

Section 4

Nature and Extent of Contamination

This section discusses the nature and extent of contamination identified at the site. The key element to this process is to collect sufficient quantitative data about the site so that a site-specific risk assessment can be developed and appropriate remedial alternatives can be developed. This process first requires an adequate description of the nature and extent of contamination at a site. The nature and extent of contamination provides input information to the fate and transport of contamination, the potential exposure pathways for risk, and the basis for evaluation and selection of remedial alternatives. This section describes the vertical and horizontal extent of contamination in soil vapor and ground water samples. The spatial and temporal trends for PCE identified from the data are also discussed. [Section 2.0](#) describes the objectives and procedures followed in the collection of these samples. [Appendix G](#) provides the DQE and confirmation of the data usability for decision-making purposes.

4.1 Identification of Contaminants

Site characterization involves the collection of data describing: (1) facility characteristics that help to identify the source location of potential releases and engineering characteristics that are important in the evaluation of remedial actions; (2) the waste characteristics, such as the type and quantity of contaminants that are contained in or released to the environment; and (3) the physical or chemical characteristics of hazardous wastes present from the source (EPA, 1988).

Contaminants in shallow soil vapor at the site were identified using two criteria: (1) known site use; and (2) the potential for that contaminant to pose a risk to receptors. [Table 4-1a](#) presents the frequency of detection (FOD) and contaminant selection for the shallow soil vapor from samples collected during the second mobilization. The data collected during both field mobilizations supports the identification of PCE as the only contaminant in shallow soil vapor, based on its known site use and the potential to pose a risk to receptors.

Contaminants in deep soil vapor at the site were identified based on the potential for the contaminant to migrate to ground water and the detection of the contaminant in ground water in excess of screening levels (discussed further in the next paragraph). [Table 4-1b](#) presents the FOD and contaminant selection for the deep soil vapor from the SVMP vapor samples collected during the

second mobilization. The data collected during both field mobilizations supports the identification of PCE as the only relevant contaminant in deep soil vapor. This selection is based on the potential for PCE to migrate to ground water and the presence of PCE in ground water in excess of screening levels.

Contaminants in ground water at the site were identified based on concentrations that exceed screening levels. The MCL was the primary screening level used to select contaminants for the site. Where a MCL had not been promulgated for a compound, concentrations were compared to the EPA Region 6 Media-Specific Screening Levels (MSSL) for tap water. **Table 4-1c** presents the FOD and contaminant selection for the ground water from samples collected during the second mobilization. Data collected during both field mobilizations support the identification of PCE, benzene, and methyl tertiary butyl ether (MTBE) as contaminants in ground water within the boundaries of the site. PCE exceeds the MCL of 5 µg/L in 18 site monitor wells and one municipal supply well. Benzene exceeds the MCL of 5 µg/L in 7 site monitor wells. MTBE exceeds the MSSL of 6.2 µg/L in one site monitor well. Uranium has not been sampled in site monitor wells, but uranium concentrations have been found by the CLC to exceed the newly promulgated SDWA regulations for primary standards in 7 municipal supply wells. Uranium is naturally occurring in the area of the site (**JSAI, 2006b**), and its concentrations are currently monitored by the CLC and NMED DWB. Exceedances of the MCL for uranium are being addressed separately by the CLC and NMED DWB.

Sections 4.1.1 and **4.1.2** describe the analytical results for soil vapor and ground water, respectively. **Section 4.2** discusses the extent of contamination observed in soil vapor and ground water based on the contaminants selected for each media.

4.1.1 Soil Vapor

Soil vapor data collected during the first mobilization indicated that PCE and TCE were present in the soil vapor at the GWP site; this investigation included the collection of over 600 soil vapor samples and installation of 7 SVMPs. The soil vapor results from the first mobilization are described in **Section 4.2.1** and in the IDRA Report (**Attachment A**). The shallow soil vapor data collected during the first mobilization were used to perform vapor intrusion screening which showed PCE in the shallow subsurface soil vapor in the residential neighborhood northeast of the intersection of East Hadley Avenue and North Walnut Street might pose a risk to potential residential receptors. It was also determined that PCE migrated from the soil to the ground water through the unsaturated zone (**EPA, 2003a**). Based on the first mobilization results, additional shallow soil vapor data were collected during the second mobilization to confirm whether soil vapor intrusion poses potential

human health risks in the residential area and at two nearby recreational facilities (i.e. Problem Statement No. 3). Another objective for collecting additional soil vapor data was to confirm the relation between the soil vapor and ground water contamination at one of the source areas, the DACTD maintenance facility (i.e. Problem Statement No. 2), where the highest ground water contamination had been observed.

