# COOPER DRUM COMPANY SUPERFUND SITE
# REMEDIAL DESIGN
# TECHNICAL MEMORANDUM
# for
# FIELD SAMPLING RESULTS

**Prepared for:**

**Contract No. 68-W-98-225 / WA No. 247-RDRD-091N**
**U.S. Environmental Protection Agency**
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## DISCLAIMER

This technical memorandum has been prepared for the United States Environmental Protection Agency by URS Group, Inc. (URS). This document is intended to transmit the information collected by URS during the remedial design field sampling effort initiated in May 2003 at the Cooper Drum Company Superfund Site.

The limited objective of this memorandum, the ongoing nature of the project, along with the evolving knowledge of site conditions and chemical effects on the environment and human health, must all be considered when evaluating the memorandum because subsequent facts may become known that may make this document premature or inaccurate.

This memorandum has been prepared by URS under the review of registered professionals. The conclusions and recommendations in this memorandum are based upon URS' data evaluation. The interpretation of the data and the conclusions drawn were governed by URS experience and professional judgment.

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AOP | advanced oxidation process |
| bgs | below ground surface |
| B(a)P-TE | benzo(a)pyrene-toxicity equivalent |
| cfm | cubic feet per minute |
| COC | contaminant of concern |
| Cooper Drum | Cooper Drum Company Superfund Site |
| CPT | cone penetrometer test |
| DCA | dichloroethane |
| DCE | dichloroethene |
| DPA | drum processing area |
| DPE | dual-phase extraction |
| DQO | data quality objective |
| DTSC | California Department of Toxic Substances Control |
| DWR | California Department of Water Resources, Southern District |
| EPA | United States Environmental Protection Agency |
| former HWA | former hard wash area |
| HRC | hydrogen release compound |
| ISCO | in situ chemical oxidation |
| MCL | California maximum contaminant level |
| MNA | monitored natural attenuation |
| PAH | polycyclic aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| PCE | tetrachloroethene |
| ppbv | parts per billion by volume |
| RD | remedial design |
| RD/TM1 | *Cooper Drum Company Superfund Site Remedial Design Field Sampling and Treatability Bench-Scale Test Results Technical Memorandum* |
| RI/FS | remedial investigation/feasibility study |
| ROD | record of decision |
| SAP | sampling and analysis plan |
| SVE | soil vapor extraction |
| SVOC | semivolatile organic compound |

## ACRONYMS AND ABBREVIATIONS (Continued)

| | |
|---|---|
| TCE | trichloroethene |
| URS | URS Group, Inc. |
| UTL | upper tolerance limit |
| VOC | volatile organic compound |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |

# 1.0 INTRODUCTION

This memorandum, produced by URS Group, Inc. (URS) for the U.S. Environmental Protection Agency (EPA), is part of the remedial resign (RD) phase of the process to implement the record of decision (ROD) for the Cooper Drum Company Superfund Site (Cooper Drum), located at 9316 South Atlantic Avenue in South Gate, Los Angeles County, California (Figure 1). The site layout is presented on Figure 2.

During the Cooper Drum Remedial Investigation, EPA identified site areas that require additional characterization (data gaps). In addition, the California Department of Toxic Substance Control (DTSC) agreed to the selected soil and groundwater remedies stated in the ROD, provided that additional data were collected to address those data gaps prior to implementation of the selected remedies. EPA included the following components in the selected soil and groundwater remedies to address these concerns.

- Conduct additional soil sampling in the drum processing area (DPA) and former hard wash area (former HWA) to further define the extent of non-volatile organic compound (VOC) contamination and the need for excavation beyond the estimated 2,700 tons of soil.
- Conduct additional soil gas sampling in the DPA to further identify the extent of VOC contamination and the need for remediation using dual-phase extraction (DPE) in this area.
- Conduct additional groundwater sampling to further define the downgradient extent of the VOC contamination (beyond the property boundary).

This technical memorandum presents the results of field sampling conducted to fill these data gaps and discusses their impact on the selected remedies. A summary of the field sampling results, including conclusions and recommendations is provided in Section 4.0 and is summarized below.

- The extent of non-VOC soil contamination is well defined in the former HWA. Based on perimeter sampling on the north side of the DPA building, soil contamination (polycyclic aromatic hydrocarbons [PAHs]) is likely to be present beneath the drum processing building. Since it is not considered feasible to excavate beneath the building, institutional controls will be needed for this area. The volume of non-VOC-contaminated soil originally estimated in the ROD has not significantly changed.
- The extent of VOC soil contamination is well defined in both the former HWA and DPA. Based on the RD soil gas sampling results for VOC contamination, in addition to the HWA, the DPA will also require remediation.
- The downgradient vertical extent of groundwater contamination is defined. The downgradient lateral extent of groundwater contamination is mostly defined. However due to the commingling of additional groundwater contamination from an adjacent plume in the shallow aquifer, there is uncertainty in defining the southeastern plume boundary. Additional groundwater sampling will be necessary to address this uncertainty.
- The most significant discovery during the sampling effort was the presence of 1,4-dioxane in the site groundwater. It has been added to the site list of contaminants of concern (COCs) and will require the use of in situ chemical oxidation (ISCO) for the groundwater remedy.

The RD sampling was performed in accordance with the *Cooper Drum Company Remedial Design Sampling and Analysis Plan* (SAP) (URS, 2003a).

Section 1.0 of this technical memorandum presents the RD field sampling effort objectives. Section 2.0 describes the field sampling effort. Section 3.0 presents the sampling results, including a data quality assessment. Section 4.0 presents conclusions and recommendations. Section 5.0 lists the references cited in this memorandum. Appendix A of this technical memorandum presents the soil boring logs, cone penetrometer test (CPT) boring logs, and monitor well boring/construction logs. Appendix B presents the soil gas contour maps. The VLEACH modeling input and output data are provided as Appendix C. Appendix D presents groundwater elevation contour maps. Appendix E presents the Data Quality Assessment. Appendix F provides the estimate for the soil volume that may require excavation.

# 2.0 REMEDIAL DESIGN FIELD SAMPLING EFFORT

This section summarizes the RD sampling effort, which was initiated in May 2003. A detailed description of the site background, site hydrogeology, data quality objectives (DQOs), and sampling rationale can be found in the SAP (URS, 2003a).

The data gaps identified in the Remedial Investigation Feasibility Study (RI/FS) report can be summarized as follows:

- Lateral extent of soil gas contamination in the former HWA;
- Concentrations and lateral and vertical extent of soil gas contamination in the DPA;
- Lateral extent PAHs in soil at the former HWA and DPA;
- Lateral and vertical extent of polychlorinated biphenyls (PCBs) in soil at the former HWA;
- Lateral extent of lead in soil at the former HWA, and lateral and vertical extent of lead in soil at the DPA; and
- Lateral and vertical extent of VOC groundwater contamination downgradient of the site.

The sampling efforts initiated in May 2003 to fill these data gaps are discussed in this section by media.

It should be noted that the tenant (Consolidated Drum) of the Cooper Drum Superfund Site terminated their lease on the property and moved their operations to off-site facilities. This allowed for soil gas sampling and installation of a soil vapor extraction (SVE) well within the DPA building. All drum-recycling equipment and associated containment piping and tanks were removed from the site. As of April 2004, there were three new tenants on site, including a pallet storage company, a towing company, and an automotive repair company (this last company had moved out as of May 2006).

## 2.1 SOIL GAS SAMPLING

### 2.1.1 Borings and Samples

Soil gas data gaps were addressed with six borings at the former HWA and 19 at the DPA. The locations are shown on Figure 3. All soil borings were completed using direct push methods, with the exception of SG-42 which was completed with a hollow-stem auger method. At the former HWA, three soil gas borings (SG-18 through SG-20) were completed in May 2003 to define the lateral extent of contamination west and north of the former HWA. Sampling data were used for design and implementation of the DPE system in this area. Based on the soil gas concentration in SG-20, an additional three soil gas borings (SG-39 through SG-41) were completed west of SG-20 in January 2004.

