SVE Pilot Test Report

Shamrock #63 UST Site

3624 Cerrillos Road, Santa Fe, New Mexico

Facility #29206, Release ID #4509

Prepared for **New Mexico Environment Department**
Santa Fe, New Mexico

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SVE Pilot Test Report
Shamrock #63 UST Site
3624 Cerrillos Road, Santa Fe, New Mexico
Facility #29206, Release ID #4509

1. Introduction

On behalf of Polk Oil Company, responsible party (RP) for Shamrock #63 (the site), Daniel B. Stephens & Associates, Inc. (DBS&A) has prepared this soil vapor extraction (SVE) pilot test report. The site is located at 3624 Cerrillos Road in Santa Fe, New Mexico (Figure 1). The property containing the former Shamrock #63 has hosted gasoline dispensing facilities since at least the mid-1950s. A used car dealership is currently occupying the property, with a Best Western hotel and an abandoned strip mall on adjacent parcels. Fuel is no longer being stored or dispensed at or adjacent to the site. A map showing site features and well locations is provided in Figure 2.

This report presents the results of field activities completed by DBS&A and AcuVac Remediation, LLC (AcuVac) of Houston, Texas under work plan identification (WPID) #17887 (DBS&A, 2016) approved by the New Mexico Environment Department (NMED) Petroleum Storage Tank Bureau (PSTB) on June 26, 2017 (NMED, 2017). Field activities consisted of completing SVE pilot testing as describe herein. All field activities were conducted in accordance with DBS&A standard operating procedures, the New Mexico Environment Department (NMED) Underground Storage Tank Bureau Guidelines for Corrective Action (Guidelines) (NMED, 2000), and the approved work plan.

1.1 Investigation History

Historical aerial photographs indicate that prior to 1958 the site was occupied by a bulk fueling facility with six aboveground storage tanks (ASTs) and four dispenser islands. Between 1979 and 1988, the parcel was subdivided, the ASTs and dispenser islands were removed, and the Shamrock #63 station was constructed on the eastern portion of the original bulk fueling plant

property. A hotel was constructed on the western portion of the former bulk fueling facility in 1991.

The UST system was removed from the former Shamrock #63 site on April 19, 2006. Basin Engineering, Inc. (Basin) conducted the minimum site assessment (MSA) and additional investigations in 2006 and 2007. Results of soil sampling revealed minor impacts to soil in the northwest corner of the former UST nest and near the diesel fuel dispensing island. Soil samples were collected from two borings that were advanced in the area of the former UST nest in December 2006. The samples showed impacts to soil at depths of up to 75 feet below ground surface (ft bgs). The first five monitor wells (MW-1 through MW-5, Figure 2) were installed on-site between 2007 and 2011 (Basin, 2014).

In May 2014 Basin installed three new on-site groundwater monitor wells (MW-6 through MW-8, Figure 2) and completed a semiannual groundwater monitoring event (Basin, 2014). Results of groundwater monitoring completed after well installation showed light nonaqueous-phase liquid (LNAPL) to be present in newly installed monitor well MW-6 at thicknesses up to 1.52 feet. This was the first observed occurrence of LNAPL at the site. Analytical results from groundwater samples collected from the other site wells showed numerous contaminants of concern (COCs) to be present at concentrations above New Mexico Groundwater Quality Control Commission (NMWQCC) and New Mexico Environmental improvement Board (NMEIB) standards.

Basin was acquired by DBS&A in June 2014. DBS&A completed a subsequent second semiannual monitoring event in September 2014, with broadly similar results (DBS&A, 2014). Six new monitor wells were installed at the site in March 2015 (MW-9 through MW-14; Figure 2). Since well installation, LNAPL has been found to also be present in new monitor wells MW-9 (up to 0.99 foot) and MW-10 (up to 5.31 feet). Dissolved-phase contamination above applicable standards was present in groundwater samples collected from new monitor wells MW-11 and MW-14. Additional site activities completed by DBS&A in 2015 included quarterly groundwater monitoring, monthly LNAPL recovery events, and an indoor air screening survey of structures (DBS&A, 2015a and 2015b). Groundwater monitoring results indicated that the extent of LNAPL and dissolved-phase contamination were not delineated west of new monitor wells MW-10 and MW-11 or to the east of new monitor well MW-14.

A work plan for additional site investigation was submitted to the NMED PSTB and approved on June 26, 2017 under WPID #17887 (NMED, 2017). This work plan authorized the installation of additional wells to delineate the extent of LNAPL and dissolved-phase contamination at the site, as well as continued groundwater monitoring and SVE pilot testing. New groundwater monitor wells were installed between October 4 and October 10, 2017 (DBS&A, 2017), and first quarterly groundwater monitoring and LNAPL recovery was conducted from October 16 to 19, 2017 (DBS&A, 2018). Field investigation activities associated with SVE pilot testing are documented in this report in fulfillment of Deliverable ID #17887-3.

1.2 Site Hydrogeology

The geology underlying the site consists of a veneer of unconsolidated alluvial sediments underlain by the Pleistocene/Pliocene-age Ancha Formation. The Ancha Formation deposits comprise heterogeneous alluvial materials, composed of predominantly silty or clayey sand with varying amounts of gravel. The contact between the surficial alluvial material and the underlying sediments of the Ancha Formation is typically not discernable in borehole cuttings. Cross-sections depicting the site geology are provided in Figures 3 and 4.

Groundwater at the site occurs under unconfined conditions and is encountered at depths ranging between 76 and 84 ft bgs. The groundwater flow direction under the site is locally variable but has generally been to the southeast with a typical gradient on the order of 0.007 foot per foot.

1.3 Contaminants of Concern

Field observations and laboratory analytical results indicate that soil and groundwater at the site have been impacted by both diesel and gasoline releases from the former site facilities. COCs at the site include LNAPL, as well as dissolved-phase petroleum hydrocarbons—including benzene, toluene, ethylbenzene, total xylenes (BTEX), methyl tertiary-butyl ether (MTBE), and naphthalenes—and the fuel additives 1,2-dichloroethane (EDC) and 1,2 dibromoethane (EDB).

Initial soil borings and well installations following removal of the USTs from the former Shamrock #63 station indicated soil contamination extending from near the surface to the water

table in the vicinity of well MW-1. Subsequent investigations conducted in 2014 and 2015 indicated soil contamination extending from near the surface to the water table at wells MW-6 and MW-9, near the former bulk plant fuel dispensers. Contamination from these source areas spread out at depth, impacting deeper soils in the vicinity of wells MW-5, MW-7, MW-10, and MW-11.

LNAPL accumulations have consistently been observed in site wells MW-6, MW-9, and MW-10 at thicknesses up to 5.31 feet. LNAPL has not been observed in other site wells. A dissolved-phase contaminant plume extends a significant distance from known source areas and LNAPL accumulations. Benzene and other constituents have been detected in groundwater at concentrations exceeding the NMWQCC standards across a large area of the site bounded in the downgradient direction by wells MW-4, MW-12, MW-13, and MW-19, but undefined to the south and west of wells MW-17 and MW-18. Benzene was also present just above the NMWQCC standard in wells MW-8 and MW-15 at the eastern extent of the plume (DBS&A, 2018). There is limited potential for installing wells upgradient to the northwest from wells with known LNAPL accumulations due to the wide and active public right-of-way (ROW) associated with Cerrillos Road.

2. SVE Pilot Tests

DBS&A coordinated SVE pilot testing at the site on October 20 through 23, 2017. DBS&A subcontracted with AcuVac to perform the SVE pilot testing. Pilot tests were conducted in accordance with the approved work plan and included three 8-hour, step-up vacuum tests and one day of shorter 1-hour quick tests (QTs). The QTs were completed in accordance with a request to access contingency set-aside funds, which was approved by the PSTB on October 18, 2017. Step-up tests involved imposing a set of increasing vacuums and measuring well flow and vapor concentration responses at the extraction well, as well as vacuum response in surrounding wells. QTs involved observation of the extraction well only and provided a substantial amount of data in a short time frame, such as vapor well flow, well vacuum, and vapor concentrations. QTs were performed on six wells (MW-17, MW-11, MW-5, MW-1, MW-7, and MW-2) on October 21, and the full-length SVE pilot tests were conducted on MW-9,

MW-10, and MW-6 on October 20, 22, and 23, respectively. Details and results of pilot testing are discussed in Sections 2.1 through 2.4.

AcuVac reports for the full-length step-up tests and QTs, including field data sheets, are included in Appendix A. The AcuVac reports conform to the requirements stipulated in the PSTB SVE Pilot Testing Reporting Requirements Guidance (NMED, 2008). Details of specific equipment, gauges, and meters used for the pilot testing were included in the pilot test work plan and are included in Appendix B. During the pilot test, soil vapor samples from each well were collected and tested in the field for oxygen, carbon dioxide, and hydrocarbon concentrations (Appendix A, Schedules A and B). Hydrocarbon concentrations were measured in the field using a Horiba Automotive Emission Analyzer, which were compared to extracted air samples analyzed at Hall Environmental Analysis Laboratory (HEAL) of Albuquerque, New Mexico (Appendix C). DBS&A field notes and photographic documentation of the pilot tests are provided in Appendices D and E, respectively.

2.1 Quick Test Summary

QTs were performed on October 21, 2017 using monitor wells MW-1, MW-2, MW-5, MW-7, MW-11, and MW-17. Applied vacuum, well flow, and vapor concentrations measured in the field for each well are summarized in Table 1 of the AcuVac quick test report (Appendix A). The highest vapor concentrations were measured in samples collected from monitor well MW-11 with a maximum concentration of 81,160 parts per million by volume (ppmv); maximum vapor concentrations exceeded 40,000 ppmv in five of the six QT wells. In the remaining well, MW-17, vapor concentrations increased steadily through the hour-long test, with a maximum concentration of 2,920 ppmv. Vapor concentrations measured in the field during all six QTs exceeded the NMED action level of 100 ppmv.

A vacuum of 50 inches of water (" H_2O) was applied during the first two QTs, similar to the anticipated typical operational vacuum of an SVE system. Vapor recovery rates during these initial QTs at wells MW-17 and MW-11 were relatively low (<4.0 standard cubic feet per minute [scfm]). During subsequent QTs at wells MW-1, MW-2, MW-5, and MW-7, substantial vapor flow (approximately 28 to 39 scfm) was achieved at lower applied vacuum ranging from 26 to 42" H_2O.

Vapor flow per foot of open well screen was approximately 0.36 scfm in well MW-17, consistent with pilot test results indicating less conductive subsurface materials in this area of the site; vapor flow per foot of screen was slightly higher in well MW-11 (0.64 scfm). The greatest vapor flows per foot of screen were noted at wells MW-2 and MW-5 (approximately 5.1 and 5.3 scfm, respectively); these wells were also subject to least induced vacuum (27 and 26" H_2O, respectively). Vapor flows per foot of screen were approximately 2.5 and 3.9 scfm from wells MW-1 and MW-7, respectively; applied vacuums at those locations were 38" H_2O at MW-1 and 42" H_2O at MW-7. Limited open well screen intervals likely affected observed results and may not be representative of actual well flow that would be extracted from more typical SVE wells.

2.2 Pilot Test Summary

Longer duration (8-hour) step-up pilot tests were conducted at site monitor wells MW-6, MW-9, and MW-10. These wells are screened from 70 to 90 ft bgs for well MW-6 and from 72 to 92 ft bgs for wells MW-9 and MW-10. LNAPL was observed in each of these wells at the start of pilot testing. Observation wells were located at various directions and distances from the extraction well (Figure 1). Table 1 summarizes details for wells utilized during the pilot tests, including screened interval and distance from each extraction well.

Data recorded during each of the pilot tests are tabulated in Schedule A of the AcuVac report. These data include meteorological conditions (temperature and barometric pressure) and Horiba analyzer concentrations for hydrocarbons, carbon dioxide, and oxygen. The imposed well vacuum, resulting air flow, and the vacuums measured at the observation wells are also included in Schedule A. Graphical representations of the tabulated data are presented in Schedule B of the AcuVac report. Schedule A and Schedule B data for each SVE test are provided in Appendix A.

2.2.1 MW-6 Pilot Test

The MW-6 pilot test (referred to by AcuVac as SVE Test #1) was conducted on October 23, 2017. Three vacuum steps were imposed at MW-6 (25, 50, and 75" H_2O) over the course of approximately 8 hours. Observation wells were left unsealed overnight to minimize the effects of residual vacuum from previous tests and to encourage equalization of formation pressure with the atmosphere prior to testing. Nonetheless, slight initial vacuums ranging from 0.41 to

0.91“ H_2O were observed at observation wells prior to the start of the test. Figure 1 of the AcuVac report (Appendix A) shows selected well vacuum readings, normalized to the average imposed vacuum and adjusted to compensate for initial static vacuum (or pressure) and changes in barometric pressure.

Vacuum response in observation wells was immediate at the start of the test, and relatively small decreases in observed vacuum were noted with increasing distance in all directions from the extraction well. Maximum observed vacuums in all observation wells occurred approximately 5.5 hours into the test and ranged from 2.31 to 3.06“ H_2O in observation wells that were 43 to 100 feet from the extraction well (Appendix A). Induced well vacuum measurements at observation wells may have been affected by the initial static vacuum present in the wells and by fluctuations in barometric pressure during the course of the test, which rose during the first part of the test and fell sharply during the afternoon. The observed vacuum response in the observation wells around MW-6 was indicative of conductive, slightly anisotropic subsurface soils.

2.2.2 MW-9 Pilot Test

The MW-9 pilot test (referred to by AcuVac as SVE Test #2) was conducted on October 20, 2017. Three vacuum steps were imposed at MW-9 (25, 50, and 75“ H_2O) over the course of approximately 8 hours. Figure 1 of the AcuVac report (Appendix A) shows selected well vacuum readings, normalized to the average imposed vacuum and adjusted to compensate for initial static vacuum (or pressure) and changes in barometric pressure.

Vacuum response in observation wells was immediate at the start of the test, and relatively small decreases in observed vacuum were noted with increasing distance in all directions from the extraction well. At the maximum applied well vacuum (75“ H_2O), maximum measured observation well vacuums ranged from 2.75 to 4.43“ H_2O in observation wells that were 43 to 93 feet from the extraction well (Appendix A). Observation well MW-12 was considerably farther from the extraction well, at 179 feet, and showed a delayed response of much smaller magnitude, with a maximum observed vacuum of 0.76“ H_2O. The barometric pressure fell sharply after 12:00 PM, which may have impacted measurement of induced vacuums at observation wells during the later portion of the test. The observed vacuum response in the

observation wells around MW-9 was indicative of conductive and slightly anisotropic subsurface soils.

2.2.3 MW-10 Pilot Test

The MW-10 pilot test (referred to by AcuVac as SVE Test #3) was conducted on October 22, 2017. Three vacuum steps were imposed at MW-10 (20, 40, and 60" H_2O) over the course of approximately 8 hours. Observation wells were sealed with well caps following the QTs conducted on October 21, and the barometric pressure rose overnight between the QTs and SVE Test #3. As a result, significant initial vacuums ranging from 1.11 to 2.30" H_2O were observed at most observation wells prior to the start of the test; outer well MW-19 did not display an initial vacuum. Figure 1 of the AcuVac report (Appendix A) shows selected well vacuum readings, normalized to the average imposed vacuum and adjusted to compensate for initial static vacuum (or pressure) and changes in barometric pressure.

Vacuum response in observation wells was immediate at the start of the test, although the initial vacuum response was inversely proportional to the pre-test static vacuum, such that wells with high static vacuum showed relatively muted initial vacuum response, regardless of distance from the test well. The greatest induced vacuum measurements at observation wells were noted during the first half of the test and were typically greater than early-time vacuum readings recorded during other tests, despite lower applied vacuum and well flow at the extraction well. Measured observation well vacuums decreased during the second half of the test despite increasing applied vacuum at the extraction well. The observed trends likely reflect equalization of the high initial vacuum over the course of the test period combined with barometric effects.

Relatively small decreases in observed vacuum were noted with increasing distance from the extraction well. Maximum induced vacuums observed during the test ranged from 2.49 to 2.83" H_2O in observation wells that were 49 to 135 feet from the extraction well (Appendix A). Despite the difficulty of quantitatively interpreting the field measurements for this test, the observations are broadly consistent with previous tests and indicate moderately conductive, anisotropic subsurface soils.

2.3 Soil Vapor Sample Analytical Results

Three soil vapor samples were collected from the extraction well for each of the 8-hour SVE pilot tests. For each pilot test, the first sample was collected approximately one hour after system startup, the second half-way through the test, and the third sample one hour prior to system shutdown. One air sample was also collected from each of the QT locations at the end of the one-hour test period. Samples were submitted to HEAL for volatile organic carbon (VOC) analysis using U.S. Environmental Protection Agency (EPA) method 8021B and total petroleum hydrocarbons (TPH) as gasoline range organics GRO) using EPA method 8015B. Soil vapor analytical results are summarized in Table 2. The complete laboratory reports, including chain of custody documentation, are included in Appendix D.

For MW-6, reported TPH (GRO) concentrations for the three samples ranged from 120,000 to 150,000 micrograms per liter (µg/L). For MW-9, reported TPH (GRO) concentrations for the three samples ranged from 140,000 to 180,000 µg/L. For MW-10, reported TPH (GRO) concentrations for the three samples ranged from 200,000 to 230,000 µg/L. TPH (GRO) concentrations in samples collected from QT wells ranged from 28,000 in well MW-17 to 200,000 µg/L in well MW-11.

2.4 SVE Pilot Test Results

SVE pilot testing provides information about soil vapor flow that can then be used for SVE system design. In addition, the observation well vacuums at a given, imposed extraction well vacuum provide information for determining the corresponding effective radius of influence (ROI). Guidance on defining the limit of ROI varies depending on the source, ranging from 0.1 to 1.0“ H_2O as a limit. Other guidance suggests using 3 percent of the applied well vacuum.

2.4.1 MW-6 Pilot Test

The MW-6 pilot test was conducted at an average flow of 6.7 scfm and a maximum flow of 7.8 scfm. Due to a transducer failure, upwelling of fluid inside the well casing cannot be assessed, and flow per foot of open screen must be estimated. Assuming that the upwelling response is similar to that observed during the tests at wells MW-9 and MW-10 (approximately 90 to 100 percent of the applied vacuum), the well yielded an average of 1.0 scfm per foot of

open well screen and a maximum of 1.3 scfm per foot of open well screen at the maximum applied well vacuum (75“ H_2O).

