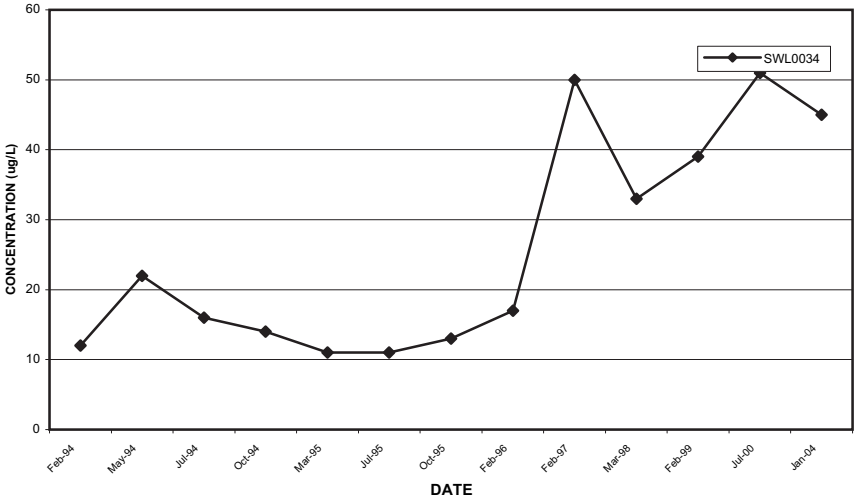
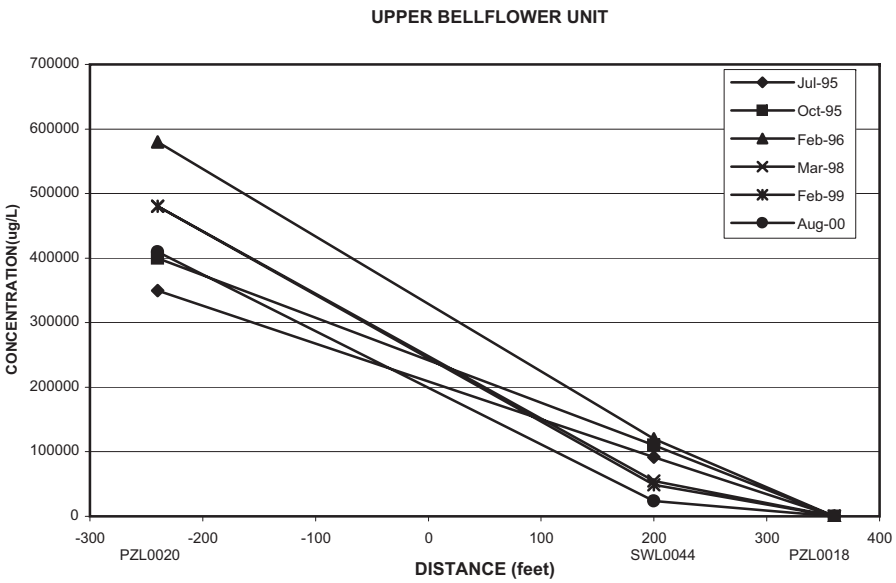
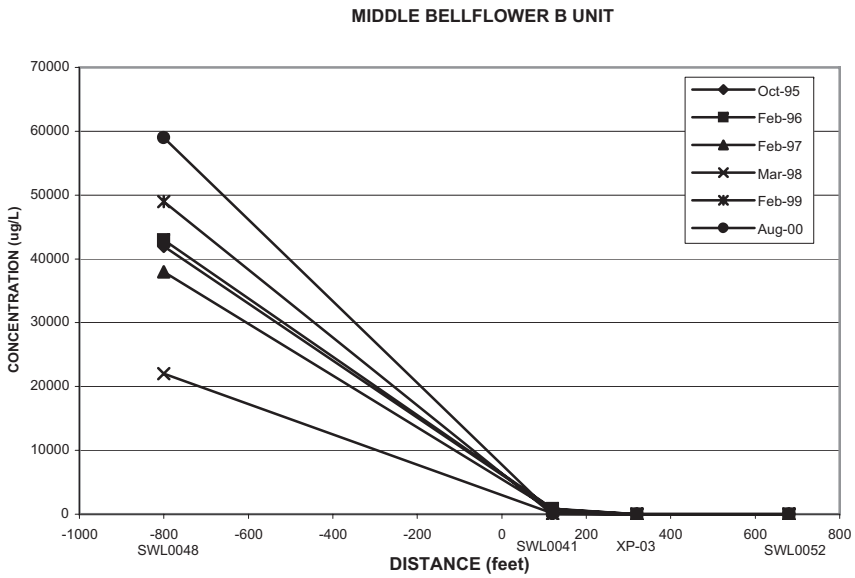
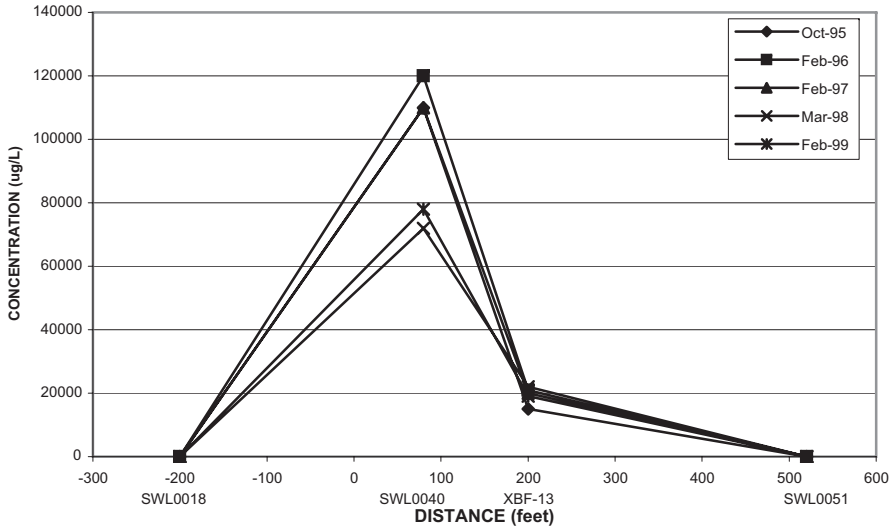
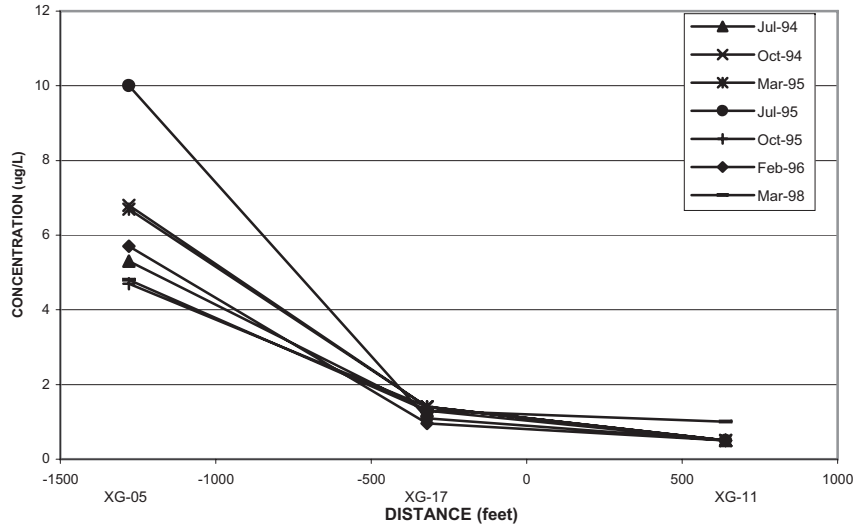