At the DPA, nine soil gas borings (SG-21 through SG-29) were initially completed in May 2003 in and around the DPA to further evaluate the extent of contamination and the need for remediation using DPE in this area. Based on soil gas concentrations in the initial DPA borings, an additional 10 soil gas borings were completed in January and February 2004.

Soil gas samples were collected from 10, 20, and 30 feet below ground surface (bgs) from each location, except for soil gas borings SG-24 through SG-27. Refusal was encountered prior to obtaining a 30-foot bgs soil gas sample at these locations. The data obtained from the 25 soil gas borings were entered into the VLEACH model to evaluate potential impacts to groundwater in these areas. The VLEACH modeling results, as well as the soil gas sampling results, are discussed in Section 3.0.

### 2.1.2 SVE Testing

Based on the results of the additional soil gas sampling and VLEACH modeling, it appeared that SVE was also warranted in the DPA, as well as the former HWA. Therefore, a 4-inch-diameter SVE well (SVE-2) and two sets of vapor probes (VP-3 and VP-4) were installed in the DPA. The borehole for SVE-2 was drilled to a depth of approximately 48 feet and constructed with 40 feet of slotted casing from 8 to 48 feet bgs. VP-3 and VP-4 consist of three nested wells at each location. The three nested wells were used to monitor soil vapor at 10, 20, and 30 feet bgs. Following installation of the wells and probes, a short-term SVE test was performed on March 3, 2004.

The SVE test was performed for approximately five hours and consisted of inducing a vacuum in SVE-2 at increasing flow rates. Induced vacuum in the subsurface was measured at VP-3 and VP-4 to evaluate air permeability and radius of influence. Samples of the soil vapor were collected in Summa canisters from SVE-2 during the test at 10, 30, 100, and 280 minutes after system startup. The soil vapor samples were submitted to the EPA Region 9 Laboratory and analyzed for Method TO-15 analytes. Test results are discussed in Section 3.0.

In addition, SVE-1 and SVE-2 were also sampled and a pumping test conducted during the RD effort to evaluate VOC concentrations and general well yield in the perched groundwater. SVE-1 was sampled and tested in December 2003 and SVE-2 was sampled and tested in April 2004.

## 2.2 SOIL SAMPLING

To assess the lateral and vertical extent of the soil contamination (PCBs, PAHs, and lead), 15 soil borings were sampled in May 2003: seven at the former HWA and eight at the DPA. The soil boring locations are shown on Figure 4. All soil boring logs are included in Appendix A. At the former HWA, seven soil borings (SB-18 through SB-23, and SB-32) were completed. Soil borings SB-18 through SB-23 were completed at locations selected to define the lateral extent of PAHs, PCBs, and lead. Soil boring SB-32 was completed adjacent to SB-10 to confirm the presence of a previously estimated PCB concentration.

Of the eight soil borings (SB-24 through SB-31) completed in the DPA, three (SB-26, SB-30, and SB-31) were proposed to be located inside the DPA building. As indicated in the SAP (URS, 2003a), pending site access, these borings could be moved outside the building, along the north side, and drilled at an angle beneath the building. Conditions inside the drum processing building prevented drilling within the building. Based on drilling conditions encountered during soil gas sampling (refusal at many locations), these borings were drilled vertically using direct push methods immediately adjacent to the building foundation. Soil boring SB-27 was completed to 15 feet bgs to define the vertical extent of a lead “hot spot” previously identified at 10 feet bgs in soil boring SB-14. The remainder of the DPA soil borings were completed at locations intended to define the lateral extent of PAHs and to evaluate the occurrence of VOC contamination.

As discussed in the following Section 2.3. 1,4-dioxane was detected in the site groundwater and has been included as a site COC. To evaluate the presence of this COC in the soil, three soil borings (SB-34, SB-35 and SB-36) were sampled at 10, 20 and 30 feet in the HWA on March 2, 2006. The boring locations were triangulated around SVE-1 which is located in the VOC source area and has shown the highest VOC concentrations in the vadose zone (see Figure 4). Although classified as a semivolatile organic compound (SVOC), 1,4-dioxane is a known solvent stabilizer and would be associated with the VOC source.

## 2.3 GROUNDWATER SAMPLING

As mentioned in Section 1.0, the primary groundwater sampling objective was to define the downgradient extent of VOC contamination (beyond the property boundary). Secondary objectives included identifying locations for installation of in-plume wells to monitored natural attenuation (MNA) parameters; monitoring points for a treatability studies for enhanced reductive dechlorination hydrogen release compound (HRC) and in situ chemical oxidation (ISCO); and further delineation of upgradient contamination related to off-site sources. The chronology of groundwater sampling events that have occurred at the site since implementation of the RD are as follows:

- MNA monitor well sampling April/May 2003,
- CPT/HydroPunch borings May 2003,
- HRC pilot-scale field test December 2003 through April 2005,
- Monitor well installation and sampling December 2003 through November 2004, and
- ISCO pilot-scale field test July 2005 through June 2006.

The following subsections discuss the above groundwater sampling events.

### 2.3.1 MNA Monitor Well Sampling April/May 2003

Locations of the on-site and off-site monitor and extraction wells present in April/May 2003 are shown on Figure 5. Fourteen existing wells and one new well were sampled during the April/May 2003 RD sampling effort for MNA parameters (e.g., dissolved oxygen, nitrate, ferrous iron, sulfate, etc.) to further evaluate groundwater treatment methods for a pilot-scale field test. The 15 wells were on-site wells MW-1 through MW-5, EW-1, and EW-2; off-site wells MW-15 through MW19 (located along Rayo Avenue); MW-10 and MW-12 (located on ELG Metals Facility); and new well MW-20, installed in February 2003 as part of the bench-scale treatability study. The wells were sampled using a low-flow purging method, with the exception of MW-12. Access to this well was limited, so the well was purged and sampled with a disposable bailer. During purging, water quality parameters including dissolved oxygen, temperature, conductivity, turbidity, pH, ferrous iron, and oxidation-reduction potential were monitored and recorded in the field. Groundwater samples were also collected and submitted for analysis of VOCs and MNA parameters including alkalinity, chloride, ethane, ethene, methane, nitrate, sulfate, and sulfide. The VOC results from the April/May 2003 sampling effort are discussed in Section 3.0 of this memorandum. Complete results of this MNA groundwater sampling effort are presented in the *Cooper Drum Company Superfund Site Remedial Design Field Sampling and Treatability Bench-Scale Test Results Technical Memorandum* (RD/TM1) (URS, 2003b).

### 2.3.2 Depth-Discrete Groundwater Sampling May 2003

Fourteen CPT/HydroPunch borings (CPT-25 through CPT-38) were installed in May 2003 to obtain lithologic data and depth-discrete groundwater samples. These data served as the basis for design and installation of the additional groundwater monitor wells at the site. Figure 5 shows the CPT boring locations.

Borings CPT-32 through CPT-36 were initially sampled for VOCs on a 48-hour analytical turnaround basis to evaluate the downgradient extent of the plume and determine locations of additional CPT borings for plume definition in this area. Based on the real time data, three additional borings (CPT-26, CPT-37, and CPT-38) were completed and sampled south of Southern Avenue. Borings CPT-25 and CPT-27 through CPT-31 were generally completed as planned in the SAP (URS, 2003a).

Total boring depths ranged from 129 to 147 feet bgs, with four to five depth-discrete groundwater samples collected between approximately 60 and 130 feet bgs. The samples were collected using the HydroPunch method as described in Subsection 6.3.1 of the SAP (URS, 2003a). The CPT boring logs are presented as Appendix A.