4.1.1.1 Shallow Soil Vapor Analytical Results

The second mobilization shallow soil vapor sampling activities included the collection of 63 shallow soil vapor samples for PCE and TCE analysis (excluding QA/QC) using a field GC instrument.

Table 4-1a lists the FOD for all constituents detected in the shallow soil vapor. As shown, PCE was detected in 58 of the 63 shallow soil vapor samples collected, and was the only compound detected.

Table 4-2 provides a list of the concentrations of PCE detected in shallow soil vapor samples (excluding QA/QC samples) and compares them to the field screening level of 120 ppbv for performing the indoor vapor intrusion risk assessment. The range of PCE concentrations detected in the shallow soil vapor samples was 21 ppbv to 644 ppbv. PCE exceeded the screening level in 36 of the shallow soil vapor samples. **Section 4.2** provides an evaluation of the extent of contamination in shallow soil vapor. **Section 5** describes the fate and transport associated with PCE in soil vapor, and **Section 7** describes the risk assessment for shallow soil vapor in terms of Problem Statement No. 3.

4.1.1.2 Deeper Soil Vapor Analytical Results

During the second field mobilization sampling event that took place November through December 2005, seven samples from SVMP01 and SVMP03 (excluding QA/QC samples) were collected and analyzed for PCE and TCE using the field GC. In addition, the field team collected 10 samples (excluding QA/QC samples) from SVMP16. The field team submitted the samples from SVMP16 to an offsite laboratory for analysis using EPA Method TO-15. This method provides for the analysis and detection of a wider range of VOCs at lower detection limits than the field GC. As previously stated, the objective of the data collected from the SVMPs was to confirm the relation between the soil vapor and ground water contamination.

Table 4-1b provides the FOD for the constituents detected in the SVMPs during November 2005. As shown in **Table 4-1b**, of the two analytes (PCE and TCE), PCE was detected in the samples collected from SVMP01 and SVMP03. Several VOCs were detected in the samples from SVMP16, including 1,1,2-trichloro-1,2,2-trifluoroethane, 1,2,4-trichlorobenzene, 1,2-dichlorotetrafluoroethane, chloroform, dichlorodifluoromethane, methylene chloride, PCE, toluene, TCE, and trichlorofluoromethane.

During the second field mobilization sampling event, PCE was detected in 15 of the 17 SVMP samples collected. Based on the FOD and its association with site activities, combined with the potential for PCE to act as a continuing source of ground water contamination, PCE is used for evaluation of contamination in the deep soil vapor.

Table 4-3 provides a list of the concentrations of PCE detected in SVMP samples (excluding QA/QC samples). The range of PCE concentrations detected in the SVMP samples was 207 ppbv to 1,186 ppbv. **Section 4.2** provides an evaluation of the extent of contamination in shallow soil vapor in terms of Problem Statement No. 2. **Section 5** describes the fate and transport associated with PCE in soil vapor.

4.1.1.3 Data Quality Evaluation

As discussed in **Section 2.2.2.2**, a subset of the soil vapor samples was sent to an offsite laboratory for QA/QC purposes. The DQE (**Appendix G**) determined that the results from these QA/QC samples were comparable to the results obtained using the onsite field GC. Therefore, the analytical results obtained from the field GC were determined to be a defensible method for the decision making purpose as described in the DQOs provided in **Table 2-1**. The laboratory reports for all soil vapor samples sent to the offsite laboratory are contained in **Appendix C**. An evaluation of the extent of PCE contamination in soil vapor is provided in **Section 4.2.1**.

4.1.2 Ground Water

Previous investigations of ground water collected by NMED (**EPA, 2000b**) showed that PCE and other VOCs were present in ground water at the GWP site. As described in **Section 2**, additional ground water data were collected by EPA for the RI in 2002, 2004, and 2005. The ground water sample results obtained in 2002 and 2004 are described in **Section 2.2.1**, and used along with the 2005 data for evaluation of contaminant trends in **Section 4.2.2.5**. Because the 2005 data collection effort (i.e. the second RI mobilization) represents a current and comprehensive look at the contamination at the site, only 2005 data are used to describe the current extent of contamination in the following paragraphs.

During the December 2005 sampling event, 78 ground water samples (excluding QA/QC) were collected from seven CLC municipal supply wells, one private well, 64 water table and multi-port monitor wells, and the six the newly installed nested monitor wells drilled and completed in November 2005. The samples were shipped to EPA's CLP laboratory for analysis of TCL VOCs. General water chemistry analyses were performed (discussed in **Section 3.8.2**) at an offsite laboratory

to evaluate the potential for attenuation of the PCE in ground water from biodegradation processes (see [Appendix I](#) and [Section 5.3](#)). This section will present the results of the VOC data only.

