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Vapor Extraction Well Performance and Recommendations for Future Soil Vapor Extraction Activities at the A-014 Outfall

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EXECUTIVE SUMMARY

The vadose zone near the A-014 Outfall contains residual volatile organic compounds that serve as a potential source for groundwater contamination. Since 1995 active soil vapor extraction has been an integral part of the corrective actions at this facility. Currently two separate soil vapor extraction systems are being used to remove contamination in the vapor phase from the subsurface. The 782-3M soil vapor extraction unit was deployed in April of 1995 and the A-014 Mobile #3 unit was deployed in January of 2009. The objective of this investigation is to evaluate the performance of individual wells associated with these systems and provide recommendations on possible optimizations to these systems. Options that are considered include continuation of active extraction, transition to a low-energy soil vapor extraction treatment, or abandon non-performing wells.

The scope of the investigation examined the eighteen (18) vadose zone wells that are associated with the ongoing Resource Conservation and Recovery Act corrective action program within A/M Area. During the evaluation process, individual wells were isolated and purged for a standard period using the existing soil vapor extraction system. Following the purge period, vapor samples were collected intermittently over the following 24–72-hour period. The objective of the sampling activity was to collect sufficient data to estimate the mass flow rate of contaminants from the individual extraction wells. Subsequent analysis then evaluated and ranked extraction performance to provide recommendations on the viability, operational scheme, and applicability of low energy soil vapor extraction.

The analysis of mass extraction rates resulted in the following recommendations related to future soil vapor extraction activities at the A-014 Outfall:

1. The 782-3M soil vapor extraction unit should continue to operate using the three conventional soil vapor extraction wells that are connected to it. Each of these wells can extract in excess of 1 pound per day of solvent from the subsurface.
2. The nine shallow direct push wells currently connected to the 782-3M soil vapor extraction unit should be abandoned. These wells have very low mass extraction rates and are no longer viable as part of the corrective action.
3. Well MRS-34, located in the capillary fringe, should be equipped with a MicroBlower™. During testing this well had a production rate of just below 1 pound per day and the subsurface configuration is suitable for this technology.
4. The A-014 Mobile #3 unit should continue to operate using four of the five fracture enhanced wells. Each of these wells can extract in excess of 1 pound per day of solvent from the subsurface.
5. Fracture enhanced well AF-8 should be converted to a vent well to allow alternate subsurface flow to enhance performance of wells AF-5 and AF-7. Monitoring of carbon dioxide should be implemented to identify short circuiting from the surface.

Although permit conditions allowing for the shutdown of the soil vapor extraction units have been reached (less than 40 pounds per week of volatile organic compounds are currently being removed from both systems), individual extraction well testing indicates significant residual mass remains in the subsurface that warrants continued active vapor extraction. This will take advantage of existing infrastructure and equipment that currently exist at the site, which is still removing more mass than the local groundwater recovery well. Volatile organics are more readily removed from the vapor phase versus the aqueous phase. Final assessment of the 782-3M system will be based upon the results of future rebound testing. The decision to shut down or transition active soil vapor extraction systems to low energy systems should consider mass removal efficiency (e.g., aspects of operations and maintenance costs) and the value of groundwater protection.

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CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFM	Cubic Feet per Minute
CH_4	Methane
CO_2	Carbon Dioxide
DNAPL	Dense non-Aqueous Phase Liquid
ERDMS	Environmental Restoration Data Management System
°F	Fahrenheit
FPM	Feet per minute
HCL	Hydrochloric Acid
H_2O	Water Vapor
M	Meters
MG	Milligram
ML	Milliliter
MW	Molecular Weight
O_2	Oxygen
N_2	Nitrogen
PCE	Tetrachloroethylene
PPMV	Parts per Million Vapor
R	Universal Gas Constant
RCRA	Resource Conservation and Recovery Act
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
SVE	Soil Vapor Extraction
SVEU	Soil Vapor Extraction Unit
T	Temperature
TCA	1,1,1, Trichloroethane
TCE	Trichloroethylene
VOC	Volatile Organic Compound
ZOI	Zone of Influnce

1.0 Background

Between 1952 and 1979 process waste from M-Area facilities was discharged at the A-014 Outfall at the Savannah River Site (SRS). A major constituent of this waste stream included free-phase forms of the chlorinated solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (PCE). The released solvents have impacted the groundwater throughout the A/M Area. In September of 1985 an extensive pump and treat system was installed to address groundwater contamination. This system included several groundwater recovery wells, including well RWM-06 located at the A-014 Outfall. This investigation evaluates the performance of the existing soil vapor extraction (SVE) systems located at the A-014 Outfall and provides guidance in regards to future operational strategies. The following narrative summarizes the evolution of active SVE activities at the A-014 Outfall. The location of the various wells at the A-014 Outfall is presented in Figure 1 and general construction information for vapor extraction wells is presented in Table 1.

1.1 Traditional SVE wells (MVE-4, MVE-9, and MVE-10)

In April of 1995 the 782-3M SVE unit (SVEU) was deployed at the A-014 Outfall to address solvents that were present in the vadose zone beneath this facility (WSRC, 1997 and 1998). In the original configuration, the 782-3M unit extracted soil vapor from vadose zone using extraction wells MVE-4, MVE-9, and MVE-10 and the system included catalytic oxidation systems to treat off-gas. These wells were drilled with 8.5-inch augers to depths on the order of 100-feet. Wells were completed with 4-inch casing having nominal 60-foot long screen zones that target the upper and middle permeable (sandy) zones of the vadose zone. Generally these wells were designed to provide high volume flow rate from the subsurface.

Between April of 1995 and January of 1997 extraction rates from the 782-3M SVEU were limited to 0.479 pounds per hour for TCE, 0.479 pounds per hour for PCE, and 8.0 pounds per hour of hydrogen chloride (HCl), a product of the catalytic oxidation treatment process. These limits were necessary to comply with requirements of the Title V Air Permit. In January of 1997 the emission limits for the 782-3M unit were modified. The modified permit combined volatile organic compounds (VOCs) emissions and allowed 7.2 pounds per hour reported as Total VOCs and increased HCl to 14.8 pounds per hour for the 782-3M unit (WSRC, 1997 and 1998). During the initial operational period rigorous and disciplined operational paradigms were implemented to ensure that air permit limits were not exceeded. This strategy was warranted due to high vapor concentrations. During this period systems were often operated with large volumes of make-up air.

1.2 Direct-push wells (MVE-13 through MVE-19, MVE-21, and MVE-22)

In 1999 characterization activities confirmed the presence of dense non-aqueous phase liquid (DNAPL) in the shallow vadose zone (10 to 25 feet below land surface) near the headwaters of the A-014 Outfall (Jackson et al., 1999). The characterization was associated with ongoing SVE operations at the outfall and was based on DNAPL specific techniques. These results indicated that DNAPL was present within discrete horizons at depths between 10 and 25 feet near the headwaters of the outfall. Based upon these observations additional extraction wells were installed for use by the existing 782-3M SVE system. The additional extraction wells were

installed with direct-push equipment and configured with short (~10 foot) screens that targeted those regions containing the highest concentrations. The additional extraction volume from the DNAPL areas was intended to provide an increase in the performance of the SVE system near the outfall and reduce the source to the groundwater.

1.3 Capillary Fringe Extraction Well (MRS-34)

In the April of 2000 well MRS-34 was installed. The boring was completed above the location where PCE concentrations from an angle boring identified the presence of DNAPL (Vangelas et al., 2001). The well was installed with a 20-foot screen zone and a 40-foot thick filter pack. The screen is located between depths of 95 and 115 feet and the filter pack is Foster Dixiana FX50 sand (0.45 – 0.55mm grain size) between depths of 91 and 120 feet. The effective screen zone includes the capillary fringe and possibly the top portion of the water table.

1.4 A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit

In April of 2004 seven additional vapor extraction wells associated with a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial decision for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit were connected to the 782-3M SVEU. This expansion was installed to treat approximately 6,000 cubic yards of TCE- and PCE-contaminated media associated with this facility (WSRC, 2008). The operating scheme involves a monthly rotational schedule between odd and even numbered wells (odd numbered wells in-service using the 782-3M SVEU while even numbered wells are in standby; in the following month even numbered wells are placed in service and the odd numbered wells are placed in standby). The A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit SVE wells are regulated under CERCLA and were not included during this investigation.

1.5 Fracture Enhanced Extraction Wells (AF-Series)

Between 2006 and 2008 a technology demonstration of fracture enhanced SVE at the A-014 Outfall was performed (Riha et al., 2008). Fracture enhanced SVE was evaluated as an enhancement to the existing SVE operations and was considered applicable for the shallow, low permeability sediments contaminated with DNAPL at the A-014 Outfall. The demonstration was performed under a Temporary Authorization (TA) to the existing Resource Conservation and recovery Act (RCRA) permit. A pilot study completed in fiscal year 2005 had demonstrated the value of SVE enhanced with soil fracturing (Riha et al. 2005). The synergistic effect of the fracture well completion methods, fracture and flow geometry, and pore water removal appears to increase the rate of solvent mass removal over that of increasing flow rate alone.

During the demonstration at the A-014 Outfall eight hydraulically fractured wells were installed to enhance SVE for the treatment of solvent contamination identified in the shallow 30-feet interval. The investigation determined that hydraulically fractured wells tend to perform better than conventional wells during SVE operation at the A-014 Outfall. During the investigation the three shallow wells vented to the surface during installation and the five remaining wells were successfully installed with a sand propping agent injected (Riha et al., 2008). The pancake like geometry associated with hydraulic fractures also leads to a significant increase in zone of influence (ZOI), as compared to conventional wells. The increase in ZOI is due to the radially extending, horizontal, high-permeability conduit nature of the hydraulic fracture; however, air-

flow into the fracture is predominately vertical (occurring at right angles to the fracture plane). During the 6-month operational period of the demonstration period more than 2,500 pounds of VOCs were removed from the fractured wells. Due to the geometry of the fractures, the mass removed was attributed to directly targeting and removing DNAPL (Riha et al., 2008). In 2008 a high vacuum SVEU system was used and removed 1,636 pounds of solvent from the fracture wells. The concentrations fluctuated with rainfall and both flow rate and concentration were observed to be slowly decrease with time (SRNS, 2009). To address the residual solvents associated with the shallow, fine-grained sediments, on February 25, 2009 the A-014 Mobile #3 Soil Vapor Extraction Unit replaced the high vacuum SVEU system at wells completed in the hydraulically fractured zone (SRNS, 2010).

1.6 Effectiveness of SVE at the A-014 Outfall

The application of SVE at the A-014 Outfall has been very effective. Figure 2 presents the performance of the two active SVE systems in terms of monthly removal rate (left ordinate) and cumulative total (right ordinate) of VOCs (TCE plus PCE) in pounds. The data for Figure 2 was accumulated from monthly operational data reported in annual corrective action reports for M-Area for calendar years 1995 through 2014. As shown in Figure 2, between April of 1995 and December of 2014 the SVE systems have removed 208,874 pounds of solvent from the subsurface. While this is a significant mass of solvent, it represents 15% of the approximately 1.395 million pounds of solvent that were released to the outfall (Marine and Bledsoe, 1984). It is assumed that most of the balance was flushed through the system or degraded as current recovery rates have decreased exponentially. A notable attribute of the monthly removal rate is the linear trend between Jan-1997 and Jun-2012 (Note: The left ordinate of Figure 2 applies to monthly extraction data and is plotted on a logarithm scale). In January of 1997 air permit limits were increased and the 782-3M system was operated at higher capacity with total VOC extraction rates on the order of 8,000 pounds per month. Through time the monthly extraction rate has decreased exponentially and current monthly extraction rates vary between 10 and 100 pounds per month. In recent years the variable extraction is attributed to changing operations as various well groups are cycled to increase extraction performance and the deployment and influence of the A-014 Mobile #3 unit.

Within the A/M Area, criteria for transition from active SVE to passive SVE has been developed based upon the removal of 40 pounds per week from active systems (Williams, 1998). This criterion was established based upon a heuristic analysis using traditional active SVE and groundwater pump and treat. As presented by Williams (1998) SVE is considered no longer necessary when extraction rates from SVE fall below the extraction rate of the groundwater pump and treat system. This concept is illustrated in Figure 3 that depicts the relationship between mass removed by active SVE and that removed by groundwater pump and treat. The calculation indicates that active SVE is reasonable as long as the mass removed by the active system is greater than that removed by pump and treat, effectively creating low mass flux across the capillary fringe. The logic then applied is that once the extraction rate of the underlying pump and treat system exceeds that of the SVE then the active SVE system is no longer necessary. In A/M Area the 40 pounds per week has been used as a guide to indicate that passive technologies should be considered for implementation. The 1998 analysis applied groundwater extraction rates and concentrations from the Spring of 1996 to establish the 40 pounds per week

threshold, that is actually reported as 39.1 pounds per week of PCE. Williams further prescribes a mechanism to determine if the criteria has been obtained (3-month shutdown followed by 3-month operation). Implicit within the criteria presented by Williams (1998) is the obligation for long term operation of groundwater pump and treat systems in areas where active SVE was deployed. This approach also does not consider the potential difference in complexity in capturing contaminants in the aqueous phase as compared to the vapor phase.

One limitation on the establishment of specific, permanent shutdown criteria in 1998 is the long-term dynamic performance of the pump and treat systems, that also decreases at an exponential rate. This is illustrated in Figure 4 that presents the historical performance of SVE and pump and treat specific to the A-014 Outfall. For the 782-3M system the shutoff threshold of 40 pounds per week (160 pounds per month) was reached in early 2007. In early 2007 groundwater recovery well RWM-06 was removing approximately 50 pounds per month from the underlying groundwater. As shown in Figure 4, mass removal rates from RWM-06 are now approaching the removal rate from the 782-3M SVE unit.

2.0 Purpose and Objective

The objective of this investigation is to evaluate the performance of the existing SVE systems located at the A-014 Outfall and provide guidance in regards to future operational strategies. The scope of the current investigation only includes those wells associated with the ongoing RCRA corrective action program within A/M Area and not the CERCLA action associated with the A-Area Miscellaneous Rubble Pile Pile (731-6A) Operable Unit. The wells included in this investigation are shown in Figure 1.

3.0 Analysis Approach

The techniques employed in this investigation are consistent with a previous SVE evaluation at the M-Area Settling Basin following the deployment of a thermal remediation system (Noonkester et al., 2012b; Jackson et al., 2013). The approach and techniques were used to prioritize the vapor extraction wells associated with the A-014 Outfall in regards to 1) primary use for active SVE, 2) component of a sustainable vapor extraction system using passive technology, or 3) minimal mass removal rates. The analysis involved:

- Collection of well specific data on concentration, temperature, and flow,
- Determining the mass flow rate for each well using the active system,
- Evaluate extraction flow data and prioritizing wells for active extraction, and
- Estimating individual well performance using MicroBlower™ technology.

3.1 Collection of Well Specific Data

Tests were performed on one or two wells at a time by extracting soil gas from either 782-3M or the A-014 Mobile #3 unit for a 24-hour period. Collection of well specific data involved opening the targeted well(s) for a 24-hour purge period followed by a 24-hour test period. Each 24-hour test period started at approximately 10:00 hours. Tests that began on the last work day of the week or were impacted by holidays were allowed to run for an extended period and completed on the following scheduled work day. Initial plans were to test the large flow rate wells (MVE-4, MVE-9, and MVE-10) over these extended periods. During the test period soil

gas samples were collected at each wellhead using a handheld vacuum pump. Soil gas samples were collected in 20-ml headspace vials and in Tedlar® bags.

Sample analysis of the 20-ml headspace vials was performed at on-site SRS laboratories using an Agilent 7890 gas chromatograph with a Gerstel auto-sampler. The system is equipped with dual columns and an electron capture detector, flame ionization detector and thermal conductivity detector for analysis of chlorinated VOCs, light hydrocarbons and fixed gasses such as carbon dioxide (CO_2), oxygen (O_2), and nitrogen (N_2). At the completion of the testing all analytical data will be assembled in an electronic deliverable suitable for loading into the Environmental Restoration Data Management System (ERDMS).

A photoacoustic analyzer (Brüæl & Kjaer Model 1312A) was used in the field to analyze the gas samples collected in Tedlar bags. This instrument provides real-time results of select parameters that allow concentration trends to be observed as testing progresses. This provided the ability to verify that the test period was sufficient time to establish a baseline VOC soil gas concentration and that a representative soil gas sample was collected. In addition to providing VOC concentration, the photoacoustic analyzer also measures the concentration of CO_2 present in the sample. This compound is generally greater in subsurface soil gas than in the atmosphere where the concentrations are on the order of 500-600 *ppmv*. Use of the photoacoustic analyzer allows real time validation that a sample from the subsurface is collected prior to shipment to the laboratory. Generally a total of five sets of samples were collected during the 24-hour testing period with samples collected at the following intervals: Day 1: 10:00, 13:00, 16:00; Day 2: 7:00 and 10:00.

During the collection of the soil vapor samples essential operational parameters were also recorded. These parameters included temperature and flow parameters at the well head. Flow and temperature were measured with an insertion style mass flow meter (Alnor AVM430) that is maintained by SRS Operations personnel.

3.2 Mass Extraction Using the Active System

Using the results from well head conditions the mass extraction rate for each well is determined. This calculation involves the conversion of the vapor concentrations reported in parts per million volume (ppmv) to mass per unit volume (mg/m^3) at the gas collection temperature. This conversion utilizes the following relationship:

$$Concentration\left[{}^{mg}/_{m^3}\right] = Concentration[ppmv] \times \frac{MW}{R \times T}$$

Where MW is the molecular weight of the specific compound, R is the universal gas constant, and T is the temperature of gas vapor. This conversion is developed from manipulation of the ideal gas law.