### 2.3.3 HRC Pilot-Scale Field Test December 2003 thru April 2005

In response to the MNA sampling, which indicated reductive conditions at the site (including low dissolved oxygen and redox potential, and the presence of daughter products), and the results of the treatability bench-scale test, an HRC pilot-scale field test (URS, 2003c) was initiated in December 2003. CPT-39 was developed as part of the pilot-scale field test in December 2003, to define the lithology to determine the injection interval for the HRC (hydrogen release compound).

Following completion of the RI/FS (URS, 2002) and the ROD, new information about emerging compounds, such as 1,4-dioxane, at solvent release sites has been reviewed and identified (in the winter of 2003) as a data gap. Therefore, after initiation of the HRC pilot-scale field test, testing for 1,4-dioxane was conducted in the site monitor wells during the HRC monitoring program. The 1,4 dioxane testing results are presented in Section 3.5.4.

### 2.3.4 Monitor Well Installations and Sampling December 2003 through November 2004

Thirteen wells (MW-20 through MW-32) were installed and sampled at the site in 2003. Table 1 presents the specifications for all wells at the site. Figure 5 shows all monitor well locations at the site.

All wells were designed based on lithologic data from adjacent CPT borings. The on-site wells and upgradient wells that monitor the shallow aquifer have been completed within a depth range of approximately 55 to 80 feet bgs; off site in the mid-plume area the depth range is slightly deeper, 70 to 90 feet bgs. Further downgradient, where the shallow aquifer thickness increases, two sets of well pairs were completed within the middle and lower portion of the shallow aquifer between a range of approximately 75 to 115 feet bgs. Wells completed in the deeper Exposition aquifer were screened from 118 to 128 feet bgs in the upgradient and mid-plume area and slightly deeper (approximately 122 to 132 feet bgs) farther downgradient along Southern Avenue.

A well location follows:

- Five downgradient wells were completed in the shallow aquifer to determine groundwater flow directions in the downgradient area of the plume and to define plume boundaries. Four of the five wells (MW-24, MW-27, MW-28, and MW-31) are near the edge of the Cooper Drum groundwater contaminant plume; the fifth well (MW-25) is located in the plume center. The in-plume well is considered necessary for the MNA sampling initiated in May 2003. These wells were screened from approximately 75 to 90 feet bgs.
- Four deeper wells were paired with a shallower well completed in the shallow aquifer near the leading edge of the groundwater plume. MW-26 and MW-32 were located adjacent to MW-25 and MW-31, respectively, and were screened from 122 to 132 feet bgs in the upper portion of the Exposition aquifer. MW-28 and MW-30 were located adjacent to MW-27 and MW-29, respectively, and were screened from 104 to 114 feet bgs. This depth corresponds to a lower portion of the shallow Gaspur aquifer. These four new wells coupled with two existing wells (MW-16 and MW-18) completed in the upper portion of the Exposition aquifer and located along Rayo Avenue will be used to monitor any vertical migration of VOC contamination from the shallow aquifer (see Figure 5, southeast corner of Cooper Drum).
- Four mid-plume and upgradient wells (MW-20 through MW-23) were completed in the shallow aquifer. MW-22, located south of the drum processing building, will be used to evaluate groundwater VOC contamination from the DPA and is screened from 63 to 73 feet bgs. MW-21 was completed in October 2003 in the former HWA as part of the monitoring program for the HRC pilot-scale field test and is screened from 55 to 75 feet bgs. MW-20 was completed in February 2003 as part of the bench-scale test and is also part of the monitoring program for the pilot-scale field test. This well is screened from 55 to 70 feet bgs. MW-23 (screened from 63 to 73 feet bgs) is located upgradient of the site along Rayo Avenue, to evaluate background conditions, flow direction, and any potential co-mingling from an off-site VOC plume apparently emanating from the Jervis Webb site.

Monitor well borings logs and construction details are included in Appendix A. Details on well installation methods and procedures used during installation can be found on the boring logs and are also discussed in Section 6.2 of the SAP (URS, 2003a).

Monitor well sampling events following the well installations are summarized as follows:

- All new wells installed in December 2003 and all existing wells were sampled for MNA parameters in January 2004.
- The six wells sampled as part of the HRC pilot-scale field test were sampled in February, April, July, and November of 2004, and April 2005.
- A second round of sampling of all new and existing wells was coordinated with the July and November 2004 HRC pilot-scale field test sampling and included analyses for 1,4-dioxane.

Results for all groundwater sampling events are presented in Section 3.0.

Based on the results of the RI/FS, further analyses of constituents such as metals, SVOCs, PCBs, pesticides, and general water quality parameters were considered no longer necessary, with one exception. PCBs were detected in a duplicate RI sample from MW-2, located in the VOC source area. One additional sample from MW-2 was collected in April 2004 and PCBs were not detected.

### 2.3.5 ISCO Treatability Study July 2005 through June 2006

Because 1,4-dioxane was detected in most site wells (see Section 3.5.4) this compound was added to the list of groundwater COCs which already includes chlorinated ethenes and ethanes (see Table 2). This resistant SVOC is miscible in water, is highly mobile in soil, and has a low Henry's Law constant. Therefore, 1,4-dioxane is expected to move with groundwater and not to volatilize into the unsaturated vadose zone and show limited adsorption to soil. Biodegradation of 1,4-dioxane by certain aerobic microbial organisms may be possible; however, the saturated soil at Cooper Drum tends to be reductive and more conducive to anaerobic bacterial activity, a feature that was enhanced by addition of HRC. Although use of HRC led to biodegradation of some chlorinated ethenes, it was not successful on 1,4-dioxane. EPA decided to perform an evaluation of ISCO technologies for the purpose of advanced treatment on all contaminants in the site groundwater.

Based on the evaluation of alternative ISCO technologies, an advanced oxidation process (AOP) was selected for evaluation using treatability studies. A bench-scale test completed in June of 2005 (URS, 2005) showed that ozone and ozone combined with hydrogen peroxide would destroy the site contaminants. A pilot-scale field test (URS, 2005) using ozone and hydrogen peroxide was initiated in July 2005 and completed in June 2006. The results show that this technology will oxidize both 1,4-dioxane and VOCs in site groundwater.

It is anticipated that this ISCO technology will be selected for the in situ groundwater remedy. Treatability study results will be presented in a final report.

# 3.0 REMEDIAL DESIGN SAMPLING RESULTS

This section presents the results of RD soil gas, soil, and groundwater sampling, and results for the VLEACH modeling using the soil gas data. Analytical data are summarized in tables, presented on figures, and a data quality summary is provided in Section 3.6. The electronic data tables provided by the laboratory and the data validation reports are available at the Records Center at EPA Region 9 in San Francisco.

## 3.1 SOIL GAS SAMPLING RESULTS

The soil gas analytical results for the former HWA and DPA are presented in Tables 3 and 4, respectively. Figures 6 and 7 show the locations, sample depths, and analytical results for 1,1-dichloroethane (1,1-DCA); vinyl chloride; cis-1,2-dichloroethane (cis-1,2-DCE); trichloroethene (TCE); and tetrachloroethene (PCE) in the former HWA and DPA, respectively. Isoconcentration maps for 10, 20, and 30 feet bgs were prepared for these compounds and are presented in Appendix B.

### 3.1.1 Former Hard Wash Area

Step-out soil gas borings SG-18 through SG-20 (sampled in May 2003) and SG-39 through SG-41 (sampled in January 2004) were used to evaluate the lateral extent of contamination to the west and north of the former HWA. Eighteen soil gas samples were collected from 10 to 30 feet bgs in these borings. Based on the low to non-detect VOC reported in borings SG-18 and SG-19, the lateral extent of contamination to the north of the former HWA has been defined. Additionally, the low to non-detect VOC concentrations reported in borings SG-39 to SG-41 indicate the moderate VOC concentrations (1,000s and 10,000s parts per billion by volume [ppbv]) detected in SG-20 are generally confined on site, along the west boundary of the former HWA.