As described in [Section 2](#), samples were collected at a subset of water table monitor wells using both PDBs and the low-flow purge sampling methodologies to evaluate the long-term effectiveness of the PDB samplers for the GWP site wells. The PDB data help to describe the nature and extent of contamination whereas the low-flow results are considered a form of QA/QC for the PDB sampling methodology. [Appendix G-2](#) provides an evaluation of the PDB analytical results in contrast to the results obtained using low-flow purge methodology and recommendations for consideration should PDBs be used at the site in the future.

4.1.2.1 Ground Water Analytical Results

[Table 4-1c](#) provides the FOD for the constituents detected in ground water sampled during the second field mobilization in December 2005. The detected constituents include (in order based on the highest detected concentration):

- MTBE
- toluene
- acetone
- PCE
- bromoform
- methyl ethyl ketone (MEK)
- benzene
- chloroform
- TCE
- 1,2-dichloroethane (1,2-DCA)
- dichlorodifluoromethane
- ethylbenzene
- cyclohexane
- carbon disulfide
- cis-1,3-dichloropropane
- isopropylbenzene
- cis-1,2-Dichloroethene (cis-1,2-DCE)
- xylenes
- trans-1,2-Dichloroethene (trans-1,2-DCE)
- trichlorofluoromethane
- chloromethane
- 1,1-Dichloroethene (1,1-DCE)

As stated in [Section 4.1](#), the contaminants identified in ground water (based on exceedences of MCLs or MSSLS) are PCE, benzene, and MTBE. PCE was detected in 49 of 78 ground water samples. Benzene was detected in 44 of 78 ground water samples, and MTBE was detected in 7 of 78 ground water samples.

[Table 4-4](#) provides a list of the concentrations of VOCs detected in ground water samples from December 2005 (excluding QA/QC samples). PCE was detected in 46 monitor wells at concentrations ranging from 0.12 LJ (see [Table 4-4](#) for definitions of the data qualifiers) µg/L to 21

µg/L. PCE was detected in three municipal supply wells at concentrations ranging from 0.68 µg/L to 35 µg/L. PCE was detected above the MCL of 5 µg/L in 18 monitor wells and one municipal supply well. Benzene was detected in 44 monitor wells at concentrations ranging from 0.12 LJ µg/L to 22 J µg/L. Benzene was detected above the MCL of 5 µg/L in 7 monitor wells. MTBE was detected in 6 monitor wells at concentrations ranging from 0.12 LJ µg/L to 130 J^ µg/L. MTBE was detected in one municipal supply well at a concentration of 0.38 LJ µg/L. MTBE was detected above the MSSL of 6.2 µg/L in one monitor well.

Section 4.2 provides an evaluation of the extent of contamination in ground water in terms of Problem Statement No. 1. **Section 5** describes the fate and transport of PCE in ground water, and **Section 7** describes the assessment of risk.

4.1.2.2 Data Quality Evaluation

EPA validated the VOC results from the ground water sampling event. **Appendix G** summarizes the results of this data validation. The analytical results were determined to be acceptable for their intended purpose. Therefore, the DQOs provided in **Table 2-1** were met. The laboratory reports for all ground water samples sent to offsite laboratories are contained in **Appendix C**.

4.2 Distribution of Contamination

This section discusses and evaluates the distribution of PCE at the site in soil vapor and ground water.

4.2.1 Soil Vapor

Extensive soil vapor sampling was performed on average to a depth of 24 ft bgs during the first field mobilization. At a subset of locations, additional soil vapor samples were collected to depths of between 50 and 115 ft bgs. During the second field mobilization, additional soil vapor samples were collected to supplement and complete the data set for purposes of completing the RI Report. The following section provides a discussion of the results obtained from the entire data set.

4.2.1.1 Overview of the Extent of Soil Vapor Contamination

The lateral extent of PCE detected in soil vapor during the first field mobilization is depicted on **Figure 4-1**. The figure illustrates the concentrations of PCE in the soil vapor detected during 2002. The 2002 soil vapor data were collected to determine the locations of sources of PCE at the site and are not intended for use in evaluating risk due to soil vapor intrusion. The PCE concentrations in soil vapor are shown on **Figure 4-1** as low and widespread. However, higher relative concentrations of PCE in the shallow soil vapor are observed in three areas of the site.