Due to the effects of initial residual vacuum and barometric pressure changes, it is likely that early-time data over estimates the induced vacuum at observation wells, while late-time observations may under estimate the induced vacuum. Observational data gathered at 12:30 PM was utilized for the purposes of this evaluation; barometric pressure at this time was close to the daily average at the site, and it is presumed that any residual static vacuum effects would have dissipated by this point in the test. Using the selected observational data, an applied well vacuum of 75“ H_2O yields a ROI of approximately 100 feet. This is based on an observed vacuum of approximately 2.25“ H_2O, representing 3 percent of the applied well vacuum (Figure 5). The 1.0-inch and 0.1-inch vacuum thresholds would lie beyond the extent of the monitor well network used in this test and are not represented on the figure. The ROI is believed to be nearly circular, despite the lack of observation wells within the Cerrillos Road ROW. The ROI determined by this analysis is greater than the calculated ROI of 55 feet derived by AcuVac’s proprietary methodology (Appendix A, Figure1).

2.4.2 MW-9 Pilot Test

The MW-9 pilot test was conducted at an average flow of 11.9 scfm at an applied well vacuum of 25“ H_2O and 17.2 scfm at applied well vacuums of 50 and 75“ H_2O. Flow per foot of open screen was approximately 2.1 scfm at an applied vacuum of 25“ H_2O and 4.7 scfm at an applied vacuum of 50“ H_2O. At the maximum applied vacuum of 75“ H_2O, upwelling resulted in an 80 percent reduction of open screen, leaving only one to two feet of exposed screen remaining. In this configuration, vapor flow to the well is affected by surging fluid levels and flow within the outer sand pack, and the measured flow of approximately 12 scfm per foot of screen is not representative of expected performance characteristics of longer open screen intervals.

Observation well data gathered at 11:30 AM was utilized for the purposes of this evaluation; barometric pressure at this time had changed little from the start of the test, and it is presumed that any residual static pressure effects would have dissipated by this time. Using the selected observation well data, the applied well vacuum of 50“ H_2O yields a ROI of approximately 100 feet. This is based on a vacuum of approximately 1.5 inches, representing 3 percent of the applied well vacuum (Figure 6). Most of the observation wells used in this test lay within the

ROI, with only outer well MW-12 showing less than 3 percent response; thus the radius is considered somewhat approximate. The ROI is also believed to be slightly irregular, with a somewhat reduced vacuum response noted in the vicinity of well MW-10. The ROI determined by this analysis is greater than the calculated ROI of 55 feet derived by AcuVac's proprietary methodology (Appendix A, Figure 1).

2.4.3 MW-10 Pilot Test

The MW-10 pilot test was conducted at an average flow of 4.7 scfm and a maximum of 5.9 scfm at an applied well vacuum of 60" H_2O. Flow per foot of open screen was approximately 0.7 scfm at an applied vacuum of 20" H_2O and 1.3 scfm at an applied vacuum of 40" H_2O. At the maximum applied vacuum of 60" H_2O, the observed upwelling resulted in an 80 percent reduction of open screen, leaving just over 1 foot of exposed screen remaining. In this configuration, vapor flow to the well is affected by surging fluid levels and flow within the outer sand pack, and the measured flow of 3.8 scfm per foot of screen is not representative of expected performance characteristics of longer open screen intervals.

Interpretation of the field vacuum data is complicated by significant residual vacuum present at the start of the test and fluctuating barometric pressure throughout the test period. For example, measured vacuum response at observation wells was observed to decrease significantly during the second half of the test, even as the applied vacuum at the extraction well was stepped up. In many cases, more distal observation wells produced greater vacuum response readings than wells nearer to the extraction point. Measurements from observation wells suggest that complex subsurface conditions exist in the vicinity of MW-10. When combined with variable ambient conditions during the test period, test results are difficult to evaluate quantitatively. Therefore, an isopleth map was not compiled for this test. AcuVac attempted to compensate for the variable test conditions using a proprietary analysis, which yielded adjusted vacuum response of 0.55 and 0.41" H_2O at outer wells MW-16 and MW-11, respectively. The ROI of approximately 30 feet estimated by AcuVac at an extraction vacuum of 50" H_2O is based on an ROI vacuum threshold of approximately 1.5" H_2O, or 3 percent of the applied vacuum (Appendix A, Figure 1). However, the rapid vacuum response at even distal observation wells indicates that soils are reasonably conductive and that this is likely a conservative estimate.

2.4.4 Emissions

The hydrocarbon concentrations in the extracted vapor for both the pilot tests and the QTs were high. As described in the AcuVac report, the calculated average hydrocarbon emission rate was 6.9 pounds per hour (lb/hr) from extraction well MW-6, 17.67 lb/hr from extraction well MW-9, and 5.52 lb/hr from extraction well MW-10. However, the results of TPH GRO laboratory confirmation sampling were lower than the corresponding field screening results by 58 percent in well MW-6, 54 percent in well MW-9, and 38 percent in well MW-10. The age and composition of the petroleum contaminants can affect results obtained from different analytical methods. The emission rates from the AcuVac report are initial estimates of extracted vapor concentration and can be considered maximum expected emission rates. Emission calculations and a final determination of the need for and type of emission controls will need to be evaluated during design and implementation of a full scale remediation system.

3. Recommended Technologies

Actionable contamination appears in both the vadose zone and groundwater at the site. The subsurface soil technologies identified for further consideration as remedial alternatives at the site are direct SVE, bioventing, and natural attenuation.

- Soil vapor extraction: SVE is an in situ, unsaturated (vadose) zone soil remediation technology in which a vacuum is applied to the soil to induce the controlled flow of air through soil to remove volatile and some semivolatile contaminants. SVE requires high well flow through well connected pores to effectively remediate a site. The vapor being extracted from the soil may need to be treated to recover or destroy the contaminants depending on local and state air discharge regulations. Extraction wells are typically used at depths of 1.5 meters (5 feet) or greater and have been successfully applied as deep as 91 meters (300 feet). SVE is an applicable technology for this site. SVE pilot testing shows the site has relatively high ROI (as much as 100 feet) at a reasonable applied well vacuum of 50 to 75“ H_2O.

- Bioventing: Bioventing stimulates the natural, in situ biodegradation of any aerobically degradable compounds in soil by providing oxygen to existing soil microorganisms. In

contrast to SVE, bioventing uses low well flow rates to provide only enough oxygen through direct air injection to sustain ongoing microbial activity in the contaminated soil. In addition to degradation of adsorbed fuel residuals (e.g. naphthalenes and other higher molecular weight compounds), VOCs are biodegraded as vapors move slowly through biologically active soil. Although the time frame for bioventing is longer that active extraction by SVE, it is a potentially applicable technology for this site

- Natural Attenuation: Natural attenuation is a collective term for conditions where natural subsurface processes—such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials—are allowed to reduce contaminant concentrations to acceptable levels. The time frame for natural attenuation is much longer than that for the other technologies. It may be appropriate in the future, but is considered a marginal technology at this time.

4. Conclusions

DBS&A completed an SVE pilot test to evaluate subsurface characteristics at the site. Well flow, vacuum responses, and contaminant concentrations indicate that SVE is a viable technology for remediating the vadose zone at the site. The ROI and anticipated vacuum and air flow rates derived from the pilot test will provide valuable information for design and implementation of a full-scale remediation system. The PSTB may also wish to consider fluid recovery and groundwater treatment to combat the LNAPL and solute plumes at the site. Additional investigation may be required to assess the extent of the LNAPL and solute plumes under the Cerrillos Road corridor abutting the site to the north. No matter the remedial alternative selected, groundwater monitoring and LNAPL recovery should continue under the approved work plan to assess the stability of the solute and LNAPL plumes.

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Figures

Image source: ESRI ArcGIS Online and data partners, including imagery from agencies supplied via the Content Sharing Program.

N

0 250 500
Feet

SHAMROCK #63
3624 CERRILLOS ROAD
SANTA FE, NEW MEXICO

Area Map

Daniel B. Stephens & Associates, Inc.
2/8/2016
JN BE14.0012

Figure 1

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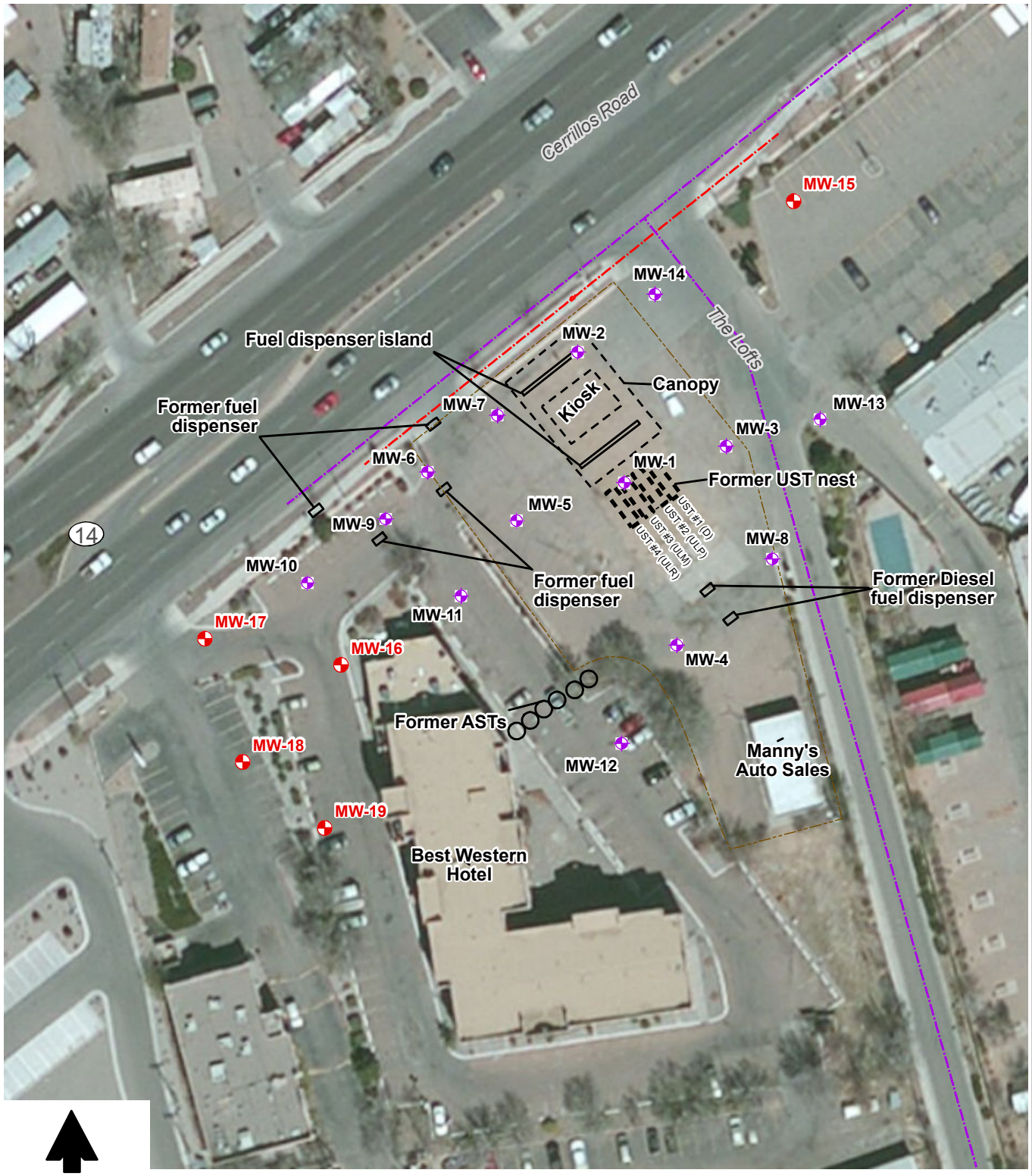

Source: 1. Adapted from ESRI ArcGIS Online and data partners imagery.
2. Fuel dispenser and AST locations detemined in consultation with NMED-PSTB.

Explanation

- Monitor well
- Newly installed monitor well
- Property line
- Sanitary sewer
- Buried electric/telecom

SHAMROCK #63
3624 CERRILLOS ROAD
SANTA FE, NEW MEXICO

Site Map

Daniel B. Stephens & Associates, Inc.
11/29/2017
JN BE14.0012

Figure 2

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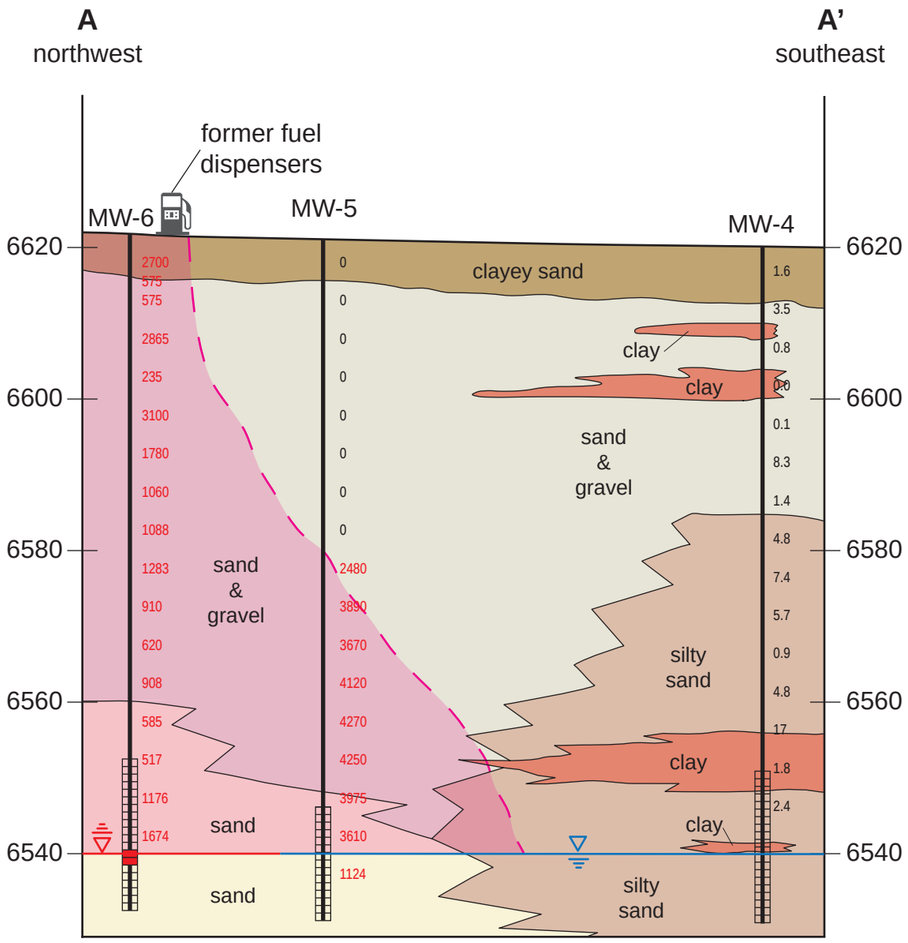
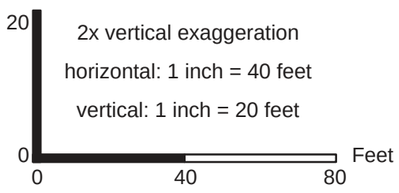
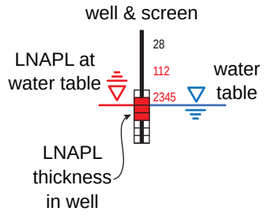


Source: 1. Adapted from ESRI ArcGIS Online and data partners imagery.
2. Fuel dispenser and AST locations detemined in consultation with NMED-PSTB.





PID readings (ppm) are shown at the depth taken next to each well; readings >100ppm are highlighted in red to show areas of actionable contamination.

Explanation

- clayey sand, clayey sand & gravel
- gravely sand
- sand, few gravels or fines
- silty sand, silty sand w/gravel
- clay
- hydrocarbon impacted soils

SHAMROCK 63

Cross Section A-A'

Figure 3

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11/20/2017 JN BE14.0012.00

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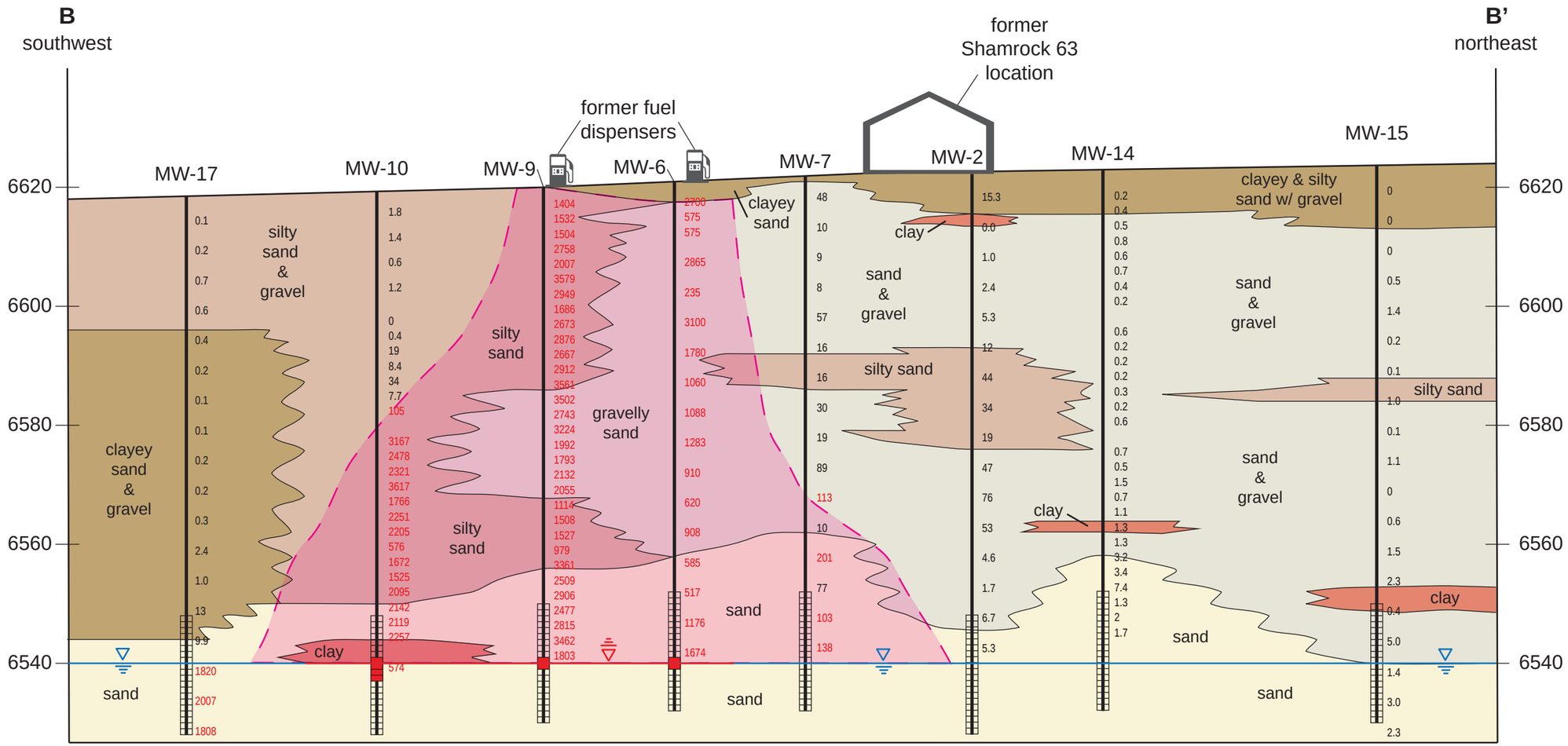

20
2x vertical exaggeration
horizontal: 1 inch = 40 feet
vertical: 1 inch = 20 feet
0
0
40
80
Feet

well & screen
LNAPL at water table
water table
LNAPL thickness in well

PID readings (ppm) are shown at the depth taken next to each well; readings >100ppm are highlighted in red to show areas of actionable contamination.