### 3.1.2 Drum Processing Area

In the RI/FS report (URS, 2002), SG-10 was determined to contain the highest concentration of shallow VOC contamination in the DPA. However, the DTSC had concerns regarding pre-RI sampling from beneath the drum processing building that identified the DPA as a potential source area. SG-21 through SG-29, drilled in May 2003, were used to evaluate the soil gas beneath the drum processing building. The borings were completed immediately adjacent to the foundation of the drum processing building, with the exception of SG-22, SG-24, and SG-25. SG-22 was located approximately 40 feet south of the drum processing building on the former Tweedy School site. SG-24 and SG-25 were completed at 30-degree angles to facilitate the collection of soil gas samples from beneath the drum processing building. Twenty-two soil gas samples were collected in May 2003 from 10 to 30 feet bgs in SG-21 through SG-29. Based on these results, additional step-out soil gas borings SG-30 through SG-38 and SG-42 were sampled in January 2004.

Samples collected from SG-23, SG-25, SG-28, and SG-29, located along the drum processing building foundation, contained 1,1-DCA (up to 54,001 ppbv); TCE (up to 22,205 ppbv); and PCE (up to 86,539 ppbv). Based on these data, it is likely that a source area is located beneath the central-eastern part of the drum processing building. The lateral extent of VOC soil gas contamination extending from this likely source area has been defined to the northwest, west, and southwest. Additional borings were sampled in January 2004 to define the lateral extent to the northeast, east, and southeast. As previously discussed, access to some of the additional boring locations needed to define the VOC contamination was no longer constrained by machinery and operations in the drum processing building, which became vacant in October 2003. The extent of soil gas contamination was defined by final step-out borings; the source appears to be located largely in the eastern portion of the drum processing building and extends to the south into the former Tweedy School site and north to northwest into the general area of the former sumps along the loading dock.

## 3.2 VLEACH MODELING RESULTS

Consistent with the ROD, the cleanup levels for VOCs in soil are to be determined based on the remedial goal of preventing the vertical migration of leachate at concentrations that would impact the shallow aquifer above drinking water standards (California maximum contaminant levels [MCLs]). To evaluate attainment of this goal, performance evaluation soil gas samples will be collected during remediation (SVE using DPE); the sampling results will then be used in the VLEACH model to evaluate potential impact to groundwater. Toward this end, the May 2003 and January 2004 soil gas sampling results were used as input to the VLEACH model to identify soil conditions in the former HWA and DPA and evaluate the need for remediation in the DPA. Individual borings were modeled using the same approach and VLEACH model used in the RI/FS report (URS, 2002). VLEACH modeling input and output files for TCE; PCE; vinyl chloride; cis-1,2-DCE; and 1,1-DCA, conducted in May 2003 at location SG-23, are provided in Appendix C.

### 3.2.1 Former Hard Wash Area

To evaluate the potential for soil contamination to impact groundwater in the former HWA, soil gas data collected from borings SG-18 through SG-20 and SG-39 through SG-41 were used to estimate the leachate concentrations prior to mixing into the shallow aquifer. The estimated concentrations of PCE (105.43 micrograms per liter [µg/L]); TCE (159.64 µg/L); cis-1,2-DCE (23.0 µg/L); vinyl chloride (3.0 µg/L); and 1,1-DCA (95.45 µg/L) in leachate at SG-20 exceeded MCLs (see Table 5). Estimated leachate concentrations from SG-18 and SG-19 were below MCLs. Because modeling results showed an impact to groundwater above the site cleanup goals, additional borings SG-39 through SG-40 were drilled and tested west of SG-20. Estimated leachate concentrations from these three borings were below MCLs, indicating the western boundary of the soil gas contamination is adequately defined.

### 3.2.2 Drum Processing Area

To evaluate the potential for soil contamination to impact groundwater in the DPA, soil gas data collected from borings SG-21 through SG-38 and SG-42 were used to estimate the leachate concentration prior to mixing into the shallow aquifer. The results of VLEACH modeling for eight boring locations (SG-22, SG-23, and SG-25 through SG-30) in the DPA, estimated a VOC leachate concentration that exceeded MCLs (see Table 5). Leachate concentrations were below the MCLs in five borings (SG-21, SG-24, SG-34, SG-37, and SG-42). VLEACH modeling was not performed on the remaining six borings based on the low-level soil gas concentrations (< 100 ppbv) in samples from these borings.

The modeling results appear consistent with the higher VOC concentrations reported in pre-RI soil samples collected in the 1980s from samples/borings directly beneath the drum processing building. As noted in the RI/FS report (URS, 2002), low VOC levels (0 to < 10 µg/L) have been found in the shallow aquifer (MW-1 and CPT borings ) around the DPA, when compared to results from the former HWA. As discussed in Section 3.5.4, groundwater sample results from new well MW-22 were also consistent with the RI results. However, based on the RD data from the borings immediately adjacent to the building foundation and angle borings beneath the building, and the estimated VOC concentrations in leachate, the soil gas contamination beneath the DPA will impact the shallow aquifer.

## 3.3 SVE TESTING RESULTS

As mentioned in Section 2.1.2, a short-term SVE test was performed at SVE-2 to evaluate potential effectiveness of SVE in the DPA and to ascertain design parameters for a full system. The SVE test was performed for approximately five hours and consisted of inducing a vacuum in SVE-2 at increasing flow rates. Induced vacuum in the subsurface was measured in multi-depth vapor wells at VP-3 and VP-4 to evaluate air permeability and radius of influence. Soil vapor samples were collected from SVE-2 during the test at 10, 30, 100, and 230 minutes after startup. Test results are summarized below. Data collected during the test are presented in Table 6.

As shown in Table 6, induced vacuum was recorded at each of three depths in both VP-3 and VP-4. The induced vacuum increased at VP-3 and VP-4 as the vacuum and flow were increased at SVE-2. The increase in both parameters (flow rate and vacuum) were plotted and shown to be linear, suggesting higher flow rates (greater than 75 cubic feet per minute [cfm]) can be achieved and may be beneficial to removal of contaminants. Additionally, a good response (or vacuum) was measured at all depths, suggesting a reasonable radius of influence can be attained; higher vacuum readings could be indicative of tighter clayey soil (in contrast to the generally silt to fine-grained sand conditions observed in this area of the site) and/or surface leakage.

Analytical results for the four soil vapor samples collected from SVE-2 during the test show VOC concentrations higher than those reported for samples collected from the soil gas borings (see Table 4). The higher concentrations are likely attributed to the SVE-2 location, which is within the drum processing building and near the center of the defined soil gas plume. In the past, soil gas investigations beneath the drum processing building were prevented by operations at the facility. Those operations have ceased and equipment has been moved from the building, providing access for the installation of SVE-2.

The depth to groundwater in SVE-2 was approximately 36 feet bgs, indicating the presence of the perched groundwater in this area. Groundwater sampling at SVE-2 was performed during a pumping test in April 2004 to evaluate VOC concentrations in the perched groundwater. The pumping test indicated a maximum flow rate of a approximately 0.5 gallons per minute could be sustained from SVE-2. As shown in Table 15, the maximum VOC concentration in perched groundwater is 76 µg/L of 1,1-DCA. The presence of perched groundwater would reduce the effectiveness of any future SVE efforts on the impacted soil. Therefore, DPE would also be appropriate in the DPA, which is consistent with the selected remedy for the HWA, as required in the ROD.