**FIGURE 5-5**
**BENZENE CONCENTRATION TRENDS IN THE GAGE AQUIFER**
FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA




## FIGURE 5-6
## BENZENE CONCENTRATIONS IN GROUNDWATER AS A FUNCTION OF DISTANCE FROM THE WASTE PITS OU

FIVE-YEAR REVIEW REPORT FOR
DEL AMO WASTE PITS OPERABLE UNIT
LOS ANGELES, CALIFORNIA



CH2MHILL

# 6.0 Technical Assessment

## 6.1 Functioning of the Remedy as Intended by Decision Documents

*Is the remedy functioning as intended by the decision documents?*

The components of the remedy that have been installed to date are functioning as intended by the Waste Pits ROD, as supported by information provided in the following sections. The SVE component of the remedy has not yet been installed. Final design of the SVE component will be completed in 2005 with installation in early 2006. The next five-year review in 2010 will address the effectiveness of the entire Waste Pits OU remedy , including the SVE system.

### 6.1.1 Remedial Action Performance

As presented in Section 4.2, Phase 1 of the remedy was implemented by February 2000. The cap, cap gas collection and treatment system, drainage channels, catch basins, and fence are functioning as intended in the Waste Pits ROD. The objectives identified for the cap in the Waste Pits ROD have been achieved through installation and subsequent maintenance of the cap, cap gas collection and treatment system, surface and subsurface water controls, and security fencing, as presented in Table 6-1.

TABLE 6-1
Summary of Objectives for RCRA-equivalent Cap
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Objective | Status of Implementation |
|---|---|
| 1. Prevent direct human contact with contaminants. | The objective has been achieved. The cap has been installed and provides a barrier between receptors and contamination present in soil and soil gas at the Waste Pits OU. |
| 2. Prevent generation of uncontrolled runoff and wind blown dust. | The objective has been achieved. The vegetation on the cap is fully established, essentially eliminating erosion from the cap. The surface water collection and diversion system prevents uncontrolled runoff. |
| 3. Prevent the emission of contaminants into the air. | The objective has been achieved. The cap gas collection and treatment system has been installed. As presented in Section 5.3.1, the effluent standard has been achieved over the past 5 years with few exceptions. Those exceptions were addressed by immediately replacing the carbon filters. The system therefore prevents the emission of unacceptable levels of constituents into the air. |
| 4. Prevent rainwater from washing through the waste pits and carrying contaminants into the groundwater. | The objective has been achieved. The cap serves as a barrier to infiltration, which could otherwise flow through the Waste Pits and transport constituents in soil and soil gas to underlying groundwater. |
| 5. Prevent rainwater from washing through the contaminated vadose zone soils below the pits and carrying them into the groundwater. | The objective has been achieved. The cap serves as a barrier to infiltration, which could otherwise flow through the vadose zone and transport constituents in soil and soil gas to underlying groundwater |

According to the O&M contractor, the cap gas collection and treatment system operates consistently for 4 hours daily, with an inlet flow rate of approximately 160 standard cubic feet per minute ($C_2$REM 2005c). The total volume of soil gas extracted daily is approximately 38,000 cubic feet, which is equivalent to approximately two pore volumes. Benzene concentrations in the effluent from the blower are generally less than the effluent standard of 5 ppmv specified in the OM&M Manual (Parsons et al. 1999a). Based on a comparison between the maximum ground level benzene concentrations estimated for the fence line (0.0154 to 0.0165 $\mu g/m^3$)[12] (Parsons et al. 1999b) and the 2004 ambient air PRG for benzene (0.25 $\mu g/m^3$) (USEPA 2004a), the effluent VOC standard of 5 ppmv remains protective of human health for nearby residential receptors and complies with SCAQMD Rule 1401, which requires that the potential human health risk from carcinogenic compounds be less than $1 \times 10^{-5}$ (Parsons et al. 1999a).