Explanation

- clayey sand, clayey sand & gravel
- gravely sand
- sand, few gravels or fines
- silty sand, silty sand w/gravel
- clay
- hydrocarbon impacted soils

SHAMROCK 63

Cross Section B-B'

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Daniel B. Stephens & Associates, Inc.
11/20/2017
JN BE14.0012.00

Figure 4

Explanation

MW-5 Well designation

2.78" H_2O Vacuum response (inches H_2O)

Vacuum response isopleth

Monitor well

Newly installed monitor well

Notes: 1. Isopleth dashed where inferred
2. NM = Not measured

Source: 1. Aerial photo dated June 2017 acquired from Google Earth.
2. Fuel dispenser and AST locations detemined in consultation with NMED-PSTB.

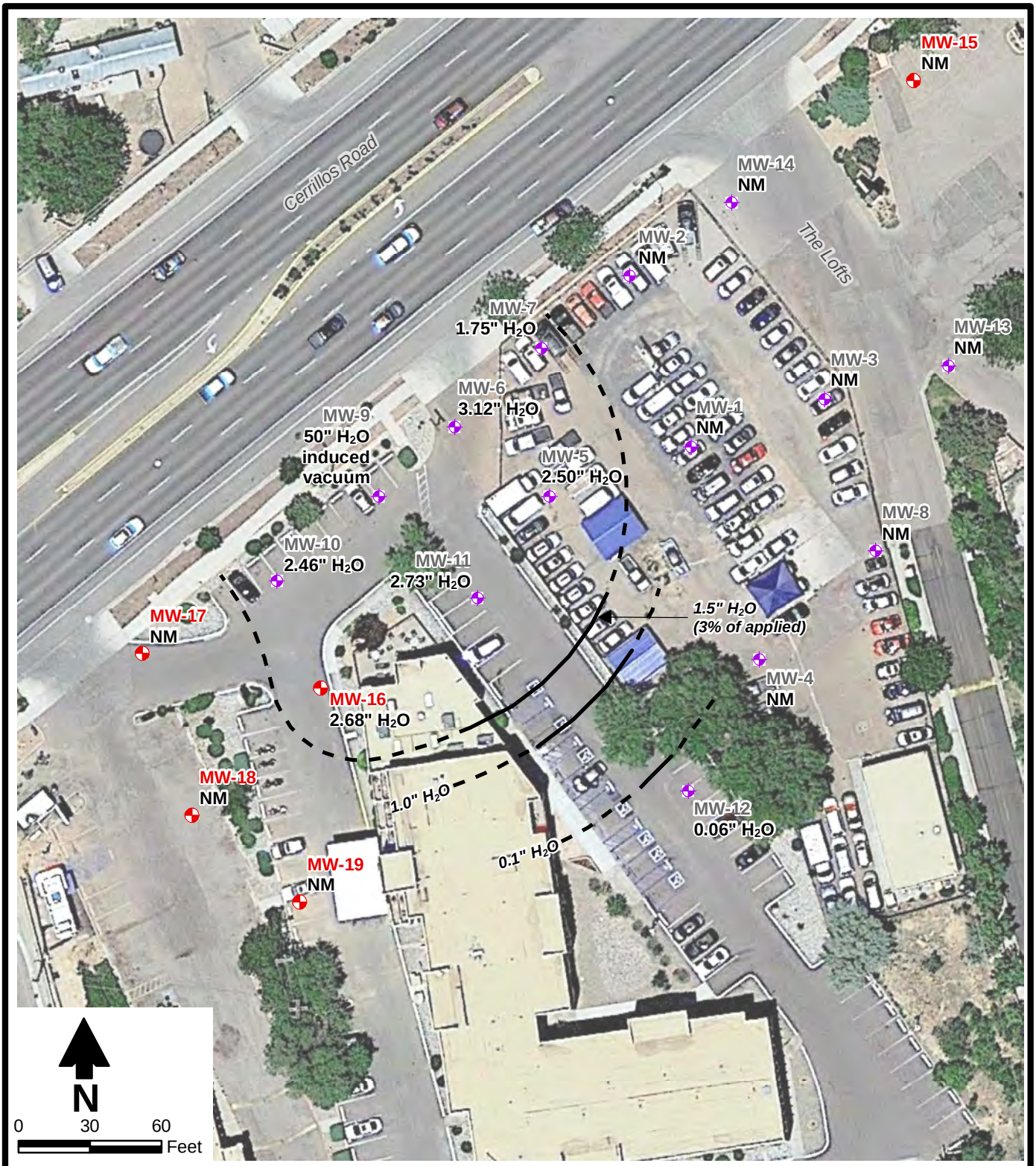
SHAMROCK #63
3624 CERRILLOS ROAD
SANTA FE, NEW MEXICO

Vacuum Response Isopleths
SVE Test 1 (MW-6)

Daniel B. Stephens & Associates, Inc.
1/17/2018 JN BE14.0012

Figure 5

S:\Projects\BE14.0012_Shamrock_63\GIS\MXDs\Reports\SVE_Pilot_2018-01\Fig05_MW-6_pilot_isopleths.mxd



Explanation

MW-5 Well designation

2.78" H_2O Vacuum response (inches H_2O)

Vacuum response isopleth

Monitor well

Newly installed monitor well

Notes: 1. Isopleth dashed where inferred
2. NM = Not measured

Source: 1. Aerial photo dated June 2017 acquired from Google Earth.
2. Fuel dispenser and AST locations detemined in consultation with NMED-PSTB.

SHAMROCK #63
3624 CERRILLOS ROAD
SANTA FE, NEW MEXICO

Vacuum Response Isopleths
SVE Test 2 (MW-9)

Daniel B. Stephens & Associates, Inc.
1/17/2018 JN BE14.0012

Figure 6

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Tables

Table 1. Summary of Extraction and Observation Well Data
Former Shamrock No. 63, Santa Fe, New Mexico

Well	Purpose	Distance from Extraction Well (feet)			Well Diameter (inches)	Screen Interval (feet bgs)	Static Water Depth (feet btoc)	LNAPL Thickness (feet)	Water Level Measure Date
		MW-6	MW-9	MW-10					
MW-1	QT	NA	NA	NA	2	74 - 94	82.08	0.00	10/21/2018
MW-2	OBS, QT	97	NA	NA	2	75 - 90	82.07	0.00	10/23/2018
MW-5	OBS, QT	NA	72	NA	2	75 - 90	80.93	0.00	10/20/2018
MW-6	EXT, OBS	—	43	99	2	70 - 90	81.32[a]	0.70	10/20/2018
MW-7	OBS, QT	49	93	NA	2	70 - 90	82.29	0.00	10/20/2018
MW-9	EXT, OBS	43	—	56	2	72 - 92	79.34[a]	0.19	10/20/2018
MW-10	EXT, OBS	99	56	—	2	72 - 92	77.99[a]	0.58	10/20/2018
MW-11	OBS, QT	72	59	85	2	72 - 92	77.79	0.00	10/20/2018
MW-12	OBS	NA	179	NA	2	72 - 92	76.12	0.00	10/20/2018
MW-16	OBS	NA	84	49	2	70 - 90	76.30	0.00	10/20/2018
MW-17	OBS, QT	NA	NA	64	2	69.5 - 89.5	78.95	0.00	10/22/2018
MW-18	OBS	NA	NA	105	2	69.5 - 89.5	76.64	0.00	10/22/2018
MW-19	OBS	NA	NA	135	2	70 - 90	76.30	0.00	10/22/2018

bgs = Below ground surface
btoc = Below top of casing
EXT = Extraction
OBS = Observation
QT = Quick test
NA = Not available
LNAPL = Light nonaqueous-phase liquid

Table 2. Summary of Analytical Organic Chemistry Data for Soil Vapor
Former Shamrock No. 63, Santa Fe, New Mexico

Sampling Point	Date Sampled	Concentration [a] (µg/L)						
		Benzene	Toluene	Ethyl-benzene	Total Xylenes	BTEX	MTBE	TPH (GRO)
MW-6 @ 0730	10/23/17	830	670	39	190	1,729	<50	150,000
MW-6 @ 1030	10/23/17	670	390	37	200	1,297	<50	120,000
MW-6 @ 1330	10/23/17	740	340	19	99	1,198	<50	130,000
MW-9 @ 0930	10/20/17	980	260	42	190	1,472	<120	180,000
MW-9 @ 1230	10/20/17	760	230	38	200	1,228	<50	140,000
MW-9 @ 1530	10/20/17	800	230	26	140	1,196	<50	150,000
MW-10 @ 0930	10/22/17	980	970	56	260	2,266	<50	200,000
MW-10 @ 1230	10/22/17	880	930	69	370	2,249	<50	220,000
MW-10 @ 1530	10/22/17	860	840	56	300	2,056	<50	230,000
MW-1 QT	10/21/17	430	76	20	120	646	<50	130,000
MW-2 QT	10/21/17	220	15	<10	<20	235	<50	77,000
MW-5 QT	10/21/17	340	130	12	63	545	<50	79,000
MW-7 QT	10/21/17	380	50	13	40	483	<50	120,000
MW-11 QT	10/21/17	890	300	34	260	1,484	<50	200,000
MW-17 QT	10/21/17	58	14	<10	<20	72	<50	28,000

[a] Analyzed in accordance with U.S. Environmental Protection Agency (EPA) methods 8021B for VOCs and 8015B for TPH (GRO).

µg/L = Micrograms per liter
BTEX = Benzene, toluene, ethylbenzene, and total xylenes
MTBE = Methyl tertiary-butyl ether
TPH = Total petroleum hydrocarbons
GRO = Gasoline range organics

Appendix A

AcuVac Reports

AcuVac Remediation, LLC
1656-H Townhurst, Houston, Texas 77043
713.468.6688 • www.acuvac.com

October 28, 2017

Mr. John Casey P.E.
Daniel B. Stevens & Associates
125 Mercado Street, Suite 119
Durango, Colorado 81301

Re: Shamrock #63, 3624 Cerrlllos Road, Santa Fe, NM

Dear John:

At your request, we performed three Soil Vapor Extraction (SVE) Pilot Tests on October 20, 22 and 23, 2017 at the above referenced site. An Environmental Specialist, with extensive experience of on-site testing, conducted the Pilot Test. The total SVE test time for each test, including static data time, was 8.6 hours. The contaminant was weathered gasoline. Phase separated Hydrocarbons (PSH) are referred to as Light Non-Aqueous Phase Liquids (LNAPL). The Tests were performed in the following order:

- October 20, 2017- SVE Test #2 was performed on Well MW-9 due to limitations related to the hotel parking lot traffic.
- October 21, 2017- SVE Quick Tests were performed on several observation wells. The results of these Quick Tests is covered in a separate report.
- October 22, SVE Test #3 was performed on well MW-10.
- October 23, 2017- SVE Test #1 was performed on well MW-6.

SUMMARY OF CONDITIONS

SVE Test #2 was performed on October 20, 2017 when the site was in its static condition- that is there was no vacuum applied to any part of the formation prior to the start of the test. At the end of the test, the well plugs were replaced in all wells that were part of the test.

On October 22, 2017, the SVE Quick Tests were performed that applied vacuum to wells throughout the formation. At the end of each test, the well plug was replaced thus sealing the well. The barometric pressure increased during the course of the Quick Tests 0.06 "Hg, or 0.82 "H_2O. The effect of the increase in barometric pressure was to increase the static vacuums in the wells.

On October 22, 2017, SVE Test #3 was performed on well MW-10. In the period of time from the end of the Quick Tests to the start of SVE Test #3, the barometric pressure had increased from 29.94 "Hg to 30.31"Hg, or 5.04 "H_2O. This created high static vacuums in the monitoring wells at the start and the conclusion of SVE Test #3. To partially compensate for the increase in the static well vacuums, the start of Test #3 was delayed 30 minutes. At the conclusion of Test #3 the wells were

left open, no plugs, but the cover to the well vault was secured. This was done to allow the wells to equilibrate overnight before the start of SVE Test #1 on October 23, 2017. By leaving the wells open, the static vacuums/(pressures) in the well at the start of SVE Test #1 were lower.

The table below illustrates the barometric pressure during the course of the tests.

		Barometric Pressure			
		Test		Increase/Decrease	
Test Number	Date	Start	End	"Hg	"H_2O
SVE #2	10/20/2017	29.98	29.82	(0.16)	(2.18)
Quick Tests	10/21/2017	29.88	29.94	0.06	0.82
SVE #3	10/22/2017	30.31	30.24	(0.07)	(0.95)
SVE #1	10/23/20107	30.31	30.27	(0.04)	(0.54)

CONDITIONS AFFECTING PILOT TESTS

- Generally, a decreasing barometric pressure results in increased well pressures (decreased vacuums) on those wells plugged and sealed at the TOC, while an increasing barometric pressure results in increased well vacuums. This is the function of liquid levels increasing and decreasing. **There are many variables that can affect Pilot Test data, but barometric pressure fluctuations have the most immediate and profound effect.** This assumes that SVE short-circuiting is not a factor.

- To offset the induced vacuum/pressure as a result of liquid depression or upwelling in the outer monitoring wells, the wells are vented periodically to atmosphere and then re-plugged prior to recording data at select intervals. The potential for increased vacuum or pressure as a result of in/decreasing liquid levels will be minimized. Liquid depression surrounding an outer observation well will result in an induced vacuum not associated with the induced vacuum created in the EW. Likewise, liquid mounding will create the opposite effect creating well pressures.

OBJECTIVES

The Objectives of an SVE Pilot Test are to:

- Evaluate the potential for removing vapor phase LNAPL from the vadose zone.
- Provide data on the vapor phase concentrations in the influent vapors.
- Determine the SVE ROI to remove vapor phase LNAPL

The purpose of the extraction well induced vacuum variable rate test is to define the pressure/flow characteristics of sub-surface soils around the extraction well and to estimate potential conditions for an operational SVE System. Starting a test with lower variable rates of vacuum and flow allows the extraction well and outer wells sufficient time to adjust and stabilize and minimizes the risk of developing preferential paths. This will also assist the development of newly installed extraction wells.

METHODS AND EQUIPMENT

The test was conducted using AcuVac's I-6 System, with Roots RAI-33 and RAI-22 blowers, various instrumentation, including the HORIBA® Analyzer, Solinst Interface Probes, Lumidor O_2 Meter, In-Situ data logger, vapor flow gauges, a sensitive instrument to determine barometric pressure, V-1 vacuum box to capture non-diluted vapor samples, and other special equipment.

The vacuum extraction portion of the AcuVac System consists of a vacuum pump driven by an internal combustion (IC) engine. The vacuum pump is connected to the extraction well and the vacuum created on the extraction well causes light hydrocarbons in the soil and on the groundwater to volatilize and flow through a moisture knockout tank, to the vacuum pump and the IC engine where they are burned as part of the normal combustion process. Propane is used as auxiliary fuel to help power the engine if the well vapors do not provide the required BTU.

The AcuVac IC engine is fully loaded for maximum power that is necessary to achieve and maintain high induced vacuums and/or high well vapor flows required to maximize the vacuum SVE Radius of Influence (ROI) for Pilot Tests and short term Event remediation. The lower part of the IC engine is encased with a liquid collection pan designed to catch any oil drips or liquid leaks if it should occur.

Emissions from the engine are passed through three catalytic converters to ensure maximum destruction of removed hydrocarbon vapors. The engine's fuel to air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for all IC engine driven equipment, all systems stop when the engine stops. This eliminates any uncontrolled release of hydrocarbons. Since the AcuVac System is held entirely under vacuum, any leaks in the seals or connections are leaked into the System and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure, over speed or overheating.

PROJECT SCOPE AND PROCEDURES

- Open selected extraction well and outer observation wells. Install In-Situ data logger in the extraction well to record any groundwater and LNAPL that enters the extraction well during the test period. Install an interface probe in the extraction well to determine if groundwater is present.
- Record the distances from the selected extraction well to the outer wells.
- Connect the AcuVac System to the extraction well and record the static/baseline well data, total depth and screen intervals and then apply vacuum. Record the vacuum and well flow, all System data (including fuel flow of propane), temperature, barometric and absolute pressures.
- Set the SVE induced vacuum and vapor well flow at the selected range.
- Install and observe the magnehelic gauges or connect a digital manometer on the outer observantion wells to determine if the selected extraction well is in vacuum communication with the outer observation wells. Record the data at a selected interval of time.
- Collect non-diluted influent vapor samples to provide on-site HORIBA® and Lumidor Analyzer analytical data consisting of TPH up to 100,000 ppmv, $C0_2$%. CO%, 0_2% and H_2S ppm.

- Record the vacuums or pressures on the outer observation wells.
- Operate the SVE System in such a manner that all well vapors are passed through the engine and catalytic converters to destruct the contaminants, and exhausted, meeting air emission standards.
- Comply with all safety regulations.
- Complete the SVE test by providing a report consisting of operating and analytical data, and projection of an SVE ROI.

The reports for each SVE Test is attached. Once you have reviewed the report, please call me if you have any questions.

Sincerely,

ACUVAC REMEDIATION, LLC

James E. Sadler,
VP Engineering/Environmental

Paul D. Faucher
VP Operations

TEST #SVE-1

PRE-TEST FUNCTIONS - TEST #SVE-1

Prior to starting this test, all the AcuVac systems were checked for normal and safe operation. The barometric and absolute pressure and ambient air temperature levels were recorded. The depth to groundwater (82.3.3 ft BTOC) and depth to LNAPL (81.45 ft BTOC), this resulted in an LNAPL thickness of 0.88 ft. in the SVE extraction well (MW-6). Each magnehelic gauge was checked and calibrated zero. The outer monitoring wells were plugged with expandable designed to accept a digital manometer. The data logger (pressure transducer) was installed in the extraction well MW-6. The propane tank fuel level was recorded so that an accurate fuel consumption could be estimated for the total test period. The HORIBA® Analyzer was set for the local elevation and calibrated with SPAN gas, which contains hexane and CO_2. All required static/baseline data was recorded before engaging the SVE System and the required safety checks were performed on the System.