## 3.4 SOIL SAMPLING RESULTS

This section presents the results of soil sampling conducted during May 2003 at the former HWA and DPA.

### 3.4.1 Former Hard Wash Area

Seven soil borings (SB-18 through SB-23, and SB-32) were completed in the former HWA. SB-18 through SB-23 were completed in locations to define the lateral extent of PAH, PCBs, and lead. SB-32 was completed adjacent to SB-10 to confirm the presence of a previously estimated PCB concentration.

SVOCs

Table 7 summarizes the soil analytical results for SVOCs in the former HWA. The table includes the values for the PAH COCs and the calculated PAH cleanup level for soil. The cleanup level is based on the upper tolerance limit (UTL) background benzo(a)pyrene-toxicity equivalent (B(a)P-TE) concentration for the Southern California PAH data set, which is 900 micrograms per kilogram (µg/kg) B(a)P-TE. Soil borings SB-19 through SB-21 were completed to define the lateral extent of contamination previously identified in soil samples collected from SB-11. Soil samples from SB-18, SB-22, SB-23, and SB-32 were inadvertently analyzed by the laboratory for SVOCs, and these results are also provided. Figure 8 shows the estimated area with PAH concentrations greater than the calculated cleanup levels for PAHs at the former HWA. Based on the analytical data collected from SB-19 through SB-21, and borings completed during the RI, the extent of PAH contamination at the former HWA is laterally limited to the area around SB-11 and vertically limited to approximately 1 foot bgs. It is also noted in Table 7 and shown on Figure 8 that the PAH concentration for the 1-foot-bgs sample from SB-20 had elevated detection limits. Using these detection limits, the calculated cleanup level is exceeded at SB-20. Therefore, it is possible shallow PAH contamination (approximately 1 foot deep) extends to the location of SB-20. Confirmation sampling at the time of soil excavation around SB-11 will determine the need to extend the excavation to the area of SB-20.

*1,4,- Dioxane*

Table 8 summarizes the soil analytical results for the three borings (see Figure 4 for locations) sampled in the HWA on March 2, 2006 and analyzed for SVOCs including 1,4-dioxane. The table includes the values for the PAHs (COCs), which were all below the detection limit. All results for 1,4-dioxane were well below the Residential PRG of 44 mg/kg. Additionally, the highest concentrations were detected in the 20- and 30-foot samples. Based on these data, 1,4 dioxane in soil will not be a COC for soil remediation at the site.

PCBs

Table 9 summarizes the soil analytical results for PCBs in the former HWA. Soil borings SB-18 through SB-23 were completed to define the lateral extent of contamination previously identified in soil samples collected from SB-9, SB-10, and SB-11. SB-32 was completed to confirm the vertical extent of contamination previously identified in SB-10. Figure 9 shows the estimated area with PCB concentrations greater than the cleanup levels for PCBs at the former HWA. Analytical data collected from SB-18 through SB-23 and SB-32 indicate that PCB contamination is laterally defined to the north, west, and south of location SB-11. However, data collected from boring SB-20 indicates the eastern extent of the shallow PCB contamination is not fully defined.

Lead

As shown on Figure 10, three soil borings (SB-21 through SB-23) were sampled at 0.5, 5, and 10 feet bgs to further define the lateral extent of lead detected in the 1-foot bgs sample at SB-9 in the former HWA. The sample results are included on Figure 10 and in Table 7. The results indicate the lead hot spot is confined to the immediate vicinity of the 1-foot bgs sample at SB-9.

### 3.4.2 Drum Processing Area

Eight soil borings (SB-24 through SB-31) were completed in the DPA. SB-27 was completed to 15 feet bgs to define the vertical extent of a lead hot spot previously identified at 10 feet bgs in SB-14. The remainder of the soil borings within the DPA were completed in locations to define the lateral extent of PAHs and evaluate the occurrence of VOC contamination.

SVOCs

Table 10 summarizes the soil analytical results for SVOCs in the DPA and includes the calculated cleanup levels for the PAHs. Soil borings SB-24 through SB-26 and SB-28 through SB-31 were completed to define the lateral extent of contamination previously identified in soil samples collected from SB-13 and SB-14, respectively. Figure 11 shows the two estimated areas with PAH concentrations greater than the calculated cleanup levels at the DPA. Generally, the sample results above PAH cleanup levels are confined to the 0.5- and 5-foot bgs samples. Results from deeper samples at SB-28, SB-29, and SB-31 had detection limits above cleanup levels; therefore, deeper SVOC soil contamination could possibly be present at these locations. It appears this would only be of concern at SB-31, because the shallower sample results at SB-28 and SB-29 were non-detect and it is unlikely contamination is only found in the deeper sample, based on the observed shallow occurrence of PAHs at the site.

Based on the sample results, the lateral extent of PAH contamination is undefined between the two areas shown on Figure 11—beneath the drum processing building, and north and east of SB-25. The overall areas requiring excavation, as shown on Figure 11, is consistent with that estimated in the ROD report (EPA, 2002). However, excavation of the contaminated soil beneath the DPA building may not be feasible; therefore, institutional controls may be used at the site (as stipulated in the ROD) and the total volume of contaminated soil might not require excavation.

Lead

As shown on Figure 12, a lead hot spot was identified at 10 feet bgs in SB-14 in the DPA. Soil borings SB-27 through SB-30 were drilled to 15 feet bgs and soil samples collected at 0.5, 5, 10, and 15 feet bgs to evaluate the lateral and vertical extent of lead contamination. SB-27 was located immediately adjacent to SB-14 to confirm previous lead results and define the vertical extent. Results from these samples are included on Figure 12 and in Table 10. Results from step-out borings SB-28 through SB-30 show lead concentrations below the cleanup level. Results from SB-27 indicate that the lead hot spot previously identified in SB-14 is limited to 5 and 10 feet bgs at these boring locations.

VOCs

Table 11 summarizes the soil analytical results for VOCs in the DPA. Soil samples were collected from 0.5 to approximately 15 feet bgs in soil borings SB-24 through SB-26 and SB-28 through SB-31. Sample results were used to evaluate the occurrence of VOC contamination and to address pre-1996 RI sampling results that reported elevated VOC concentrations in the shallow soil beneath the DPA. Based on the data collected from SB-24 through SB-26 and SB-28 through SB-31, VOC soil contamination appears to be laterally limited to the locations of SB-30 and SB-31 (see Figure 4). The VOC occurrence appears to be consistent with the soil gas sampling conducted at the DPA. For example, the higher soil gas concentrations were found in the eastern portion of the DPA.

## 3.5 GROUNDWATER SAMPLING RESULTS

This section presents the results of depth-to-groundwater measurements, CPT/HydroPunch sampling for VOCs, and groundwater sampling from the existing and new monitor wells collected in May 2003, December 2003, January 2004, February 2004, April 2004, July 2004, November 2004, and April 2005. The objective of the CPT/HydroPunch sampling for VOCs performed in May 2003 was largely to design and install a monitor well network to define the downgradient extent of the VOC groundwater plume. Therefore, the data presentation in this section focuses on that objective. The results of CPT logging and depth-to-groundwater measurements are presented below, followed by a presentation of the VOC data from the CPT/HydroPunch and the existing and new monitor well sampling events.

### 3.5.1 CPT Logging

This section presents a brief summary of the lithologic conditions of the shallow (Gaspur) aquifer beneath the site and any new findings from the CPT borings. A detailed description of the site hydrogeology can be found in the RI/FS report (URS, 2002).