The mass flow rate is then determined as the product of the converted vapor concentration and the observed volume flow rate.

$$Mass\ Flux\ \left[{pound}/{day}\right] = Concentration\ \left[{mg}/{m^3}\right] \times Flow\ [{feet^3}/{min}] \times CF$$

Where CF is the conversion factor:

$$CF = \left({1\ m^3}/{35.3\ feet^3}\right) \times \left({1\ pound}/{453{,}592\ mg}\right) \times \left({1440\ minutes}/{day}\right)$$

3.3 Evaluate Extraction Rate Data and Prioritize Wells for Active Extraction

The extraction rate data under active vapor extraction is averaged for each well and ranked to recommend which wells should continue to be used for active vapor extraction and which wells are viable candidates for low energy extraction.

3.4 Estimate Well Performance Using MicroBlower™ Technology

Wells that are identified as candidates for transition to low energy operation are further analyzed and estimates of performance under MicroBlower™ extraction are performed. This utilizes earlier observations on the performance of these systems within A/M Area (Noonkester et al., 2012a).

4.0 Results and Discussion

4.1 Collection of Well Specific Data

Field activities associated with sampling and collection of well head data in support of this activity occurred between December of 2014 and February of 2015. The five (5) fracture wells that are connected to the A-014 Mobile #3 SVEU were sampled between December 9, 2014 and December 22, 2014. The remaining thirteen (13) wells that are associated with the 782-3M SVEU, not including the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit wells, were tested between January 5, 2015 and February 26, 2015. Field observations and sample identification information were recorded in a controlled laboratory notebook (SRNL, 2015). Recorded Field Observations are included in Appendix 7.1 and analytical results for the select compounds are included in Appendix 7.2 in an abbreviated ERDMS data table format. Table 2 presents average values of flow, temperature, and laboratory vapor concentration data collected in this investigation.

Highest concentrations were observed in the fracture series. Well AF-2 had the highest concentrations observed. Laboratory results from samples collected at wells MVE-14, MVE-18, and MVE-19 were reported as non-detect. Highest flow rates were obtained from the original three wells, MVE-4, MVE-9, and MVE-10. Generally the lowest flow rates were obtained from the shallow 2-inch direct push wells.

To evaluate local effectiveness of SVE, soil gas concentrations (where available) from previous investigations are compared to those obtained in this study. The comparison includes a well by

well evaluation of concentration in soil gas as obtained by photoacoustic analyzer. Two previous investigations (Jackson et al., 1999 and Riha et al., 2008) provide initial soil gas concentration for fourteen of the eighteen vapor wells examined in this investigation. The wells with no early/initial soil gas data identified were MVE-4, MVE-9, MVE-10, and MRS-34. For those wells evaluated the Student t-test was first used to evaluate the statistical significance of the difference in the pre- and current- average total VOC concentration (i.e., justifying that any difference was not by chance, allowing rejection of the null hypothesis of equal means). Using the average total VOC values the reduction in concentration for each well was then calculated. The results of this evaluation are presented in Table 3.

As presented in Table 3, the average total VOC concentration in soil gas decreased for the fourteen wells. All of the decreases are considered significant at greater than 95% (Student T-test, two-sided). Supporting statistical information on the well by well evaluation of using Student's T-Test is provided in Appendix 7.3. Reduction in concentration varies between 30 and 99%. The wells with the greatest initial soil vapor concentrations, MVE-13 and MVE-17, also have high reductions in concentration. The screen zones for both of these wells were located in fine-grained sediments that contained DNAPL (Jackson et al., 1999). The reduction in concentration is illustrated graphically in Figure 5, Figure 6, and Figure 7. This sequence of illustrations provides box-plots of the historical and current data sets for each well. The minimum boundary of the box indicates the 25th percentile, the line within the box marks the median, and the maximum boundary of the box indicates the 75th percentile. Whiskers above and below the box indicate the 90th and 10th percentiles.

4.2 Mass Flow Rate Using the Active Extraction System

Using the values of concentration and flow rate that are presented in Table 2, the mass flow rate of organic constituents PCE, TCE, and 1,1,1-trichloroethane (TCA) was calculated as the product of the vapor concentration and the volume of flow rate and reported as pounds per day. These values were then summed to estimate the total VOC removal rate for each well using the active extraction system. These results are presented in Table 4. Additional details supporting these calculations are available in Appendix 7.4. Table 4 also identifies the intergroup ranking of the various wells relative to extraction system. As indicated by this analysis wells AF-2 and MVE-10 provide the greatest extraction rate of VOCs from the subsurface. Table 4 also includes a third ranking criteria – RANK BY DESIGN. This criterion is used in subsequent sections as a basis for continued active vapor extraction.

4.3 Evaluate Extraction Flow Data and Prioritize Wells for Active Extraction

In this investigation four different well designs exist, each having unique aspects relative to the wells location in the subsurface and future viability as part of the vadose zone corrective action. The proximity of the wells to each other (horizontal and vertical) considers the potential effects of active vapor extraction on the performance of nearby wells operated with a passive technology. Based upon these aspects subsequent discussions will be based upon the following groupings:

1. Traditional SVE wells (MVE-4, MVE-9, and MVE-10),
2. Shallow direct-push wells (MVE-13 through MVE-19, MVE-21, and MVE-22),
3. Capillary Fringe Extraction Well (MRS-34),

4. Fracture Enhanced Extraction Wells (AF-Series using A-014 Mobile #3 unit).

4.3.1 *Traditional SVE wells (MVE-4, MVE-9, and MVE-10)*

From the perspective of volume flow rate these wells have the highest capacity of the wells located at the A-014 Outfall. In this regard they also have the greatest radius of capture. Within A/M Area the radius of capture of the active SVE systems has been reported to be on the order of 100 to 300 feet for extraction rates of 150 cfm (WSRC, 1997). During testing activities well MVE-9 and MVE-10 had flows in excess of 300 cfm. The flow at well MVE-4 was observed to be on the order of 120 cfm. The lower flow at this well was likely associated with a hole that was identified in the flexible hose that connects this well to the 782-3M unit. Once this repair is completed, flow rates on the order of 300 cfm are expected, which would essentially double the mass removal rate presented in Table 4. Under similar operating conditions MVE-4 and MVE-9 are expected to have similar extraction rates (on the order of 1.2 pounds per day).

Within the design group of Traditional SVE Wells, the mass removal rate from MVE-10 was twice that of other wells with this type of well design, even after adjustment for damage to MVE-4. It is likely that this well had been out of service for an extended period of time (greater than 12-months) prior to testing. The 782-3M unit should be operated at maximum capacity using a minimum amount of make-up air. Operational strategy should be to balance the flow from all of the wells connected to the unit (including those associated A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit) with a limited amount of make-up air. The objective should be to establish an operational condition such that the blower is operating at the best efficiency point as determined by the manufacturer's performance curves. Operations should include semi-annual monitoring at the wellhead using either laboratory or field (i.e., B&K) techniques to allow periodic assessment of well performance by the project team.

Observations from this investigation indicate that when operated under flow rates of 300 cfm this group of wells can produce on the order of 1 pound per day of solvent. This is comparable to performance data from the 782-3M SVEU in 2014, which on average removed 35.5 pounds of VOCs per month. This still exceeds the amount removed by the active groundwater pump and treat well (RWM-06) located at the A-014 Outfall, which on average removed about 25 pounds of VOCs per month. Continued operation of these wells with the 782-3M SVEU still provides significant mass removal, although declining with time. Future decisions regarding long-term operation of these wells should also incorporate operational and maintenance costs of this system as compared to conversion to MicroBlower™ technology.

4.3.2 *Direct-push wells (MVE-13 through MVE-19, MVE -21, and MVE -22)*

Based upon results from photoacoustic analyzer the vapor concentrations in these wells have decreased from April, 1999 observations (Figure 6 and Figure 7). Wells MVE-13 and MVE-17 had DNAPL present in the previous investigation. Soil gas data obtained in this investigation indicates this material has been removed. As shown in Table 2 laboratory based soil gas concentrations from wells MVE-14, MVE-18, and MVE-19 were non-detectable and the highest soil gas concentration observed was for PCE from well MVE-13. From a mass removal perspective all of the wells are at or below 0.1 pound per day (Table 4). The well with the highest extraction rate was MVE-13 with an extraction rate of 0.1 pound per day. Well MVE-13

is located between fracture wells AF-7 and AF-8. The design of these wells is unique in that the screen zones are located in fine-grained sediments generally not amenable to SVE. The current version of the MicroBlower™ generates a maximum vacuum of 10 inches of water. It is unlikely that this configuration is capable of any appreciable vapor extraction from these wells. Based upon these observations and later operational recommendations associated with the AF series of wells, this group of wells (i.e., MVE-13 through MVE-19, MVE-21, and MVE-22) should be abandoned.

4.3.3 *Capillary Fringe Extraction Well (MRS-34)*

As presented in Table 4, well MRS-34 had a total extraction capacity just under 1 pound per day of total VOCs at a flow rate of 57 cfm (Table 2). The well is positioned in the lower portion of the vadose zone, likely in the capillary fringe. The large screen zone, likely modest permeability, and low extraction rates under active SVE makes this well a candidate for transition to passive remediation using a MicroBlower™. A consideration for transition to MicroBlower™ operation includes the possible drawdown in pressure from operation of nearby MVE-9 and/or MVE-10. Transition and operation of well MRS-34 to passive remediation is discussed in more detail in Section 4.4.

4.3.4 *Fracture Enhanced Extraction Wells (AF-Series)*

The five fracture enhanced wells had extraction rates ranging between 0.2 and 2.3 pounds per day. As a group the flow rate was fairly consistent ranging between 16 and 28 cfm (Table 2). As shown in Table 4, the wells with the highest production rate in this design group were AF-2 and AF-4, both providing greater than 1.0 pound per day of mass extraction. Wells AF-5 and AF-7 both provide an extraction rate just below 1.0 pound per day. Previous investigation also demonstrated that the wells have a much larger zone of influence over other shallow, direct-push wells (Riha at al., 2008). As with the 782-3M unit, the A-014 Mobile #3 should be operated at maximum capacity using a minimum amount of make-up air. Operations should include semi-annual monitoring at the wellhead using either laboratory or field (i.e., B&K) techniques to allow periodic assessment of well performance by the project team.

Within this class, fracture well AF-8 had the lowest performance data in terms of flow rate and concentration (Table 2 and Table 4). These observations would make the well a candidate for abandonment. An alternative over abandonment would be to disconnect the well from the A-014 Mobile #3 unit and allow the well to act as a vent well. In this manner alternate routes of air flow will be introduced, specifically for AF-5 and AF-7, and may further improve the operation of these wells. If well AF-8 is converted to a vent well, the well head should be modified to provide a short (5-ft) air inlet screen with an isolation valve. Monitoring of VOC concentration along with carbon dioxide using field instruments (i.e., B&K) provides an adequate method for identifying short circuiting from the surface.

The AF series of wells are unique in design and require high vacuum vapor extraction units to produce flow. While the 24-volt version of the MicroBlower™ is capable of a maximum flow rate of 18 cfm, the device is only capable of generating a maximum vacuum of 10 inches of water. During testing, the A-014 Mobile #3 unit was providing on the order of 21 inches of mercury vacuum, approximately 28 times the amount of vacuum available from the 24-Volt

MicroBlower™. It is unlikely that the current configuration of the MicroBlower™ is capable of any appreciable vapor extraction from wells of this configuration. Therefore active SVE is still applicable.

4.4 Estimate of Well Performance using MicroBlower™ Technology

In Section 4.3.3, vapor extraction well MRS-34 was identified as a potential candidate for use as a passive vapor extraction well. In comparison to other MicroBlower™ deployments (Noonkester et al., 2012a), the well has a similar diameter (2-inch) and has an effective screen length (length of the filter pack) of 29-feet. These parameters couple to create large well bore volume that would facilitate the use of the highest capacity system available.

The 24-volt version of the MicroBlower™ is designed to operate 24 hours a day and is capable of generating a maximum vacuum of 10 inches of water and a maximum flow rate of 18 cfm (Noonkester et al., 2012a). The actual performance will vary depending upon the pressure and flow characteristics of each well; a reasonable performance of 10 cfm should be expected from this well. Table 5 presents estimated extraction rates for MRS-34 using 24-volt MicroBlowers™ operating at 10 cfm. While wells MVE-4, MVE-9, and MVE-10 are not currently recommended for transition to passive, scoping calculations projecting mass removal rates under passive remediation are also presented in Table 5.

An important aspect for application of passive vapor extraction is the role that any ongoing active extraction will have on the performance of the MicroBlower™. A MicroBlower™ that is installed within the zone of influence of an active extraction system will likely be ineffective. This would be due to the drawdown associated with active extraction at a nearby extraction well. Within A/M Area the radius of capture of active systems is reported to be on the order of 100 to 300 feet for extraction rates of 150 cfm (WSRC, 1997). These observations were reported for vapor extraction wells associated with the former 782-5M SVEU that was located just north of the MASB along the abandoned process sewer line. In contrast, it was recently reported that 24-volt MicroBlowers™ have a radius of influence of 41 feet when operating at 10.3 cfm (Noonkester et al., 2012a). The later investigation was performed between the 782-5M SVEU and the M-Area Settling Basin. The increased pressure differential associated with the active system may result in damage to the MicroBlower™. The implementation of the passive system at each wellhead should consider engineering or operational controls to isolate the system as necessary. An example of an operational control would be a manual isolation valve that would be closed when the vacuum pressure in the subsurface exceeded the pressure capacity of the MicroBlower™. This concept could be automated using a pressure switch and relay to control the power to the MicroBlower™. Once MRS-34 is equipped with a MicroBlower™, the operation of the device should be verified while the 782-3M system is operating.

4.5 Wells that are Recommended to be Removed from Service and Abandoned

There are a total of nine (9) vapor extraction wells that are recommended for abandonment. All nine (9) of these wells were installed in 1999 in response to DNAPL identified in the shallow subsurface. These wells are presented in Table 6 along with rationale for identifying the wells for abandonment.

5.0 Recommendations and Conclusions

The use and adaptation of soil vapor extraction at the A-014 Outfall has resulted in a significant amount of mass removal from the subsurface. Although permit conditions allowing for the shutdown of the SVEUs have been reached (less than 40 pounds per week of VOCs are currently being removed from both systems), individual extraction well testing indicates significant residual mass remains in the subsurface that warrants continued active vapor extraction. Continued extraction will take advantage of existing infrastructure and equipment that currently exist at the site, which is still removing more mass than the local groundwater recovery well.

Future active SVE operations should continue to employ the A-014 Mobile #3 and 782-3M SVEU. For both systems the units should be operated at maximum capacity using a minimum amount of make-up air. The operational strategy should be to balance the flow from all of the wells connected to the unit (for the 782-3M SVEU this includes wells associated A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit) with a limited amount of make-up air. Operations should include semi-annual monitoring at the wellhead using either laboratory or field (i.e., B&K) techniques to allow periodic assessment of well performance by the project team.

Specific to the A-014 Mobile #3 SVEU, well AF-8 should be converted to a vent well equipped with an isolation valve. This modification may create new/alternate flow paths in the subsurface further increasing mass removal rates associated with AF-5 and AF-7. Well MRS-34 should be transitioned to low energy remediation (MicroBlower™) under the conditions that excessive vacuum drawdown from the operation of MVE-9 or MVE-10 do not inhibit operation. The high capacity (24-Volt or greater) MicroBlower™ system should be used in the deployment.

The nine (9) shallow direct push wells installed in 1999 should be removed from service and abandoned. The wells are not amenable to passive applications due to the location of screen zones in fine-grained materials.

The current shutdown strategy for active soil-vapor extraction only considers mass removal rates as compared to circa 1996 removal rates for groundwater pump and treat. Final assessment of the 782-3M system will be based upon the results of future rebound testing. The decision to shut down or transition active SVEU systems to low energy systems should consider mass removal efficiency (e.g., aspects of operations and maintenance costs) and the value of groundwater protection.