DISCUSSION OF DATA - TEST #SVE-1

Test #SVE-1, with vacuum extraction, was an 8.6 hour MDP test, including static well data, conducted from well MW-6 as the extraction well. Immediately prior to starting the test, the selected outer observation wells; MW-9 (43.0 ft), MW-11 (73.0 ft) and MW-10 (99.0 ft), were recording slight vacuums of 0.90 "H_2O, 0.41 "H_2O and 0.51 "H_2O, respectively. The high static vacuums on the wells is most likely the results of previous SVE Tests and SVE Quick Tests, and the increase in barometric pressure from the conclusion of the QTs to the start of Test #SVE-3. Wells MW-5 (49.0 ft), MW-7 (50.0 ft) and MW-2 (100.0 ft) were not accessible. The general weather conditions were clear and cool. At the start of the SVE test, the extraction induced vacuum was set at 25"H_2O, with an initial well vapor flow of 4.72 scfm.

An In-Situ Data Logger was positioned slightly above the bottom (90.0 ft BTOC) of the extraction well MW-6 and well MW-9 (43.0 ft) to determine the extent of upwelling that may occur during the test.

During the first 2.0 hours of the test, the extraction well induced vacuum remained constant at 25"H_2O with a well vapor flow of 4.72 scfm, which remained steady during the period. Outer well MW-9, which is located 43.0 ft from the extraction well, immediately recorded an increasing well vacuum from 0.90 to 0.94"H_2O and continued on an increasing vacuum trend during the test period to 1.83"H_2O. Outer well MW-11 which is located 73.0 ft from the extraction well had an immediate reaction to the induced well vacuum, increasing to 1.34"H_2O during the test period. Well MW-10 which is located 99.0 ft from the extraction well had an immediate reaction to the induced well vacuum, increasing to 1.26"H_2O during the test period. Outer wells MW-5, MW-7 and MW-2 were not accessible at the start of the test. Accordingly, no data was recorded for these wells.

HORIBA® analytical data indicated the two influent vapor samples taken from the extraction well had TPH vapor concentrations of 55,770 and 75,720 ppmv, with CO_2 at 2.06 and 2.54%, CO at 1.78 and 4.22%, O_2 at 6.9 and 5.7% and H_2S at 3.1 and 2.1 ppm. Some propane was required as the influent vapors were supplying approximately 70% of the IC engine fuel. The HC levels were within the

range normally found in soil gas samples collected from an area contaminated with gasoline and weathered gasoline.

At test hour 2.0, the test continued with the induced vacuum increased to 50"H_2O and a well flow of 6.94 scfm. The test period was 3.0 hours with the extraction well induced vacuum and well vapor flow remaining steady during the period. Outer well MW-9 continued on an increasing vacuum trend to 2.16"H_2O at test hour 2.0 and then increased for the next 2.5 hours to 2.94"H_2O. Outer well MW-11 continued to record an increasing vacuum trend to 1.71"H_2O at test hour 2 and then increased for the next 2.5 hours to 2.57"H_2O at test hour 4.5. Outer well MW-10 continued to record an increasing vacuum trend to 1.26"H_2O at test hour 2 and then increased for the next 2.5 hours to 2.36"H_2O at test hour 4.5. Outer wells MW-5, MW-7 and MW-2 became accessible at test hour 3.0. These wells recorded vacuums at test hour 3.0 and remained on an increasing trend through test hour 4.5. The ambient air temperature increased to 55.0°F and the barometric increased from 30.32 to 30.37"Hg. The influent vapor temperature increased from 56.0 to 60°F.

Additional HORIBA® analytical data indicated the influent vapor samples recorded TPH levels of 77,870, 74,890, 77,550 and 76,240 ppmv, with CO_2 at 2.40, 2.10, 2.53 and 2.47%, CO at 4.36, 4.34, 4.48 and 4.40%, O_2 at 5.9, 5.5, 5.7, and 5.9% and H_2S at 0 ppm. The influent vapors supplied 100% of the IC engine's fuel and the TPH levels continued to be within the range of gasoline.

At test hour 5.0, the test continued with the induced vacuum increased to 75"H_2O and a well flow of 7.75 scfm. The test period was 3.0 hours, and the extraction well induced vacuum and well vapor flow remained steady. Outer well MW-9 vacuum increased to 2.97 "H_2O and remained mostly steady until test hour 7.5 when it deceased to 2.79 "H_2O. Outer well MW-11 continued to record an increasing vacuum trend to 2.70"H_2O at test hour 5.5 and then had a decreasing trend for the remainder of the test, most likely as a result of the deceasing barometric pressure. Outer wells MW-5, MW-7, and MW-2 recorded a mostly decreasing trend from test hour 5 through the end of the test. The ambient air temperature increased to 65.0°F and the barometric pressure decreased to 30.28 "Hg. The influent vapor temperature increased from 60 to 64°F.

Additional HORIBA® analytical data indicated the influent vapor samples recorded HC levels of 82,700, 79,980, 81,110 and 72,340 ppmv, with CO_2 at 2.60, 4.58, 4.70, and 3.52%, CO at 5.34, 1.72, 1.82 and 1.28%, O_2 at 6.9, 6.7, 6.5 and 6.3% and H_2S at 3.0, 3.0, 3.1 and 2.0 ppm. The influent vapors continued to supply 100% of the IC engine's fuel.

RADIUS OF INFLUENCE

Figure #1 indicates that the effective vacuum radius of influence from Test #SVE-1 would be from 34.17 to 39.44 ft, with extraction well flow of 6.50 to 7.50 scfm and extraction well vacuum in the 55 to 60"H_2O range. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is 1.65 to 1.80"H_2O or approximately 3.0% of the average induced vacuum of 55.41"H_2O. It is assumed that beyond the lower point, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well. Under continuous operation, vacuum and radius of influence will most likely continue to increase horizontally and vertically**.**

All ROI calculations are site specific. At this site, the projected ROI is based on approximately 6.0 ft of well screen available to the induced vacuum. This equates to approximately 1.12 scfm per foot of screen. With an induced vacuum in the 55 - 60"H_2O range, liquid most likely will continue to accumulate in the well. A liquid recovery system may be required and be operational on the same schedule as the SVE induced vacuum.

The effective vacuum radius of influence is based on calculations and equations using a software program of which data was provided from an extensive database collected by AcuVac over a period of years. Each projection is based on the test data and site parameters, and takes into consideration such variables as barometric pressure oscillations and gauge error. Although we cannot provide total assurance of accuracy, past experience and results have proven these projections to be well within the acceptable range of accuracy.

To calculate MDP well placement, the equation we use is as follows:

L= 2 ROI Cos 30° (L = distance between wells; ROI = radius of influence)

All other data, including the groundwater depth, well placement, extraction well screened intervals, induced vacuum and vapor well flow, and liquid recovery rate, must be considered in the final design for a Corrective Action Plan (CAP).

CONCLUSION

Pilot Tests are conducted to provide information on short term tests that can be projected into long term remedial plans. These feasibility tests indicated that Soil Vapor Extraction (SVE) should provide **the most effective method** of remediation for this facility. **The tests results provided sufficient data to project that certain wells are in vacuum communication with the selected extraction well.** The vacuum radius of influence defines the region within which the vapor in the vadose zone flows to the extraction well under the influence of a vacuum. The radius of influence depends on the soil properties of the vented zone, properties of surrounding soil layers, the depth at which the well is screened, well installation and the presence of any impermeable boundaries such as the water table, clay layers, surface seal, building basements and the presence of such areas as tank pits with backfill and underground utilities..

EMISSION DATA

During this Pilot Test, HORIBA® data indicated that the influent vapors had an average hydrocarbon level (TPH) of 75,417 ppmv. Using an average well flow of 6.72 scfm from this extended test, **the calculated emissions from <u>one</u> extraction well without vapor treatment were as follows:**

HC	=	165.60 lbs/day	=	6.90 lbs/hr
Benzene (1%)	=	1.66 lbs/day	=	0.07 lbs/hr

ADDITIONAL INFORMATION

The HORIBA® analytical instrument is calibrated with Hexane and CO_2.

The formula used to calculate the emission rate is:

$$ER = HC\ (ppmv) \times MW\ (Hexane) \times Flow\ Rate\ (scfm) \times 1.58E^{-7} \frac{(min)(lb\ mole)}{(hr)(ppmv)(ft^3)} = lbs/hr$$

ATTACHED SCHEDULES AND FIGURES

- Figure #1: Plot of Observed Vacuum vs Distance at the Facility (ROI) at 3% of Induced Vacuum
- Table #1A: Well Data
- Table #1B: Extraction Well Operating Data
- Table #1C: Observation Well Operating Data
- Schedule A: Summary of Test Data
- Schedule B: Graphic Summary of Data
- Field Operating Data and Notes – Test #SVE-1
- Site Photographs

TEST #SVE-2

PRE-TEST FUNCTIONS - TEST #SVE-2

Prior to starting this test, all the AcuVac systems were checked for normal and safe operation. The barometric and absolute pressure and ambient air temperature levels were recorded. The depth to groundwater (79.53 ft BTOC) and depth to LNAPL (79.34 ft BTOC), this resulted in an LNAPL thickness of 0.19 ft. in the SVE extraction well (MW-6). Each magnehelic gauge was checked and calibrated zero. The outer monitoring wells were plugged with expandable designed to accept a digital manometer. The data logger (pressure transducer) was installed in the extraction well MW-9. The propane tank fuel level was recorded so that an accurate fuel consumption could be estimated for the total test period. The HORIBA® Analyzer was set for the local elevation and calibrated with SPAN gas, which contains hexane and CO_2. All required static/baseline data was recorded before engaging the SVE System and the required safety checks were performed on the System.

DISCUSSION OF DATA - TEST #SVE-2

Test #SVE-2, with vacuum extraction, was an 8.6 hour MDP test, including static well data, conducted from well MW-9 as the extraction well. Immediately prior to starting the test, the selected outer observation wells; MW-6 (43.0 ft), MW-10 (56.0 ft) and MW-11 (59.0 ft), were recording slight pressures or no influence of (0.49) "H_2O, 0 "H_2O and (0.06) "H_2O, respectively. Wells MW-5 (72.0 ft), MW-7 (93.0 ft) and MW-12 (179.0 ft) were not accessible. The general weather conditions were clear and cool. At the start of the SVE test, the extraction induced vacuum was set at 25"H_2O, with an initial well vapor flow of 11.91 scfm.

An In-Situ Data Logger was positioned slightly above the bottom (92.0 ft BTOC) of the extraction well MW-9 and well MW-6 (43.0 ft) to determine the extent of upwelling that may occur during the test.

During the first 2.0 hours of the test, the extraction induced vacuum remained constant at 25"H_2O with a well vapor flow of 11.91 scfm, which remained steady during the period. Outer well MW-6, which is located 43.0 ft from the extraction well, immediately recorded an increasing well vacuum from a pressure of (0.49) to a vacuum of 0.21"H_2O and continued on an increasing vacuum trend during the test period to 1.67"H_2O. Outer well MW-10 which is located 56.0 ft from the extraction well had an immediate reaction to the induced well vacuum, increasing to 1.32"H_2O during the test period. Well MW-16 which is located 84.0 ft from the extraction well had an immediate reaction to the induced well vacuum, increasing to 1.14"H_2O during the test period. Outer wells MW-5, MW-7 and MW-12 were not accessible at the start of the test. Accordingly, no data was recorded for these wells.

HORIBA® analytical data indicated the two influent vapor samples taken from the extraction well had TPH vapor concentrations of 83,120 and 80,300 ppmv, with CO_2 at 2.68 and 2.28%, CO at 5.28, and 5.05%, O_2 at 5.7 and 4.8% and H_2S at 4.1 and 3.1 ppm. The influent vapors were supplying 100% of the IC engine fuel. The HC levels were within the range normally found in soil gas samples collected from an area contaminated with gasoline and weathered gasoline.

At test hour 2.0, the test continued with the induced vacuum increased to 50"H_2O and a well flow of 17.09 scfm. The test period was 3.0 hours with the extraction well induced vacuum and well vapor flow remaining mostly steady during the period. Outer well MW-6 continued on an increasing vacuum trend to 2.39"H_2O at test hour 2.0 and then increased for the next 2.5 hours to 3.22"H_2O. Outer well MW-10 continued to record an increasing vacuum trend to 1.61"H_2O at test hour 2 and then increased for the next 2.5 hours to 2.37"H_2O at test hour 4.5. Outer well MW-11 continued to record an increasing vacuum trend to 1.71"H_2O at test hour 2.0 and then increased for the next 2.5 hours to 2.86"H_2O at test hour 4.5. Outer wells MW-5, MW-7 and MW-2 became accessible at test hour 3.0. These wells recorded vacuums at test hour 3.0 and remained on an increasing trend through test hour 4.5. The ambient air temperature increased to 61.0°F and the barometric decreased from 29.98 to 29.89"Hg. The influent vapor temperature increased from 60.0 to 62°F.

Additional HORIBA® analytical data indicated the influent vapor samples recorded HC levels of 81,160, 75,330 and 78,010 ppmv, with CO_2 at 2.50, 2.30, 1.87, and 2.20%, CO at 4.26, 4.14, 3.76 and 5.56%, O_2 at 5.5, 5.3, 5.5, and 4.8% and H_2S at 0, 0, 0 and 2.0 ppm. The influent vapors continued to supply 100% of the IC engine's fuel.

At test hour 5.0, the test continued with the induced vacuum increased to 75"H_2O and a well flow of 17.18 scfm. The test period was 3.0 hours, and the extraction well induced vacuum and well vapor flow remained mostly steady. Outer well MW-6 vacuum increased to 3.49 "H_2O and continued on a mostly increasing trend for the remainder of the test. Outer well MW-10 continued to record an increasing vacuum trend to 3.91"H_2O at test hour 8.0. Outer wells MW-11, MW-5, MW-16, MW-7, and MW-2 recorded a mostly increasing trend from test hour 5 through the end of the test. The ambient air temperature increased to 63.0°F and the barometric pressure decreased to 29.82 "Hg. The influent vapor temperature decreased from 62 to 60°F.

Additional HORIBA® analytical data indicated the influent vapor samples recorded HC levels of 85,960, 86,750 and 85,960 ppmv, with CO_2 at 2.20, 2.62 and 2.10%, CO at 5.56, 5.80 and 4.78%, O_2 at 4.8, 5.2 and 5.4% and H_2S at 2.0 ppm. The influent vapors continued to supply 100% of the IC engine's fuel.

RADIUS OF INFLUENCE

Figure #1 indicates that the effective vacuum radius of influence from Test #SVE-2 would be from 40.68 to 45.96 ft, with extraction well flow of 16.0 to 17.5 scfm and extraction well vacuum in the 45 to 50"H_2O range. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is 1.50 to 1.35"H_2O or approximately 3.0% of the average induced vacuum of 55.41"H_2O. It is assumed that beyond the lower point, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well. Under continuous operation, vacuum and radius of influence will most likely continue to increase horizontally and vertically**.**

The radius of influence calculation was affected by the high static well vacuums that were recorded prior to the start and after the conclusion of SVE Test #1. SVE Test #2 was performed after SVE Tests #2, SVE Test #3 and the SVE Quick Tests.

All ROI calculations are site specific. At this site, the projected ROI is based on approximately 6.0 ft of well screen available to the induced vacuum. This equates to approximately 2.65 scfm per foot of screen. With an induced vacuum in the 45 - 50"H_2O range, liquid most likely will continue to accumulate in the well.

The effective vacuum radius of influence is based on calculations and equations using a software program of which data was provided from an extensive database collected by AcuVac over a period of years. Each projection is based on the test data and site parameters, and takes into consideration such variables as barometric pressure oscillations and gauge error. Although we cannot provide total assurance of accuracy, past experience and results have proven these projections to be well within the acceptable range of accuracy.

To calculate MDP well placement, the equation we use is as follows:

L= 2 ROI Cos 30° (L = distance between wells; ROI = radius of influence)

All other data, including the groundwater depth, well placement, extraction well screened intervals, induced vacuum and vapor well flow, and liquid recovery rate, must be considered in the final design for a Corrective Action Plan (CAP).

CONCLUSION

Pilot Tests are conducted to provide information on short term tests that can be projected into long term remedial plans. These feasibility tests indicated that Soil Vapor Extraction (SVE) should provide **the most effective method** of remediation for this facility. **The tests results provided sufficient data to project that certain wells are in vacuum communication with the selected extraction well.** The vacuum radius of influence defines the region within which the vapor in the vadose zone flows to the extraction well under the influence of a vacuum. The radius of influence depends on the soil properties of the vented zone, properties of surrounding soil layers, the depth at which the well is screened, well installation and the presence of any impermeable boundaries such as the water table, clay layers, surface seal, building basements and the presence of such areas as tank pits with backfill and underground utilities..

EMISSION DATA

During this Pilot Test, HORIBA® data indicated that the influent vapors had an average hydrocarbon level (TPH) of 81,565 ppmv. Using an average well flow of 15.91 scfm from this extended test, **the calculated emissions from <u>one</u> extraction well without vapor treatment were as follows:**

HC	=	424.05 lbs/day	=	17.67 lbs/hr
Benzene (1%)	=	4.24 lbs/day	=	0.18 lbs/hr

ADDITIONAL INFORMATION

The HORIBA® analytical instrument is calibrated with Hexane and CO_2.

The formula used to calculate the emission rate is:

$$ER = HC\ (ppmv) \times MW\ (Hexane) \times Flow\ Rate\ (scfm) \times 1.58E^{-7} \frac{(min)(lb\ mole)}{(hr)(ppmv)(ft^3)} = lbs/hr$$

ATTACHED SCHEDULES AND FIGURES

- Figure #1: Plot of Observed Vacuum vs Distance at the Facility (ROI) at 3% of Induced Vacuum
- Table #1A: Well Data
- Table #1B: Extraction Well Operating Data
- Table #1C: Observation Well Operating Data
- Schedule A: Summary of Test Data
- Schedule B: Graphic Summary of Data
- Field Operating Data and Notes – Test #SVE-2
- Site Photographs

TEST #SVE-3

PRE-TEST FUNCTIONS - TEST #SVE-3

Prior to starting this test, all the AcuVac systems were checked for normal and safe operation. The barometric and absolute pressure and ambient air temperature levels were recorded, depth to groundwater (78.91 ft BTOC) and depth to LNAPL (78.09ft BTOC), were recorded as in the vapor extraction well (MW-10) resulting in and an LNAPL thickness of 0.82 ft. Each magnehelic gauge was checked and calibrated to zero. The outer monitoring wells were plugged with expandable well plugs designed to accept the digital manometer. The data logger was installed in the extraction well (MW-10). The propane tank fuel level was recorded so that an accurate fuel consumption could be estimated for the total test period. The HORIBA® Analyzer was set for the local elevation and calibrated with SPAN gas, which consists of Hexane and $C0_2$. All required static/baseline data was recorded before engaging the SVE System and the required safety checks were performed on the System.