While the SVE system selected in the Waste Pits ROD has not yet been installed, data recorded at perimeter wells indicate that elevated concentrations of VOCs in the soil gas are not migrating off-site, beyond the perimeter wells (Section 5.3). Soil gas contamination is therefore limited in extent to the area within the boundaries of the Waste Pits OU.

The Del Amo Respondents (Shell Oil Company) and USEPA have evaluated alternative treatment technologies for implementation of the SVE component of the remedy, as presented in Section 6.3. A remedial design is soon to be approved for a treatment system consisting of a combination of SVE and In-Situ Bioventing Technology (IBT). This system will be constructed in early 2006. The long-term effectiveness of this treatment system in protecting groundwater beneath the waste pits will be evaluated during the second five-year review (to be performed in 2010).

### 6.1.2 Opportunities for Optimization

While the cap gas collection and treatment system is operating effectively, there are opportunities for optimization that could reduce costs associated with system operation and monitoring while maintaining the effectiveness and protectiveness of the system. The system currently operates for 4 hours daily and removes approximately two pore volumes of soil gas daily. To reduce operating costs, the operating time of the cap gas collection and treatment system should be reduced in a staged fashion (i.e., from 4 to 2 hours daily, every other day, weekly, bi-weekly, etc.). While this would likely result in an increase in VOC concentrations in the system influent, past monitoring data suggest that the efficiency of the system improves with increased VOC concentrations in the system influent. A reduction in operating time would therefore optimize the system and reduce costs associated with system operation. Routine monitoring should be performed following this optimization to ensure that the effluent standard is not being exceeded.

### 6.1.3 Implementation of Institutional Controls

As stated in Section 4.2.3, LUCs have been recorded for the two parcels that comprise the Waste Pits OU. The Unilateral Administrative Order for Remedial Action (1999) requires that the Respondents implement, monitor, and maintain the institutional controls selected in the Waste Pits ROD. The LUCs outline the restrictions associated with the Waste Pits OU, including

[12] Benzene concentrations at the fence line were estimated through an evaluation of emissions from a thermal oxidizer (the SVE treatment technology selected in the Waste Pits ROD) and an air dispersion analysis, as presented in the Prefinal Design Report (Parsons 1999b)

prohibiting use as a hospital, school, day care, or for residential purposes and prohibiting disturbance to the cap, SVE system, or groundwater monitoring wells without notification to and approval by USEPA. The LUCs also identify provisions for Waste Pits OU access and enforcement by DTSC and USEPA. The covenants state that the Del Amo Participating Party (Shell Oil Company) shall be responsible for the ongoing monitoring and enforcement of the environmental covenants and restrictions. The Waste Pits OU inspection showed that the LUCs are effective. All restrictions established in the LUCs are in place and functioning properly. No use of the property inconsistent with the LUCs was observed during the inspection.

Monitoring, reporting, and enforcement protocols are in place to successfully implement the deed restrictions for the Waste Pits OU. The Unilateral Administrative Order for the Waste Pits OU remedial design specifies that the deed restrictions are part of the remedy to be implemented and that the remedy is to be operated and protected as described in the O&M Manual (Parsons et al. 1999a). The O&M Manual specifies that the deed restrictions are part of the remedy, and also contains the following specifications relevant to implementation and monitoring of the deed restrictions:

- An objective of the plan is to maintain the integrity of the cap;
- An annual report describing the inspections, maintenance, monitoring and evaluation will be submitted;
- If a condition arises that could cause exposure to the surrounding community, USEPA and DTSC shall be notified within 24 hours;
- O&M activities include inspections, which are cursory visual observations of the remedy components;
- Inspections of all remedy components shall occur quarterly; and
- The types of things to look for during inspections are specified.

The remedial action objectives for the deed restrictions are two-fold: to prevent residential use, and to prevent any other use that could impact the integrity of the cap. Although the O&M Manual does not specifically state that the site will be inspected for residential use, the inspection specifications do include examining the integrity of the cap. Because any residential or other prohibited use of the Waste Pits OU land would require some amount of excavation, such activities would be observed during our inspections and would be reported accordingly.

The reporting protocols specified in the O&M Manual include a requirement for USEPA and DTSC to be notified within 24 hours if a condition arises at the site that could cause exposure to the surrounding community.

Although the site inspections are only specified to occur quarterly, O&M Manual provisions for operating the cap gas collection and treatment system currently require biweekly site visits to monitor the system. This biweekly site presence enables more frequent observations than the quarterly inspections. Maintenance personnel would presumably note, during their biweekly visits, any conditions at the site that require immediate attention, such as deed restriction violations.