6.0 References

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Table 1: Vapor Extraction Wells located at the A-014 Outfall with Salient Construction Details

WELL ID	SVE UNIT	Total Depth (ft)	Top Screen (ft)	Bottom Screen (ft)	Screen Length (ft)	Comment
MVE-4	SVEU 782-3M	117.5	-53.6	-115	61.4	4" Casing in 8.5-inch auger hole, wire wrapped screen
MVE-9	SVEU 782-3M	108	-35.4	-102	66.6	4" Casing in 8.5-inch auger hole, wire wrapped screen
MVE-10	SVEU 782-3M	113.0	-43.1	-108.8	65.7	4" Casing in 8.5-inch auger hole, wire wrapped screen
MVE-13	SVEU 782-3M	42.5	-17	-27	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-14	SVEU 782-3M	62.5	-17	-27	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-15	SVEU 782-3M	60	-15	-25	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-16	SVEU 782-3M	64	-16	-26	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-17	SVEU 782-3M	64	-16	-26	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-18	SVEU 782-3M	63	-16	-26	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-19	SVEU 782-3M	52	-14	-24	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-21	SVEU 782-3M	67	-14	-24	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-22	SVEU 782-3M	67	-14	-24	10	2" Sch 5 304 SS with Mini-Louver Screen
MVE-34	SVEU 782-3M	120	-95	-115	20	FX50 filter pack 91 and 120 feet.
AF-2	Mobile #3 SVEU	26	-26	Fracture, contains 2,800# sand		
AF-4	Mobile #3 SVEU	23	-23	Fracture, contains 2,000# sand		
AF-5	Mobile #3 SVEU	18	-18	Fracture, contains 1,800# sand		
AF-7	Mobile #3 SVEU	17	-17	Fracture, contains 2,000# sand		
AF-8	Mobile #3 SVEU	23	-23	Fracture, contains 2,800# sand		

Sch = Schedule; SS = Stainless Steel

Table 2: Average of Vapor Conditions from Extraction Wells at the A-014 Outfall

WELL ID	Q (cfm)	T (°F)	PCE (mg/m3)	TCE (mg/m3)	111-TCA (mg/m3)
AF-2	22.0	58.3	1.12E+03	2.71E+01	2.16E+00
AF-4	16.1	56.3	6.38E+02	1.28E+01	U
AF-5	27.6	55.2	3.72E+02	7.12E-01	U
AF-7	28.6	52.9	3.11E+02	6.96E-01	U
AF-8	17.2	61.6	1.38E+02	6.33E-01	U
MRS-34	56.9	49.3	1.73E+02	9.47E+00	U
MVE-4	121.4	46.6	5.33E+01	3.57E+00	U
MVE-9	490.8	53.3	2.48E+01	1.18E+00	U
MVE-10	373.0	59.3	7.29E+01	3.33E+00	U
MVE-13	9.1	51.3	1.29E+02	5.64E-01	U
MVE-14	8.3	49.4	U	U	U
MVE-15	6.2	66.5	2.77E-01	U	U
MVE-16	6.2	48.1	2.22E+00	U	U
MVE-17	6.9	70.0	9.05E+00	U	U
MVE-18	12.3	44.4	U	U	U
MVE-19	7.3	49.3	U	U	U
MVE-21	34.0	52.3	6.90E-01	U	U
MVE-22	20.5	52.7	4.13E+01	U	U

Notes: Analytical Results are from GC/MS Laboratory Analysis
U indicates compound was non-detected

Table 3: Comparison of Soil Gas Concentrations with Previously Reported Results

WELL ID	Prior Data PCE+TCE (ppmv)	This Study PCE+TCE (ppmv)	Probability (2-Tailed)	Percent Reduction
AF-2	1.17E+03	1.80E+02	2.75E-10	84.63%
AF-4	8.06E+02	1.01E+02	3.15E-06	87.47%
AF-5	4.84E+02	5.41E+01	3.60E-04	88.82%
AF-7	8.14E+02	4.95E+01	1.35E-03	93.92%
AF-8	1.89E+02	2.34E+01	4.52E-06	87.65%
MVE-13	4.05E+03	2.13E+01	9.41E-03	99.47%
MVE-14	1.97E+00	9.78E-01	1.46E-06	50.31%
MVE-15	2.44E+00	1.50E+00	2.96E-02	38.37%
MVE-16	3.59E+01	1.35E+00	3.54E-03	96.24%
MVE-17	5.58E+03	2.58E+00	6.94E-05	99.95%
MVE-18	1.29E+00	8.99E-01	3.88E-02	30.35%
MVE-19	7.29E+02	1.15E+00	7.98E-03	99.84%
MVE-21	1.07E+02	1.44E+00	9.49E-03	98.65%
MVE-22	1.72E+02	6.72E+00	2.12E-02	96.10%

Note: Total VOC Comparisons are based upon observations made with field photoacoustic analyzer.

Table 4: Extraction Rate of Individual Vapor Extraction Wells at the A-014 Outfall

WELL ID	PCE (lbs/day)	TCE (lbs/day)	111-TCA (lbs/day)	∑ VOC (lbs/day)	RANK BY DESIGN	RANK BY UNIT	OVERALL RANK
SVEU Unit A-014 Mobile #3							
Fracture Enhanced Extraction Wells							
AF-2	2.21E+00	5.33E-02	4.54E-03	2.27E+00	1	1	2
AF-4	1.02E+00	2.17E-02	0.00E+00	1.04E+00	2	2	4
AF-5	8.85E-01	1.68E-03	0.00E+00	8.86E-01	3	3	6
AF-7	8.05E-01	1.80E-03	0.00E+00	8.07E-01	4	4	7
AF-8	2.12E-01	9.84E-04	0.00E+00	2.13E-01	5	5	9
SVEU 782-3M							
Capillary Fringe Extraction Well							
MRS-34	8.87E-01	4.85E-02	0.00E+00	9.36E-01	1	3	5
Traditional SVE wells							
MVE-4 [1]	5.82E-01	3.89E-02	0.00E+00	6.21E-01	3	4	8
MVE-9	1.10E+00	5.23E-02	0.00E+00	1.15E+00	2	2	3
MVE-10	2.44E+00	1.11E-01	0.00E+00	2.56E+00	1	1	1
Shallow direct-push wells							
MVE-13	1.03E-01	7.15E-05	0.00E+00	1.03E-01	1	5	10
MVE-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7	11	16
MVE-15	8.29E-05	0.00E+00	0.00E+00	8.29E-05	6	10	15
MVE-16	1.23E-03	0.00E+00	0.00E+00	1.23E-03	5	9	14
MVE-17	5.62E-03	0.00E+00	0.00E+00	5.62E-03	3	7	12
MVE-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7	11	16
MVE-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7	11	16
MVE-21	2.11E-03	0.00E+00	0.00E+00	2.11E-03	4	8	13
MVE-22	7.81E-02	0.00E+00	0.00E+00	7.81E-02	2	6	11

Notes:
(1) Extraction flow from MVE-4 was limited due to damaged flexible hose.

Table 5: Estimated Performance of MVE-4, MVE-9, MVE-10, and MRS-34 Vapor Extraction Wells Using MicroBlower™ Technology[1]

Well Name	PCE (lbs/day)	TCE (lbs/day)	111-TCA (lbs/day)	Total VOC (lbs/day)
MVE-4 [2]	4.79E-02	3.21E-03	0.00E+00	5.11E-02
MVE-9 [2]	2.23E-02	1.06E-03	0.00E+00	2.34E-02
MVE-10 [2]	6.56E-02	2.99E-03	0.00E+00	6.85E-02
MRS-34	1.55E-01	8.52E-03	0.00E+00	1.64E-01

Notes:

(1) Performance based upon Best Estimate of Conditions presented in Table 4 and 24-Volt MicroBlower™ System at 10 cfm.

(2) Performance of this well provided for Information Only. Current recommendation is to continue operation as an active component of 782-3M system.

Table 6: Vapor Extraction Wells that are Recemmended for Abandonment (n=9)

Well ID	Basis for Abandonment
MVE-13	Low Extraction rate, Significant decrease in concentration, covered by wells AF-7 and AF-8.
MVE-14	Low Extraction rate, Significant decrease in concentration.
MVE-15	Low Extraction rate, Significant decrease in concentration.
MVE-16	Low Extraction rate, Significant decrease in concentration.
MVE-17	Low Extraction rate, Significant decrease in concentration.
MVE-18	Low Extraction rate, Significant decrease in concentration.
MVE-19	Low Extraction rate, Significant decrease in concentration.
MVE-21	Low Extraction rate, Significant decrease in concentration.
MVE-22	Low Extraction rate, Significant decrease in concentration.

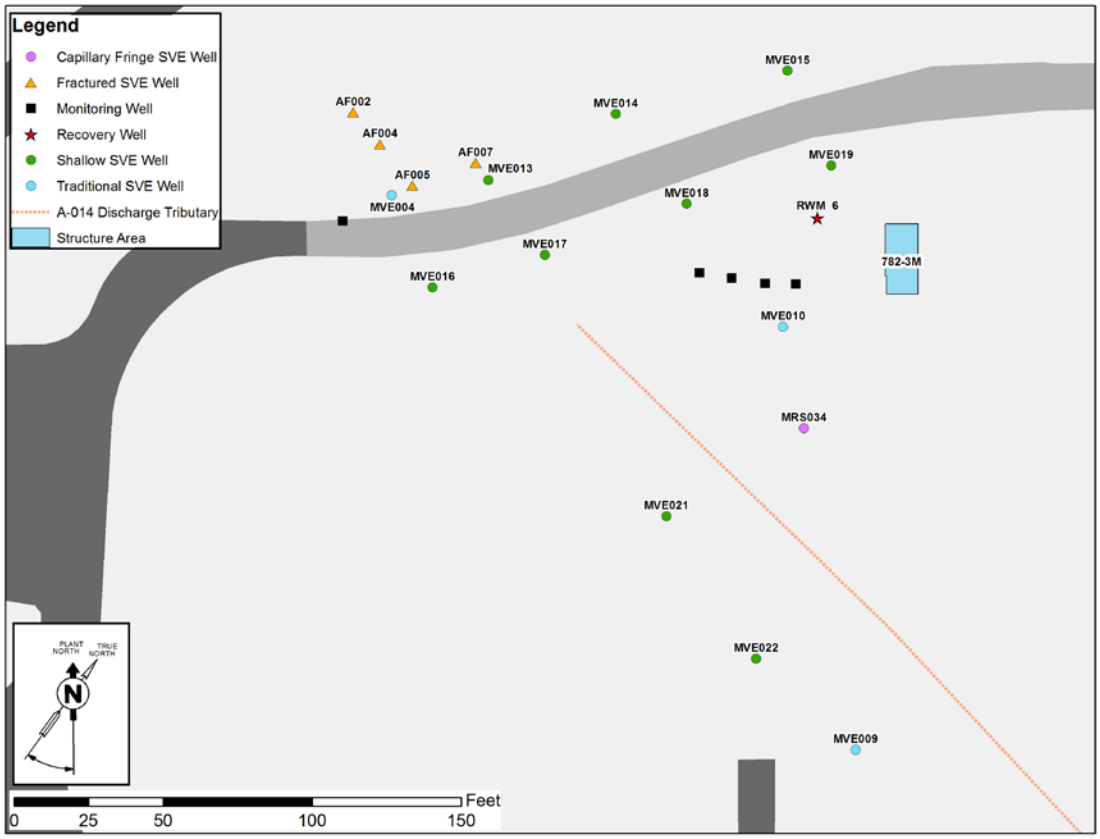

Figure 1: Soil Vapor Extraction Wells at the A-014 Outfall

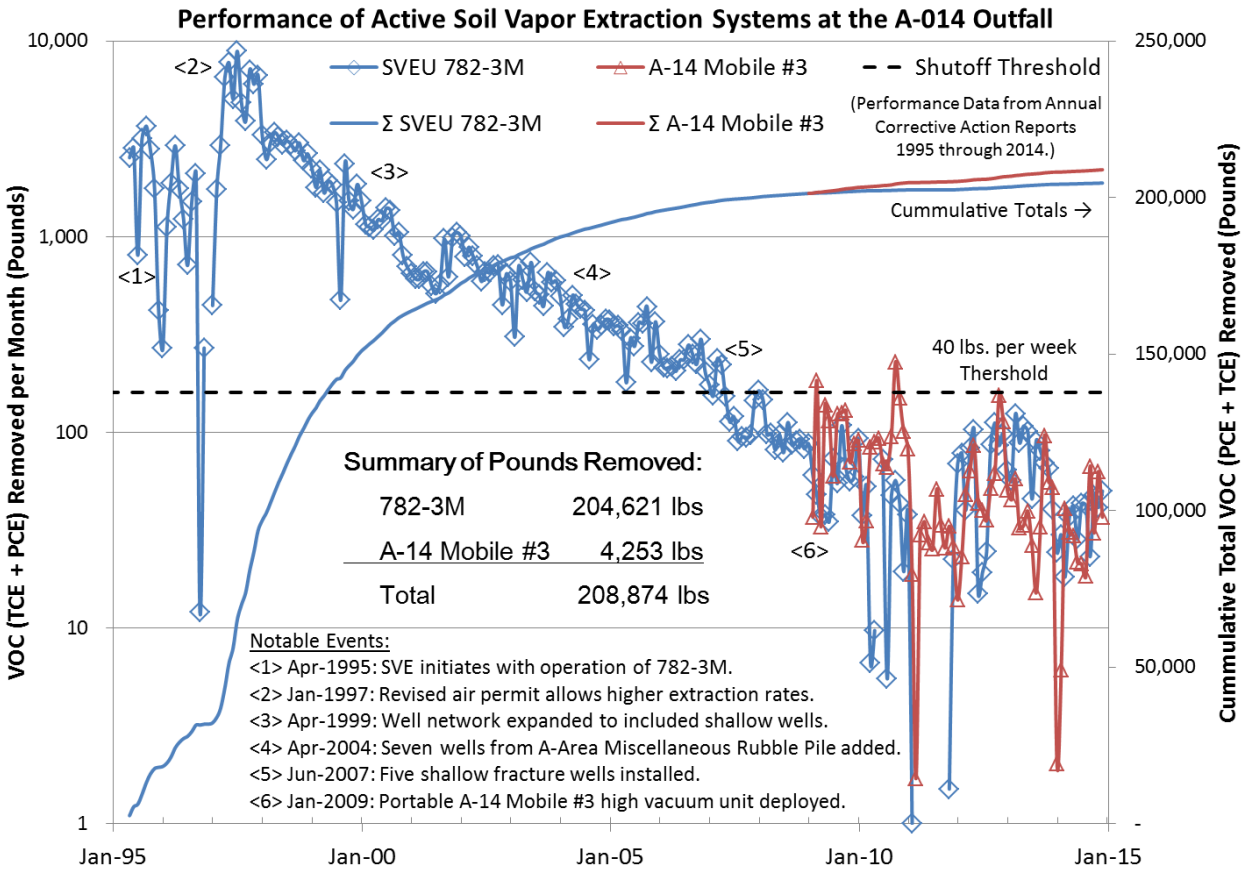

Figure 2: Historical Performance of Soil Vapor Extraction Systems at the A-014 Outfall

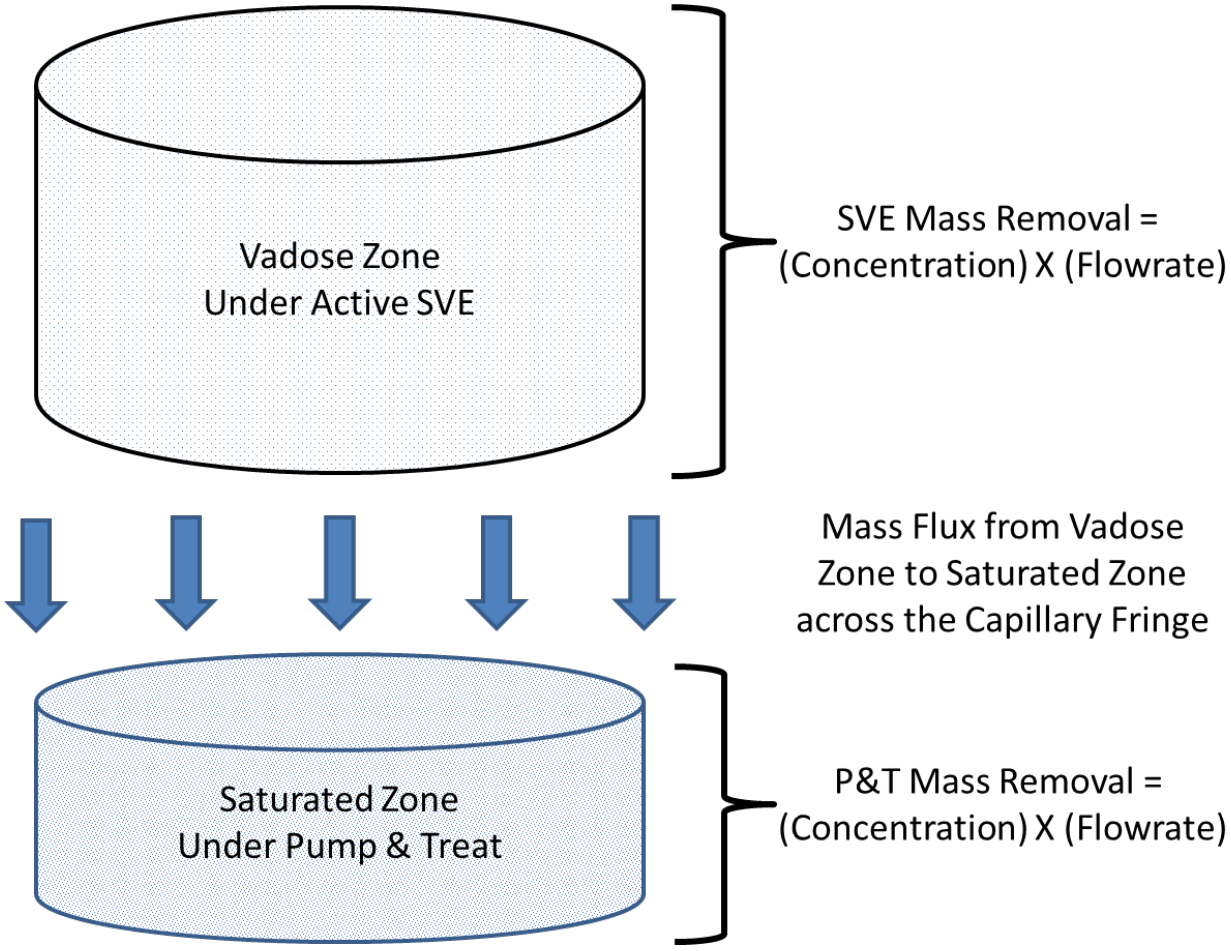

Figure 3: Conceptual Relationship between Mass Flux between Soil Vapor Extraction and Groundwater Pump and Treat.