- In the vicinity of the North Solano Drive/East Hadley Avenue intersection (at sample location SVMP03);
- In the vicinity of the East Hadley Avenue/North Walnut Street intersection (at sample location PA077); and,
- In the vicinity of the East Griggs Avenue/North Walnut Street intersection (at sample locations SVMP01, DA028, R8005, and R2017).

The analytical results from the first field mobilization are included in the IDRA Report (**EPA, 2003a**).

These three areas are the three identified PCE release (or source) areas for the site (see **Figure 4-1**). The PCE source areas were identified as property formerly occupied by the New Mexico National Guard Armory (on property currently owned by CLC), property formerly occupied by the Crawford Municipal Airport (on property currently owned by CLC), and the DACTD maintenance facility (on property currently owned by DAC). The PCE concentrations in soil vapor decrease laterally away from these three areas.

The vertical extent of PCE detected in soil vapor during the first field mobilization is illustrated in cross-sectional view in **Figures 4-2, 4-3, and 4-4**. The locations of these cross-sections are shown on **Figure 4-1**. Although the PCE concentrations in soil vapor are fairly uniform, they do increase slightly with depth immediately below the three identified source areas. This data set is limited to the vadose zone, and does not reach the water table at most locations. SVMP03 (located at the Former National Guard Armory) was the only location near one of the identified source areas where a sample could be obtained near the water table (a sample was collected at 108 ft bgs, compared to the water table which occurs at about 117 ft bgs at this location). Results at this location were generally uniform at depth, increasing only slightly from 68 feet bgs to 108 feet bgs.

At SVMP16, installed during the second field mobilization at the DACTD maintenance facility, the PCE concentration detected was highest in the 135 ft bgs sample port (753 ppbv) and lowest in the 184 ft bgs sample port (207 ppbv). The data indicate that the PCE concentration increases slightly with depth down to 135 ft bgs at SVMP16. Below 135 ft bgs, the PCE concentration varies at increasing depths (see **Table 4-5**). The 184 ft bgs sample port was completed within a clay layer just above the water table (at 185.5 ft bgs).

The concentration of PCE observed in shallow soil vapor is likely to have been influenced by disturbance of the soil (soil disturbance can enhance volatilization) and other activities since the time

the PCE was released to the environment. The concentrations of PCE commonly observed in soil vapor can be decreased by disturbance of the soil associated with development, precipitation, or irrigation. In addition, advective flow and pressure gradients between the atmosphere and soil vapor could result in the transfer of PCE from the soil vapor to the atmosphere near ground surface. Because of this, there may be a variation in concentrations of PCE in soil vapor immediately around the release area, with near surface concentrations detected at or below detection limits and greater concentrations at depth. In addition, volatilization can be limited by construction of surface features, such as parking lots, roads, or buildings, and higher concentrations may appear under paved areas adjacent to unpaved areas where PCE concentrations have dispersed.

A review of the shallow soil vapor data collected during the first field mobilization, and subsequent vapor intrusion screening using this data, indicated that there was a potential risk posed to receptors in the residential neighborhood northeast of the intersection of East Hadley Avenue and North Walnut Street. Additional shallow soil vapor data were collected during the second field mobilization to evaluate the potential risk posed by PCE through the vapor intrusion pathway. Shallow soil vapor data also were collected at the PAL Boxing Facility and the Meerscheidt Recreation Center to evaluate the vapor intrusion pathway at these locations.

4.2.1.2 Extent of Shallow Soil Vapor Contamination in the Residential Neighborhood, at the PAL Boxing Facility, and at the Meerscheidt Recreation Center

As stated previously, additional shallow soil vapor samples were collected in the residential neighborhood northeast of the intersection of East Hadley Avenue and North Walnut Street, at the PAL Boxing Facility, and at the Meerscheidt Recreation Center to evaluate the indoor vapor intrusion pathway. These data were collected in 2005 using a different sampling approach from the data collected in 2002. [Appendix B-1](#) provides a discussion of the different sample collection methods used to collect soil vapor samples during 2002 and 2005. The following paragraphs discuss the extent of soil vapor contamination at these locations based on the RI sample results.