Based on the existing operation and maintenance protocols established in the O&M Manual which are enforceable by the Unilateral Administrative Order for Remedial Design, USEPA concludes that acceptable monitoring procedures for the deed restrictions are in place.

## 6.2 Current Validity of Assumptions Used During Remedy Selection

*Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?*

The following sections present an evaluation of the Applicable or Relevant and Appropriate Requirements (ARARs), assumptions used in the human health risk assessment, and assumptions used during the remedy selection process.

### 6.2.1 Regulatory Review

Section 121(d) of CERCLA requires that remedial actions implemented at CERCLA sites attain any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be ARARs.

Applicable requirements are those cleanup standards, criteria, or limitations promulgated under federal or state law that address the specific situation at a CERCLA site.

If a requirement is not applicable, the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations sufficiently similar to the circumstances of the proposed response action and are well-suited to the conditions of the site. The criteria for determining relevance and appropriateness are listed in Title 40, Code of Federal Regulations (CFR), Section 300.400(g)(2) [40 CFR 300.400(g)(2)].

Pursuant to USEPA guidance, ARARs generally are classified into three categories: chemical-specific, location-specific, and action-specific requirements. These categories of ARARs are defined below:

- **Chemical-specific ARARs** include those laws and requirements that regulate the release to the environment of materials possessing certain chemical or physical characteristics or containing specified chemical compounds. These requirements generally set health- or risk-based concentration limits or discharge limitations for specific hazardous substances. If, in a specific situation, a chemical is subject to more than one discharge or exposure limit, the more stringent of the requirements should generally be applied.
- **Location-specific ARARs** are those requirements that relate to the geographical or physical position of the site, rather than the nature of the contaminants. These requirements may limit the placement of remedial action features, and may impose additional constraints on the cleanup action. For example, location-specific ARARs may refer to activities in the vicinity of wetlands, endangered species habitat, or areas of historical or cultural significance.

- **Action-specific ARARs** are requirements that apply to specific actions that may be associated with site remediation. Action-specific ARARs often define acceptable handling, treatment, and disposal procedures for hazardous substances. Examples of action-specific ARARs include requirements applicable to landfill closure, wastewater discharge, hazardous waste disposal, and emissions of air pollutants.

To-be-considered (TBC) criteria are defined in 40 CFR 300.400(g)(3). TBCs are non-promulgated criteria, advisories, guidance, and proposed standards issued by federal or state governments that may provide useful information or recommended procedures for remedial action. These requirements were reviewed as part of this five-year review and are presented along with the ARARs in Tables 5-4 and 5-5.

### 6.2.2 Five-Year Review of ARARs

The ARARs and TBCs reviewed for this five-year review are those presented in the Waste Pits ROD and the ESD. This review focuses on the identification of any changes to the ARARs provided in the Waste Pits ROD and the ESD. In the preamble to the final National Contingency Plan, USEPA states that it will not reopen remedy selection decisions contained in RODs (i.e., ARARs are normally frozen at the time of ROD signature) unless a new or modified requirement calls into question the protectiveness of the selected remedy (55 FR 8757, March 8, 1990).

The Waste Pits ROD and the ESD identified relevant portions of the following requirements as ARARs:

- California Hazardous Waste Control Act
- California Health and Safety Code Section 2500 et seq and regulations for recycled materials
- RCRA
- Clean Air Act, SCAQMD

### 6.2.3 Summary of Potentially Significant Changes to Existing ARARs

Tables 5-4 and 5-5 present the updated action specific ARARs. No chemical-specific or location-specific ARARs exist for the Waste Pits ROD or ESD remedies.

There are minimal changes to ARARs since the issuance of the Waste Pits ROD or the ESD that would affect the protectiveness of the remedy. There are several Clean Air Act regulations (under the authority of the SCAQMD) that have been amended since the issuance of the Waste Pits ROD and the ESD. Remedial activities will comply with the provisions of these rules. These rules do not pose a significant change to the protectiveness of the remedy but are called out here for consistency with Tables 5-4 and 5-5:

- Clean Air Act, Regulation XI – Rule 1150.2; Control of Gaseous Emissions from Inactive Landfills was rescinded in 1998.

- Clean Air Act, Regulation XI – Rule 1166, Emission Standards from Soil Decontamination is being amended for the VOC test methods to correspond with the test methods recently adopted by the Bay Area Air Quality Management District.

- Clean Air Act, Regulation XIII – Rule 1401, New Source Review for Toxic Air Contaminants was amended to specify limits on cancer risks and the non-cancer acute and chronic hazard index for units that emit toxic air contaminants.

In summary, the ARARs established in the Waste Pits ROD and the ESD do not require revision to ensure the protectiveness of current remedial actions or to comply with state or federal requirements.