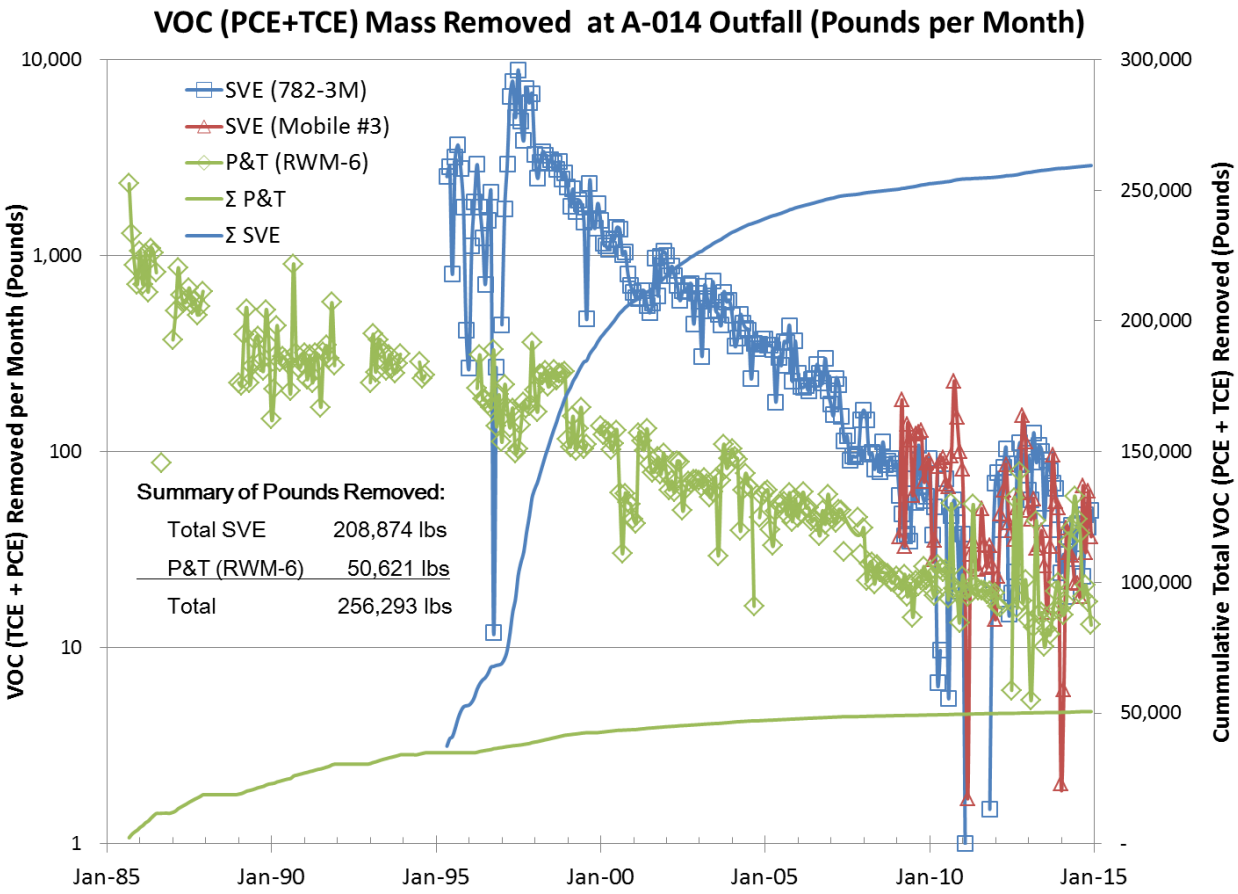

Figure 4: Historical Performance of SVE and Pump and Treat Systems at the A-014 Outfall

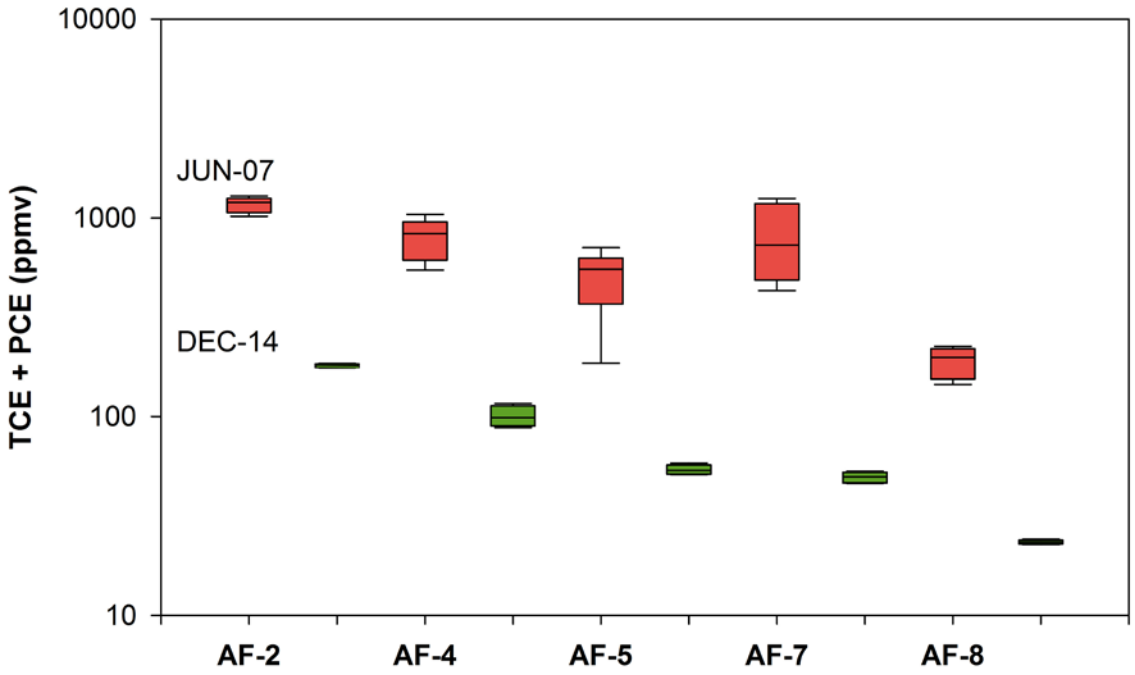

Figure 5: Box and Whiskers Plot Illustrating the Reduction in Total VOC Concentration for the AF Series of Extraction Wells

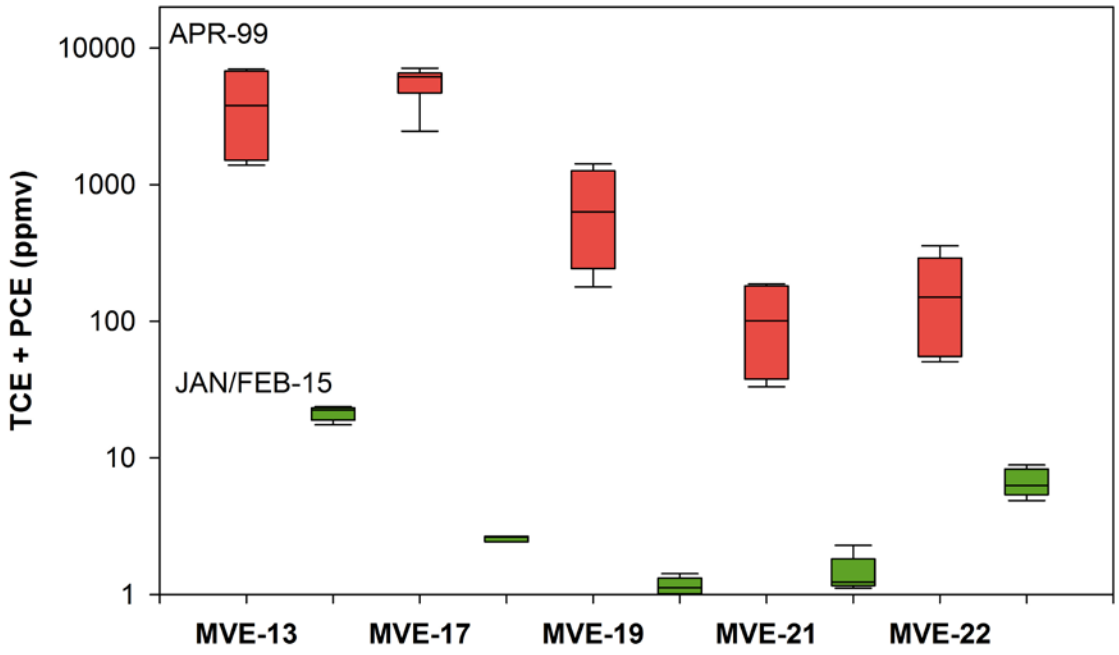

Figure 6: Box and Whiskers Plot Illustrating the Reduction in Total VOC Concentration for the High Concentration MVE Series of Extraction Wells

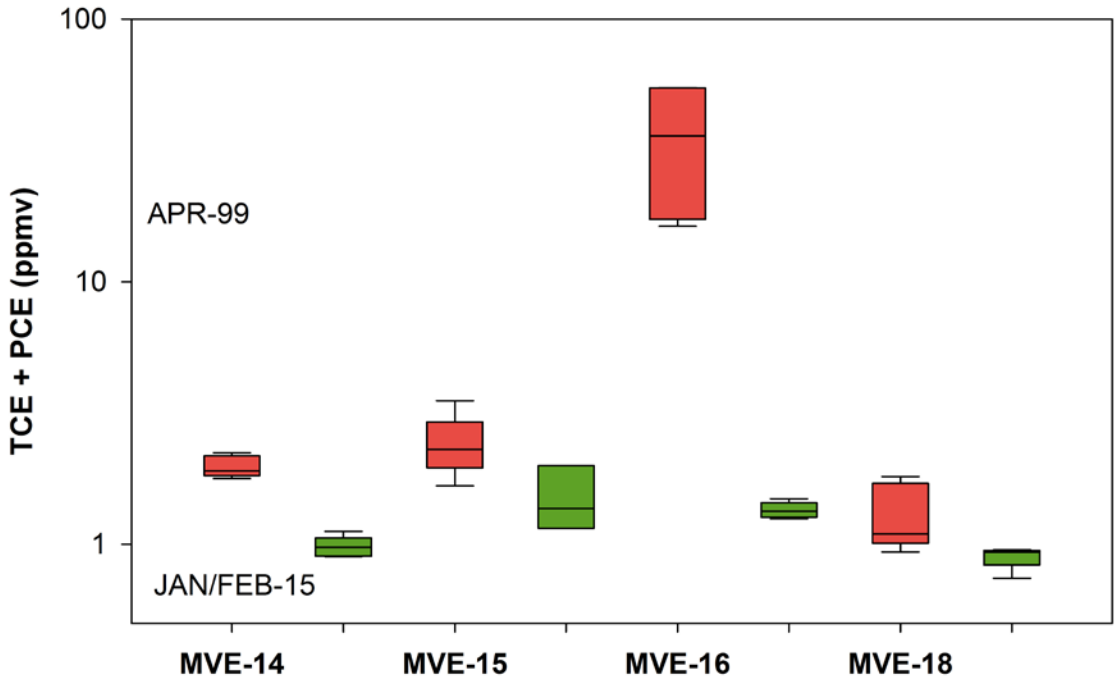

Figure 7: Box and Whiskers Plot Illustrating the Reduction in Total VOC Concentration for the Low Concentration MVE Series of Extraction Wells

7.0 Appendices

Appendix 7.1 Recorded Field Observations

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table

Appendix 7.3 Well by Well Evaluation of Concentration Differences using Student's T-Test

Appendix 7.4 Mass Extraction Calculations

Appendix 7.1 Recorded Field Observations

DATE/TIME	WELL ID	Q (cfm)	V (fpm)	T (°F)	Ambient CO2	A:PCE (ppmv)	B:TCE (ppmv)	D:CH4 (ppmv)	E:CO2 (ppmv)	W:H2O (°C)	SAMPLE ID
12/19/14 10:00	AF-2	21	237	55.3	543	1.74E+02	5.58E+00	4.20E+00	7.48E+03	1.13E+01	A014-00000220
12/19/14 13:00	AF-2	22	259	69.2	526	1.79E+02	6.07E+00	8.65E+00	7.46E+03	1.72E+01	A014-00000221
12/19/14 16:00	AF-2	20	226	66.1	521	1.77E+02	5.79E+00	6.40E+00	7.59E+03	1.80E+01	A014-00000222
12/22/14 7:30	AF-2	24.3	246	49.2	552	1.71E+02	4.85E+00	4.35E+00	7.71E+03	8.10E+00	A014-00000223
12/22/14 10:00	AF-2	22.6	262	51.8	597	1.73E+02	4.97E+00	7.26E+00	7.49E+03	1.04E+01	A014-00000224
12/17/14 10:00	AF-4	9	142	56	531	8.62E+01	1.89E+00	4.38E+00	5.64E+03	1.17E+01	A014-00000215
12/17/14 13:00	AF-4	11	133	67.8	513	8.93E+01	2.15E+00	4.97E+00	5.62E+03	1.68E+01	A014-00000216
12/17/14 16:00	AF-4	8.63	98	64.7	815	9.62E+01	2.54E+00	5.05E+00	5.66E+03	1.95E+01	A014-00000217
12/18/14 7:30	AF-4	26.06	304	36	583	1.07E+02	3.13E+00	3.62E+00	5.73E+03	3.06E+00	A014-00000218
12/18/14 10:00	AF-4	25.79	311	56.9	563	1.13E+02	3.52E+00	6.39E+00	5.76E+03	8.96E+00	A014-00000219
12/11/14 9:45	AF-5	86	92	55.4	N/A	5.14E+01	2.96E-01	2.54E+00	7.11E+03	1.22E+01	A014-00000205
12/11/14 13:00	AF-5	7.2	75	65.3	583	5.31E+01	5.11E-01	4.64E+00	6.99E+03	1.34E+01	A014-00000206
12/11/14 16:00	AF-5	11.6	151	61.7	533	5.53E+01	4.87E-01	4.00E+00	7.46E+03	1.54E+01	A014-00000207
12/12/14 7:15	AF-5	28	338	37.3	566	5.03E+01	7.89E-01	3.54E+00	7.27E+03	1.01E+01	A014-00000208
12/12/14 10:00	AF-5	5.04	53	56.5	603	5.78E+01	6.06E-01	2.98E+00	7.37E+03	1.21E+01	A014-00000209
12/9/14 10:00	AF-7	20.9	N/A	52	N/A	5.14E+01	3.44E-01	3.51E+00	6.49E+03	9.17E+00	A014-00000200
12/9/14 13:00	AF-7	34	N/A	60	N/A	4.93E+01	4.83E-01	3.88E+00	6.34E+03	1.83E+01	A014-00000201
12/9/14 16:00	AF-7	30	368	63	N/A	5.27E+01	4.69E-01	3.20E+00	6.65E+03	1.21E+01	A014-00000202
12/10/14 7:30	AF-7	35	412	34.7	N/A	4.64E+01	2.81E-01	2.52E+00	6.36E+03	5.22E+00	A014-00000203
12/10/14 9:45	AF-7	23	260	54.6	N/A	4.58E+01	3.09E-01	2.67E+00	6.27E+03	8.29E+00	A014-00000204

Appendix 7.1 Recorded Field Observations (Continued)

DATE/TIME	WELL ID	Q (cfm)	V (fpm)	T (°F)	Ambient CO2	A:PCE (ppmv)	B:TCE (ppmv)	D:CH4 (ppmv)	E:CO2 (ppmv)	W:H2O (°C)	SAMPLE ID
12/15/14 10:00	AF-8	25	283	55.5	591	2.21E+01	5.99E-01	3.36E+00	7.22E+03	1.23E+01	A014-00000210
12/15/14 13:00	AF-8	14.31	167	70.8	521	2.21E+01	8.72E-01	6.05E+00	7.10E+03	2.05E+01	A014-00000211
12/15/14 16:00	AF-8	14	161	69.2	557	2.25E+01	1.15E+00	7.45E+00	7.09E+03	2.19E+01	A014-00000212
12/16/14 7:30	AF-8	17	202	48.1	582	2.28E+01	5.86E-01	4.25E+00	7.21E+03	1.00E+01	A014-00000213
12/16/14 10:00	AF-8	15.7	184	64.4	N/A	2.31E+01	1.07E+00	8.10E+00	7.04E+03	1.31E+01	A014-00000214
2/19/15 10:00	MRS-34	55.41	2602	27.3	452	4.03E+01	2.72E+00	3.35E+00	1.08E+04	1.79E+00	A014-00000275
2/19/15 13:00	MRS-34	57.16	2657	46.7	568	3.88E+01	2.65E+00	3.11E+00	1.12E+04	1.97E+00	A014-00000276
2/19/15 16:00	MRS-34	58.4	2628	48.9	479	3.62E+01	2.50E+00	3.02E+00	1.12E+04	1.97E+00	A014-00000277
2/23/15 7:30	MRS-34	56.76	2565	60.4	546	1.75E+01	1.78E+00	4.36E+00	1.27E+04	1.29E+01	A014-00000278
2/23/15 10:00	MRS-34	56.95	2598	63.1	538	1.79E+01	1.90E+00	5.58E+00	1.31E+04	1.58E+01	A014-00000279
1/8/15 10:00	MVE-4	120.21	1414	40.2	565	1.15E+01	1.60E+00	3.02E+00	1.30E+04	-1.10E+00	A014-00000235
2/17/15 10:00	MVE-4	120.26	1373	47.7	522	9.68E+00	1.29E+00	2.63E+00	1.26E+04	7.01E+00	A014-00000270
2/17/15 13:00	MVE-4	126.02	1434	52.2	527	9.51E+00	1.41E+00	5.46E+00	1.18E+04	9.85E+00	A014-00000271
2/17/15 16:00	MVE-4	120.7	1371	57.1	562	8.96E+00	1.14E+00	4.04E+00	1.20E+04	7.21E+00	A014-00000272
2/18/15 7:30	MVE-4	119.01	1356	35.4	523	9.40E+00	1.12E+00	3.06E+00	1.21E+04	3.37E+00	A014-00000273
2/18/15 10:00	MVE-4	122	1390	47.2	499	8.48E+00	1.01E+00	2.78E+00	1.17E+04	4.20E+00	A014-00000274
1/15/15 10:00	MVE-9	520.65	5973	50.7	537	3.54E+00	6.84E-01	3.49E+00	1.09E+04	1.03E+01	A014-00000246
1/15/15 13:00	MVE-9	520	5965	52.8	527	4.02E+00	8.26E-01	4.13E+00	1.17E+04	1.12E+01	A014-00000247
2/11/15 10:00	MVE-9	477	5600	49	517	4.38E+00	7.83E-01	2.49E+00	1.25E+04	1.15E+01	A014-00000256
2/11/15 13:00	MVE-9	438.51	5085	58.7	526	4.59E+00	8.44E-01	4.48E+00	1.23E+04	1.44E+01	A014-00000257
2/11/15 16:00	MVE-9	500.32	5749	62.9	528	4.76E+00	8.98E-01	4.13E+00	1.23E+04	1.59E+01	A014-00000258
2/12/15 7:30	MVE-9	502.62	5704	43.9	750	5.55E+00	8.51E-01	N/A	1.55E+04	5.32E+00	A014-00000259
2/12/15 10:00	MVE-9	476.82	5593	54.9	514	4.50E+00	7.81E-01	2.36E+00	1.26E+04	1.50E+01	A014-00000260