[Figure 4-5](#) presents the PCE concentrations detected in the residential neighborhood northeast of the intersection of East Hadley Avenue and North Walnut Street. This figure also shows the PCE concentrations detected at 10 ft bgs in this area during the 2002 sampling event for informational purposes. [Note: The reporting units for the more data collected in 2005 are in ppbv vs. $\mu\text{g/L}$ for earlier results. [Section 2.2.2.2.1](#) contains an explanation on how to convert the units.] Based on the analytical results collected during November 2005, the PCE concentrations are lower at 5 ft bgs than at 10 ft bgs in the residential neighborhood (see [Figure 4-5](#)). In the 5 ft bgs samples, the PCE concentrations ranged from 34 ppbv up to 356 ppbv, and the PCE concentration exceeded the

screening level of 120 ppbv at 14 of the 24 locations sampled. In the 10 ft bgs samples, the PCE concentrations ranged from 53 ppbv up to 644 ppbv. The PCE concentration at the 10 ft bgs interval exceeded the screening level at 20 of the 21 locations sampled. Horizontally, the PCE concentrations varied considerably among the seven residences sampled, and no definitive directions of decreasing PCE concentrations were observed. Shallow soil vapor samples collected during the first field mobilization in 2002 demonstrate decreasing PCE concentrations to the north and east. The data show that PCE concentrations are highest near the intersection of East Hadley Avenue and North Walnut Street.

Figure 4-6 presents the PCE concentrations detected at the Meerscheidt Recreation Center. This figure also shows the PCE concentrations detected at 10 ft bgs within the same vicinity of this area during the 2002 sampling event for informational purposes. For purposes of performing the BHHRA, additional samples were collected at 5 ft bgs at the Meerscheidt Recreation Facility during the second field mobilization. PCE was detected at three of the six locations sampled. At these locations, the PCE concentration did not exceed the screening level; therefore, no additional samples were necessary.

Figure 4-7 presents the PCE concentrations detected at the PAL Boxing Facility. This figure also shows the PCE concentrations detected at 5 and 10 ft bgs near the boxing facility during the 2002 sampling event for informational purposes. The analytical results collected from the second field mobilization for completing the risk assessment revealed PCE concentrations to be lower at 5 ft bgs than at 10 ft bgs (see **Figure 4-7**). In the 5 ft bgs samples, the PCE concentrations ranged from 29 ppbv up to 87 ppbv. The PCE concentration did not exceed the screening level at any of the four locations sampled. In the 10 ft bgs samples, the PCE concentrations ranged from 44 ppbv up to 206 ppbv. The PCE concentration at 10 ft bgs exceeded the screening level at two of the four locations sampled. Horizontally, the PCE concentrations are highest on the south and west sides of the building.

The PCE concentrations detected in soil vapor during the 2005 sampling event were, in general, lower than the concentrations detected during the 2002 sampling event. It is unlikely this difference is due to the effects of seasonal variability (see **Section 7.1.5.4**). The apparent reduction in PCE concentrations could be the result of the attenuation of PCE in the soil vapor over time, the variation in depths sampled (the 2002 data was collected from 10 feet bgs or more, the 2005 data was collected from 10 feet bgs or less), the locations sampled (the street vs. the yards), and/or the different method of collection.

4.2.1.3 Extent of Contamination in Soil Vapor Monitor Points

SVMP01, SVMP03, and SVMP16 were sampled to evaluate the relation between PCE in the soil vapor and ground water. These data also served to refine the site characterization by assisting in understanding the PCE migration from ground surface to ground water at the source areas. The following paragraphs discuss the extent of soil vapor contamination at these three sampling locations. **Table 4-5** lists the PCE soil vapor concentrations detected in the SVMPs during the first and second field mobilizations.

Based on the December 2005 sample results at SVMP01, located at the DACTD maintenance facility, the PCE concentration was highest in the deepest sample port at 100 ft bgs (1,186 ppbv) and lowest in the 20 ft bgs port (result was non-detect). Data collected during the first field mobilization indicated that the PCE concentration in soil vapor increased slightly with depth at this location; however, the second mobilization did not reveal a distinct increasing or decreasing concentration trend with depth (see **Table 4-5**). The 80 ft bgs sample port exhibited a high vacuum during purging, indicating that the port was plugged. Therefore, this port was not sampled.

At SVMP16, also located at the DACTD maintenance facility, the PCE concentration detected during the second field mobilization was highest in the 135 ft bgs sample port (753 ppbv) and lowest in the 184 ft bgs sample port (207 ppbv). The data indicate that the PCE concentration increases slightly with depth down to 135 ft bgs at SVMP16. Below 135 ft bgs, the PCE concentration varies at increasing depths (see **Table 4-5**). The 184 ft bgs sample port was completed within a clay layer just above the water table (at 185.5 ft bgs).