TABLE 6-2
Action-specific ARARS Identified in the ESD (for resin adsorption treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| California Code of Regulations | 22 CCR §66261.1-4, 21, 24 | A hazardous waste is considered a RCRA hazardous waste if it exhibits any of the characteristics of ignitability, corrosivity, reactivity, or toxicity, or if it is listed as a hazardous waste. Most waste determinations will focus on whether the generated waste could be classified as toxicity characteristic waste as defined by the contaminant concentrations. Wastes can be classified as non-RCRA, State-only hazardous wastes if they exceed the soluble threshold limit concentration or total threshold limit concentration values. | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| California Code of Regulations | 22 CCR §66264.190,192-199 | Article 10. Tank Systems. Regulations are for facilities that use tank systems for transferring, storing or treating hazardous waste. The absorption system waste will be recycled thus the regulations are AR. Residual amounts of wastes would be disposed of as hazardous waste and this regulation applicable for those liquids. | Applicable or relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. If the final treatment technology requires transfer, storage or treatment of hazardous waste in tank systems, the provisions of these regulations will be complied with. |
| California Code of Regulations | 22 CCR §66264.600-602 | Article 1 – Facilities that transfer, treat, store or dispose of hazardous waste in miscellaneous units. | Relevant and appropriate for recycled waste and applicable for non-recycled waste. | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. If the final treatment technology results in generation of either recycled or non-recycled waste and utilizes miscellaneous units, the provisions of these regulations will be complied with. |
| California Code of Regulations | 22 CCR §66264.700-708 | Article 17 – Specifies the required environmental monitoring at permitted facilities. | Relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities |

TABLE 6-2
Action-specific ARARS Identified in the ESD (for resin adsorption treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| | | | | will comply with the substantive requirements of these regulations. |
| California Code of Regulations | 22 CCR §66264.1030-1036 | Article 27 – Air emission standards for process vents. | Applicable or relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. If the final treatment technology includes facilities that treat, store or dispose of hazardous waste with organic concentrations of at least 10 ppmw and uses process vents, the provisions of these regulations will be complied with. |
| California Code of Regulations | 22 CCR §66264.1050-1065 | Article 28 – Air emission standards for equipment leaks. Regulations are for systems that handle hazardous waste with an organic content of at least 10 ppm. The system is expected to exceed this content. | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| California Code of Regulations | 22 CCR §66265.400-406 | Article 17 – Chemical, physical, and biological treatment. | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| California Health and Safety Code | CHSC § 25143.2 | This regulation provides definitions for recyclable materials, describes exemptions from waste classification for recyclable materials, and provides management and handling requirements and reporting requirements. These regulations apply to the chemicals that are recovered from the SVE. | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| South Coast Air Quality Management | SCAQMD Rule 463 – Organic Liquid Storage | This rule would apply if the final design calls for tanks whose capacity exceeds | Applicable | There have been no substantive changes that would bear on the protectiveness of the remedy. |

TABLE 6-2
Action-specific ARARS Identified in the ESD (for resin adsorption treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| District | | 19,815 gallons. | | Remedial activities will comply with provisions of these regulations. |
| South Coast Air Quality Management District | SCAQMD Rule 466 – Pumps and Compressors | This rule is applicable if the final design calls for pumps or compressors to handle the recovered chemicals, which are VOCs. Substantive requirements only applicable. | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with the substantive requirements of this rule. |
| South Coast Air Quality Management District | SCAQMD Rule 466.1 – Valves and Flanges | This rule is applicable if the final design calls for valves and flanges that work with reactive organic compounds. Substantive requirements only applicable. | Applicable or relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with the substantive requirements of this rule. |
| South Coast Air Quality Management District | SCAQMD Rule 467- Pressure Release Devices | This rule is applicable if the final design calls for pressure relief devices that handle VOCs. | Relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| South Coast Air Quality Management District | SCAQMD Rule 476 – Steam Generating Equipment | This rule sets nitrogen oxides emission limits for steam generating equipment whose maximum head input rate exceeds 50 million British thermal units (BTUs) per hour. | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| South Coast Air Quality Management District | SCAQMD Rule 1146 – Emissions of Oxides of Nitrogen from small industrial, institutional and commercial boilers, steam generators and process heaters | This rule sets nitrogen oxides emission limits whose heat input capacity exceeds 5 million BTUs per hour. This rule would be applicable if the final design calls for equipment of that size and type. | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| South Coast Air Quality | SCAQMD Rule 1146.1- Emissions of Oxides of | This rule sets nitrogen oxides emission limits whose heat input capacity exceeds | Applicable | There have been no changes to these requirements that would significantly |

TABLE 6-2
Action-specific ARARS Identified in the ESD (for resin adsorption treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| Management District | Nitrogen from small industrial, institutional and commercial boilers, steam generators and process heaters | 2 million BTUs per hour but is less than 5 million BTUs per hour. This rule would be applicable if the final design calls for equipment of that size and type. | | impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| South Coast Air Quality Management District | SCAQMD Rule 1146.2 – Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers | This rules sets nitrogen oxides emission limits for boilers, steam generators and process heaters whose heat input capacity exceeds 75,000 BTUs per hour but is less than 2 million BTUs per hour. | Applicable | Amended January 7, 2005: "On or after January 1, 2006, no person shall operate any unit in the District, more than 15 years old, based on the original date of manufacture….units with varying rated heat inputs." Remedial activities will comply with provisions of these regulations. |
| South Coast Air Quality Management District | SCAQMD Rule 1173 – Fugitive Emissions of VOCs | This rule controls VOC leaks from valves, fittings, pumps and other equipment at specific types of facilities | Relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| South Coast Air Quality Management District | SCAQMD Rule 1176 – Emissions from Wastewater Systems | This rule controls VOC emissions from wastewater systems. | Relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |

TABLE 6-3
Action-specific ARARs from the Waste Pits ROD (for Thermal Oxidation treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| California Code of Regulations | 22 CCR § 66262.11 | Hazardous Waste Determination by Generators | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR § 66262.34 | Accumulation Time | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | CCR § 66264.14 (a), (b) | Hazardous Facility General Security Requirements | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | CCR § 66264.15 | General Facility Inspection Requirements for SVE including Vapor Water Treatment | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | CCR § 66264.17 | Hazardous Waste Facility General Requirements for Ignitable, Reactive or Incompatible Wastes | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | CCR § 66264.25 | Hazardous Waste Facility Seismic and Precipitation Design Standards | Applicable | There have been no changes to these requirements that would significantly |