Appendix 7.1 Recorded Field Observations (Continued)

DATE/TIME	WELL ID	Q (cfm)	V (fpm)	T (°F)	Ambient CO2	A:PCE (ppmv)	B:TCE (ppmv)	D:CH4 (ppmv)	E:CO2 (ppmv)	W:H2O (°C)	SAMPLE ID
1/27/15 10:00	MVE-10	365.63	4201	56.9	512	8.23E+00	1.67E+00	2.19E+00	1.92E+04	5.65E+00	A014-00000254
1/27/15 13:00	MVE-10	368.52	4292	60	544	7.55E+00	1.86E+00	4.26E+00	1.84E+04	9.32E+00	A014-00000255
2/9/15 10:00	MVE-10	357	4157	60.2	506	1.39E+01	1.01E+00	4.07E+00	1.48E+04	1.68E+01	A014-00000265
2/9/15 13:00	MVE-10	375.14	4161	63.5	599	1.46E+01	1.65E+00	8.79E+00	1.47E+04	1.93E+01	A014-00000266
2/9/15 16:00	MVE-10	382	4175	61.5	583	1.42E+01	1.07E+00	4.83E+00	1.46E+04	1.58E+01	A014-00000267
2/10/15 7:30	MVE-10	346.41	4222	56.9	741	1.43E+01	1.07E+00	5.15E+00	1.43E+04	1.16E+01	A014-00000268
2/10/15 10:00	MVE-10	416	4290	56.4	537	1.40E+01	1.09E+00	5.34E+00	1.41E+04	1.23E+01	A014-00000269
1/6/15 10:00	MVE-13	4.6	194	56.2	N/A	2.32E+01	5.37E-01	4.95E+00	1.52E+03	8.89E+00	A014-00000225
1/6/15 13:00	MVE-13	2.2	104	61	N/A	2.15E+01	8.91E-01	7.34E+00	1.49E+03	1.52E+01	A014-00000227
1/6/15 16:00	MVE-13	13.32	622	61.8	533	2.21E+01	6.26E-01	5.40E+00	1.46E+03	1.07E+01	A014-00000229
1/7/15 7:30	MVE-13	22.85	1052	33.2	567	1.99E+01	4.80E-01	4.65E+00	1.38E+03	1.96E+00	A014-00000231
1/7/15 10:00	MVE-13	2.52	128	44.2	517	1.71E+01	3.89E-01	4.83E+00	1.29E+03	6.58E+00	A014-00000233
2/25/15 13:00	MVE-14	13.59	626	55.9	542	4.92E-01	4.82E-01	4.41E+00	1.63E+03	1.05E+01	A014-00000290
2/25/15 16:00	MVE-14	10.3	473	50.7	648	5.02E-01	6.17E-01	6.38E+00	2.04E+03	6.75E+00	A014-00000291
2/26/15 8:00	MVE-14	7.58	348	41.1	555	3.77E-01	5.22E-01	5.10E+00	1.61E+03	5.32E+00	A014-00000292
2/26/15 10:00	MVE-14	6.89	313	47.1	572	3.38E-01	5.64E-01	6.08E+00	1.54E+03	8.38E+00	A014-00000293
2/26/15 13:00	MVE-14	2.91	129	52.4	598	4.15E-01	5.81E-01	5.46E+00	1.29E+03	1.02E+01	A014-00000294
1/21/15 14:30	MVE-15	9.99	632	70.6	516	8.75E-01	1.12E+00	6.92E+00	4.04E+03	2.09E+01	A014-00000248
1/21/15 16:00	MVE-15	5.48	251	72.4	494	5.14E-01	6.35E-01	4.57E+00	4.09E+03	1.77E+01	A014-00000250
1/22/15 10:00	MVE-15	3.2	144	56.5	529	5.39E-01	8.31E-01	5.93E+00	3.73E+03	1.15E+01	A014-00000252

Appendix 7.1 Recorded Field Observations (Continued)

DATE/TIME	WELL ID	Q (cfm)	V (fpm)	T (°F)	Ambient CO2	A:PCE (ppmv)	B:TCE (ppmv)	D:CH4 (ppmv)	E:CO2 (ppmv)	W:H2O (°C)	SAMPLE ID
2/24/15 10:00	MVE-16	4.73	217	52.4	590	9.00E-01	4.90E-01	3.27E+00	8.43E+03	8.64E+00	A014-00000280
2/24/15 13:00	MVE-16	8.13	355	55.7	576	8.87E-01	6.03E-01	3.46E+00	8.10E+03	5.98E+00	A014-00000282
2/24/15 16:00	MVE-16	4.5	204	51.6	556	7.76E-01	5.11E-01	3.36E+00	8.38E+03	4.49E+00	A014-00000284
2/25/15 7:30	MVE-16	6.1	279	34.4	552	7.28E-01	6.08E-01	3.14E+00	8.18E+03	2.65E+00	A014-00000286
2/25/15 10:00	MVE-16	7.69	325	46.4	562	7.16E-01	5.33E-01	3.32E+00	8.01E+03	5.42E+00	A014-00000288
1/21/15 14:30	MVE-17	17	675	73.1	500	2.07E+00	5.97E-01	4.77E+00	9.41E+02	1.18E+01	A014-00000249
1/21/15 16:00	MVE-17	1.15	66	72.5	504	2.15E+00	4.79E-01	4.35E+00	9.84E+02	7.35E+00	A014-00000251
1/22/15 10:00	MVE-17	2.59	123	64.5	518	1.83E+00	6.00E-01	6.14E+00	8.88E+02	1.03E+01	A014-00000253
2/24/15 10:00	MVE-18	6.3	302	45.4	546	2.17E-01	5.25E-01	4.74E+00	6.26E+02	5.48E+00	A014-00000281
2/24/15 13:00	MVE-18	7.5	355	45.5	549	3.44E-01	6.09E-01	5.06E+00	6.76E+02	5.84E+00	A014-00000283
2/24/15 16:00	MVE-18	28.58	1353	44.6	530	3.61E-01	5.72E-01	4.81E+00	6.78E+02	4.51E+00	A014-00000285
2/25/15 7:30	MVE-18	7.62	325	37.7	563	4.24E-01	5.02E-01	4.85E+00	6.74E+02	3.54E+00	A014-00000287
2/25/15 10:00	MVE-18	11.25	536	49	584	3.31E-01	6.10E-01	4.82E+00	6.85E+02	7.87E+00	A014-00000289
1/13/15 10:00	MVE-19	21.64	985	59.2	525	4.19E-01	5.57E-01	4.69E+00	2.73E+03	1.34E+01	A014-00000236
1/13/15 13:00	MVE-19	3.4	159	54.5	550	5.15E-01	6.96E-01	6.34E+00	2.81E+03	1.08E+01	A014-00000238
1/13/15 16:00	MVE-19	7.5	339	48.5	578	5.16E-01	6.06E-01	5.22E+00	2.79E+03	7.76E+00	A014-00000240
1/14/15 7:30	MVE-19	2.52	111	38.8	623	4.41E-01	5.69E-01	4.76E+00	2.40E+03	1.22E+01	A014-00000242
1/14/15 10:00	MVE-19	1.45	66	45.7	590	6.37E-01	7.87E-01	6.24E+00	2.48E+03	1.40E+01	A014-00000244
1/6/15 10:00	MVE-21	31.23	1422	49.9	N/A	6.25E-01	5.87E-01	3.83E+00	3.83E+03	1.45E+01	A014-00000226
1/6/15 13:00	MVE-21	35.75	1634	63.1	N/A	1.18E+00	1.11E+00	7.47E+00	3.98E+03	2.08E+01	A014-00000228
1/6/15 16:00	MVE-21	35.75	16.48	65	N/A	7.45E-01	6.10E-01	4.33E+00	4.12E+03	1.48E+01	A014-00000230
1/7/15 7:30	MVE-21	33.88	15.48	37.8	539	5.77E-01	5.33E-01	3.25E+00	4.40E+03	2.66E+00	A014-00000232
1/7/15 10:00	MVE-21	33.52	1575	45.5	589	6.36E-01	6.00E-01	3.62E+00	4.44E+03	7.88E+00	A014-00000234

Appendix 7.1 Recorded Field Observations (Continued/End)

DATE/TIME	WELL ID	Q (cfm)	V (fpm)	T (°F)	Ambient CO2	A:PCE (ppmv)	B:TCE (ppmv)	D:CH4 (ppmv)	E:CO2 (ppmv)	W:H2O (°C)	SAMPLE ID
1/13/15 10:00	MVE-22	13.47	607	59.4	544	4.32E+00	5.55E-01	4.80E+02	5.01E+03	1.50E+01	A014-00000237
1/13/15 13:00	MVE-22	21.77	1012	56.4	684	5.17E+00	7.00E-01	5.56E+00	5.06E+03	1.18E+01	A014-00000239
1/13/15 16:00	MVE-22	24.9	1158	50.8	624	5.60E+00	6.81E-01	5.51E+00	4.74E+03	9.81E+00	A014-00000241
1/14/15 7:30	MVE-22	21.08	978	48.2	607	7.14E+00	5.92E-01	4.39E+00	4.64E+03	1.28E+01	A014-00000243
1/14/15 10:00	MVE-22	21.46	980	48.9	560	7.79E+00	1.07E+00	8.01E+00	4.69E+03	1.91E+01	A014-00000245