At SVMP03, located at the Former National Guard Armory, the PCE concentration detected during the second field mobilization was highest in the 48 ft bgs sample port (658 ppbv) and lowest in the 30 ft bgs port (578 ppbv). The 68 and 90 ft bgs sample ports exhibited a high vacuum during purging, indicating that the ports were plugged. Therefore, these ports could not be sampled. The 108 ft bgs sample port exhibited a partial vacuum during purging, which resulted in rejection of the sample result for this port. The data indicate that the PCE concentration increases slightly from 30 ft bgs to 48 ft bgs at this location (see **Table 4-5**), but the data set is limited to these two depths. The data collected during the first field mobilization indicated that the PCE concentration in soil vapor increased slightly with depth at SVMP03. The PCE concentrations detected in the 30 ft bgs and 48 ft bgs ports at SVMP03 were similar for both field mobilizations.

There are limited available comparisons of soil vapor and ground water concentrations where the soil vapor concentrations are measured very close to the water table because of the depth to ground water

at the GWP site. The limited data available (from SVMP03 and SVMP16) suggest that PCE in soil vapor and ground water are at or near equilibrium, although there are many uncertainties involved in such an evaluation. The general decrease in PCE concentrations observed in ground water from water table monitor wells provides a more definitive indication that soil vapor is not an ongoing significant source of PCE to the ground water (refer to the water table well trend graph in [Appendix K-8](#)).

4.2.2 Ground Water

Ground water was sampled December 2002, January 2004, and December 2005. The monitor wells installed at the DACTD maintenance facility as part of the UST investigation (wells MW-1 through MW-6) were installed and first sampled in 1998. The monitor wells installed by NMED as part of their site inspection activities (wells MW-SF1 through MW-SF10) were installed and sampled in 2000.

The following sections provide an overview of the extent of the ground water contamination based on the results from the second field mobilization, which occurred in December 2005. The distribution of the benzene and MTBE contamination are discussed in [Sections 4.2.2.1](#) and [4.2.2.2](#). The extent of the PCE contamination is discussed in the remainder of this section. PCE concentration trends over time for site monitor wells are discussed at the end of this section to evaluate how the PCE concentrations in the plume have changed with time.

4.2.2.1 Distribution of Benzene in Ground Water

The distribution of benzene in ground water during December 2005 is illustrated on [Figure 4-8](#). Where detected, the benzene concentrations are generally below the MCL. However, benzene concentrations do exceed the MCL at GWMW03 ports 4, 5, and 6, GWMW04 port 6, GWMW09 ports 1 and 3, and at MW-1. Benzene has not been detected in the CLC municipal supply wells at the site, and the distribution of benzene does not appear to be consistent with the distribution of PCE. At a few wells, the concentrations increase with depth (i.e. less than 1 ppb in upper ports and above the MCL in deeper ports). At GWMW09, however, the concentrations are higher in the upper ports and lower in the deeper ports. Benzene is a one of the many aromatic compounds formed during oil refining and is typically associated with gasoline.

4.2.2.2 Distribution of MTBE in Ground Water

The distribution of MTBE in ground water during December 2005 is illustrated on [Figure 4-9](#). Its presence is not consistent across the site, and its distribution does not appear to be consistent with the distribution of PCE. Where detected, the MTBE concentrations are generally below the MSSL,

although it does exceed the MSSL at GWMW08 port 1. MTBE was also detected in CLC Well No. 21 at a concentration of 0.38 LJ $\mu\text{g/L}$. MTBE is an additive in unleaded gasoline.

4.2.2.3 Horizontal Distribution of PCE in Ground Water

Ground water contamination at the GWP site is best defined by the distribution of the contaminant PCE. PCE is the most widespread contaminant at the site. The highest PCE concentrations observed in the ground water in January 2004 occurred in the UHZ near CLC Well 18 and multi-port monitor well GWMW01 (at the DACTD maintenance facility). At that time, the ground water plume extended from between CLC Well No. 10 and monitor well GWMW06 towards the east to near I-25. PCE concentrations exceeded the MCL in two separate locations within the plume. The first area is located northwest of the plume at monitor wells GWMW06 and MW-SF8, near the Former National Guard Armory. The second location extends from the DACTD maintenance facility east to monitor wells GWMW10 and MW-SF10. Deeper within the aquifer, and within the LHZ, the horizontal extent of the ground water plume where PCE concentrations exceeded the MCL occurred between CLC Well Nos. 18, 19, 21, and 27 (CH2M HILL, 2004).