TABLE 6-3
Action-specific ARARs from the Waste Pits ROD (for Thermal Oxidation treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| | | | | impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | CCR § 66264.31-35 and .37 | Preparedness & Prevention-Design and Operation of Facility | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | CCR § 66264.51-.56 | Contingency Plan | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR § 66264.111 | Hazardous Waste Facility Closure Performance Standard | Applicable or relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR §66264.114 | Hazardous Waste Facility Closure Disposal decontamination of Equipment, Structure and Soils | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR §66264.117 (a), (b)(1)(excluding reference to Article 6) and (d) | Hazardous Waste Facility Post-closure Care and Use of Property for RCRA Cap and SVE | Applicable or relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this |

TABLE 6-3
Action-specific ARARs from the Waste Pits ROD (for Thermal Oxidation treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| | | | | regulation. |
| California Code of Regulations | 22 CCR §66264.119 (a) (b)(1) | Hazardous Waste Facility Post-closure Notices | Applicable or relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR §66264.171-178 | Use and Management of Containers | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR §66262.34 | Hazardous Waste Accumulation Time Requirements | Applicable | There have been no substantive changes that would bear on the protectiveness of the remedy. Remedial activities will comply with provisions of these regulations. |
| California Code of Regulations | 22 CCR §66264.228 | Facility Closure and Post-closure Care for Surface Impoundments | Relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR §66264.310 | Hazardous Waste Facility Closure and Post-closure for Landfills | Relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR §66264.341-351 | Hazardous Waste Incinerators Requirements | Relevant and appropriate | There have been no changes to these requirements that would significantly |

TABLE 6-3
Action-specific ARARs from the Waste Pits ROD (for Thermal Oxidation treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| | | | | impact the current remedial actions or cleanup standards. These ARARs are applicable for the original ROD; however, it does not seem likely that any type of thermal destruction will be used in treating the soil vapor. These ARARs remain relevant, but not applicable at this time. |
| California Code of Regulations | 22 CCR § 66264.1101 | Containment Buildings Design and Operating Standards | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR §66268.1 | Purpose, Scope, and Applicability | Applicable or relevant and appropriate | There have been no substantive changes that would bear on the protectiveness of the remedy. Remedial activities will comply with provisions of these regulations. |
| California Code of Regulations | 22 CCR §66268.3 | Hazardous Waste Dilution Prohibition as Substitute for Treatment | Applicable or relevant and appropriate | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| California Code of Regulations | 22 CCR §66268 Articles 4, 10 and 11 | Hazardous Waste Treatment Standards and Non-RCRA Land Disposal Restrictions | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| Clean Air Act SCAQMD | Rule 401 | Visible Emissions<br><br>In California, the authority for | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or |

TABLE 6-3
Action-specific ARARs from the Waste Pits ROD (for Thermal Oxidation treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| | | enforcing the standards established under the Clean Air Act have been delegated to the State. The program is administered by the SCAQMD in Los Angeles. | | cleanup standards. Remedial activities will comply with provisions of this regulation. |
| Clean Air Act SCAQMD | Rule 402 | Nuisance | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| Clean Air Act SCAQMD | Rule 403 | Fugitive Dust | Applicable | Amended in February 2004. There have been no substantive changes that would bear on the protectiveness of the remedy. Remedial activities will comply with provisions of this rule. |
| Clean Air Act SCAQMD | Rule 473 | Disposal of Solid and Liquid Wastes | Applicable | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of these regulations. |
| Clean Air Act SCAQMD | Regulation X NESHAP | Substantive Standards for Benzene | Applicable | Amended to “certify a notice of exemption” on May 7, 2004. There have been no substantive changes that would bear on the protectiveness of the remedy. Remedial activities will comply with provisions of this rule. |
| Clean Air Act SCAQMD | Regulation XI – Rule 1150.2 | Source Specific Standards – Control of Gaseous Emissions from Inactive Landfills | Relevant and appropriate | Rescinded by South Coast Air Quality Monitoring Governing Board on April 10, 1998. May no longer be applicable. |
| Clean Air Act | Regulation XI – Rule 1166 | Source Specific Standards – | Applicable | Suggested that the test method in the |

TABLE 6-3
Action-specific ARARs from the Waste Pits ROD (for Thermal Oxidation treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| SCAQMD | | Emissions from Soil Decontamination | | proposed amended rule used for measuring VOC concentrations in soil be amended to correspond with the test method adopted by the Bay Area Air Quality Management District. The rule is currently being amended and undergoing the exemption from California Environmental Quality Act requirements as recommended by staff. Remedial activities will comply with provisions of this rule. |
| Clean Air Act SCAQMD | Regulation XIII – Rule 1303 | New Source Review – Attainment of State and Federal Ambient Air Quality Standards | Applicable | Amended December 6, 2002, as part of resolution 02-31. There have been no substantive changes that would bear on the protectiveness of the remedy. Remedial activities will comply with provisions of this rule. |
| Clean Air Act SCQAMD | Regulation XIV – Rule 1401 | New Source Review –Toxic Air Contaminants | Applicable (substantive standards only) | Amended March 4, 2005, and adopted resolution no. 05-11. Certification of the addendum was made to the July 1998 Final Environmental Assessment for Rule 1401. Remedial activities will comply with provisions of this rule. |
| Clean Air Act SCQAMD | Regulation XIV | Toxics | Applicable (substantive standards only) | There have been no changes to these requirements that would significantly impact the current remedial actions or cleanup standards. Remedial activities will comply with provisions of this regulation. |
| USEPA | Hydrologic Performance of Landfill Performance Mode, Vol I and II | | TBC | |
| USEPA | Landfill and Surface Impoundment Evaluation | | TBC | |