As noted in the RI/FS report (URS 2002), the shallow aquifer exhibits an increase in the percentage of coarser material (from silt and sandy silt to predominately sand and gravely sand) beginning on the eastern portion of site and continuing to the east and southeast toward the Los Angeles River and south down Rayo Avenue. These lithologic conditions are also confirmed in new CPT borings (see Appendix A) completed on the eastern portion of the Tweedy School site (CPT-31 and CPT-32), along Rayo Avenue (CPT-28), on the Bimbo Bakery site (CPT-29 and -30), on the Seam Master site (CPT-36), and south of Southern Avenue (CPT-26, CPT-33, CPT-34, CPT-35, CPT-37, and CPT-38). The overall thickness of the coarse material is approximately 50 feet (from approximately 55 to 105 feet bgs). The presence and thickness of coarser material may be interpreted as a former stream channel and/or is representing the Gaspur aquifer identified in this area of the Los Angeles Coastal Plain Central Basin (California Department of Water Resources, Southern District [DWR], 1961). The maximum depth of the shallow aquifer appears to extend to approximately 116 feet bgs south of Southern Avenue at CPT-37 and CPT-38. Wells MW-28 and MW-30 were installed at these CPT locations (along with a shallower well pair MW-27 and MW-29) to monitor contaminant migration in the lower portion of the shallow aquifer.

### 3.5.2 Depth-to-Groundwater Measurement/Flow Patterns

This section evaluates the horizontal and vertical flow patterns observed at the site. The depth to groundwater measurements relate to the shallow Gaspur and deeper Exposition aquifers and do not include the perched aquifer water levels with the exception of wells MW-5 and SVE-1. A summary of historical groundwater surface elevations is presented in Table 12. As shown in Table 12, the depth to groundwater in the shallow aquifer is approximately 48.5 feet bgs and has shown seasonal fluctuations of approximately 2 feet between May 2003 and June 2006.

<u>Horizontal Gradients</u>

Groundwater elevation contours from May 2003 are presented on Figure 13. The May 2003 contours are consistent with previous groundwater flow directions in the shallow (Gaspur) aquifer, which shows a generally southern flow direction in the eastern portion of the site and along Rayo Avenue. Groundwater elevations from MW-1 and MW-3, the two westernmost wells, have consistently been higher than the wells to the east, suggesting an eastern flow direction in the middle of the site. This may be related to the completion of these wells in the area of the shallow aquifer that is dominated by finer grained silts and clays, which can be interpreted as overbank deposits. Groundwater elevation contours from December 2003 are presented on Figure 14.

Additional groundwater elevation contour maps from sounding events in April, August, and December of 2004, April 2005, and June 2006 are included in Appendix D. The groundwater gradients from all sounding events have ranged from 0.0014 to 0.0018 feet per foot, which is slightly less than the gradient of 0.002 feet per foot identified in the RI. The December 2003 (and later) maps include groundwater level data from the wells installed in December 2003. The contours can be used to evaluate flow patterns in the downgradient portion of the groundwater contaminant plume. These data indicate that the southern groundwater flow pattern continues along Rayo Avenue, beneath the Bimbo Bakery site, and south of Southern Avenue. The groundwater flow direction generally parallels the slope of the ground surface and the southern flow direction of the Los Angeles River, which is located approximately 1,200 feet east of MW-30. The groundwater flow patterns also suggest the presence of a southwest flow direction (as opposed to the more southern direction along Rayo Avenue) on the east side of the contours, in the vicinity of wells MW-8 and MW-31. This would imply that VOC contamination in groundwater beneath the ELG Metals site and Seam Master site (see below) flows toward the Cooper Drum plume, which is migrating to the south along Rayo Avenue.

The southwest flow direction east of the Cooper Drum site should be confirmed from additional well installations on the Seam Master site. Currently, the easternmost well location is MW-14, located on the ELG Metals site. As shown on Figure 14 and in Table 10, groundwater surface elevations at this well have always been higher than in other areas of the ELG Metals site. This possibly indicates the presence of a ridge in the water table which may be due to the hydraulic influence of the Los Angeles River. Additional wells located on the Seam Master site would be required to confirm flow directions east of the Cooper Drum plume.

Vertical Gradients

Table 13 compares groundwater levels within the shallow Gaspur aquifer with those measured in the underlying Exposition aquifer. The differences in groundwater levels indicate a slight downward vertical gradient within the shallow aquifer and a greater vertical gradient between the shallow aquifer and the Exposition aquifer. The difference in groundwater levels within the shallow aquifer ranged from 0.22 feet at wells MW-27 and MW-28 to 0.67 feet at MW-29 and MW-30. The difference in groundwater levels between the two aquifers ranged from 2.91 feet at MW-15 and MW-16 to 5.48 feet at MW-17 and MW-18.

The magnitude of the groundwater level difference does not necessarily indicate that a large transfer of water is taking place between the shallow and deep aquifer systems; this is based on analytical results from groundwater samples collected in the deeper Exposition aquifer that generally show non-detectable contaminant concentrations (see Sections 3.5.3 and 3.5.4). The volume of water that passes between the aquifer zones is also dependent on the lateral continuity, thickness and composition of the aquifer material, and leakage between the aquifers. The difference in groundwater levels is likely due to withdrawal of water from water supply wells completed in aquifers below the Exposition.

### 3.5.3 CPT/HydroPunch Depth-Discrete Groundwater Sampling Results

Results of the May 2003 CPT/HydroPunch borings are presented in the RD/TM1 (URS, 2003b) and are summarized below. The VOC analytical results for all detected analytes are listed in Table 14.

CPT/HydroPunch results (for TCE; cis-1,2-DCE; and 1,1,-DCA) from all CPT borings completed as part of the Cooper Drum RI (dating back to October 1998) and this RD investigation are presented on Figure 15. The sample depths associated with the VOC results shown on Figure 15 for the CPT/HydroPunch borings, are presented in Table 14. The estimated lateral and downgradient extent of TCE contamination associated with the Cooper Drum plume is also shown on Figure 15. The isocontours were based on depth-discrete groundwater samples collected from HydroPunch borings adjacent to the CPT boring(s) and the May 2003 monitor well sampling round. In addition to identifying downgradient monitor well locations, Figure 15 can also be used to identify potential VOC contamination along the east side of the Cooper Drum plume. Other VOC plumes east of the Cooper Drum plume were tentatively identified in the RI/FS report (as the Jervis Webb [or Northeast plume] and the Seam Master [Southeast] plume). The estimated plume boundaries are included on Figure 15. These plume boundaries are estimated from the multi-depth HydroPunch data collected between 1998 to 2003. As discussed below, these other plumes appear to be mixing with the Cooper Drum plume, thereby preventing delineation of the eastern lateral and downgradient lateral extent of the Cooper Drum plume.

The vertical and downgradient extent of VOC contamination is shown on Figure 16, which is a geologic cross-section C-C' extracted from the RI/FS report (URS, 2002) and updated with the new lithologic data from the CPT borings, the May 2003 CPT/HydroPunch VOC data, and July/November 2004 new and existing monitor well data. The cross-section also shows the water-bearing units beneath the site (URS, 2002). The cross-section line generally follows the axis of the Cooper Drum plume. For purpose of presentation, a number of the CPT borings and wells have been projected (as indicated on the figure) onto the cross-section from the east and west sides of the Cooper Drum plume. In some cases, the projections are up to 216 feet away and should be examined closely. The significant features of the CPT data are discussed below.