DISCUSSION OF DATA - TEST #SVE-3

It should be noted in Test SVE #3 that the actual well vacuums were lower that what was recorded due to the high static vacuums that were recorded prior to the start of the test.

Test #SVE-3, with vacuum extraction, was an 8.6 hour MDP test, including static well data, conducted from well MW-10 as the extraction well. Immediately prior to starting the test, the selected outer observation wells; MW-16 (49.0 ft), MW-9 (56.0 ft) and MW-17 (65.0 ft), MW-11 (85.0 ft), and MW-6 (99.0 ft) were recording vacuums ranging from 1.11"H_2O to 2.30 "H_2O. The high static vacuums on the wells is most likely the results of previous SVE Test and SVE Quick Tests, and the increase in barometric pressure from the conclusion of the QTs to the start of Test #SVE-3. On October 22, 2017, SVE Test #3 was performed on well MW-10. From the end of the Quick Tests which were performed on October 21, to the start of SVE Test #3, the barometric pressure had increased from 29.94 "Hg to 30.31 "Hg, or 5.04 "H_2O. This created high static vacuums at the start of SVE Test #3. To partially compensate for the increase in static well vacuums, the start of Test #3 was delayed 30 minutes. Well MW-18 (106.0 ft) was not accessible. The general weather conditions were clear and cool. At the start of the SVE test, the extraction induced vacuum was set at 25"H_2O, with an initial well vapor flow of 3.24 scfm.

An In-Situ Data Logger was positioned slightly above the bottom (92.0 ft BTOC) of the extraction well MW-10 and well MW-16 (49.0 ft) to determine the extent of upwelling that may occur during the test.

During the first 2.0 hours of the test, the extraction induced vacuum remained constant at 20"H_2O with a well vapor flow of 3.24 scfm, which remained mostly steady during the period. The changes in the well vapor flow related to increasing temperature of the influent vapors. Outer well MW-16, which is located 49.0 ft from the extraction well, immediately recorded an increasing well vacuum of 2.07"H_2O and continued on an increasing vacuum trend during the test period to 2.27"H_2O. Outer well MW-9 which is located 56.0 ft from the extraction well had an immediate reaction to the induced well vacuum, increasing to 2.73"H_2O during the test period. Well MW-17 which is located 65.0 ft from the extraction well had an immediate reaction to the induced well vacuum, increasing to 2.64"H_2O

during the test period. Well MW-6 and MW-19 which are located 99.0 ft and 135.0 ft from the extraction well had an immediate reaction to the induced well vacuum, remained on an increasing trend during the test period. Outer well MW-18 was not accessible at the start of the test. Accordingly, no data was recorded for this well.

HORIBA® analytical data indicated the two influent vapor samples taken from the extraction well had TPH vapor concentrations of 82,100 and 79,340 ppmv, with CO_2 at 1.30 and 1.30%, CO at 5.22 and 4.08%, O_2 at 5.9 and 5.7% and H_2S at 7.4 and 6.3 ppm. The influent vapors were supplying approximately 70% of the IC engine fuel. The HC levels were within the range normally found in soil gas samples collected from an area contaminated with gasoline and weathered gasoline.

At test hour 2.0, the test continued with the induced vacuum increased to 40"H_2O and a well flow of 4.40 scfm. The test period was 3.0 hours with the extraction well induced vacuum and well vapor flow remaining mostly steady during the period. Outer well MW-16 continued on an increasing vacuum trend to 2.32"H_2O at test hour 2.5 and then increased until test hour 3.0 to 2.53"H_2O and then started a mostly decreasing trend until test hour 5.0. Outer well MW-9 continued to record an increasing vacuum trend to 2.83"H_2O at test hour 2.5 and then decreased through test hour 4.5 to 2.31"H_2O. Outer well MW-17 continued to record an increasing vacuum trend to 1.71"H_2O at test hour 2 and then decreased for the next 2.5 hours to 2.24"H_2O at test hour 4.5. Outer wells MW-5, MW-7 and MW-2 became accessible at test hour 3.0. These wells recorded vacuums at test hour 3.0 and remained on an increasing trend through test hour 4.5. The ambient air temperature increased to 56.0°F and the barometric was steady at 30.32"Hg. The influent vapor temperature increased from 56.0 to 62°F.

Additional HORIBA® analytical data indicated the influent vapor samples recorded HC levels of 84,180, 83,050, 89,380 and 80,120 ppmv, with CO_2 at 1.22, 1.10, 1.33, and 1.14%, CO at 5.18, 4.72, 5.92 and 4.60%, O_2 at 6.0, 6.2, 6.8, and 5.4% and H_2S at 6.1, 3.4, 2.0 and 2.0 ppm. The influent vapors continued to supply 80% of the IC engine's fuel.

At test hour 5.0, the test continued with the induced vacuum increased to 60"H_2O and a well flow of 5.91 scfm. The test period was 3.0 hours, and the extraction well induced vacuum and well vapor flow remained mostly steady. Outer well MW-16 vacuum decreased to 2.08"H_2O and continued on a mostly decreasing trend for the remainder of the test. Outer well MW-9 continued to record a decreasing vacuum trend to 1.69"H_2O at test hour 8.0. Outer well MW-17 continued to record a decreasing vacuum trend to 1.45"H_2O at test hour 8.0. Outer wells MW-11, MW-6, MW-18, and MW-19 recorded a mostly decreasing trend from test hour 5 through the end of the test. The ambient air temperature increased to 59.0°F and the barometric pressure decreased to 30.24"Hg. The influent vapor temperature increased from 64 to 66°F.

Additional HORIBA® analytical data indicated the influent vapor samples recorded HC levels of 87,050, 92,080, 87,830 and 91,690 ppmv, with CO_2 at 0.80, 0.78, 1.10, and 1.32%, CO at 6.46, 4.23, 6.30 and 5.69%, O_2 at 5.2, 5.2, 5.7, and 5.6% and H_2S at 2.0 ppm. The influent vapors continued to supply 90% of the IC engine's fuel.

RADIUS OF INFLUENCE

Figure #1 indicates that the effective vacuum radius of influence from Test #SVE-3 would be from 26.24 to 31.01 ft, with extraction well flow of 4.8 to 5.9 scfm and extraction well vacuum in the 50 to 55"H_2O range. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is 1.50 to 1.65"H_2O or approximately 3.0% of the average induced vacuum of 52.53"H_2O. It is assumed that beyond the lower point, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well. Under continuous operation, vacuum and radius of influence will most likely continue to increase horizontally and vertically**.**

It should be noted in Test SVE #3 that the actual well vacuums were lower that what was recorded due to the high static vacuums that were recorded prior to the start of the test.

All ROI calculations are site specific. At this site, the projected ROI is based on approximately 6.0 ft of well screen available to the induced vacuum. This equates to approximately 0.79 scfm per foot of screen. With an induced vacuum in the 50 - 55"H_2O range, liquid most likely will continue to accumulate in the well.

The effective vacuum radius of influence is based on calculations and equations using a software program of which data was provided from an extensive database collected by AcuVac over a period of years. Each projection is based on the test data and site parameters, and takes into consideration such variables as barometric pressure oscillations and gauge error. Although we cannot provide total assurance of accuracy, past experience and results have proven these projections to be well within the acceptable range of accuracy.

To calculate MDP well placement, the equation we use is as follows:

L= 2 ROI Cos 30° (L = distance between wells; ROI = radius of influence)

All other data, including the groundwater depth, well placement, extraction well screened intervals, induced vacuum and vapor well flow, and liquid recovery rate, must be considered in the final design for a Corrective Action Plan (CAP).

CONCLUSION

Pilot Tests are conducted to provide information on short term tests that can be projected into long term remedial plans. These feasibility tests indicated that Soil Vapor Extraction (SVE) should provide **the most effective method** of remediation for this facility. **The tests results provided sufficient data to project that certain wells are in vacuum communication with the selected extraction well.** The vacuum radius of influence defines the region within which the vapor in the vadose zone flows to the extraction well under the influence of a vacuum. The radius of influence depends on the soil properties of the vented zone, properties of surrounding soil layers, the depth at which the well is screened, well installation and the presence of any impermeable boundaries such as the water table, clay layers, surface seal, building basements and the presence of such areas as tank pits with backfill and underground utilities..

EMISSION DATA

During this Pilot Test, HORIBA® data indicated that the influent vapors had an average hydrocarbon level (TPH) of 81,565 ppmv. Using an average well flow of 15.91 scfm from this extended test, **the calculated emissions from one extraction well without vapor treatment were as follows:**

HC	=	132.55 lbs/day	=	5.52 lbs/hr
Benzene (1%)	=	1.33 lbs/day	=	0.06 lbs/hr

ADDITIONAL INFORMATION

The HORIBA® analytical instrument is calibrated with Hexane and CO_2.

The formula used to calculate the emission rate is:

$$ER = HC\ (ppmv) \times MW\ (Hexane) \times Flow\ Rate\ (scfm) \times 1.58E^{-7} \frac{(min)(lb\ mole)}{(hr)(ppmv)(ft^3)} = lbs/hr$$

ATTACHED SCHEDULES AND FIGURES

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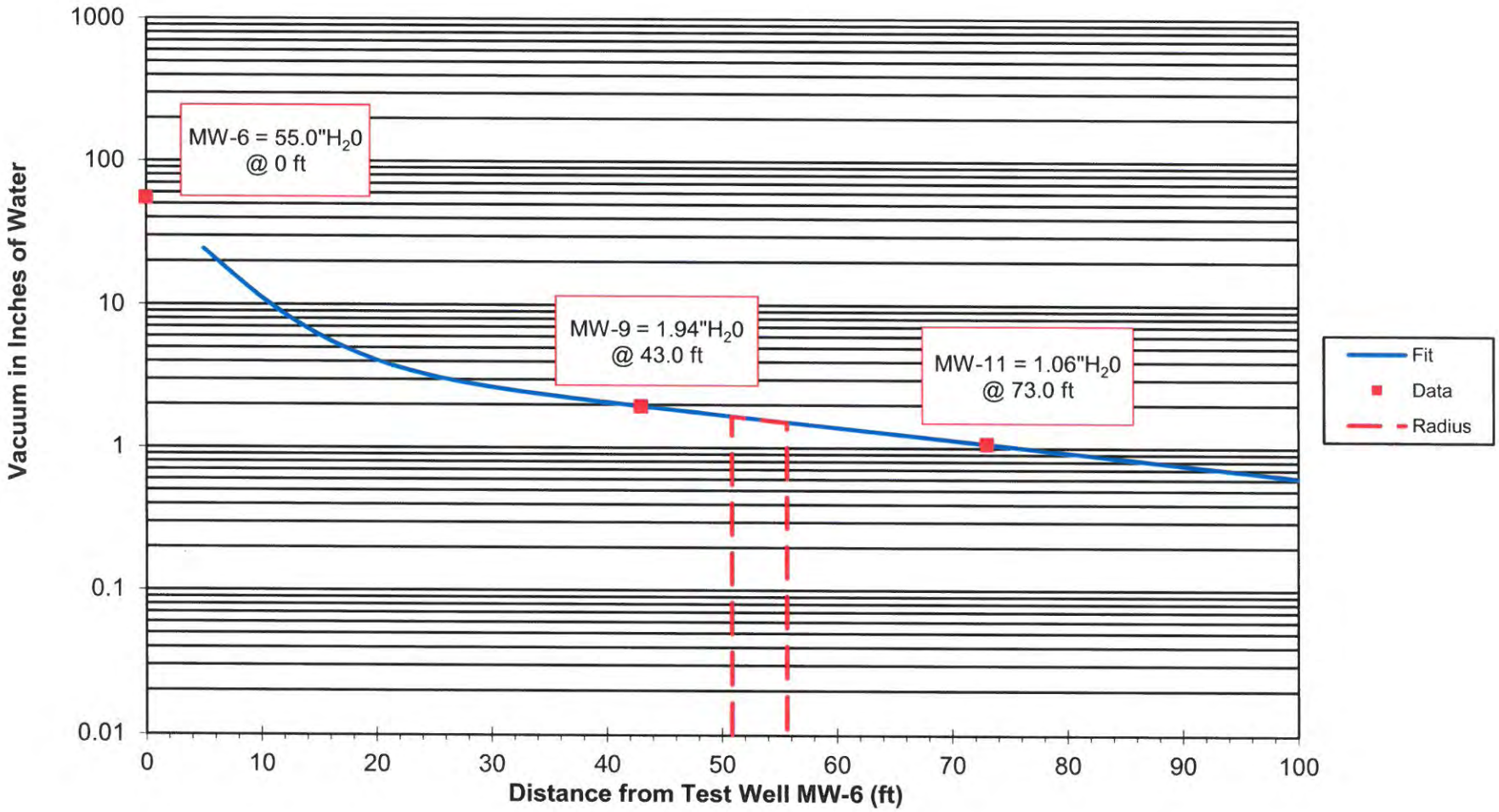
Figure #1
Radius of Influence
Data from Pilot Test #SVE-1 at 3% of Induced Vacuum



WELL DATA
TEST #SVE-1
TABLE #1A

Location: Shamrock #63, Santa Fe, NM								
Project Date 10/23/2017		**MW-6**	**MW-9**	**MW-7**	**MW-5**	**MW-11**	**MW-10**	**MW-2**
Well Data								
TD	ft	90.0	92.0	90.0	90.0	92.0	92.0	90.0
Screen	ft	70.0 90.0	72.0- 92.0	70.0 90.0	75.0 - 90.0	72.0- 92.0	72.0- 92.0	75.0 - 90.0
Well Size	in	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Distance From EW	ft	0	43.0	49.0	50.0	73.0	99.0	100.00
Static Basleine Data- Start	"H_2O	-	0.90	ND	ND	0.41	0.51	ND
Static Basleine Data- Start	"H2O	-	2.05	2.15	1.90	2.05	1.95	1.79

ND- No Data Recorded

EXTRACTION WELL MW-6
OPERATING DATA TEST #SVE-1
TABLE #1B

Location: Shamrock #63, Santa Fe, NM

					EXTRACTION WELL				OBSERVATION WELL	
					MW-6				MW-9	
Project Date 10/23/2017				**Units**	**DTGW**	**GWU (GWD)**	**Vacuum "H_2O**	**Vapor Flow SCFM**	**DTGW**	**GWU (GWD)**
Well Data										
TD				ft bgs	90.0	-	-	-	92.00	-
Screen				ft	70.0 - 90.0	-	-	-	72.0 - 92.0	-
Well Size				in	2.0	-	-	-	2.0	-
Static Data- 0750 Hrs										
DTGW				ft bgs	82.33	-	-		79.90	-
DTGW Hydro Equivalent				ft bgs	81.68	-	-		79.46	-
DTNAPL				ft bgs	81.45	-	-		79.30	-
NAPL				ft bgs	0.88	-	-		0.60	-
Drawdown Data										
Data Logger	0620	hrs	Static	ft	7.88	-	-	-	9.87	-
Data Logger	0630	hrs	Start	ft	7.49	(0.39)	25	4.72	9.90	0.03
Data Logger	0700	hrs		ft	7.68	(0.20)	25	4.72	9.92	0.05
Data Logger	0730	hrs		ft	7.68	(0.20)	25	4.71	9.93	0.06
Data Logger	0800	hrs		ft	7.68	(0.20)	25	4.71	9.93	0.06
Data Logger	0830	hrs		ft	7.28	(0.60)	50	6.94	9.95	0.08
Data Logger	0900	hrs		ft	7.62	(0.26)	50	7.35	9.96	0.09
Data Logger	0930	hrs		ft	7.65	(0.23)	50	7.35	9.96	0.09
Data Logger	1000	hrs		ft	7.66	(0.22)	50	6.54	9.97	0.10
Data Logger	1030	hrs		ft	7.62	(0.26)	50	6.54	9.98	0.11
Data Logger	1100	hrs		ft	7.63	(0.25)	50	6.54	9.98	0.11
Data Logger	1130	hrs		ft	7.60	(0.28)	75	7.78	9.99	0.12
Data Logger	1200	hrs		ft	7.64	(0.24)	75	7.78	9.99	0.12
Data Logger	1230	hrs		ft	7.65	(0.23)	75	7.74	10.00	0.13
Data Logger	1300	hrs		ft	7.67	(0.21)	75	7.74	10.01	0.14
Data Logger	1330	hrs		ft	7.69	(0.19)	75	7.74	10.01	0.14
Data Logger	1400	hrs		ft	7.69	(0.19)	75	7.72	10.01	0.14
Data Logger	1430	hrs	Stop	ft	7.69	(0.19)	75	7.72	10.02	0.15
Data Logger	1500	hrs	Static	ft	7.72	(0.16)	-		9.95	0.08
DTGW	1500	hrs			81.82	-	-		80.37	-
DTGW Hydro Equivalent					81.60	-	-		79.66	-
DTNAPL					81.52	-	-		79.41	-
NAPL					0.30	-	-		0.96	-
Average GW Upwelling / (Depression)					-	(0.26)	-			0.10

OBSERVATION WELLS
INDUCED HYDRAULIC GRADIENT DATA
TEST #SVE-1
TABLE #1C

Location: Shamrock #63, Santa Fe, NM								
Project Date 10/23/2017		**MW-6**	**MW-9**	**MW-7**	**MW-5**	**MW-11**	**MW-10**	**MW-2**
Well Data								
TD	ft	90.0	92.0	90.0	90.0	92.0	92.0	90.0
Screen	ft	70.0 90.0	72.0- 92.0	70.0 90.0	75.0 - 90.0	72.0- 92.0	72.0- 92.0	75.0 - 90.0
Well Size	in	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Distance From EW	ft	0	43.0	49.0	50.0	73.0	99.0	100.00
Static/Start Data - 0620 hrs								
DTGW	ft	82.33	79.90	82.43	81.14	77.79	78.72	82.07
DTGW - Hydro Equivalent	ft	81.68	79.46	82.43	81.14	77.79	78.31	82.07
DTNAPL	ft	81.45	79.30	-	-	-	78.17	-
NAPL	ft	0.88	0.60	-	-	-	0.55	-
Drawdown Data - 1500 hrs								
DTGW	ft	81.82	80.37	82.35	81.08	77.82	78.73	82.02
DTGW - Hydro Equivalent	ft	81.60	79.66	82.35	81.08	77.82	78.26	82.02
DTNAPL	ft	81.52	79.41	-	-	-	78.09	-
LNAPL	ft	0.30	0.96	-	-	-	0.64	-
Change ion Hydro Equavalent	ft	0.08	(0.20)	0.08	0.06	(0.03)	0.06	0.05