The horizontal extent of PCE in the UHZ, the upper portion of LHZ, and the lower portion of LHZ during December 2005 is provided on [Figures 4-10](#) through [4-12](#) respectively. The upper and lower portions of the LHZ are presented to show changes in the plume extent with depth at the site. The data from individual wells are presented and contoured to show the distribution of PCE contamination. The concentrations of samples collected from the CLC municipal supply wells are provided on each figure for reference purposes although they are not used to contour the extent of the PCE contamination in ground water. Where sampling was conducted using both the PDBs and the low-flow purge method, the PDB results are provided on the figures. Each figure is contoured to a PCE concentration of one-half the MCL (2.5 $\mu\text{g/L}$).

The recent data set indicates that within most areas of the site, the horizontal extent of the PCE plume has not significantly changed since January 2004. The recent data set shows the extent of PCE in ground water slightly farther south of the DACTD maintenance facility. PCE was also detected east of I-25 at monitor wells GWMW15-S (18 $\mu\text{g/L}$) and GWMW15-D (0.18 LJ $\mu\text{g/L}$), extending the plume footprint east of these wells.

The GWP site plume extends laterally west-to-east from near monitor well GWMW06 and CLC Well No. 10 eastward beyond the Las Cruces Flood Control Dam. Near GWMW06, the PCE detections are limited to the UHZ. The horizontal extent of the PCE detections in ground water is approximately 9,500 ft in length. The area of PCE detections extending from the DACTD maintenance facility

downgradient to east of monitor well GWMW15 is approximately 6,000 ft in length. The plume, at its widest point, extends north-to-south from north of CLC Well No. 21 to south of CLC Well No. 19 and is approximately 2,700 ft wide (see [Figure 4-10](#)). The plume configuration appears to be largely influenced by municipal well pumping.

The PCE concentrations in the UHZ (at the water table) still exceed the MCL in two areas (see [Figure 4-10](#)). The first area is located at monitor well GWMW06 in the northwestern part of the plume. This area is located upgradient of and near the Former National Guard Armory. The extent of the PCE plume in the UHZ upgradient (west and northwest) of GWMW06 to concentrations at or below the MCL is not defined. The PCE concentration decreases towards the east and downgradient of GWMW06 to concentrations less than 1 µg/L in monitor well GWMW03 at the Former National Guard Armory. The PCE concentration in ground water increases downgradient of the Former National Guard Armory to above the MCL near the DACTD maintenance facility. The second area where PCE concentrations exceed the MCL extends from near monitor well MW-SF3 (located at the DACTD maintenance facility) and to the east toward monitor well MW-SF10. The eastern, downgradient extent of the PCE plume to concentrations less than 2.5 µg/L (the lowest concentration contoured on [Figure 4-10](#)) is not well defined in the UHZ. The PCE concentration in monitor well GWMW09 port 1 was less than 1 µg/L, while the PCE concentration in monitor well GWMW15-S was 18 µg/L. Both of these wells are screened within the upper portion of the LHZ near the boundary between the UHZ and the upper portion of the LHZ (see [Figure 3-6](#) and [4-14](#)). As stated in [Section 3.7.2](#), the finer grained units that separate the UHZ from the upper portion of the LHZ are thin or absent in this area of the site and the boundary between the two zones is less well defined. Due to these uncertainties, the extent of the PCE detections above a concentration of 2.5 µg/L is extended to beyond GWMW15-S.

In the LHZ (upper and lower portions), PCE concentrations exceed the MCL in the area extending east and downgradient from the DACTD maintenance facility (see [Figures 4-11](#) and [4-12](#)). The area of the plume where PCE exceeds the MCL in the deepest monitor well ports screened within the lower portion ([Figure 4-12](#)) of the LHZ occurs at the DACTD maintenance facility near monitor well GWMW01. PCE concentrations in the upper portion of the LHZ ([Figure 4-11](#)), above an elevation of 3,675 ft MSL, exceed the MCL in a broad area extending from the east side of the DACTD maintenance facility downgradient to the east of monitor well GWMW15-S. The downgradient (eastern) lateral extent of PCE in the upper portion of the LHZ is not defined to concentrations at or below the MCL.

PCE was detected at very low concentrations at GWMW07 in port 1 (1 µg/L), port 2 (0.14 LJ µg/L), and port 5 (0.13 LJ µg/L). PCE was not detected at private well LRG-3191 or GWMW04 (all ports) during December 2005. Based on the lack of PCE detections in LRG-3191 and GWMW04 and the ground water flow direction at the site (discussed in [Section 3.7.2.4.4](#)), the PCE detections southwest of the site in monitor well GWMW07 do not appear related to the GWP site plume.