Observations from the CPT/HydroPunch boring results, as presented in the RD/TM1 (URS, 2003b) and shown on Figures 15 and 16, were as follows:

- The shallow aquifer slightly thickens off site and downgradient along Rayo Avenue and south of Southern Avenue. The aquifer is predominately composed of silty sand, sand, and gravelly sand from a depth of approximately 60 to 100 feet bgs. There are thin units (2 to 3 feet thick) of finer material at depths of approximately 80 and 90 feet bgs. Finer grained units such as silts and clays are more abundant between approximately 100 to 120 feet bgs resulting in some confinement between the deeper Exposition aquifer and the shallow Gaspur aquifer (see CPT logs in Appendix A).
- The vertical extent of VOC contamination beneath the Cooper Drum plume has not changed from previous CPT/HydroPunch boring results and remains at approximately 100 feet bgs.
- The lateral downgradient extent of contamination appears to be within 150 feet south of Southern Avenue.
- One CPT boring result (CPT-26) indicates increasing TCE concentrations with depth, with a maximum concentration of 240 µg/L at 102 feet bgs. However, the fact that TCE concentrations at this location are greater than at upgradient locations indicates that these greater concentrations may have resulted because of co-mingling of the Cooper Drum plume and a VOC plume originating at an adjacent site (Seam Master site). Deeper (100 feet bgs) VOC contamination identified beneath the ELG Metals site could also be impacting the lower portion of the shallow aquifer, as discussed below.

Features shown on Figure 15 that are related to the other VOC plumes include the following:

- TCE contamination, apparently originating from the Jervis Webb site, is shown in the northeast corner of Figure 15, beginning at CPT-12 and MW-19. Downgradient of these two locations, deeper (approximately 100 feet bgs) TCE contamination is present beneath the ELG Metals site at CPT-17 and CPT -18 and might also be related to the Jervis Webb plume. The highest TCE concentrations at these two borings were 390 and 320 µg/L at the 97 and 100 foot bgs samples, respectively.
- Elevated TCE concentrations (up to 16,000 µg/L) were reported at the Seam Master site on the southeast corner (see Figure 15). The western and southern extent of this contamination is undefined. However, based on the previously discussed southwest flow direction in this area, it is very likely that the high TCE concentrations (up to 240 µg/L at 100 feet bgs) found at CPT-26 are attributed to contamination from the Seam Master site and possibly from upgradient sources identified at CPT-17 and CPT-18.

Review of the vertical distribution of TCE and cis-1,2-DCE in the downgradient area of the Cooper Drum plume (see geologic cross-section, Figure 16) shows that TCE concentrations tend to be highest at the mid-depth (70 to 80 feet bgs) of the shallow aquifer, and decrease at approximately 100 feet bgs. However, this trend is not evident at CPT-26, where the TCE concentration appears to increase all the way down to approximately 100 feet bgs.

### 3.5.4 Monitor Well Sampling Results

Based on the CPT results, nine monitor wells were installed in the downgradient area of the Cooper Drum plume along and south of Southern Avenue. Wells MW-24, MW- 25, MW-27, MW-29, and MW-31 were installed in the shallow (Gaspur) aquifer; MW-28 and MW-30 were installed in a lower portion of the shallow aquifer; and MW-26 and MW-30 were installed in the top portion of the Exposition aquifer. Four additional wells were installed in the shallow aquifer: MW-23 was installed upgradient of the Cooper Drum plume, MW-22 was installed along the downgradient (southern) side of the drum processing building, and MW-20 and MW-21 were completed within the Cooper Drum plume as part of the HRC treatability study. The well locations are shown on Figure 5.

Volatile Organic Compounds

VOC results from the new and existing wells sampled since May 2003 are presented in Table 15. For purposes of evaluating contaminant trends at individual wells, a summary of historical results for selected VOCs from all wells is presented in Table 16.

Estimated lateral VOC distributions, including TCE; cis-1,2-DCE; vinyl chloride; 1,1-DCA; and 1,2-DCA, are presented on Figures 17 through 21, respectively. These figures include VOC data from all wells; however, the isoconcentrations are based on wells completed in the shallow aquifer. The estimated vertical VOC distribution (based on TCE concentrations) in the vicinity of the Cooper Drum plume is defined and presented on Figure 16. Please note that the actual location of the isoconcentrations line for some VOCs (TCE; cis-1,2-DCE; and 1,2-DCA) south of Southern Ave and along the eastern and downgradient portions of the Cooper Drum plume contain significant uncertainity as a result of limited characterization of VOC contamination by responsible parties in those areas. Features shown on Figures 17 through 21 that are related to the Cooper Drum Plume and other VOC plumes in the area, include the following:

- The estimated lateral and vertical extent of 1,1-DCA and vinyl chloride are defined and appear to be confined to the shallow aquifer.
- The vertical extent of VOCs at concentrations above MCLs is defined along Southern Avenue by results from wells MW-26 and MW-32. These two wells are completed in the upper portion of the Exposition aquifer. Although no wells are completed in the Exposition Aquifer south of Southern Avenue, the trend of limited vertical migration would be anticipated further downgradient.
- The lateral extents of TCE; cis-1,2-DCE; and 1,2-DCA are generally undefined to the east and downgradient of the plume. The limited plume definition in these areas is partially attributed to other groundwater plumes in these areas. Recommendations for additional monitor wells to further define VOC distribution south of Southern are presented in Section 4.0.

1,4-Dioxane Results

Following completion of the RI (URS, 2002), information about emerging compounds, such as 1,4-dioxane, at solvent release sites was reviewed and identified in the winter of 2003 as a data gap. This compound was not routinely analyzed in the past, apparently because there was no MCL associated with it and because the laboratory method could not detect this analyte at detections limits less than 100 µg/L. Current analytical methods allow for detection as low as 1.0 µg/L. Groundwater samples for analysis of 1,4-dioxane were initially collected from the six HRC treatabilty test wells in the HWA in April 2004. Based on these results, which showed significant levels of this compound, a complete round of monitor well sampling and analysis was performed during the scheduled sample events in July and November of 2004.

1,4-dioxane sampling results are summarized in Table 17. As shown in Table 17, 1,4-dioxane was detected in most site wells, with a maximum concentration of 710 µg/L. The estimated lateral distribution of 1,4-dioxane is presented on Figure 22. This figure includes 1,4-dioxane results from all wells; however, the isoconcentrations are based on wells completed in the shallow aquifer. The significant features shown on the Figure 22 include:

- 1,4-dioxane was not detected in any of the wells (MW-16, MW-26, and MW-32) completed in the deeper Exposition aquifer.
- The lateral extent of 1,4-dioxane appears to be similar to the previously described Cooper Drum VOC plume, suggesting the source area is also in the former HWA.
- Upgradient wells MW-3, MW-23, and MW-19 all showed detectable levels (0.8 to 17 µg/L) of 1,4-dioxane, indicating this compound may also be present in other plumes in the site vicinity.
- The downgradient extent of 1,4-dioxane is partially undefined in the southeastern area of the plume. The highest concentrations (17 µg/L) south of Southern Ave is found in well MW-31, which is adjacent to the Seam Master site. These results are generally consistent with the VOC distribution south of Southern Avenue.

An MCL has not been established for 1,4-dioxane. However, EPA has established a screening level for preliminary remediation goals of 6.1 µg/L for ingestion of drinking water containing 1,4-dioxane. The value of the cleanup goal for 1,4-dioxane in site groundwater will be determined in a subsequent risk assessment.

## 3.6 DATA QUALITY ASSESSMENT

This section summarizes the data quality assessment for soil, soil gas, and groundwater data collected during seven separate sampling events in April/May 2003, December 2003, January 2004, February 2004, April 2004, July 2004, and November 2004. All additional data since November 2004 will be summarized in the final reports for the treatability studies. Data validation reports can be found in the Records Center at EPA Region 9 in San Francisco, California.

Six VOC analytes in one sample collected from EW-1 on April 28, 2004, were rejected due to 0 percent surrogate recoveries. All other data are acceptable for decision-making purposes, with some estimated data due to sampling and/or laboratory data quality issues. In general, the qualified data are typical of the calibration, blank contamination, and matrix problems associated with a large data set of several environmental sample media, with a wide range of analytical methods and submitted to multiple analytical laboratories. The overall field sampling procedures and analytical laboratory performance meet acceptable data quality guidelines, with the data completeness result exceeding 99 percent. A detailed description of all qualified data by analytical method and matrix is presented in Appendix E.