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
AF-2	A014-00000220	12/19/2014 10:00:00 AM	PCE	0.0134	150.1680479	[PPMV]	A	AIR
AF-2	A014-00000220	12/19/2014 10:00:00 AM	TCE	0.05	4.977386466	[PPMV]	A	AIR
AF-2	A014-00000220	12/19/2014 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-2	A014-00000221	12/19/2014 1:00:00 PM	PCE	0.0134	142.95947	[PPMV]	A	AIR
AF-2	A014-00000221	12/19/2014 1:00:00 PM	TCE	0.05	4.639278302	[PPMV]	A	AIR
AF-2	A014-00000221	12/19/2014 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-2	A014-00000222	12/19/2014 4:00:00 PM	PCE	0.0134	167.8625038	[PPMV]	A	AIR
AF-2	A014-00000222	12/19/2014 4:00:00 PM	TCE	0.05	5.325906864	[PPMV]	A	AIR
AF-2	A014-00000222	12/19/2014 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-2	A014-00000223	12/22/2014 7:30:00 AM	PCE	0.0134	164.1412806	[PPMV]	A	AIR
AF-2	A014-00000223	12/22/2014 7:30:00 AM	TCE	0.05	4.645461663	[PPMV]	A	AIR
AF-2	A014-00000223	12/22/2014 7:30:00 AM	TCA	0.111	0.373802714	[PPMV]	A	AIR
AF-2	A014-00000224	12/22/2014 10:00:00 AM	PCE	0.0134	170.195022	[PPMV]	A	AIR
AF-2	A014-00000224	12/22/2014 10:00:00 AM	TCE	0.05	4.7270361	[PPMV]	A	AIR
AF-2	A014-00000224	12/22/2014 10:00:00 AM	TCA	0.111	0.377589816	[PPMV]	A	AIR
AF-4	A014-00000215	12/17/2014 10:00:00 AM	PCE	0.0134	69.43819394	[PPMV]	A	AIR
AF-4	A014-00000215	12/17/2014 10:00:00 AM	TCE	0.05	1.495104455	[PPMV]	A	AIR
AF-4	A014-00000215	12/17/2014 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-4	A014-00000216	12/17/2014 1:00:00 PM	PCE	0.0134	75.24835314	[PPMV]	A	AIR
AF-4	A014-00000216	12/17/2014 1:00:00 PM	TCE	0.05	1.684387799	[PPMV]	A	AIR
AF-4	A014-00000216	12/17/2014 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-4	A014-00000217	12/17/2014 4:00:00 PM	PCE	0.0134	81.9351318	[PPMV]	A	AIR
AF-4	A014-00000217	12/17/2014 4:00:00 PM	TCE	0.05	1.890641901	[PPMV]	A	AIR
AF-4	A014-00000217	12/17/2014 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
AF-4	A014-00000218	12/18/2014 7:30:00 AM	PCE	0.0134	111.557448	[PPMV]	A	AIR
AF-4	A014-00000218	12/18/2014 7:30:00 AM	TCE	0.05	3.087822934	[PPMV]	A	AIR
AF-4	A014-00000218	12/18/2014 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-4	A014-00000219	12/18/2014 10:00:00 AM	PCE	0.0134	112.9821269	[PPMV]	A	AIR
AF-4	A014-00000219	12/18/2014 10:00:00 AM	TCE	0.05	3.274735866	[PPMV]	A	AIR
AF-4	A014-00000219	12/18/2014 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-5	A014-00000205	12/11/2014 10:00:00 AM	PCE	0.0134	48.04296248	[PPMV]	A	AIR
AF-5	A014-00000205	12/11/2014 10:00:00 AM	TCE	0.05	0.11451115	[PPMV]	A	AIR
AF-5	A014-00000205	12/11/2014 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-5	A014-00000206	12/11/2014 1:00:00 PM	PCE	0.0134	51.72156513	[PPMV]	A	AIR
AF-5	A014-00000206	12/11/2014 1:00:00 PM	TCE	0.05	0.121080672	[PPMV]	A	AIR
AF-5	A014-00000206	12/11/2014 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-5	A014-00000207	12/11/2014 4:00:00 PM	PCE	0.0134	50.2876726	[PPMV]	A	AIR
AF-5	A014-00000207	12/11/2014 4:00:00 PM	TCE	0.05	0.118937057	[PPMV]	A	AIR
AF-5	A014-00000207	12/11/2014 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-5	A014-00000208	12/12/2014 7:45:00 AM	PCE	0.0134	55.18987816	[PPMV]	A	AIR
AF-5	A014-00000208	12/12/2014 7:45:00 AM	TCE	0.05	0.136182221	[PPMV]	A	AIR
AF-5	A014-00000208	12/12/2014 7:45:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-5	A014-00000209	12/12/2014 10:00:00 AM	PCE	0.0134	58.05593646	[PPMV]	A	AIR
AF-5	A014-00000209	12/12/2014 10:00:00 AM	TCE	0.05	0.144531753	[PPMV]	A	AIR
AF-5	A014-00000209	12/12/2014 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-7	A014-00000200	12/9/2014 10:05:00 AM	PCE	0.0134	39.966664	[PPMV]	A	AIR
AF-7	A014-00000200	12/9/2014 10:05:00 AM	TCE	0.05	0.112555992	[PPMV]	A	AIR
AF-7	A014-00000200	12/9/2014 10:05:00 AM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
AF-7	A014-00000201	12/9/2014 1:05:00 PM	PCE	0.0134	48.13051415	[PPMV]	A	AIR
AF-7	A014-00000201	12/9/2014 1:05:00 PM	TCE	0.05	0.125866495	[PPMV]	A	AIR
AF-7	A014-00000201	12/9/2014 1:05:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-7	A014-00000202	12/9/2014 3:55:00 PM	PCE	0.0134	42.13591404	[PPMV]	A	AIR
AF-7	A014-00000202	12/9/2014 3:55:00 PM	TCE	0.05	0.115948259	[PPMV]	A	AIR
AF-7	A014-00000202	12/9/2014 3:55:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-7	A014-00000203	12/10/2014 7:30:00 AM	PCE	0.0134	43.88414664	[PPMV]	A	AIR
AF-7	A014-00000203	12/10/2014 7:30:00 AM	TCE	0.05	0.131136445	[PPMV]	A	AIR
AF-7	A014-00000203	12/10/2014 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-7	A014-00000204	12/10/2014 10:00:00 AM	PCE	0.0134	44.85311467	[PPMV]	A	AIR
AF-7	A014-00000204	12/10/2014 10:00:00 AM	TCE	0.05	0.132417189	[PPMV]	A	AIR
AF-7	A014-00000204	12/10/2014 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-8	A014-00000210	12/15/2014 10:00:00 AM	PCE	0.0134	17.75476359	[PPMV]	A	AIR
AF-8	A014-00000210	12/15/2014 10:00:00 AM	TCE	0.05	0.116083113	[PPMV]	A	AIR
AF-8	A014-00000210	12/15/2014 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
AF-8	A014-00000211	12/15/2014 1:00:00 PM	PCE	0.0134	19.98378458	[PPMV]	A	AIR
AF-8	A014-00000211	12/15/2014 1:00:00 PM	TCE	0.05	0.113081443	[PPMV]	A	AIR
AF-8	A014-00000211	12/15/2014 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-8	A014-00000212	12/15/2014 4:00:00 PM	PCE	0.0134	19.34570695	[PPMV]	A	AIR
AF-8	A014-00000212	12/15/2014 4:00:00 PM	TCE	0.05	0.108051766	[PPMV]	A	AIR
AF-8	A014-00000212	12/15/2014 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
AF-8	A014-00000213	12/16/2014 7:30:00 AM	PCE	0.0134	20.25169423	[PPMV]	A	AIR
AF-8	A014-00000213	12/16/2014 7:30:00 AM	TCE	0.05	0.114784325	[PPMV]	A	AIR
AF-8	A014-00000213	12/16/2014 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
AF-8	A014-00000214	12/16/2014 10:00:00 AM	PCE	0.0134	21.80556915	[PPMV]	A	AIR
AF-8	A014-00000214	12/16/2014 10:00:00 AM	TCE	0.05	0.120220638	[PPMV]	A	AIR
AF-8	A014-00000214	12/16/2014 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MRS-34	A014-00000275	2/19/2015 7:30:00 AM	PCE	0.0134	23.08267214	[PPMV]	A	AIR
MRS-34	A014-00000275	2/19/2015 7:30:00 AM	TCE	0.05	1.763165626	[PPMV]	A	AIR
MRS-34	A014-00000275	2/19/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MRS-34	A014-00000276	2/19/2015 1:00:00 PM	PCE	0.0134	29.70303245	[PPMV]	A	AIR
MRS-34	A014-00000276	2/19/2015 1:00:00 PM	TCE	0.05	1.948112688	[PPMV]	A	AIR
MRS-34	A014-00000276	2/19/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MRS-34	A014-00000277	2/19/2015 4:00:00 PM	PCE	0.0134	33.82715725	[PPMV]	A	AIR
MRS-34	A014-00000277	2/19/2015 4:00:00 PM	TCE	0.05	2.068038941	[PPMV]	A	AIR
MRS-34	A014-00000277	2/19/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MRS-34	A014-00000278	2/23/2015 7:30:00 AM	PCE	0.0134	16.99841575	[PPMV]	A	AIR
MRS-34	A014-00000278	2/23/2015 7:30:00 AM	TCE	0.05	1.283440025	[PPMV]	A	AIR
MRS-34	A014-00000278	2/23/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MRS-34	A014-00000279	2/23/2015 10:00:00 AM	PCE	0.0134	16.9512833	[PPMV]	A	AIR
MRS-34	A014-00000279	2/23/2015 10:00:00 AM	TCE	0.05	1.272065932	[PPMV]	A	AIR
MRS-34	A014-00000279	2/23/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-10	A014-00000254	1/27/2015 10:00	PCE	0.0134	5.181058621	[PPMV]	A	AIR
MVE-10	A014-00000254	1/27/2015 10:00	TCE	0.05	1.092432539	[PPMV]	A	AIR
MVE-10	A014-00000254	1/27/2015 10:00	TCA	0.111		[PPMV]	U	AIR
MVE-10	A014-00000255	1/27/2015 13:00	PCE	0.0134	5.346903785	[PPMV]	A	AIR
MVE-10	A014-00000255	1/27/2015 13:00	TCE	0.05	1.099429776	[PPMV]	A	AIR
MVE-10	A014-00000255	1/27/2015 13:00	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
MVE-10	A014-00000265	2/9/2015 10:00:00 AM	PCE	0.0134	13.33378741	[PPMV]	A	AIR
MVE-10	A014-00000265	2/9/2015 10:00:00 AM	TCE	0.05	0.434995151	[PPMV]	A	AIR
MVE-10	A014-00000265	2/9/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-10	A014-00000266	2/9/2015 1:00:00 PM	PCE	0.0134	12.67027556	[PPMV]	A	AIR
MVE-10	A014-00000266	2/9/2015 1:00:00 PM	TCE	0.05	0.403854013	[PPMV]	A	AIR
MVE-10	A014-00000266	2/9/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-10	A014-00000267	2/9/2015 4:00:00 PM	PCE	0.0134	9.438740861	[PPMV]	A	AIR
MVE-10	A014-00000267	2/9/2015 4:00:00 PM	TCE	0.05	0.34939571	[PPMV]	A	AIR
MVE-10	A014-00000267	2/9/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-10	A014-00000268	2/10/2015 7:30:00 AM	PCE	0.0134	14.41536502	[PPMV]	A	AIR
MVE-10	A014-00000268	2/10/2015 7:30:00 AM	TCE	0.05	0.434153218	[PPMV]	A	AIR
MVE-10	A014-00000268	2/10/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-10	A014-00000269	2/10/2015 10:00:00 AM	PCE	0.0134	12.44761575	[PPMV]	A	AIR
MVE-10	A014-00000269	2/10/2015 10:00:00 AM	TCE	0.05	0.376833109	[PPMV]	A	AIR
MVE-10	A014-00000269	2/10/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-13	A014-00000225	1/6/2015 10:00:00 AM	PCE	0.0134	20.98955697	[PPMV]	A	AIR
MVE-13	A014-00000225	1/6/2015 10:00:00 AM	TCE	0.05	0.111660147	[PPMV]	A	AIR
MVE-13	A014-00000225	1/6/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-13	A014-00000227	1/6/2014 1:00:00 PM	PCE	0.0134	20.67747263	[PPMV]	A	AIR
MVE-13	A014-00000227	1/6/2014 1:00:00 PM	TCE	0.05	9.09E-02	[PPMV]	A	AIR
MVE-13	A014-00000227	1/6/2014 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-13	A014-00000229	1/6/2014 4:00:00 PM	PCE	0.0134	16.24872468	[PPMV]	A	AIR
MVE-13	A014-00000229	1/6/2014 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-13	A014-00000229	1/6/2014 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
MVE-13	A014-00000231	1/7/2015 7:30:00 AM	PCE	0.0134	17.419639	[PPMV]	A	AIR
MVE-13	A014-00000231	1/7/2015 7:30:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-13	A014-00000231	1/7/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-13	A014-00000233	1/7/2015 10:00:00 AM	PCE	0.0134	15.46589908	[PPMV]	A	AIR
MVE-13	A014-00000233	1/7/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-13	A014-00000233	1/7/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-14	A014-00000290	2/25/2015 1:00:00 PM	PCE	0.0134		[PPMV]	U	AIR
MVE-14	A014-00000290	2/25/2015 1:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-14	A014-00000290	2/25/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-14	A014-00000291	2/25/2015 4:00:00 PM	PCE	0.0134		[PPMV]	U	AIR
MVE-14	A014-00000291	2/25/2015 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-14	A014-00000291	2/25/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-14	A014-00000292	2/26/2015 7:30:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-14	A014-00000292	2/26/2015 7:30:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-14	A014-00000292	2/26/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-14	A014-00000293	2/26/2015 10:00:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-14	A014-00000293	2/26/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-14	A014-00000293	2/26/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-14	A014-00000294	2/26/2015 1:00:00 PM	PCE	0.0134		[PPMV]	U	AIR
MVE-14	A014-00000294	2/26/2015 1:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-14	A014-00000294	2/26/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-15	A014-00000248	1/21/2015 2:30:00 PM	PCE	0.0134	4.04E-02	[PPMV]	A	AIR
MVE-15	A014-00000248	1/21/2015 2:30:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-15	A014-00000248	1/21/2015 2:30:00 PM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
MVE-15	A014-00000250	1/21/2015 4:00:00 PM	PCE	0.0134		[PPMV]	U	AIR
MVE-15	A014-00000250	1/21/2015 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-15	A014-00000250	1/21/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-15	A014-00000252	1/22/2015 10:00:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-15	A014-00000252	1/22/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-15	A014-00000252	1/22/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-16	A014-00000280	2/24/2015 10:00:00 AM	PCE	0.0134	0.336179304	[PPMV]	A	AIR
MVE-16	A014-00000280	2/24/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-16	A014-00000280	2/24/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-16	A014-00000282	2/24/2015 1:00:00 PM	PCE	0.0134	0.331684423	[PPMV]	A	AIR
MVE-16	A014-00000282	2/24/2015 1:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-16	A014-00000282	2/24/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-16	A014-00000284	2/24/2015 4:00:00 PM	PCE	0.0134	0.361990158	[PPMV]	A	AIR
MVE-16	A014-00000284	2/24/2015 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-16	A014-00000284	2/24/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-16	A014-00000286	2/25/2015 7:30:00 AM	PCE	0.0134	0.232522456	[PPMV]	A	AIR
MVE-16	A014-00000286	2/25/2015 7:30:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-16	A014-00000286	2/25/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-16	A014-00000288	2/25/2015 10:00:00 AM	PCE	0.0134	0.288757275	[PPMV]	A	AIR
MVE-16	A014-00000288	2/25/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-16	A014-00000288	2/25/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-17	A014-00000249	1/21/2015 2:30:00 PM	PCE	0.0134	1.338540776	[PPMV]	A	AIR
MVE-17	A014-00000249	1/21/2015 2:30:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-17	A014-00000249	1/21/2015 2:30:00 PM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
MVE-17	A014-00000251	1/21/2015 4:00:00 PM	PCE	0.0134	1.461159441	[PPMV]	A	AIR
MVE-17	A014-00000251	1/21/2015 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-17	A014-00000251	1/21/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-17	A014-00000253	1/22/2015 10:00:00 AM	PCE	0.0134	1.154121611	[PPMV]	A	AIR
MVE-17	A014-00000253	1/22/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-17	A014-00000253	1/22/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-18	A014-00000281	2/24/2015 10:00:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-18	A014-00000281	2/24/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-18	A014-00000281	2/24/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-18	A014-00000283	2/24/2015 1:00:00 PM	PCE	0.0134		[PPMV]	U	AIR
MVE-18	A014-00000283	2/24/2015 1:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-18	A014-00000283	2/24/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-18	A014-00000285	2/24/2015 4:00:00 PM	PCE	0.0134		[PPMV]	U	AIR
MVE-18	A014-00000285	2/24/2015 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-18	A014-00000285	2/24/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-18	A014-00000287	2/25/2015 7:30:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-18	A014-00000287	2/25/2015 7:30:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-18	A014-00000287	2/25/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-18	A014-00000289	2/25/2015 10:00:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-18	A014-00000289	2/25/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-18	A014-00000289	2/25/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-19	A014-00000236	1/13/2015 10:00:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-19	A014-00000236	1/13/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-19	A014-00000236	1/13/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
MVE-19	A014-00000238	1/13/2015 1:00:00 PM	PCE	0.0134		[PPMV]	U	AIR
MVE-19	A014-00000238	1/13/2015 1:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-19	A014-00000238	1/13/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-19	A014-00000240	1/13/2015 4:00:00 PM	PCE	0.0134		[PPMV]	U	AIR
MVE-19	A014-00000240	1/13/2015 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-19	A014-00000240	1/13/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-19	A014-00000242	1/14/2015 7:30:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-19	A014-00000242	1/14/2015 7:30:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-19	A014-00000242	1/14/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-19	A014-00000244	1/14/2015 10:00:00 AM	PCE	0.0134		[PPMV]	U	AIR
MVE-19	A014-00000244	1/14/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-19	A014-00000244	1/14/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-21	A014-00000226	1/6/2015 10:00:00 AM	PCE	0.0134	9.82E-02	[PPMV]	A	AIR
MVE-21	A014-00000226	1/6/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-21	A014-00000226	1/6/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-21	A014-00000228	1/6/2014 1:00:00 PM	PCE	0.0134	0.120111747	[PPMV]	A	AIR
MVE-21	A014-00000228	1/6/2014 1:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-21	A014-00000228	1/6/2014 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-21	A014-00000230	1/6/2014 4:00:00 PM	PCE	0.0134	0.091337553	[PPMV]	A	AIR
MVE-21	A014-00000230	1/6/2014 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-21	A014-00000230	1/6/2014 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-21	A014-00000232	1/7/2015 7:30:00 AM	PCE	0.0134	9.44E-02	[PPMV]	A	AIR
MVE-21	A014-00000232	1/7/2015 7:30:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-21	A014-00000232	1/7/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
MVE-21	A014-00000234	1/7/2015 10:00:00 AM	PCE	0.0134	8.16E-02	[PPMV]	A	AIR
MVE-21	A014-00000234	1/7/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-21	A014-00000234	1/7/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-22	A014-00000237	1/13/2015 10:00:00 AM	PCE	0.0134	3.786498148	[PPMV]	A	AIR
MVE-22	A014-00000237	1/13/2015 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-22	A014-00000237	1/13/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-22	A014-00000239	1/13/2015 1:00:00 PM	PCE	0.0134	4.564041919	[PPMV]	A	AIR
MVE-22	A014-00000239	1/13/2015 1:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-22	A014-00000239	1/13/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-22	A014-00000241	1/13/2015 4:00:00 PM	PCE	0.0134	5.261575345	[PPMV]	A	AIR
MVE-22	A014-00000241	1/13/2015 4:00:00 PM	TCE	0.05		[PPMV]	U	AIR
MVE-22	A014-00000241	1/13/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-22	A014-00000243	1/14/2015 7:30:00 AM	PCE	0.0134	7.671361421	[PPMV]	A	AIR
MVE-22	A014-00000243	1/14/2015 7:30:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-22	A014-00000243	1/14/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-22	A014-00000245	1/14/2013 10:00:00 AM	PCE	0.0134	7.766719375	[PPMV]	A	AIR
MVE-22	A014-00000245	1/14/2013 10:00:00 AM	TCE	0.05		[PPMV]	U	AIR
MVE-22	A014-00000245	1/14/2013 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-4	A014-00000235	1/8/2015 10:00:00 AM	PCE	0.0134	5.706582647	[PPMV]	A	AIR
MVE-4	A014-00000235	1/8/2015 10:00:00 AM	TCE	0.05	0.902011355	[PPMV]	A	AIR
MVE-4	A014-00000235	1/8/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-4	A014-00000270	2/17/2015 10:00:00 AM	PCE	0.0134	6.675144888	[PPMV]	A	AIR
MVE-4	A014-00000270	2/17/2015 10:00:00 AM	TCE	0.05	0.556715078	[PPMV]	A	AIR
MVE-4	A014-00000270	2/17/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
MVE-4	A014-00000271	2/17/2015 1:00:00 PM	PCE	0.0134	8.077878111	[PPMV]	A	AIR
MVE-4	A014-00000271	2/17/2015 1:00:00 PM	TCE	0.05	0.602853115	[PPMV]	A	AIR
MVE-4	A014-00000271	2/17/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-4	A014-00000272	2/17/2015 4:00:00 PM	PCE	0.0134	8.067287851	[PPMV]	A	AIR
MVE-4	A014-00000272	2/17/2015 4:00:00 PM	TCE	0.05	0.583235815	[PPMV]	A	AIR
MVE-4	A014-00000272	2/17/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-4	A014-00000273	2/18/2015 7:30:00 AM	PCE	0.0134	7.51839337	[PPMV]	A	AIR
MVE-4	A014-00000273	2/18/2015 7:30:00 AM	TCE	0.05	0.537886434	[PPMV]	A	AIR
MVE-4	A014-00000273	2/18/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-4	A014-00000274	2/18/2015 10:00:00 AM	PCE	0.0134	8.516579474	[PPMV]	A	AIR
MVE-4	A014-00000274	2/18/2015 10:00:00 AM	TCE	0.05	0.573062021	[PPMV]	A	AIR
MVE-4	A014-00000274	2/18/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-9	A014-00000246	1/15/2015 10:00:00 AM	PCE	0.0134	2.856509316	[PPMV]	A	AIR
MVE-9	A014-00000246	1/15/2015 10:00:00 AM	TCE	0.05	0.206915969	[PPMV]	A	AIR
MVE-9	A014-00000246	1/15/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-9	A014-00000247	1/15/2015 1:00:00 PM	PCE	0.0134	3.235359311	[PPMV]	A	AIR
MVE-9	A014-00000247	1/15/2015 1:00:00 PM	TCE	0.05	0.213976215	[PPMV]	A	AIR
MVE-9	A014-00000247	1/15/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-9	A014-00000256	2/11/2015 10:00:00 AM	PCE	0.0134	2.911603817	[PPMV]	A	AIR
MVE-9	A014-00000256	2/11/2015 10:00:00 AM	TCE	0.05	0.19877318	[PPMV]	A	AIR
MVE-9	A014-00000256	2/11/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-9	A014-00000257	2/11/2015 1:00:00 PM	PCE	0.0134	2.965082105	[PPMV]	A	AIR
MVE-9	A014-00000257	2/11/2015 1:00:00 PM	TCE	0.05	0.191547864	[PPMV]	A	AIR
MVE-9	A014-00000257	2/11/2015 1:00:00 PM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.2 Analytical Results for Compounds PCE, TCE, and TCA – Abbreviated ERDMS Table (continued/end)

Well ID	Sample Name	Sample Date	Compound	Detection Limit	Concentration	Units	LabQual	Matrix
MVE-9	A014-00000258	2/11/2015 4:00:00 PM	PCE	0.0134	4.164572731	[PPMV]	A	AIR
MVE-9	A014-00000258	2/11/2015 4:00:00 PM	TCE	0.05	0.212839253	[PPMV]	A	AIR
MVE-9	A014-00000258	2/11/2015 4:00:00 PM	TCA	0.111		[PPMV]	U	AIR
MVE-9	A014-00000259	2/12/2015 7:30:00 AM	PCE	0.0134	4.032110451	[PPMV]	A	AIR
MVE-9	A014-00000259	2/12/2015 7:30:00 AM	TCE	0.05	0.219147577	[PPMV]	A	AIR
MVE-9	A014-00000259	2/12/2015 7:30:00 AM	TCA	0.111		[PPMV]	U	AIR
MVE-9	A014-00000260	2/12/2015 10:00:00 AM	PCE	0.0134	4.323514869	[PPMV]	A	AIR
MVE-9	A014-00000260	2/12/2015 10:00:00 AM	TCE	0.05	0.229795587	[PPMV]	A	AIR
MVE-9	A014-00000260	2/12/2015 10:00:00 AM	TCA	0.111		[PPMV]	U	AIR

Appendix 7.3 Well by Well Evaluation of Concentration Differences using Student's T-Test

WELL ID	DATE	PCE (ppmv)	TCE (ppmv)	PCE+TCE (ppmv)
AF-2	Jun-07	1.28E+03	7.80E+00	1.29E+03
AF-2	Jun-07	1.23E+03	8.00E+00	1.24E+03
AF-2	Jun-07	1.25E+03	9.00E+00	1.26E+03
AF-2	Jun-07	1.24E+03	8.70E+00	1.25E+03
AF-2	Jun-07	1.13E+03	8.50E+00	1.14E+03
AF-2	Jun-07	1.03E+03	9.10E+00	1.04E+03
AF-2	Jun-07	1.01E+03	9.40E+00	1.02E+03
AF-2	Jun-07	1.14E+03	1.30E+01	1.15E+03
AF-2	Dec-14	1.74E+02	5.58E+00	1.80E+02
AF-2	Dec-14	1.79E+02	6.07E+00	1.85E+02
AF-2	Dec-14	1.77E+02	5.79E+00	1.83E+02
AF-2	Dec-14	1.71E+02	4.85E+00	1.76E+02
AF-2	Dec-14	1.73E+02	4.97E+00	1.78E+02