TABLE 6-3
Action-specific ARARs from the Waste Pits ROD (for Thermal Oxidation treatment)
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Source | Citation | Description | Status | Findings and Comments |
|---|---|---|---|---|
| Clean Air Act SCQAMD | | Best Available Control Technology (BACT) Guidelines Document | TBC | This policy is a TBC. On December 11, 1998, the Governing Board approved: (1) a new format for listing BACT determinations; and (2) a revised process for updating AQMD BACT Guidelines that complies with federal and state laws. On October 20, 2000, the Governing Board approved revisions to the New Source Review regulations that: (1) maintained the federal Lowest Achievable Emission Rate requirement for major polluting facilities; and 2) established a minor source BACT for non-major polluting facilities that will consider cost before making minor source BACT more stringent. |
| USEPA | | Region 9 PRGs (1996) | TBC | |

### 6.2.4 Assumptions of the Human Health Risk Assessment

The assumptions made in performing the human health risk assessment include:

- Uses of the Waste Pits OU will not change and the site remains undeveloped.
- A fence is located around the perimeter of the Waste Pits OU and is frequently inspected and maintained.
- All seeps that occur are mitigated.
- Fill soil and vegetation over pits are protected to minimize erosion.
- The people most affected by any hazardous substance releases from the Waste Pits OU are residents located at the fence line on the south side of the pits, office workers located at the northern fence line, and maintenance workers on the site.
- The only pathway by which people could be exposed to constituents at or near the ground surface would be from inhaling vapors.

The assumptions made in performing the human health risk assessment remain valid. The uses of the Waste Pits OU have not changed, and the site remains undeveloped. A fence remains along the perimeter of the Waste Pits OU. The fence and potential seeps in the cap are inspected on a routine basis by the O&M contractor, and repairs are performed as needed. (Seeps have not been observed during routine site inspections.) The presence of the cap and routine maintenance of the cap ensure that the soil and vegetation over the pits are maintained to minimize erosion, and therefore prevent human exposure to the waste.

The receptors evaluated in the human health risk assessment (off-site residents, office workers and on-site maintenance workers) remain valid. The risk assessment conservatively assumed that residents live at the fence line 24 hours per day, 350 days per year, for 30 years, and that the office workers are working at the fence line 10 hours per day, 5 days per week, for 25 years. For maintenance workers at the Waste Pits OU, the assessment compared their potential exposure to the Occupational Health and Safety Administration permissible exposure limits for the workplace, because they would be expected to work at the Waste Pits area only periodically. As a result of the construction and maintenance of the cap and enforcement of the LUC, the risk assessment assumption that the only pathway by which people could be exposed to constituents at or near the ground surface would be from inhaling chemical vapors remains valid. However, the cap gas capture and treatment system prevents this exposure.

The toxicity factors used in the human health risk assessment have changed since the human health risk assessment was originally performed. For example, benzene and naphthalene toxicity factors have been modified.[13] However, the human health risk assessment concluded that constituents at the Waste Pits OU do not present a significant risk to potential on- and off-site receptors. Cleanup goals were consequently not identified in the Waste Pits ROD for the waste material itself because the site was capped. Changes in toxicity factors therefore do not affect the remedial action objectives for the site. The cap has been successful at containing the waste material and the gas collection and treatment

[13] The benzene toxicity value was modified by USEPA, and the naphthalene value was modified by California EPA.

captures any vapors that emanate from it. As stated in Section 6.1, the effluent standard of 5 ppmv for VOCs captured and treated in the cap's vapor collection and treatment system remains protective of off-site residential receptors, in spite of the change in the toxicity factor for benzene. That standard was calculated using the SCAQMD air emission model assuming the effluent flowrate of a 1900 scfm SVE system. This means that when applied to a small cap gas collection and treatment system, with a small fraction of that flow, there is a factor of safety of several orders of magnitude.

### 6.2.5 Assumptions in Selecting Remedy

In selecting the remedy for the Waste Pits OU, it was assumed that the properties along 204th Street, immediately adjacent to (and south of) the waste pits, would be permanently removed from residential or related uses as a result of a private non-CERCLA buy-out agreement between community residents and several responsible parties (USEPA 1997a). Because of this assumption, USEPA did not evaluate the purchase of any residential properties or permanent relocation of any residents as part of the remedy for the Waste Pits OU. The residential structures immediately south of the Waste Pits have been removed, as shown in the aerial photograph presented on Figure 3-2, therefore the assumption made in selecting the remedy for the Waste Pits OU remains valid.