PCE concentrations were low in monitor wells GWMW11-S/I/D during December 2005 (less than 1 µg/L). PCE was not detected in CLC Well Nos. 26 and 61 during the most recent sampling conducted by the CLC in June 2005 (see [Table 1-2](#)). Based on the low concentrations south of the DACTD maintenance facility, the lack of PCE detections in CLC Well Nos. 26 and 61, and the ground water flow direction at the site (discussed in [Section 3.7.2.4.4](#)), the PCE detections south of the site in private well LRG-1457 and CLC Well No. 24 appear to be not related to the ground water releases that occurred at the GWP site. However, the ground water modeling results (discussed in [Section 2.5](#)), indicate that the plume will migrate towards the southeast in the area between the DACTD maintenance facility and CLC Well 19. The modeling activity has not demonstrated that the GWP PCE plume, based on the current data available, has migrated to CLC Well 24, although it may in the future.

Based on the data currently available, the vertical extent of the GWP site plume is defined to concentrations below the MCL. The horizontal extent of PCE concentrations above the MCL is not defined in the UHZ upgradient (west and northwest) of well GWMW06. The MCL exceedences in ground water in this area are separated from the main portion of the GWP site plume located near and downgradient of the DACTD maintenance facility by intervening wells where PCE is detected at concentrations less than the MCL. The horizontal extent of PCE concentrations above the MCL is not defined in the upper portion of the LHZ downgradient (east) of well GWMW15. Monitor well GWMW15 has been sampled only once, in December 2005. Therefore, data sufficient to characterize PCE concentration trends in this area of the plume are not available. The ground water model results indicate that the plume is migrating towards the southeast between the DACTD maintenance facility and CLC Well 19. Water level measurements collected at the site indicate that the ground water is flowing towards the east and northeast at the site in the LHZ. This is not necessarily contradictory; it may simply be a function of the lack of water level measurements in this particular area of the site. A monitor well located south of CLC Well 27 and GWMW10 would potentially confirm the results of the model.

4.2.2.4 Vertical Distribution of PCE in Ground Water

The vertical distribution of PCE at the GWP site from December 2005 is presented in cross-sectional view on **Figures 4-13** through **4-15**. These cross-sections are the same views as those presented on the hydro-geophysical cross-sections A-A', B-B', and D-D' in **Section 3**. A cross-section for the C-C' area was not necessary because of the low amounts of contamination in this area. The locations of these cross-sections are provided on **Figure 3-4**. Based on the data currently available, the vertical extent of the GWP site plume is defined to concentrations below the MCL.

In the northwestern part of the plume, the highest detections of PCE occur in the UHZ at GWMW06 port 1 (10 µg/L, see **Figure 4-13**). The PCE concentrations decrease away from this monitor well location. In the LHZ in this area, the PCE concentrations are low (less than 1 µg/L) or not detected. This infers that the concentrations observed at GWMW06 are confined to the upper reaches of the aquifer and do not contribute significantly to the rest of the plume.

In the eastern area of the plume, between monitor wells GWMW01 and GWMW15, the PCE contamination extends deep within the aquifer as shown on **Figures 4-13** through **4-15**. The highest PCE concentrations in this area occur at monitor wells GWMW01, GWMW09, GWMW10, and GWMW15. In the area near GWMW01, the contamination extends from the water table down to the lower portion of the LHZ. At this monitor well, PCE was encountered at levels exceeding the MCL in port 6 down to an elevation of 3,515 ft MSL. At monitor wells GWMW09 and GWMW10, PCE concentrations exceeding the MCL extend from the upper portion of the LHZ down to elevations of 3,560 ft MSL at GWMW09 (port 5) and 3,615 ft MSL at GWMW10 (port 4). PCE is not detected above the MCL in the UHZ at these two well locations. At GWMW15, PCE concentrations exceeding the MCL are confined to the upper portion of the LHZ, in well GWMW15-S (at an elevation of 3,780 ft MSL).

The vertical distribution of PCE, within the deeper parts of the eastern area of the plume indicates direct influence from pumping at the nearby CLC municipal supply wells. This is best illustrated near CLC Well No. 18, as shown by the PCE detections in port 6 at monitor well GWMW01.

4.2.2.5 PCE Concentration Trends

Figures 4-16 through **4-18** present graphs of the PCE concentration trends over time from selected monitor wells located west of the DACTD maintenance facility, at the DACTD maintenance facility, and east of the DACTD maintenance facility respectively. The figures illustrate how the PCE concentrations in ground water have changed over time from these three areas. **Appendix K** provides graphs illustrating PCE concentration trends over time from all monitor wells on site.