	Variable 1	*Variable 2*
Mean	1.17E+03	1.80E+02
Variance	1.05E+04	1.37E+01
Observations	8.00E+00	5.00E+00
Pooled Variance	6.70E+03	
Hypothesized Mean Difference	0.00E+00	
df	1.10E+01	
t Stat	2.13E+01	
P(T<=t) one-tail	1.38E-10	
t Critical one-tail	1.80E+00	
P(T<=t) two-tail	2.75E-10	
t Critical two-tail	2.20E+00	

AF-4	Jun-07	1.04E+03	2.60E+00	1.04E+03
AF-4	Jun-07	8.98E+02	3.20E+00	9.01E+02
AF-4	Jun-07	9.70E+02	3.70E+00	9.74E+02
AF-4	Jun-07	5.69E+02	2.60E+00	5.72E+02
AF-4	Jun-07	5.44E+02	2.00E+00	5.46E+02
AF-4	Jun-07	8.72E+02	3.70E+00	8.76E+02
AF-4	Jun-07	7.34E+02	5.20E+00	7.39E+02
AF-4	Jun-07	7.92E+02	4.40E+00	7.96E+02
AF-4	Dec-14	8.62E+01	1.89E+00	8.81E+01
AF-4	Dec-14	8.93E+01	2.15E+00	9.15E+01
AF-4	Dec-14	9.62E+01	2.54E+00	9.87E+01
AF-4	Dec-14	1.07E+02	3.13E+00	1.10E+02
AF-4	Dec-14	1.13E+02	3.52E+00	1.17E+02

	Variable 1	*Variable 2*
Mean	8.06E+02	1.01E+02
Variance	3.22E+04	1.47E+02
Observations	8.00E+00	5.00E+00
Pooled Variance	2.05E+04	
Hypothesized Mean Difference	0.00E+00	
df	1.10E+01	
t Stat	8.63E+00	
P(T<=t) one-tail	1.58E-06	
t Critical one-tail	1.80E+00	
P(T<=t) two-tail	3.15E-06	
t Critical two-tail	2.20E+00	

Appendix 7.3 Well by Well Evaluation of Concentration Differences using Student's T-Test (continued)

WELL ID	DATE	PCE (ppmv)	TCE (ppmv)	PCE+TCE (ppmv)
AF-5	Jun-07	6.90E+02	1.93E+01	7.09E+02
AF-5	Jun-07	6.05E+02	2.24E+01	6.27E+02
AF-5	Jun-07	5.23E+02	2.97E+01	5.53E+02
AF-5	Jun-07	5.30E+02	3.00E+01	5.60E+02
AF-5	Jun-07	3.63E+02	2.23E+01	3.85E+02
AF-5	Jun-07	1.72E+02	1.35E+01	1.86E+02
AF-5	Jun-07	3.49E+02	2.01E+01	3.69E+02
AF-5	Dec-14	5.14E+01	2.96E-01	5.17E+01
AF-5	Dec-14	5.31E+01	5.11E-01	5.36E+01
AF-5	Dec-14	5.53E+01	4.87E-01	5.58E+01
AF-5	Dec-14	5.03E+01	7.89E-01	5.11E+01
AF-5	Dec-14	5.78E+01	6.06E-01	5.84E+01

	Variable 1	*Variable 2*
Mean	4.84E+02	5.41E+01
Variance	3.23E+04	9.12E+00
Observations	7.00E+00	5.00E+00
Pooled Variance	1.94E+04	
Hypothesized Mean Difference	0.00E+00	
df	1.00E+01	
t Stat	5.27E+00	
P(T<=t) one-tail	1.80E-04	
t Critical one-tail	1.81E+00	
P(T<=t) two-tail	3.60E-04	
t Critical two-tail	2.23E+00	

AF-7	Jul-07	3.89E+02	4.25E+01	4.32E+02
AF-7	Jul-07	6.73E+02	5.87E+01	7.32E+02
AF-7	Jul-07	1.18E+03	7.40E+01	1.25E+03
AF-7	Jul-07	5.16E+02	2.74E+01	5.43E+02
AF-7	Jul-07	1.01E+03	9.77E+01	1.11E+03
AF-7	Dec-14	5.14E+01	3.44E-01	5.17E+01
AF-7	Dec-14	4.93E+01	4.83E-01	4.98E+01
AF-7	Dec-14	5.27E+01	4.69E-01	5.32E+01
AF-7	Dec-14	4.64E+01	2.81E-01	4.67E+01
AF-7	Dec-14	4.58E+01	3.09E-01	4.61E+01

	Variable 1	*Variable 2*
Mean	8.14E+02	4.95E+01
Variance	1.27E+05	9.51E+00
Observations	5.00E+00	5.00E+00
Pooled Variance	6.33E+04	
Hypothesized Mean Difference	0.00E+00	
df	8.00E+00	
t Stat	4.80E+00	
P(T<=t) one-tail	6.75E-04	
t Critical one-tail	1.86E+00	
P(T<=t) two-tail	1.35E-03	
t Critical two-tail	2.31E+00	

Appendix 7.3 Well by Well Evaluation of Concentration Differences using Student's T-Test (continued)

WELL ID	DATE	PCE (ppmv)	TCE (ppmv)	PCE+TCE (ppmv)
AF-8	Jul-07	1.40E+02	4.90E+00	1.45E+02
AF-8	Jul-07	1.94E+02	4.40E+00	1.98E+02
AF-8	Jul-07	2.22E+02	4.50E+00	2.27E+02
AF-8	Jul-07	2.09E+02	4.10E+00	2.13E+02
AF-8	Jul-07	1.61E+02	2.80E+00	1.64E+02
AF-8	Dec-14	2.21E+01	5.99E-01	2.27E+01
AF-8	Dec-14	2.21E+01	8.72E-01	2.30E+01
AF-8	Dec-14	2.25E+01	1.15E+00	2.37E+01
AF-8	Dec-14	2.28E+01	5.86E-01	2.34E+01
AF-8	Dec-14	2.31E+01	1.07E+00	2.42E+01

	Variable 1	*Variable 2*
Mean	1.89E+02	2.34E+01
Variance	1.16E+03	3.32E-01
Observations	5.00E+00	5.00E+00
Pooled Variance	5.82E+02	
Hypothesized Mean Difference	0.00E+00	
df	8.00E+00	
t Stat	1.09E+01	
P(T<=t) one-tail	2.26E-06	
t Critical one-tail	1.86E+00	
P(T<=t) two-tail	4.52E-06	
t Critical two-tail	2.31E+00	

MVE-13	Apr-99	1.50E+03	5.43E+01	1.55E+03
MVE-13	Apr-99	1.35E+03	4.23E+01	1.39E+03
MVE-13	Apr-99	1.84E+03	4.17E+01	1.88E+03
MVE-13	Apr-99	4.04E+03	1.68E+03	5.72E+03
MVE-13	Apr-99	4.86E+03	1.86E+03	6.72E+03
MVE-13	Apr-99	5.14E+03	1.91E+03	7.05E+03
MVE-13	Jan-15	2.32E+01	5.37E-01	2.37E+01
MVE-13	Jan-15	2.15E+01	8.91E-01	2.24E+01
MVE-13	Jan-15	2.21E+01	6.26E-01	2.27E+01
MVE-13	Jan-15	1.99E+01	4.80E-01	2.04E+01
MVE-13	Jan-15	1.71E+01	3.89E-01	1.75E+01

	Variable 1	*Variable 2*
Mean	4.05E+03	2.13E+01
Variance	7.38E+06	6.13E+00
Observations	6.00E+00	5.00E+00
Pooled Variance	4.10E+06	
Hypothesized Mean Difference	0.00E+00	
df	9.00E+00	
t Stat	3.29E+00	
P(T<=t) one-tail	4.71E-03	
t Critical one-tail	1.83E+00	
P(T<=t) two-tail	9.41E-03	
t Critical two-tail	2.26E+00	

Appendix 7.3 Well by Well Evaluation of Concentration Differences using Student's T-Test (continued)

WELL ID	DATE	PCE (ppmv)	TCE (ppmv)	PCE+TCE (ppmv)
MVE-14	Apr-99	2.05E+00	1.81E-01	2.23E+00
MVE-14	Apr-99	1.89E+00	2.60E-01	2.15E+00
MVE-14	Apr-99	1.78E+00	0.00E+00	1.78E+00
MVE-14	Apr-99	1.84E+00	0.00E+00	1.84E+00
MVE-14	Apr-99	1.87E+00	2.85E-02	1.90E+00
MVE-14	Apr-99	1.91E+00	0.00E+00	1.91E+00
MVE-14	Feb-15	4.92E-01	4.82E-01	9.74E-01
MVE-14	Feb-15	5.02E-01	6.17E-01	1.12E+00
MVE-14	Feb-15	3.77E-01	5.22E-01	8.99E-01
MVE-14	Feb-15	3.38E-01	5.64E-01	9.02E-01
MVE-14	Feb-15	4.15E-01	5.81E-01	9.96E-01

	Variable 1	*Variable 2*
Mean	1.97E+00	9.78E-01
Variance	3.24E-02	8.06E-03
Observations	6.00E+00	5.00E+00
Pooled Variance	2.16E-02	
Hypothesized Mean Difference	0.00E+00	
df	9.00E+00	
t Stat	1.11E+01	
P(T<=t) one-tail	7.31E-07	
t Critical one-tail	1.83E+00	
P(T<=t) two-tail	1.46E-06	
t Critical two-tail	2.26E+00	

MVE-15	Apr-99	2.27E+00	1.04E-01	2.37E+00
MVE-15	Apr-99	2.10E+00	1.18E-01	2.22E+00
MVE-15	Apr-99	2.01E+00	1.72E-01	2.18E+00
MVE-15	Apr-99	1.96E+00	3.00E-02	1.99E+00
MVE-15	Apr-99	2.63E+00	9.47E-01	3.58E+00
MVE-15	Apr-99	2.19E+00	7.00E-01	2.89E+00
MVE-15	Apr-99	2.31E+00	7.18E-01	3.03E+00
MVE-15	Apr-99	2.53E+00	1.26E-01	2.66E+00
MVE-15	Apr-99	1.85E+00	0.00E+00	1.85E+00
MVE-15	Apr-99	1.65E+00	0.00E+00	1.65E+00
MVE-15	Jan-15	8.75E-01	1.12E+00	2.00E+00
MVE-15	Jan-15	5.14E-01	6.35E-01	1.15E+00
MVE-15	Jan-15	5.39E-01	8.31E-01	1.37E+00

	Variable 1	*Variable 2*
Mean	2.44E+00	1.50E+00
Variance	3.54E-01	1.93E-01
Observations	1.00E+01	3.00E+00
Pooled Variance	3.24E-01	
Hypothesized Mean Difference	0.00E+00	
df	1.10E+01	
t Stat	2.50E+00	
P(T<=t) one-tail	1.48E-02	
t Critical one-tail	1.80E+00	
P(T<=t) two-tail	2.96E-02	
t Critical two-tail	2.20E+00	

Appendix 7.3 Well by Well Evaluation of Concentration Differences using Student's T-Test (continued)

WELL ID	DATE	PCE (ppmv)	TCE (ppmv)	PCE+TCE (ppmv)
MVE-16	Apr-99	5.33E+01	1.36E+00	5.47E+01
MVE-16	Apr-99	5.42E+01	6.60E-01	5.49E+01
MVE-16	Apr-99	5.09E+01	5.08E-01	5.14E+01
MVE-16	Apr-99	2.00E+01	4.53E-01	2.05E+01
MVE-16	Apr-99	1.72E+01	4.18E-01	1.76E+01
MVE-16	Apr-99	1.59E+01	3.86E-01	1.63E+01
MVE-16	Feb-15	9.00E-01	4.90E-01	1.39E+00
MVE-16	Feb-15	8.87E-01	6.03E-01	1.49E+00
MVE-16	Feb-15	7.76E-01	5.11E-01	1.29E+00
MVE-16	Feb-15	7.28E-01	6.08E-01	1.34E+00
MVE-16	Feb-15	7.16E-01	5.33E-01	1.25E+00

	Variable 1	*Variable 2*
Mean	3.59E+01	1.35E+00
Variance	3.82E+02	8.89E-03
Observations	6.00E+00	5.00E+00
Pooled Variance	2.12E+02	
Hypothesized Mean Difference	0.00E+00	
df	9.00E+00	
t Stat	3.91E+00	
P(T<=t) one-tail	1.77E-03	
t Critical one-tail	1.83E+00	
P(T<=t) two-tail	3.54E-03	
t Critical two-tail	2.26E+00	

MVE-17	Apr-99	4.69E+03	2.10E+02	4.90E+03
MVE-17	Apr-99	2.38E+03	8.57E+01	2.47E+03
MVE-17	Apr-99	5.86E+03	2.95E+02	6.16E+03
MVE-17	Apr-99	6.50E+03	3.02E+02	6.80E+03
MVE-17	Apr-99	6.85E+03	2.83E+02	7.13E+03
MVE-17	Apr-99	4.43E+03	5.12E+01	4.48E+03
MVE-17	Apr-99	5.59E+03	1.64E+02	5.75E+03
MVE-17	Apr-99	6.05E+03	3.07E+02	6.36E+03
MVE-17	Apr-99	5.84E+03	3.39E+02	6.18E+03
MVE-17	Jan-15	2.07E+00	5.97E-01	2.67E+00
MVE-17	Jan-15	2.15E+00	4.79E-01	2.63E+00
MVE-17	Jan-15	1.83E+00	6.00E-01	2.43E+00

	Variable 1	*Variable 2*
Mean	5.58E+03	2.58E+00
Variance	2.07E+06	1.62E-02
Observations	9.00E+00	3.00E+00
Pooled Variance	1.66E+06	
Hypothesized Mean Difference	0.00E+00	
df	1.00E+01	
t Stat	6.49E+00	
P(T<=t) one-tail	3.47E-05	
t Critical one-tail	1.81E+00	
P(T<=t) two-tail	6.94E-05	
t Critical two-tail	2.23E+00	

Appendix 7.3 Well by Well Evaluation of Concentration Differences using Student's T-Test (continued)

WELL ID	DATE	PCE (ppmv)	TCE (ppmv)	PCE+TCE (ppmv)
MVE-18	Apr-99	1.09E+00	0.00E+00	1.09E+00
MVE-18	Apr-99	1.60E+00	0.00E+00	1.60E+00
MVE-18	Apr-99	1.81E+00	0.00E+00	1.81E+00
MVE-18	Apr-99	1.74E+00	0.00E+00	1.74E+00
MVE-18	Apr-99	1.06E+00	3.90E-02	1.10E+00
MVE-18	Apr-99	9.92E-01	0.00E+00	9.92E-01
MVE-18	Apr-99	1.06E+00	0.00E+00	1.06E+00
MVE-18	Apr-99	9.35E-01	0.00E+00	9.35E-01
MVE-18	Feb-15	2.17E-01	5.25E-01	7.42E-01
MVE-18	Feb-15	3.44E-01	6.09E-01	9.53E-01
MVE-18	Feb-15	3.61E-01	5.72E-01	9.33E-01
MVE-18	Feb-15	4.24E-01	5.02E-01	9.26E-01
MVE-18	Feb-15	3.31E-01	6.10E-01	9.41E-01

	Variable 1	*Variable 2*
Mean	1.29E+00	8.99E-01
Variance	1.30E-01	7.80E-03
Observations	8.00E+00	5.00E+00
Pooled Variance	8.59E-02	
Hypothesized Mean Difference	0.00E+00	
df	1.10E+01	
t Stat	2.35E+00	
P(T<=t) one-tail	1.94E-02	
t Critical one-tail	1.80E+00	
P(T<=t) two-tail	3.88E-02	
t Critical two-tail	2.20E+00	

MVE-19	Apr-99	3.75E+02	1.05E+01	3.86E+02
MVE-19	Apr-99	2.19E+02	5.22E+00	2.24E+02
MVE-19	Apr-99	1.75E+02	3.79E+00	1.79E+02
MVE-19	Apr-99	2.56E+02	6.50E+00	2.63E+02
MVE-19	Apr-99	6.18E+02	1.35E+01	6.32E+02
MVE-19	Apr-99	9.07E+02	1.72E+01	9.24E+02
MVE-19	Apr-99	1.40E+03	2.40E+01	1.42E+03
MVE-19	Apr-99	1.37E+03	1.24E+01	1.38E+03
MVE-19	Apr-99	1.14E+03	9.87E+00	1.15E+03
MVE-19	Jan-15	4.19E-01	5.57E-01	9.76E-01
MVE-19	Jan-15	5.15E-01	6.96E-01	1.21E+00
MVE-19	Jan-15	5.16E-01	6.06E-01	1.12E+00
MVE-19	Jan-15	4.41E-01	5.69E-01	1.01E+00
MVE-19	Jan-15	6.37E-01	7.87E-01	1.42E+00

	Variable 1	*Variable 2*
Mean	7.29E+02	1.15E+00
Variance	2.53E+05	3.24E-02
Observations	9.00E+00	5.00E+00
Pooled Variance	1.69E+05	
Hypothesized Mean Difference	0.00E+00	
df	1.20E+01	
t Stat	3.18E+00	
P(T<=t) one-tail	3.99E-03	
t Critical one-tail	1.78E+00	
P(T<=t) two-tail	7.98E-03	
t Critical two-tail	2.18E+00	

Appendix 7.3 Well by Well Evaluation of Concentration Differences using Student's T-Test (continued/end)

WELL ID	DATE	PCE (ppmv)	TCE (ppmv)	PCE+TCE (ppmv)
MVE-21	Apr-99	1.38E+02	4.46E+00	1.42E+02
MVE-21	Apr-99	1.76E+02	4.07E+00	1.80E+02
MVE-21	Apr-99	1.84E+02	3.98E+00	1.88E+02
MVE-21	Apr-99	5.92E+01	4.62E-01	5.97E+01
MVE-21	Apr-99	3.93E+01	0.00E+00	3.93E+01
MVE-21	Apr-99	3.29E+01	2.71E-01	3.32E+01
MVE-21	Jan-15	6.25E-01	5.87E-01	1.21E+00
MVE-21	Jan-15	1.18E+00	1.11E+00	2.29E+00
MVE-21	Jan-15	7.45E-01	6.10E-01	1.36E+00
MVE-21	Jan-15	5.77E-01	5.33E-01	1.11E+00
MVE-21	Jan-15	6.36E-01	6.00E-01	1.24E+00