Specific Gravity .74

SCHEDULE A
TEST #SVE-1
SUMMARY TEST DATA

		DATA ELEMENT						
	Units	STATIC 6:20	START 6:30	1 7:00	2 7:30	3 8:00	4 8:30	5 9:00
Influent Vapor Data								
Horiba TPH	ppmv	ND	ND	ND	55,770	75,720	77,870	74,890
Horiba CO_2	%	ND	ND	ND	2.06	2.54	2.40	2.10
Horiba CO	%	ND	ND	ND	1.78	4.22	4.36	4.34
Lumidor O_2	%	ND	ND	ND	6.9	5.7	5.9	5.5
Lumidor H_2S	ppm	ND	ND	ND	3.1	2.1	2.0	2.0
Influent Vapor	°F	OFF	50.0	52.0	54.0	54.0	56.0	56.0
Extraction Well- Well SVE-1								
Well Flow	scfm	0.00	4.72	4.72	4.71	4.71	6.94	7.35
Well Vacuum	"H_2O	OFF	25.0	25.0	25.0	25.0	50.0	50.0
Observation Well Data- Vacuum (Pressure)								
MW-9 - 43.0 ft	"H_2O	0.90	0.94	0.99	1.15	1.83	2.16	2.35
MW-7 - 50.0 ft	"H_2O	ND	ND	ND	ND	ND	ND	ND
MW-5 - 49.0 ft	"H_2O	ND	ND	ND	ND	ND	ND	ND
MW-11 - 73.0 ft	"H_2O	0.41	0.72	1.01	1.27	1.34	1.71	1.87
MW-10 - 99.0 ft	"H_2O	0.51	0.62	0.88	1.10	1.26	1.56	1.75
MW-2 - 100.0 ft	"H_2O	ND	ND	ND	ND	ND	ND	ND
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	30.31	30.31	30.31	30.31	30.32	30.32	30.34
Absolute Pressure	"Hg	23.73	23.73	23.73	23.73	23.73	23.73	23.75

( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE A
TEST #SVE-1
SUMMARY TEST DATA

		DATA ELEMENT						
	Units	7 9:30	8 10:00	9 10:30	10 11:00	11 11:30	12 12:00	13 12:30
Influent Vapor Data								
Horiba TPH	ppmv	**ND**	**77,550**	**ND**	**76,240**	**82,700**	**79,980**	**ND**
Horiba CO_2	%	**ND**	**2.53**	**ND**	**2.47**	**2.60**	**4.58**	**ND**
Horiba CO	%	**ND**	**4.48**	**ND**	**4.40**	**5.34**	**1.72**	**ND**
Lumidor O_2	%	**ND**	**5.7**	**ND**	**8.9**	**6.9**	**6.7**	**ND**
Lumidor H_2S	ppm	**ND**	**2.1**	**ND**	**3.0**	**3.0**	**3.0**	**ND**
Influent Vapor	°F	**56.0**	**56.0**	**58.0**	**60.0**	**60.0**	**60.0**	**62.0**
Extraction Well- Well SVE-1								
Well Flow	scfm	**7.35**	**6.54**	**6.52**	**6.51**	**7.75**	**7.75**	**7.74**
Well Vacuum	"H_2O	**50.0**	**50.0**	**50.0**	**50.0**	**75.0**	**75.0**	**75.0**
Observation Well Data- Vacuum (Pressure)								
MW-9 - 43.0 ft	"H_2O	**2.53**	**2.83**	**2.87**	**2.94**	**2.97**	**3.06**	**2.98**
MW-7 - 50.0 ft	"H_2O	**2.10**	**2.55**	**2.55**	**2.63**	**2.65**	**2.73**	**2.65**
MW-5 - 49.0 ft	"H_2O	**2.23**	**2.65**	**2.64**	**2.73**	**2.74**	**2.81**	**2.78**
MW-11 - 73.0 ft	"H_2O	**2.13**	**2.51**	**2.53**	**2.57**	**2.60**	**2.70**	**2.58**
MW-10 - 99.0 ft	"H_2O	**2.04**	**2.29**	**2.31**	**2.36**	**2.36**	**2.44**	**2.35**
MW-2 - 100.0 ft	"H_2O	**1.96**	**2.26**	**2.26**	**2.33**	**2.29**	**2.31**	**2.25**
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	**30.35**	**30.37**	**30.37**	**30.37**	**30.35**	**30.35**	**30.33**
Absolute Pressure	"Hg	**23.76**	**23.77**	**23.77**	**23.77**	**23.76**	**23.76**	**23.74**

( ) Indicates Well Pressure
ND - No Recorded Data

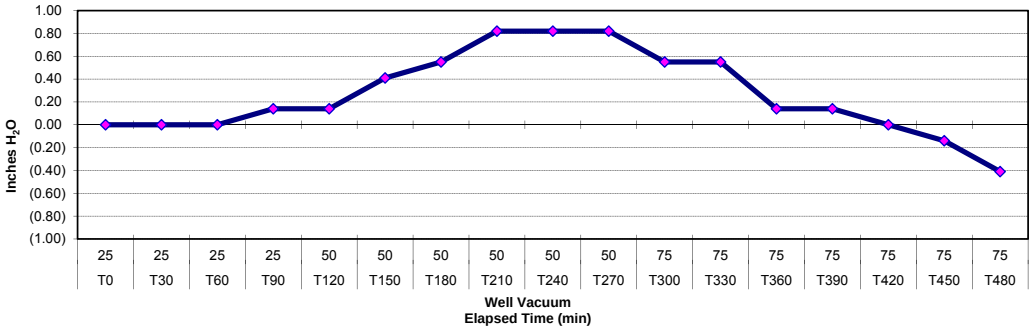
SCHEDULE A
TEST #SVE-1
SUMMARY TEST DATA

		DATA ELEMENT						
	Units	14 13:00	15 13:30	16 14:00	17 14:30	Static 15:00	Average Data	Maximum Data
Influent Vapor Data								
Horiba TPH	ppmv	**81,110**	**ND**	**72,340**	**ND**	**ND**	**75,417**	**82,700**
Horiba CO_2	%	**4.70**	**ND**	**3.52**	**ND**	**ND**	**2.95**	**4.70**
Horiba CO	%	**1.82**	**ND**	**1.28**	**ND**	**ND**	**3.37**	**5.34**
Lumidor O_2	%	**6.5**	**ND**	**6.3**	**ND**	**ND**	**6.5**	**8.9**
Lumidor H_2S	ppm	**3.1**	**ND**	**2.0**	**ND**	**ND**	**2.5**	**3.1**
Influent Vapor	°F	**62**	**62**	**64**	**64**	**OFF**	**58**	**64**
Extraction Well- Well SVE-1								
Well Flow	scfm	**7.74**	**7.74**	**7.72**	**7.72**	**OFF**	**6.72**	**7.75**
Well Vacuum	"H_2O	**75.0**	**75.0**	**75.0**	**75.0**	**OFF**	**54.4**	**75.0**
Observation Well Data- Vacuum (Pressure)								
MW-9 - 43.0 ft	"H_2O	**2.96**	**2.91**	**2.95**	**2.79**	**2.02**	**2.42**	**3.06**
MW-7 - 50.0 ft	"H_2O	**2.60**	**2.51**	**2.54**	**2.38**	**2.16**	**2.54**	**2.73**
MW-5 - 49.0 ft	"H_2O	**2.72**	**2.65**	**2.67**	**2.53**	**1.99**	**2.65**	**2.81**
MW-11 - 73.0 ft	"H_2O	**2.57**	**2.51**	**2.52**	**2.35**	**2.05**	**2.09**	**2.70**
MW-10 - 99.0 ft	"H_2O	**2.30**	**2.26**	**2.27**	**2.13**	**1.95**	**1.90**	**2.44**
MW-2 - 100.0 ft	"H_2O	**2.18**	**2.07**	**2.09**	**1.97**	**1.79**	**2.18**	**2.33**
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	**30.32**	**30.31**	**30.30**	**30.28**	**30.27**	**30.33**	**30.37**
Absolute Pressure	"Hg	**23.73**	**23.72**	**23.72**	**23.71**	**23.70**	**23.74**	**23.77**

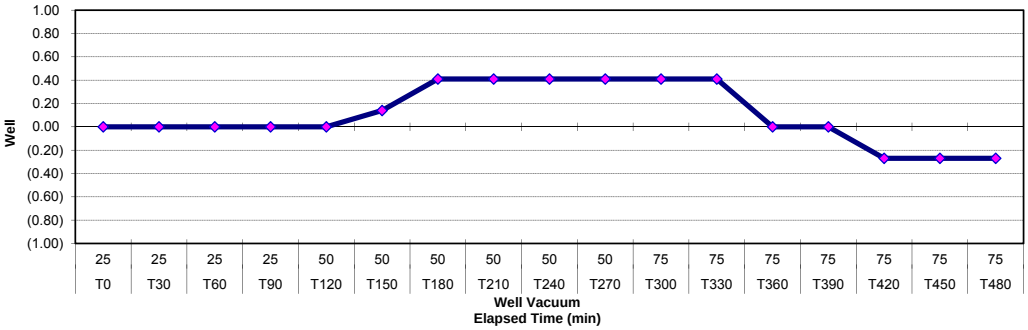
( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE B
Summary of TEST #SVE-1
Atmospheric Conditions