# 4.0 CONCLUSIONS AND RECOMMENDATIONS

The RD sampling effort was performed to provide additional field sampling data prior to implementation of the selected remedy in the ROD. This section presents conclusions and recommendations on the RD field sampling results and the impact these results may have on the selected soil and groundwater remedies.

- The extent of non-VOC soil contamination is well defined in the former HWA. Based on perimeter sampling on the north side of the DPA building, soil contamination (PAHs) is likely to be present beneath the drum processing building. Since it is not considered feasible to excavate beneath the building, institutional controls will be needed for this area. The volume of non-VOC-contaminated soil originally estimated in the ROD has not significantly changed.
- The extent of VOC soil contamination is well defined in both the former HWA and DPA. For VOC soil contamination, the selected remedy in the ROD is DPE in the former HWA. Based on the RD soil gas sampling results for VOC contamination, in addition to the HWA, the DPA will also require remediation.
- The downgradient vertical extent of groundwater contamination is defined. The downgradient lateral extent of groundwater contamination is mostly defined. However due to the commingling of additional groundwater contamination from an adjacent plume in the shallow aquifer, there is uncertainty regarding plume definition at the southeastern plume boundary. Additional groundwater sampling is necessary to address this uncertainty.
- The most significant discovery during the sampling effort was the presence of 1,4-dioxane in the site groundwater. This compound has been added to the site list of COCs. Selection of the groundwater remedy is contingent on the results of in situ treatability studies performed at the site and may include groundwater extraction and treatment. Due to the presence of 1,4-dioxane in the groundwater; the use of HRC as the in situ remedial alternative was determined to not be feasible. The ISCO in situ field pilot study was shown to oxidize both 1,4-dioxane and the other COCs in the site groundwater; therefore, ISCO will be used for the groundwater remedy.

## 4.1 SOIL NON-VOCS

Based on the results of the non-VOC soil sampling in the DPA and HWA, the following conclusions are drawn:

- The additional soil data results from May 2003 indicate the overall estimated volume of soil requiring excavation in the former HWA and DPA (as depicted on Figures 8 through 12) is approximately 2,310 cubic yards (2,780 tons). This estimate discounts the co-contaminated lead and PAH soil volume (230 cubic yards, 280 tons) at SB-14 and SB-27 and the material beneath the drum processing building. The total volume estimated in the ROD for non-VOC soil contamination was 2,700 tons, which is only 80 tons less than the current estimated volume. The basis for determining the total volume is included in Appendix F.
- It is recommended that confirmation sampling in the areas east of borings SB-20 (former HWA) and SB-25 (DPA) be performed if these areas are excavated.
- The selected remedy in the ROD for soil contaminated with non-VOCs is excavation, and institutional controls in areas where excavation is not feasible. A final determination on the feasibility of excavating areas with soil contamination will be made during the remainder of the RD

phase. Consideration will be given to the cost of excavation and transport to an approved disposal facility. In addition, it may not be feasible to excavate the site before remediation of VOCs in the vadose zone, because this action would remove the existing paved cap and potentially result in exposure to VOCs.

## 4.2 SOIL GAS VOCS

The soil gas data gaps identified in HWA and DPA have been filled. Conclusions drawn from soil gas sampling are provided below.

Former Hard Wash Area

Results from borings SB-18 and SB-19 indicate VOC soil gas contamination is sufficiently defined to the north of the former HWA. Results from borings SB-39 through SB-41 showed low VOC concentrations (less than 100 ppbv) and defined the western extent of VOC contamination in the former HWA (see Figure 6 and Appendix B). Based on the additional data, VOC soil gas contamination is sufficiently defined for the RD.

Drum Processing Area

Results from the 19 borings and SVE testing at SVE-2 also indicate that soil gas contamination is fully defined in the DPA, and sufficient data are available for the RD. VLEACH modeling indicates that groundwater would be impacted at concentrations above the site groundwater goals. During installation and testing of SVE-2, it was determined the perched aquifer is also present beneath the DPA and contains VOCs above the MCLs (approximately 230 µg/L of total VOCs, see Table 15). Therefore, soil remediation using DPE is recommended to meet the site cleanup goals in this area.

## 4.3 DOWNGRADIENT EXTENT OF GROUNDWATER PLUME

Based on results of groundwater sampling, conclusions and further actions required are stated below. The extent of the Cooper Drum plume in the shallow Gaspur and the deeper Exposition aquifers are addressed, as well as the convergence with adjacent plumes from the Jervis Webb site and the Seam Master site in the area of Southern Avenue.

- The COCs vertical extents are defined in the Exposition aquifer along Southern Avenue at concentrations below MCLs. (See data from wells MW-26 and MW-32 which are completed in the upper portion of the Exposition aquifer.) The contamination is confined to the shallow Gaspur aquifer.
- The downgradient lateral extent of groundwater contamination is mostly defined. The estimated lateral extents of 1,1-DCA and vinyl chloride from the Cooper Drum plume are defined (see Figures 19 and 20). TCE; cis-1,2-DCE; and 1,2-DCA in the shallow Gaspur aquifer at concentrations above MCLs, extend south of Southern Avenue and are partially undefined along the southeastern and southern plume boundaries (see Figure 15 [see especially, 100 µg/L contour for northeast plume/Jervis Webb site and high concentrations in CPT-26] and Figures 17, 18, and 21).
- It is recommended that CPT/HydroPunch borings be completed along McCallum Ave (see Figure 23) to provide lithologic and groundwater data for locating monitor wells. A minimum of two CPT/HydroPunch borings would be required. Pending those results, the locations of additional monitor wells will be determined. It is also recommended that up to three CPT/HydroPunch borings

be complete along Southern Avenue east of MW-31 (see Figure 23) to address groundwater contamination migrating from the Seam Master site.

- To address the downgradient extent of the Cooper Drum plume, at least two monitor well pairs completed in the middle and lower portion of the shallow Gaspur aquifer are recommended to be located pending the outcome of the CPT boring results. The vertical extent of the Cooper Drum plume is defined at Southern Avenue; therefore, completion of an additional deeper monitor well in the Exposition aquifer is not considered necessary.

## 4.4 GROUNDWATER REMEDY

The selected remedy in the ROD for VOCs in groundwater is pump-and-treat for the downgradient containment of contamination and in situ chemical treatment, using either reductive dechlorination or chemical oxidation. The following conclusions are related to the need to remediate 1,4-dioxane in groundwater:

- The lateral and vertical distribution of 1,4-dioxane in groundwater is very similar to the Cooper Drum VOC plume and appears to be confined to the shallow aquifer. The downgradient extent of 1,4-dioxane will also be defined by the additional wells recommended for the downgradient VOC plume definition.
- The detection of 1,4-dioxane in the site groundwater is significant because this compound has been shown to persist in anaerobic groundwater plumes at the same time VOCs are being removed via natural or enhanced reductive dechlorination. Groundwater monitoring results for VOCs have historically shown evidence of naturally occurring reductive dechlorination in the site groundwater. The HRC treatability study also showed further VOC reduction; however, this alternative is ineffective on 1,4-dioxane. The treatment of the site groundwater using ISCO (ozone and hydrogen peroxide) has been shown to oxidize both 1,4-dioxane and VOC contamination during the recently completed field pilot test. Therefore, ISCO will be included in the groundwater remedy.
- The options for pump-and-treat will be evaluated during the RD. The groundwater remedy could include a downgradient groundwater extraction well(s) for hydraulic containment with upgradient re-injection of the extracted groundwater, along with the ISCO technology installed in several barrier lines in the source area and downgradient area of the plume.

## 5.0 REFERENCES

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