	Variable 1	*Variable 2*
Mean	1.07E+02	1.44E+00
Variance	5.09E+03	2.33E-01
Observations	6.00E+00	5.00E+00
Pooled Variance	2.83E+03	
Hypothesized Mean Difference	0.00E+00	
df	9.00E+00	
t Stat	3.28E+00	
P(T<=t) one-tail	4.74E-03	
t Critical one-tail	1.83E+00	
P(T<=t) two-tail	9.49E-03	
t Critical two-tail	2.26E+00	

MVE-22	Apr-99	3.54E+02	3.76E+00	3.58E+02
MVE-22	Apr-99	2.66E+02	2.56E+00	2.69E+02
MVE-22	Apr-99	2.32E+02	1.94E+00	2.34E+02
MVE-22	Apr-99	6.61E+01	6.24E-01	6.67E+01
MVE-22	Apr-99	5.60E+01	6.20E-01	5.66E+01
MVE-22	Apr-99	5.00E+01	5.05E-01	5.05E+01
MVE-22	Jan-15	4.32E+00	5.55E-01	4.88E+00
MVE-22	Jan-15	5.17E+00	7.00E-01	5.87E+00
MVE-22	Jan-15	5.60E+00	6.81E-01	6.28E+00
MVE-22	Jan-15	7.14E+00	5.92E-01	7.73E+00
MVE-22	Jan-15	7.79E+00	1.07E+00	8.86E+00

	Variable 1	*Variable 2*
Mean	1.72E+02	6.72E+00
Variance	1.74E+04	2.48E+00
Observations	6.00E+00	5.00E+00
Pooled Variance	9.65E+03	
Hypothesized Mean Difference	0.00E+00	
df	9.00E+00	
t Stat	2.78E+00	
P(T<=t) one-tail	1.06E-02	
t Critical one-tail	1.83E+00	
P(T<=t) two-tail	2.12E-02	
t Critical two-tail	2.26E+00	

Appendix 7.4 Mass Extraction Calculations

SAMPLE ID	WELL ID	PCE (ppmv)	TCE (ppmv)	111-TCA (ppmv)	PCE (mg/m3)	TCE (mg/m3)	111-TCA (mg/m3)	PCE (lbs/day)	TCE (lbs/day)	111-TCA (lbs/day)	∑ VOC (lbs/day)
A014-00000220	AF-2	1.50E+02	4.98E+00	U	1.06E+03	2.79E+01	-	2.00E+00	5.26E-02	-	
A014-00000221	AF-2	1.43E+02	4.64E+00	U	9.83E+02	2.53E+01	-	1.94E+00	5.00E-02	-	
A014-00000222	AF-2	1.68E+02	5.33E+00	U	1.16E+03	2.92E+01	-	2.09E+00	5.25E-02	-	
A014-00000223	AF-2	1.64E+02	4.65E+00	3.74E-01	1.17E+03	2.63E+01	2.15E+00	2.56E+00	5.75E-02	4.70E-03	
A014-00000224	AF-2	1.70E+02	4.73E+00	3.78E-01	1.21E+03	2.66E+01	2.16E+00	2.46E+00	5.41E-02	4.39E-03	
						AVERAGE	**AF-2**	2.21E+00	5.33E-02	4.54E-03	2.27E+00
A014-00000215	AF-4	6.94E+01	1.50E+00	U	4.90E+02	8.36E+00	-	3.96E-01	6.76E-03	-	
A014-00000216	AF-4	7.52E+01	1.68E+00	U	5.19E+02	9.20E+00	-	5.13E-01	9.10E-03	-	
A014-00000217	AF-4	8.19E+01	1.89E+00	U	5.68E+02	1.04E+01	-	4.41E-01	8.06E-03	-	
A014-00000218	AF-4	1.12E+02	3.09E+00	U	8.19E+02	1.80E+01	-	1.92E+00	4.21E-02	-	
A014-00000219	AF-4	1.13E+02	3.27E+00	U	7.96E+02	1.83E+01	-	1.84E+00	4.24E-02	-	
						AVERAGE	**AF-4**	1.02E+00	2.17E-02	0.00E+00	1.04E+00
A014-00000205	AF-5	4.80E+01	1.15E-01	U	3.39E+02	6.41E-01	-	2.62E+00	4.95E-03	-	
A014-00000206	AF-5	5.17E+01	1.21E-01	U	3.58E+02	6.65E-01	-	2.32E-01	4.30E-04	-	
A014-00000207	AF-5	5.03E+01	1.19E-01	U	3.51E+02	6.58E-01	-	3.66E-01	6.86E-04	-	
A014-00000208	AF-5	5.52E+01	1.36E-01	U	4.04E+02	7.90E-01	-	1.02E+00	1.99E-03	-	
A014-00000209	AF-5	5.81E+01	1.45E-01	U	4.09E+02	8.07E-01	-	1.85E-01	3.66E-04	-	
						AVERAGE	**AF-5**	8.85E-01	1.68E-03	0.00E+00	8.86E-01

Appendix 7.4 Mass Extraction Calculations (continued)

SAMPLE ID	WELL ID	PCE (ppmv)	TCE (ppmv)	111-TCA (ppmv)	PCE (mg/m3)	TCE (mg/m3)	111-TCA (mg/m3)	PCE (lbs/day)	TCE (lbs/day)	111-TCA (lbs/day)	∑ VOC (lbs/day)
A014-00000200	AF-7	4.00E+01	1.13E-01	U	2.84E+02	6.34E-01	-	5.34E-01	1.19E-03	-	
A014-00000201	AF-7	4.81E+01	1.26E-01	U	3.37E+02	6.98E-01	-	1.03E+00	2.13E-03	-	
A014-00000202	AF-7	4.21E+01	1.16E-01	U	2.93E+02	6.39E-01	-	7.91E-01	1.72E-03	-	
A014-00000203	AF-7	4.39E+01	1.31E-01	U	3.23E+02	7.65E-01	-	1.02E+00	2.41E-03	-	
A014-00000204	AF-7	4.49E+01	1.32E-01	U	3.17E+02	7.42E-01	-	6.56E-01	1.53E-03	-	
						AVERAGE	**AF-7**	8.05E-01	1.80E-03	0.00E+00	8.07E-01
A014-00000210	AF-8	1.78E+01	1.16E-01	U	1.25E+02	6.49E-01	-	2.82E-01	1.46E-03	-	
A014-00000211	AF-8	2.00E+01	1.13E-01	U	1.37E+02	6.14E-01	-	1.76E-01	7.90E-04	-	
A014-00000212	AF-8	1.93E+01	1.08E-01	U	1.33E+02	5.89E-01	-	1.67E-01	7.41E-04	-	
A014-00000213	AF-8	2.03E+01	1.15E-01	U	1.45E+02	6.52E-01	-	2.22E-01	9.96E-04	-	
A014-00000214	AF-8	2.18E+01	1.20E-01	U	1.51E+02	6.61E-01	-	2.14E-01	9.33E-04	-	
						AVERAGE	**AF-8**	2.12E-01	9.84E-04	0.00E+00	2.13E-01
A014-00000275	MRS-34	2.31E+01	1.76E+00	U	1.72E+02	1.04E+01	-	8.59E-01	5.20E-02	-	
A014-00000276	MRS-34	2.97E+01	1.95E+00	U	2.13E+02	1.11E+01	-	1.10E+00	5.70E-02	-	
A014-00000277	MRS-34	3.38E+01	2.07E+00	U	2.42E+02	1.17E+01	-	1.27E+00	6.15E-02	-	
A014-00000278	MRS-34	1.70E+01	1.28E+00	U	1.19E+02	7.11E+00	-	6.07E-01	3.63E-02	-	
A014-00000279	MRS-34	1.70E+01	1.27E+00	U	1.18E+02	7.01E+00	-	6.04E-01	3.59E-02	-	
						AVERAGE	**MRS-34**	8.87E-01	4.85E-02	0.00E+00	9.36E-01

Appendix 7.4 Mass Extraction Calculations (continued)

SAMPLE ID	WELL ID	PCE (ppmv)	TCE (ppmv)	111-TCA (ppmv)	PCE (mg/m3)	TCE (mg/m3)	111-TCA (mg/m3)	PCE (lbs/day)	TCE (lbs/day)	111-TCA (lbs/day)	∑ VOC (lbs/day)
A014-00000235	MVE-4	5.71E+00	9.02E-01	U	4.15E+01	5.20E+00	-	4.49E-01	5.62E-02	-	
A014-00000270	MVE-4	6.68E+00	5.57E-01	U	4.79E+01	3.16E+00	-	5.17E-01	3.42E-02	-	
A014-00000271	MVE-4	8.08E+00	6.03E-01	U	5.74E+01	3.39E+00	-	6.50E-01	3.85E-02	-	
A014-00000272	MVE-4	8.07E+00	5.83E-01	U	5.68E+01	3.25E+00	-	6.16E-01	3.53E-02	-	
A014-00000273	MVE-4	7.52E+00	5.38E-01	U	5.52E+01	3.13E+00	-	5.91E-01	3.35E-02	-	
A014-00000274	MVE-4	8.52E+00	5.73E-01	U	6.11E+01	3.26E+00	-	6.70E-01	3.57E-02	-	
						AVERAGE	**MVE-4**	5.82E-01	3.89E-02	0.00E+00	6.21E-01
A014-00000246	MVE-9	2.86E+00	2.07E-01	U	2.04E+01	1.17E+00	-	9.53E-01	5.47E-02	-	
A014-00000247	MVE-9	3.24E+00	2.14E-01	U	2.30E+01	1.20E+00	-	1.07E+00	5.63E-02	-	
A014-00000256	MVE-9	2.91E+00	1.99E-01	U	2.08E+01	1.13E+00	-	8.93E-01	4.83E-02	-	
A014-00000257	MVE-9	2.97E+00	1.92E-01	U	2.08E+01	1.07E+00	-	8.20E-01	4.20E-02	-	
A014-00000258	MVE-9	4.16E+00	2.13E-01	U	2.90E+01	1.17E+00	-	1.30E+00	5.28E-02	-	
A014-00000259	MVE-9	4.03E+00	2.19E-01	U	2.91E+01	1.25E+00	-	1.32E+00	5.67E-02	-	
A014-00000260	MVE-9	4.32E+00	2.30E-01	U	3.06E+01	1.29E+00	-	1.31E+00	5.52E-02	-	
						AVERAGE	**MVE-9**	1.10E+00	5.23E-02	0.00E+00	1.15E+00

Appendix 7.4 Mass Extraction Calculations (continued)

SAMPLE ID	WELL ID	PCE (ppmv)	TCE (ppmv)	111-TCA (ppmv)	PCE (mg/m3)	TCE (mg/m3)	111-TCA (mg/m3)	PCE (lbs/day)	TCE (lbs/day)	111-TCA (lbs/day)	∑ VOC (lbs/day)
A014-00000254	MVE-10	5.18E+00	1.09E+00	U	3.65E+01	6.10E+00	-	1.20E+00	2.00E-01	-	
A014-00000255	MVE-10	5.35E+00	1.10E+00	U	3.74E+01	6.10E+00	-	1.24E+00	2.02E-01	-	
A014-00000265	MVE-10	1.33E+01	4.35E-01	U	9.33E+01	2.41E+00	-	2.99E+00	7.74E-02	-	
A014-00000266	MVE-10	1.27E+01	4.04E-01	U	8.81E+01	2.23E+00	-	2.97E+00	7.50E-02	-	
A014-00000267	MVE-10	9.44E+00	3.49E-01	U	6.59E+01	1.93E+00	-	2.26E+00	6.64E-02	-	
A014-00000268	MVE-10	1.44E+01	4.34E-01	U	1.02E+02	2.42E+00	-	3.16E+00	7.54E-02	-	
A014-00000269	MVE-10	1.24E+01	3.77E-01	U	8.77E+01	2.10E+00	-	3.28E+00	7.87E-02	-	
						AVERAGE	**MVE-10**	2.44E+00	1.11E-01	0.00E+00	2.56E+00
A014-00000225	MVE-13	2.10E+01	1.12E-01	U	1.48E+02	6.24E-01	-	6.12E-02	2.58E-04	-	
A014-00000227	MVE-13	2.07E+01	9.09E-02	U	1.44E+02	5.03E-01	-	2.86E-02	9.95E-05	-	
A014-00000229	MVE-13	1.62E+01	U	U	1.13E+02	-	-	1.36E-01	0.00E+00	-	
A014-00000231	MVE-13	1.74E+01	U	U	1.29E+02	-	-	2.64E-01	0.00E+00	-	
A014-00000233	MVE-13	1.55E+01	U	U	1.12E+02	-	-	2.53E-02	0.00E+00	-	
						AVERAGE	**MVE-13**	1.03E-01	7.15E-05	0.00E+00	1.03E-01
A014-00000290	MVE-14	U	U	U	-	-	-	-	-	-	
A014-00000291	MVE-14	U	U	U	-	-	-	-	-	-	
A014-00000292	MVE-14	U	U	U	-	-	-	-	-	-	
A014-00000293	MVE-14	U	U	U	-	-	-	-	-	-	
A014-00000294	MVE-14	U	U	U	-	-	-	-	-	-	
						AVERAGE	**MVE-14**	0.00E+00	0.00E+00	-	0.00E+00

Appendix 7.4 Mass Extraction Calculations (continued)

SAMPLE ID	WELL ID	PCE (ppmv)	TCE (ppmv)	111-TCA (ppmv)	PCE (mg/m3)	TCE (mg/m3)	111-TCA (mg/m3)	PCE (lbs/day)	TCE (lbs/day)	111-TCA (lbs/day)	∑ VOC (lbs/day)
A014-00000248	MVE-15	4.04E-02	U	U	2.77E-01	-	-	2.49E-04	-	-	
A014-00000250	MVE-15	U	U	U	-	-	-	-	-	-	
A014-00000252	MVE-15	U	U	U	-	-	-	-	-	-	
						AVERAGE	**MVE-15**	8.29E-05	-	-	8.29E-05
A014-00000280	MVE-16	3.36E-01	U	U	2.39E+00	-	-	1.02E-03	-	-	
A014-00000282	MVE-16	3.32E-01	U	U	2.34E+00	-	-	1.71E-03	-	-	
A014-00000284	MVE-16	3.62E-01	U	U	2.58E+00	-	-	1.04E-03	-	-	
A014-00000286	MVE-16	2.33E-01	U	U	1.71E+00	-	-	9.39E-04	-	-	
A014-00000288	MVE-16	2.89E-01	U	U	2.08E+00	-	-	1.43E-03	-	-	
						AVERAGE	**MVE-16**	1.23E-03	-	-	1.23E-03
A014-00000249	MVE-17	1.34E+00	U	U	9.14E+00	-	-	1.40E-02	-	-	
A014-00000251	MVE-17	1.46E+00	U	U	9.99E+00	-	-	1.03E-03	-	-	
A014-00000253	MVE-17	1.15E+00	U	U	8.01E+00	-	-	1.86E-03	-	-	
						AVERAGE	**MVE-17**	5.62E-03	0.00E+00	0.00E+00	5.62E-03
A014-00000281	MVE-18	U	U	U	-	-	-	-	-	-	
A014-00000283	MVE-18	U	U	U	-	-	-	-	-	-	
A014-00000285	MVE-18	U	U	U	-	-	-	-	-	-	
A014-00000287	MVE-18	U	U	U	-	-	-	-	-	-	
A014-00000289	MVE-18	U	U	U	-	-	-	-	-	-	
						AVERAGE	**MVE-18**	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Appendix 7.4 Mass Extraction Calculations (continued/end)

SAMPLE ID	WELL ID	PCE (ppmv)	TCE (ppmv)	111-TCA (ppmv)	PCE (mg/m3)	TCE (mg/m3)	111-TCA (mg/m3)	PCE (lbs/day)	TCE (lbs/day)	111-TCA (lbs/day)	∑ VOC (lbs/day)
A014-00000236	MVE-19	U	U	U	-	-	-	-	-	-	
A014-00000238	MVE-19	U	U	U	-	-	-	-	-	-	
A014-00000240	MVE-19	U	U	U	-	-	-	-	-	-	
A014-00000242	MVE-19	U	U	U	-	-	-	-	-	-	
A014-00000244	MVE-19	U	U	U	-	-	-	-	-	-	
						AVERAGE	**MVE-19**	0.00E+00	0.00E+00	0.00E+00	0.00E+00
A014-00000226	MVE-21	9.82E-02	U	U	7.01E-01	-	-	1.97E-03	-	-	
A014-00000228	MVE-21	1.20E-01	U	U	8.36E-01	-	-	2.69E-03	-	-	
A014-00000230	MVE-21	9.13E-02	U	U	6.33E-01	-	-	2.04E-03	-	-	
A014-00000232	MVE-21	9.44E-02	U	U	6.90E-01	-	-	2.10E-03	-	-	
A014-00000234	MVE-21	8.16E-02	U	U	5.88E-01	-	-	1.77E-03	-	-	
						AVERAGE	**MVE-21**	2.11E-03	0.00E+00	0.00E+00	2.11E-03
A014-00000237	MVE-22	3.79E+00	U	U	2.65E+01	-	-	3.21E-02	-	-	
A014-00000239	MVE-22	4.56E+00	U	U	3.22E+01	-	-	6.30E-02	-	-	
A014-00000241	MVE-22	5.26E+00	U	U	3.75E+01	-	-	8.39E-02	-	-	
A014-00000243	MVE-22	7.67E+00	U	U	5.50E+01	-	-	1.04E-01	-	-	
A014-00000245	MVE-22	7.77E+00	U	U	5.56E+01	-	-	1.07E-01	-	-	
						AVERAGE	**MVE-22**	7.81E-02	-	-	7.81E-02