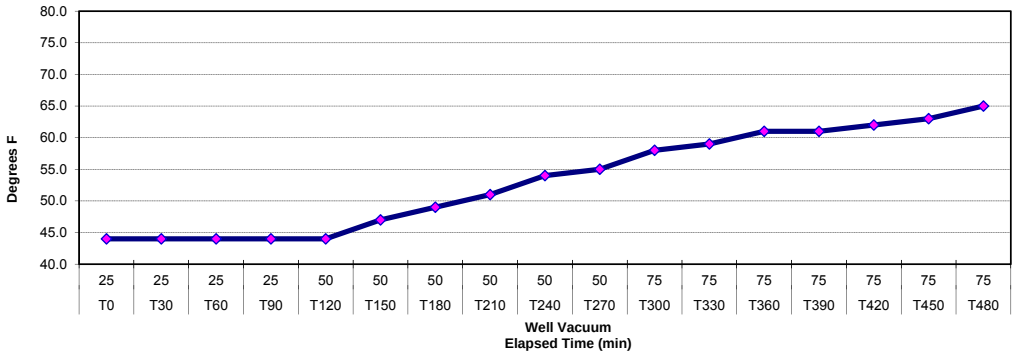
Barometric Pressure Change



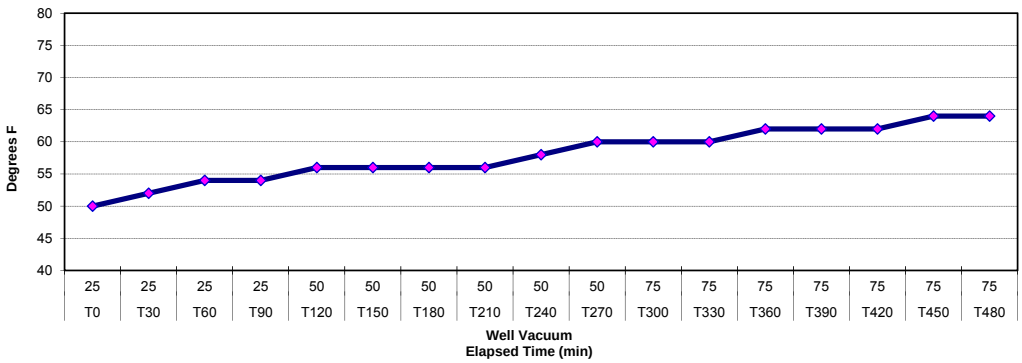
Absolute Pressure



Air Temperature

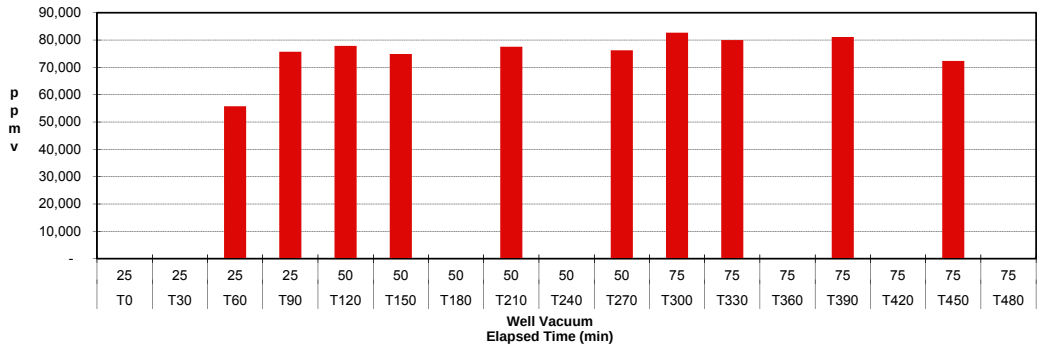


Influent Temperature

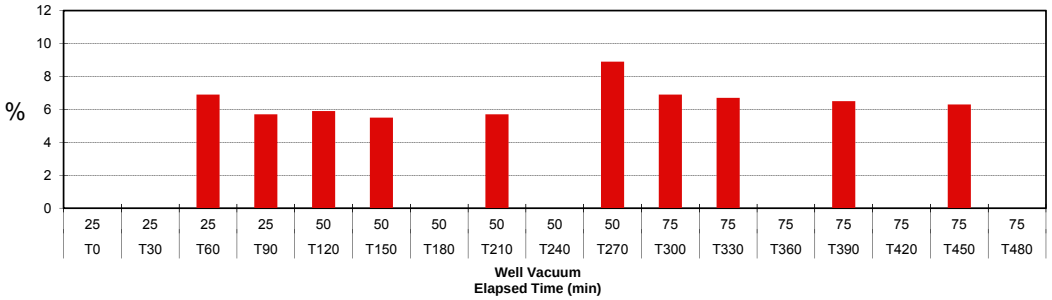


SCHEDULE B
Summary of TEST #SVE-1
Influent Vapors

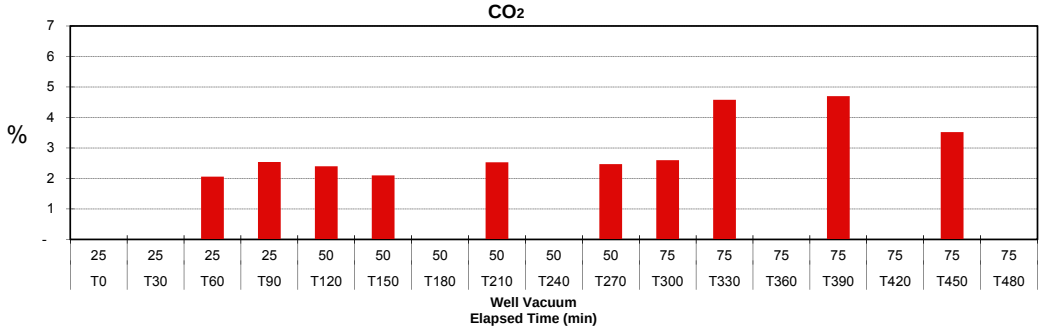
TPH Concentration



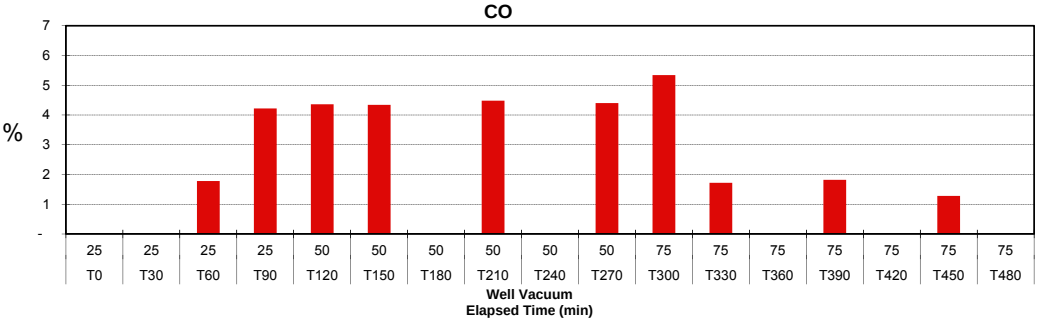
O_2



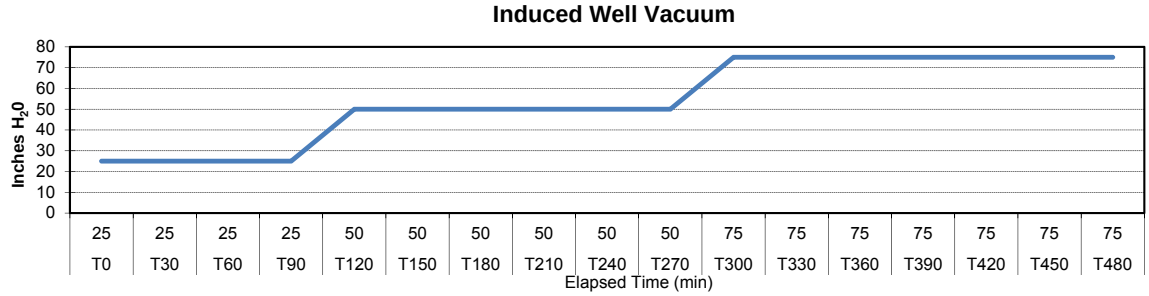
CO_2

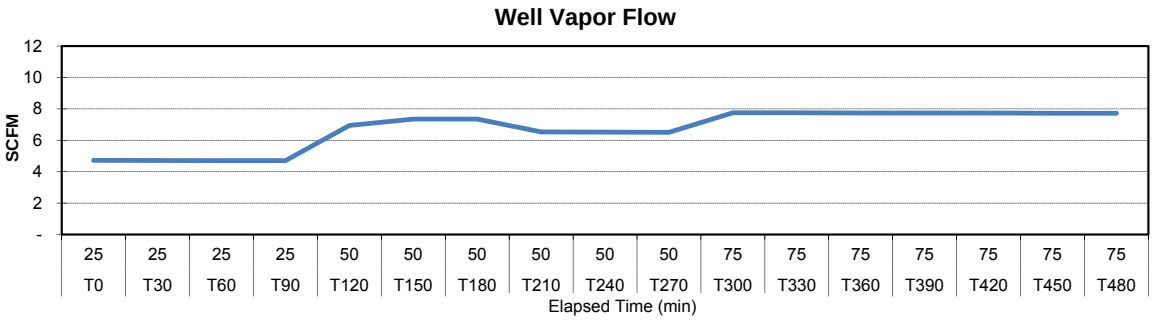


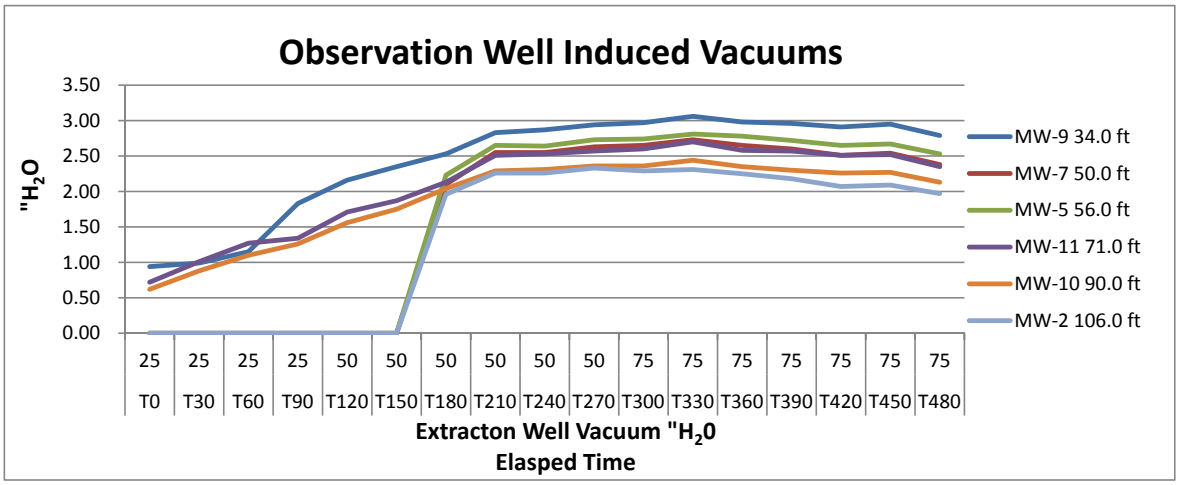
CO

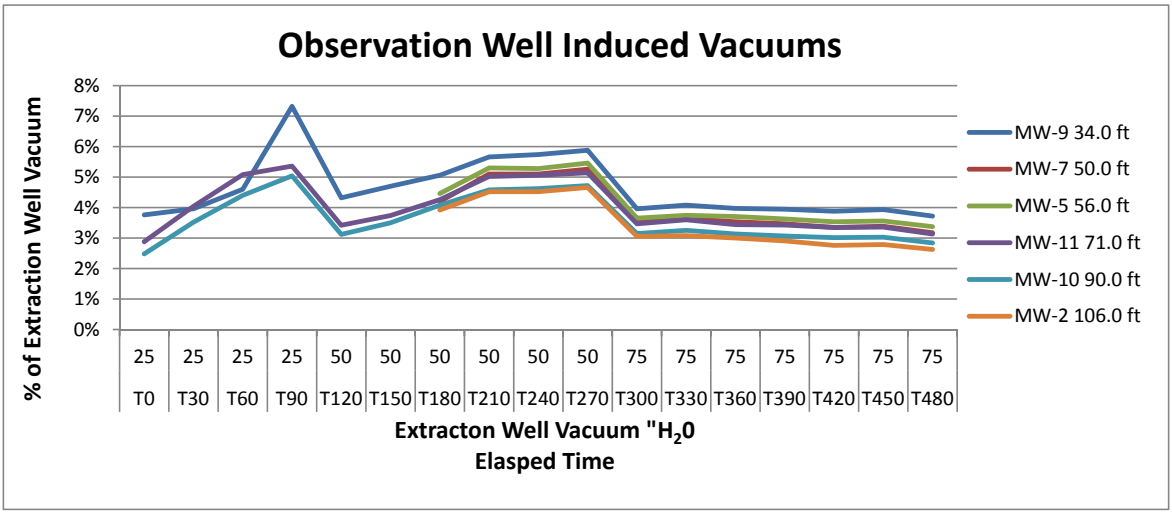


SCHEDULE B
Summary of Test #SVE-1
Recorded Well Vacuums

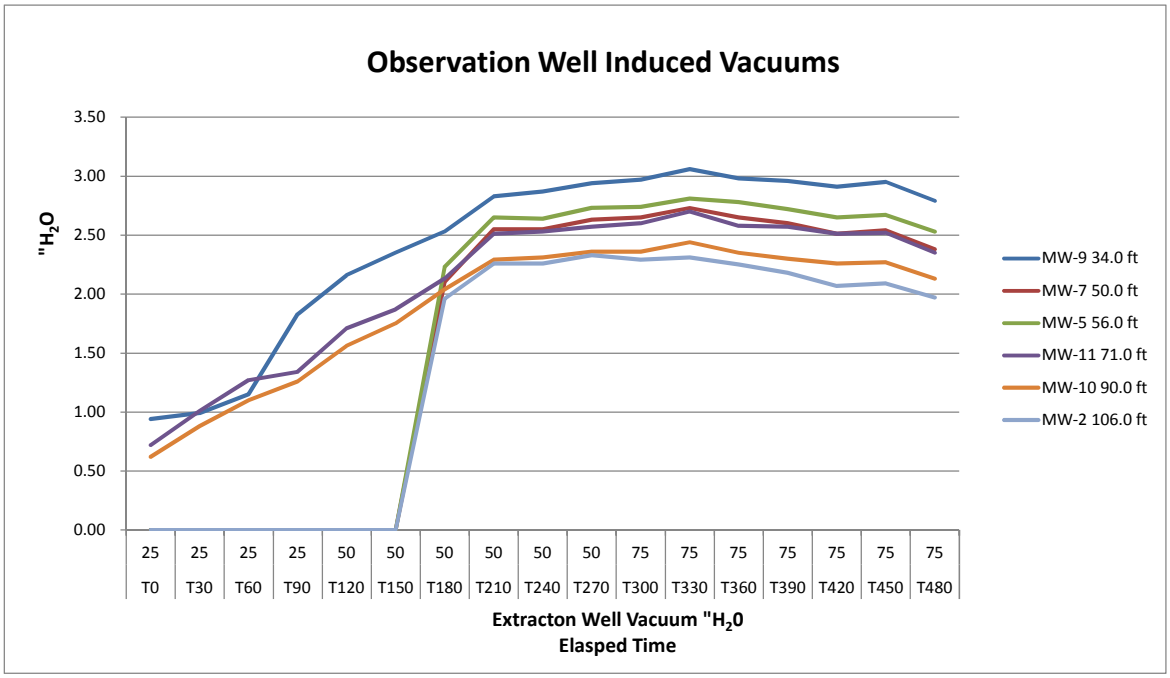


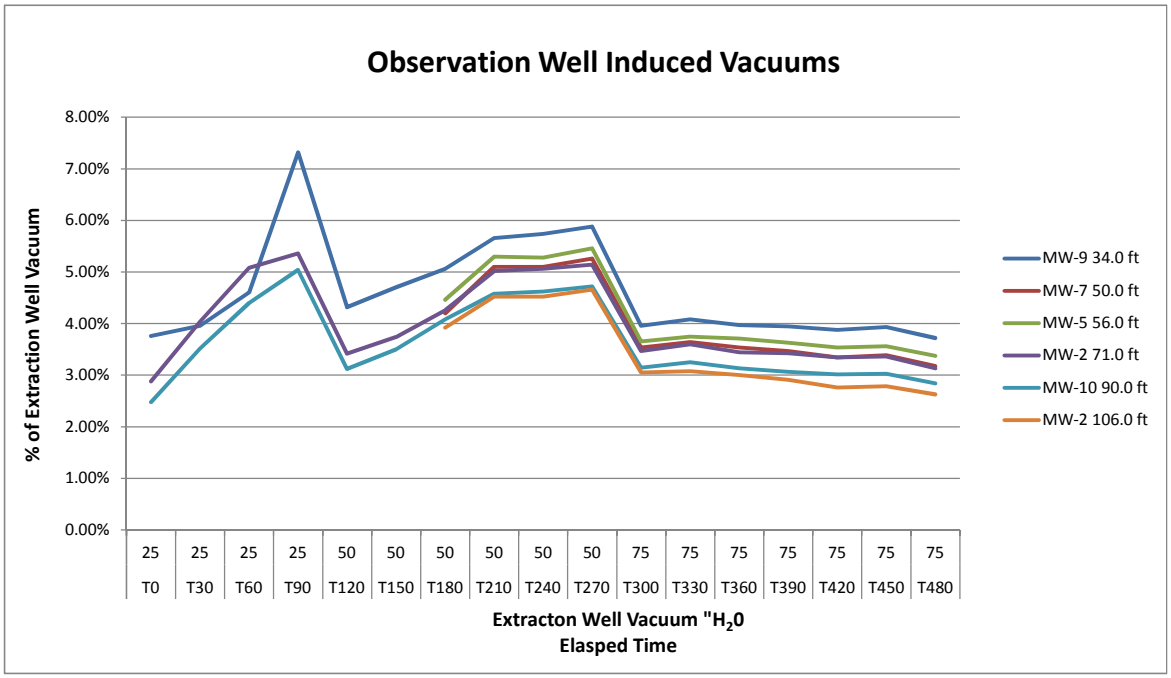






SCHEDULE B
Summary of Test #SVE-1
Recorded Well Vacuums





AcuVac Remediation

OPERATING DATA - TEST # SVE #1 **PAGE # 1** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/23/17					
Diameter- 2.0" TD- 90.0 Ft bgs Well Screen- ~~70~~.0 – 90.0 ft bgs EXTRACTION WELL- **MW-6**			Time 0620 Hr Meter -	Time 0630 Hr Meter 8245.0	Time 0700 Hr Meter 8245.5	Time 0730 Hr Meter 8246.0	Time 0800 Hr Meter 8246.5	Time 0830 Hr Meter 8247.0
ENGINE/BLOWER	Engine Speed	rpm		2000	1900	1800	1800	1800
	Oil Pressure	psi		50	50	50	50	50
	Water Temp	°F		120	120	120	120	120
	Alternator	Volts		14	14	14	14	14
	Intake Vac.	"Hg		16	18	18	18	18
	Propane	cfh		90	85	80	80	0
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O	OFF	25	25	25	25	50
	Extraction Well Flow	scfm	OFF	4.72	4.72	4.71	4.71	6.94
	Influent Vapor Temp.	°F	OFF	50	52	54	54	56
	Air Temp.	°F	43	44	44	44	44	44
	Barometric Pressure	"Hg	30.31	30.31	30.31	30.31	30.32	30.32
	Absolute Pressure	"Hg	23.73	23.73	23.73	23.73	2373	23.73
MONITOR WELL VACUUM	**MW-9 34.0 ft**	"H_2O	.90	.94	.99	1.15	1.03	2.16
	MW-7 50.0 ft	"H_2O	ND	ND	ND	ND	ND	ND
	MW-5 56.0 ft	"H_2O	ND	ND	ND	ND	ND	ND
	MW-11 71.0 ft	"H_2O	.41	.72	1.01	1.27	1.34	1.71
	MW-10 90.0 ft	"H_2O	.51	.62	.88	1.10	1.26	1.56
	MW-2 106.0 ft	"H_2O	ND	ND	ND	ND	ND	ND
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	SVE	ON/OFF	OFF	ON	ON	ON	ON	ON
	Data Logger	ft	7.88	7.49	7.68	7.68	7.68	7.28
	GW Upwelling < DOP >	ft	—	(.39)	(.20)	(.20)	(.20)	(.60)
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

( ) Indicates Well Pressure

AcuVac Remediation

OPERATING DATA SVE PILOT TEST #1 **PAGE____** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM							**Project Managers: Faucher/Hendley**
Date		10/23/17					
Time		0730	0800	0830			
TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA
	Well No.	MW-6	MW-6	MW-6			
VAPOR/INFLUENT	HC ppmv	55,770	75,720	77,870			
	CO_2 %	2.06	2.59	2.40			
	CO %	1.78	4.22	4.36			
	O_2 %	6.9	5.7	5.9			
	H_2S ppm	3.1	2.1	2.0			

0550 HRS	POSITIONED ACUVAC SYSTEM NEAR WELL MW-6. OPENED AND GAUGED
	WELLS MW-6 AND MW-9. INSTALLED SVE MANIFOLD ON WELL MW-6
	AND A DATA LOGGER MANIFOLD ON MW-9. OPENED, GAUGED AND PLUGGED
	ALL ACCESSIBLE WELLS - MW-11 AND MW-10. BP 30.31" H_g
0630 HRS	TEST STARTED. INITIAL WELL VAC 25" H_2O, WVF 4.72 SCFM, OBTAINED
	MANOMETER READINGS ON OUTER WELLS - ALL RECORDED INCREASE IN
	VACUUM INFLUENCE. GW IN MW-6 ↓ 7.49 FT, GW IN MW-9 ↑ TO 9.90 FT
0700 HRS	BP STEADY AT 30.31" H_g. ALL OUTER WELLS RECORDED INCREASES IN VACUUM
	INFLUENCE FROM .88 TO 1.01" H_2O. GW UPWELLING IN MW-6 7.68 FT.
0730 HRS	BP STEADY AT 30.31" H_g. ALL OUTER WELL RECORDED INCREASES IN VACUUM
	INFLUENCE FROM 1.10 TO 1.27" H_2O. WELL VAPOR SAMPLE OBTAINED TPH
	VAPOR CONCENTRATIONS 55,770 PPMV.
0800 HRS	BP ↑ TO 30.32" H_g TPH CONCENTRATIONS ↑ 75,720 PPM. OUTER WELL MW-9
	VAC INFLUENCE ↑ TO 2.03, ALL OTHER OUTER WELL VACUUM INFLUENCE
	INCREASED.
0830 HRS	BP STEADY AT 30.32" H_g. WELL VAC ↑ TO 50" H_2O, WVF ↑ TO 6.96. GW IN
	MW-6 IS BEING FRAGMENTED BY WELL VAC, REDUCING PRESSURE ON
	DL CREATING APPARENT GW DEPRESSION. MANOMETER READINGS
	OBTAINED AT 0835 HRS - ALL OUTER WELLS RECORDED INCREASES
	IN VACUUM INFLUENCE.

AcuVac Remediation

OPERATING DATA - TEST # SVE #1 **PAGE # 3** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/23/17					
Diameter- 2.0" TD- 90.0 Ft bgs Well Screen- 79.0 – 90.0 ft bgs EXTRACTION WELL- **MW-6**			Time 0900	Time 0930	Time 1000	Time 1030	Time 1100	Time 1130
			Hr Meter 8247.5	Hr Meter 8248.0	Hr Meter 8248.5	Hr Meter 8249.0	Hr Meter 8249.5	Hr Meter 8250.0
ENGINE/BLOWER	Engine Speed	rpm	1800	1800	1800	1800	1800	1800
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	125	125	125	130	130	130
	Alternator	Volts	14	14	14	14	14	14
	Intake Vac.	"Hg	18	18	18	18	18	18
	Propane	cfh	0	0	0	0	0	0
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O	50	50	50	50	50	75
	Extraction Well Flow	scfm	7.35	7.35	6.54	6.52	6.51	7.75
	Influent Vapor Temp.	°F	56	56	56	58	60	60
	Air Temp.	°F	47	49	51	54	55	58
	Barometric Pressure	"Hg	30.34	30.35	30.37	30.37	30.37	30.35
	Absolute Pressure	"Hg	23.75	23.76	23.77	23.77	23.77	23.76
MONITOR WELL VACUUM	**MW-9 34.0 ft**	"H_2O	2.35	2.53	2.83	2.87	2.94	2.97
	MW-7 50.0 ft	"H_2O	ND	2.10	2.55	2.55	2.63	2.65
	MW-5 56.0 ft	"H_2O	ND	2.23	2.65	2.64	2.73	2.74
	MW-11 71.0 ft	"H_2O	1.87	2.13	2.51	2.53	2.57	2.60
	MW-10 90.0 ft	"H_2O	1.75	2.04	2.29	2.31	2.36	2.36
	MW-2 106.0 ft	"H_2O	ND	1.96	2.26	2.26	2.33	2.29
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	SVE	ON/OFF	ON	ON	ON	ON	ON	ON
	Data Logger	ft	7.62	7.65	7.66	7.62	7.63	7.60
	GW Upwelling	ft	(.26)	(.23)	(.22)	(.26)	(.25)	(.28)
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

( ) Indicates Well Pressure

AcuVac Remediation

OPERATING DATA SVE PILOT TEST #1 **PAGE** 4 **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM							**Project Managers: Faucher/Hendley**
Date		10/23/17					
Time		0900	1000	1100	1130		
TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA
	Well No.	MW-6	MW-6	MW-6	MW-6		
VAPOR/INFLUENT	HC ppmv	74,890	77,550	76,240	82,700		
	CO_2 %	2.10	2.53	2.47	2.60		
	CO %	4.34	4.48	4.40	5.34		
	O_2 %	5.5	5.7	8.9	6.9		
	H_2S ppm	2.0	2.1	3.0	3.0		

0900 Hrs	BP ↑ 30.34 "Hg. WELL FLOW ↑ TO 7.83 SCFM. UPWELLING IN MW-6 1.26 FT.
	TPH CONCENTRATIONS ↓ TO 74,890 PPMV. ALL OUTER RECORDED INCREASES
	IN VACUUM INFLUENCE FROM 1.75 TO 2.35 "H_2O
0930 Hrs	BP ↑ 30.35 "Hg. ALL OUTER WELL RECORDED INCREASES IN VACUUM
	INFLUENCE FROM 1.96 TO 2.53 "H_2O
1000 Hrs	BP ↑ 30.37 "Hg TPH VAPORS ↑ 77,550 PPMV. WVF ↓ 6.54 SCFM. ALL OUTER
	WELLS RECORDED INCREASED VACUUM INFLUENCE WHICH COULD BE THE
	RESULT OF RISING BP. INCREASE IN BP = .28 "H_2O
1030 Hrs	BP STEADY AT 30.37 "Hg. OUTER WELLS RECORDED MINOR INCREASES/DECREASES
	IN VACUUM INFLUENCE.
1100	BP STEADY AT 30.37 "Hg. TPH VAPOR CONCENTRATIONS ↓ 76,240 PPMV
	ALL OUTER WELLS RECORDED SLIGHT INCREASES IN VACUUM INFLUENCE
1130 Hrs	BP ↓ 30.35 "Hg OBTAINED WELL VAPOR SAMPLE BEFORE VACUUM ↑
	TPH VAPORS ↑ 82,700 PPMV. INDUCED WELL VAC ↑ 75 "H_2O, WVF ↑ 7.78 SCFM
	OBTAINED MANOMETERS AT 1135 HRS. WELL HAD MINOR RESPONSE TO
	INCREASED VAC.