In selecting the remedy for the Waste Pits OU, the Waste Pits ROD relied on the conclusions of a scoping-level ecological risk assessment performed under State of California oversight. The assessment was performed following a field survey conducted on August 30, 1988. Plant and animal species present on-site were identified during the field survey. That assessment concluded that no plant species listed as rare, endangered, or sensitive were observed at the Waste Pits OU or in the immediate vicinity, and that these species are not expected to occur there in the future. In addition, the assessment concluded that, due to the disturbed nature of the site and lack of open natural habitat in the region, it is highly unlikely that any rare, endangered, or sensitive wildlife species would use the site (Dames & Moore 1990). Based on the results of that assessment, the potential risk to ecological receptors was not evaluated further (Dames & Moore 1991).

Information from the scoping-level assessment presented in the Remedial Investigation Report (Dames & Moore 1990) and from the revised draft Baseline Risk Assessment Report (GeoSyntec & URS 2005) was evaluated as part of this five-year review. In addition, information collected during the site inspection performed in April 2005 (Section 5.5) was used to develop a reconnaissance-level understanding of current ecological conditions at the site. It was concluded that no native wildlife habitat exists at the site, and the site is inhabited only by organisms typical of highly developed urban areas. No threatened or endangered species were encountered or were expected to utilize the Waste Pits OU. USEPA has concluded that actual or potential exposure to ecological receptors on the site is likely negligible (USEPA 2005a).

## 6.3 Recent Information Affecting the Protectiveness of the Remedy

*Has any other information come to light that could call into question the protectiveness of the remedy?*

No, no other information has come to light that could call into question the protectiveness of the remedy.

# 7.0 Issues and Recommendations

Issues identified during the five-year review process relate to system optimization, evaluation of ARARs for bioventing technology, and the remedial action objectives for the Waste Pits OU. This section discusses the issues in detail and provides recommendations for follow-up. Table 7-1 summarizes these issues and recommendations as well as presents the party responsible, oversight agency, and the effect that it has on the protectiveness of the environment and human health currently and in the future.

## Issue

Operation of the cap gas collection and treatment system should be optimized.

## Recommendation

As presented in Section 6.1, the operating time of the cap gas collection and treatment system should be reduced in a staged reduction (i.e., from 4 to 2 hours daily, every other day, weekly, bi-weekly, etc.). While this would likely result in an increase in VOC concentrations in the system influent, past monitoring data suggest that the efficiency of the system improves with increased VOC concentrations in the system influent. A reduction in operating time would therefore optimize the system and reduce costs associated with system operation.

It is recommended that the system continue to be monitored biweekly to ensure that effluent concentrations do not exceed 5 ppmv. The frequency of system monitoring should be re-evaluated following a period of evaluation and assessment of the revised operating conditions (initially recommended to be one year).

## Issue

Remedial design for an SVE/IBT system is currently being finalized. Potential ARARs were identified in a screening level review. An ARARs determination will be made for the bioventing treatment technology.

## Recommendation

The previously identified ARARs for the SVE system will be reviewed to ensure the IBT component is addressed; if not IBT ARARs will be identified and included in a ROD Explanation of Significant Differences (ESD).

## Issue

The following remedial action objectives identified for the Waste Pits OU have not yet been achieved:

- Protection of future groundwater users from constituents that may migrate from the Waste Pits in the future.
- Protection of future groundwater users from downward advective and dispersive transport of constituents already in the soils below the Waste Pits and above the water table.

- Protection of future groundwater users from constituents already in the soil below the Waste Pits and above the water table in the event that the water table rises into the contaminated soil.

These remedial action objectives have not been achieved because the aboveground components of the SVE system have not been constructed or operated; these elements will be constructed and operated beginning in early 2006.

## Recommendation

The SVE/IBT system that is being designed will be installed to reduce impacts to groundwater and to achieve the remedial action objectives for the Waste Pits OU.

TABLE 7-1
Issues, Recommendations, and Follow-up Actions
*Five-Year Review Report, Del Amo Waste Pits Operable Unit, Los Angeles, California*

| Issue | Recommendations and Follow-up Actions | Party Responsible | Oversight Agency | Milestone Date | Affects Protectiveness (Y/N) | |
|---|---|---|---|---|---|---|
| | | | | | Current | Future |
| Operation of the cap gas collection and treatment system should be optimized. | a.) The operating time of the cap gas collection and treatment system will be reduced from 4 to 2 hours daily.<br>b.) The system will continue to be monitored biweekly to ensure that effluent concentrations do not exceed 5 ppmv.<br>c.) The frequency of system monitoring will be re-evaluated following one year of system operation under the revised conditions. | Del Amo Respondents. | USEPA | Autumn 2005 | N | N |
| USEPA has not made an ARARs determination for the bioventing treatment technology. | a.) USEPA will follow-up with evaluating the potential ARARs to determine whether there are ARARs that would apply to the IBT, and have not been previously identified in the Waste Pits ROD or ESD. | USEPA | | Autumn 2005 | N | N |
| The remedial action objectives identified for the Waste Pits OU in regards to groundwater have not been fully achieved. | a.) The SVE/IBT system that is being designed will be installed to reduce impacts to groundwater and to achieve the remedial action objectives for the Waste Pits OU. | Del Amo Respondents. | USEPA | According to construction schedule | N | Y |

# 8.0 Protectiveness Statement

The remedy at the Waste Pits OU is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled. It is protective in the short term as no current exposures are occurring due to the LUCs. Once the SVE/IBT system is operating as designed, the remedy will be fully protective.

# 9.0 Next Five-Year Review

The next five-year review should be performed in 2010. A report to document the results of that review shall be completed by September 30, 2010.

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