AcuVac Remediation

OPERATING DATA - TEST # SVE #1 **PAGE # 5** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/23/17						STATIC 1500
Diameter- 2.0" TD- 90.0 Ft bgs Well Screen- 79.0 – 90.0 ft bgs			Time 1200	Time 1230	Time 1300	Time 1330	Time 1400	Time 1430	
EXTRACTION WELL- **MW-6**			Hr Meter 8250.5	Hr Meter 8251.0	Hr Meter 8251.5	Hr Meter 8252.0	Hr Meter 8252.5	Hr Meter 8253.0	
ENGINE/BLOWER	Engine Speed	rpm	1800	1800	1800	1800	1800	1800	
	Oil Pressure	psi	50	50	50	50	50	50	
	Water Temp	°F	135	135	135	140	140	140	
	Alternator	Volts	14	14	14	14	14	14	
	Intake Vac.	"Hg	18	18	18	18	18	18	
	Propane	cfh	0	0	0	0	0	0	
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O	75	75	75	75	75	75	
	Extraction Well Flow	scfm	7.75	7.74	7.74	7.74	7.72	7.72	
	Influent Vapor Temp.	°F	60	62	62	62	64	64	
	Air Temp.	°F	59	61	61	62	63	65	
	Barometric Pressure	"Hg	30.35	30.33	30.32	30.31	30.30	30.28	30.27
	Absolute Pressure	"Hg	23.76	23.74	23.73	23.72	23.72	23.71	23.70
MONITOR WELL VACUUM	**MW-9 34.0 ft**	"H_2O	3.06	2.98	2.96	2.91	2.95	2.79	2.02
	MW-7 50.0 ft	"H_2O	2.73	2.65	2.60	2.51	2.54	2.38	2.16
	MW-5 56.0 ft	"H_2O	2.81	2.78	2.72	2.65	2.67	2.53	1.99
	MW-11 71.0 ft	"H_2O	2.70	2.58	2.57	2.51	2.52	2.35	2.05
	MW-10 90.0 ft	"H_2O	2.44	2.35	2.30	2.26	2.27	2.13	1.95
	MW-2 106.0 ft	"H_2O	2.31	2.25	2.18	2.07	2.09	1.97	1.79
		"H_2O							
		"H_2O							
		"H_2O							
		"H_2O							
MANIFOLD	SVE	ON/OFF	ON	ON	ON	ON	ON	OFF	
	Data Logger	ft	7.64	7.65	7.67	7.69	7.69	7.69	
	GW Upwelling	ft	(.24)	(.23)	(.21)	(.19)	(.19)	(.15)	
	Extraction Well	DTNAPL							
	Extraction Well	DTGW							

( ) Indicates Well Pressure

AcuVac Remediation

OPERATING DATA SVE PILOT TEST #1 **PAGE 6** **ACUVAC SVE SYSTEM**

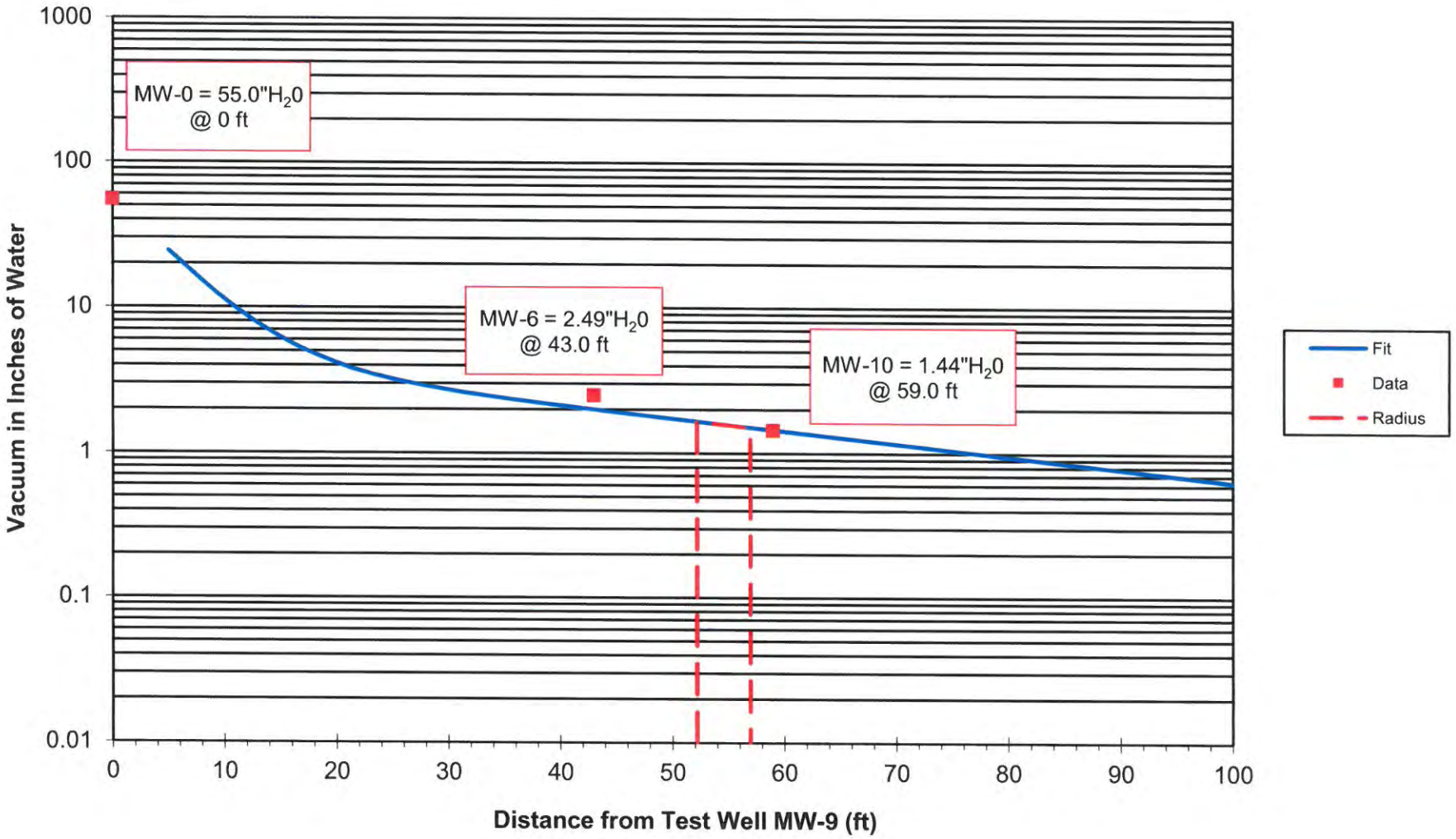
Location: Shamrock #63, Santa Fe, NM						**Project Managers: Faucher/Hendley**		
Date		10/23/17						
Time		1200	1300	1400				
TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	
	Well No.	MW-6	MW-6	MW-6				
VAPOR/INFLUENT	HC ppmv	79980	81,110	72340				
	CO_2 %	4.58	4.70	3.52				
	CO %	1.72	1.82	1.28				
	O_2 %	6.7	6.5	6.3				
	H_2S ppm	3.0	3.1	2.0				

1200 HRS	BP STEADY AT 30.35" H_g. TPH VAPOR CONCENTRATION ↓ 79,980 PPMV
	ALL OUTER WELL RECORDED AN INCREASE IN THE VACUUM INFLUENCE
1230 HRS	BP↓ 30.33" H_g. OUTER WELL RECORDED DECREASES IN VACUUM INFLUENCE
	MOST LIKELY DUE TO DECREASED BP (.28" H_2O)
1300 HRS	BP↓ 30.32" H_g TPH VAPORS ↑ 81,110 PPMV. ALL OUTER WELL RECORDED
	SLIGHTLY DECREASED VACUUM INFLUENCE.
1330 HRS	BP↓ 30.31" H_g ALL OUTER WELLS CONTINUE TO RECORD SLIGHTLY
	DECREASING VACUUM INFLUENCE.
1400 HRS	BP↓ 30.30" H_g. TPH VAPORS ↓ 72,340 PPMV. ALL OUTER WELLS RECORDED
	SLIGHTLY INCREASING VACUUM INFLUENCE.
1430 HRS	BP↓ 30.28" H_g. ALL OUTER WELLS RECORDED DECREASED VACUUM
	INFLUENCE. TEST CONCLUDED.
1445 HRS	STARTED WITH MOST DISTANT WELLS AND RECORDED STATIC MANOMETER
	READING AND WORKED IN TO WELLS MW-6 AND MW-9.
1500	COMPLETED ALL STATIC READINGS. SECURED ALL WELLS.
	DEPARTED SITE.

SHAMROCK #63
TEST SVE #1
SANTA FE, NM

SHAMROCK #63
TEST SVE #1
SANTA FE, NM

Figure #1
Radius of Influence
Data from Pilot Test #SVE-2 at 3% of Induced Vacuum



OBSERVATION WELLS
INDUCED HYDRAULIC GRADIENT DATA
TEST #SVE-2
TABLE #1A

Location: Shamrock #63, Santa Fe, NM								
Project Date 10/20/2017		**MW-6**	**MW-9**	**MW-5**	**MW-7**	**MW-11**	**MW-10**	**MW-2**
Well Data								
TD	ft	90.0	92.0	90.0	90.0	92.0	92.0	90.0
Screen	ft	70.0 90.0	72.0- 92.0	70.0 90.0	75.0 - 90.0	72.0- 92.0	72.0- 92.0	75.0 - 90.0
Well Size	in	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Distance From EW	ft	0	43.0	49.0	50.0	73.0	99.0	100.00
Static Basleine Data- Start	"H_2O	-	0.90	ND	ND	0.41	0.51	ND
Static Basleine Data- Start	"H_2O	-	2.05	2.15	1.90	2.05	1.95	1.79

ND- No Data Recorded

EXTRACTION WELL MW-6
OPERATING DATA TEST #SVE-2
Table #1B

Location: Shamrock #63, Santa Fe, NM

					EXTRACTION WELL				OBSERVATION WELL	
					MW-9				MW-6	
Project Date 10/20/2017				**Units**	**DTGW**	**GWD GWU**	**Vacuum "H_2O**	**Vapor Flow SCFM**	**DTGW**	**GWD GWU**
Well Data										
TD				ft bgs	92.0	-	-	-	90.00	-
Screen				ft	72.0 - 92.0	-	-	-	70.0 - 90.0	-
Well Size				in	2.0	-	-	-	2.0	-
Static Data- 0750 Hrs										
DTGW				ft bgs	79.53	-	-		82.02	-
DTGW Hydro Equivalent				ft bgs	79.20	-	-		80.80	-
DTNAPL				ft bgs	79.34	-	-		81.32	-
NAPL				ft bgs	0.19	-	-		0.70	-
Drawdown Data										
Data Logger	0820	hrs	Start	ft	13.08	-	-	-	7.65	-
Data Logger	0830	hrs		ft	14.92	1.84	25	11.91	7.70	0.05
Data Logger	0900	hrs		ft	14.83	1.75	25	11.91	7.72	0.07
Data Logger	0930	hrs		ft	14.95	1.87	25	11.91	7.73	0.08
Data Logger	1000	hrs		ft	14.89	1.81	25	11.91	7.74	0.09
Data Logger	1030	hrs		ft	17.01	3.93	50	17.09	7.77	0.12
Data Logger	1100	hrs		ft	17.20	4.12	50	17.09	7.79	0.14
Data Logger	1130	hrs		ft	16.95	3.87	50	17.09	7.80	0.15
Data Logger	1200	hrs		ft	16.97	3.89	50	17.09	7.54	(0.11)
Data Logger	1230	hrs		ft	17.00	3.92	50	17.09	7.81	0.16
Data Logger	1300	hrs		ft	16.90	3.82	50	17.09	7.82	0.17
Data Logger	1330	hrs		ft	19.45	6.37	75	17.21	7.55	(0.10)
Data Logger	1400	hrs		ft	18.61	5.53	75	17.18	7.86	0.21
Data Logger	1430	hrs		ft	19.46	6.38	75	17.18	7.86	0.21
Data Logger	1500	hrs		ft	18.94	5.86	75	17.18	7.88	0.23
Data Logger	1530	hrs		ft	18.81	5.73	75	17.21	7.53	(0.12)
Data Logger	1600	hrs		ft	19.06	5.98	75	17.21	7.88	0.23
Data Logger	1630	hrs	Stop	ft	18.55	5.47	75	17.21	7.00	(0.65)
Data Logger	1700	hrs	Static	ft	12.80	(0.28)	-	-	7.89	0.24
DTGW	1700	hrs			79.86	-	-	-	81.95	-
DTGW Hydro Equivalent					79.32	-	-	-	81.51	-
DTNAPL					79.13	-	-	-	81.36	-
NAPL					0.73	-	-	-	0.59	-
Average GW Upwelling / (Depression)					-	4.24	-	-		0.05

OBSERVATION WELL DATA
TEST #SVE-2
TABLE #1C

Location: Shamrock #63, Santa Fe, NM									
Project Date 10/20/2017		**MW-9**	**MW-6**	**MW-10**	**MW-11**	**MW-5**	**MW-16**	**MW-7**	**MW-12**
Well Data									
TD	ft	90.0	92.0	90.0	92.0	90.0	90.0	90.0	92.0
Screen	ft	70.0 90.0	72.0- 92.0	70.0 90.0	72.0- 92.0	75.0- 90.0	70.0 90.0	70.0 90.0	72.0 - 92.0
Well Size	in	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Distance From EW	ft	0	43.0	56.0	59.0	72.0	84.0	93.0	179.00
Static/Start Data - 0620 hrs									
DTGW	ft	79.53	82.02	78.57	77.62	80.93	76.30	82.29	76.12
DTGW - Hydro Equivalent	ft	79.39	81.50	78.14	77.62	80.93	76.30	82.29	76.12
DTNAPL	ft	79.34	81.32	77.99	-	-	-	-	-
NAPL	ft	0.19	0.70	0.58	-	-	-	-	-
Drawdown Data - 1500 hrs									
DTGW	ft	79.86	81.95	78.55	77.73	81.02	76.44	82.30	76.04
DTGW - Hydro Equivalent	ft	79.32	81.51	78.07	77.73	81.02	76.44	82.30	76.04
DTNAPL	ft	79.13	81.36	77.90	-	-	-	-	-
LNAPL	ft	0.73	0.59	0.65	-	-	-	-	-
Change ion Hydro Equavalent	ft	0.07	(0.01)	0.07	(0.11)	(0.09)	(0.14)	(0.01)	0.08

Specific Gravity .74

SCHEDULE A
TEST # SVE-2
SUMMARY OF TEST DATA

SHAMROCK #63
SANTA FE, NM
Ocotber 20, 2017

10/22/2017	Units	DATA ELEMENT						
		STATIC 8:20	START 8:30	1 9:00	2 9:30	3 10:00	4 10:30	5 11:00
Influent Vapor Data								
Horiba TPH	ppmv	ND	ND	83,120	80,300	ND	81,160	75,330
Horiba CO_2	%	ND	ND	2.68	2.28	ND	2.50	2.30
Horiba CO	%	ND	ND	5.28	5	ND	4	4.14
Lumidor O_2	%	ND	ND	5.7	4.8	ND	5.5	5.3
Lumidor H_2S	ppm	ND	ND	4	3	ND	0	0
Influent Vapor	°F	OFF	60.0	60.0	60.0	60.0	60.0	60.0
Extraction Well- Well SVE-1								
Well Flow	scfm	0.00	11.91	11.91	11.91	11.91	17.09	17.09
Well Vacuum	"H_2O	OFF	25.0	25.0	25.0	25.0	50.0	50.0
Observation Well Data- Vacuum (Pressure)								
MW-6 - 43.0 ft	"H_2O	(0.49)	0.21	1.03	1.38	1.67	2.39	2.85
MW-10 - 56.0 ft	"H_2O	0.00	0.35	0.50	0.90	1.24	1.61	2.09
MW-11 - 59.0 ft	"H_2O	(0.06)	0.23	0.70	1.03	1.32	1.71	2.44
MW-5 - 72.0 ft	"H_2O	ND	ND	ND	0.71	1.15	1.68	2.14
MW-16 - 84.0 ft	"H_2O	(0.03)	0.46	0.44	0.77	1.14	1.54	2.05
MW-7 - 93.0 ft	"H_2O	ND	ND	ND	0.31	0.69	1.10	1.49
MW-12 - 179.0 ft	"H_2O	ND	ND	ND	ND	ND	ND	ND
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	29.98	29.98	29.98	29.98	29.98	29.98	29.98
Absolute Pressure	"Hg	23.46	23.46	23.46	23.46	23.46	23.46	23.46

( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE A
TEST SVE-2
SUMMARY OF TEST DATA

SHAMROCK #63
SANTA FE, NM
Ocotber 20, 2017

10/22/2017	Units	DATA ELEMENT						
		7 11:30	8 12:00	9 12:30	10 13:00	11 13:30	12 14:00	13 14:30
Influent Vapor Data								
Horiba TPH	ppmv	**ND**	**ND**	**78,010**	**ND**	**85,960**	**ND**	**86,750**
Horiba CO_2	%	**ND**	**ND**	**1.87**	**ND**	**2.20**	**ND**	**2.62**
Horiba CO	%	**ND**	**ND**	**3.76**	**ND**	**5.56**	**ND**	**5.80**
Lumidor O_2	%	**ND**	**ND**	**5.5**	**ND**	**4.8**	**ND**	**5.2**
Lumidor H_2S	ppm	**ND**	**ND**	**0.0**	**ND**	**2.0**	**ND**	**2.0**
Influent Vapor	°F	**60.0**	**60.0**	**62.0**	**62.0**	**62.0**	**62.0**	**62.0**
Extraction Well- Well SVE-1								
Well Flow	scfm	**17.09**	**17.09**	**17.06**	**17.06**	**17.18**	**17.18**	**17.18**
Well Vacuum	"H_2O	**50.0**	**50.0**	**50.0**	**50.0**	**75.0**	**75.0**	**75.0**
Observation Well Data- Vacuum (Pressure)								
MW-6 - 43.0 ft	"H_2O	**3.12**	**3.15**	**3.21**	**3.22**	**3.49**	**3.62**	**4.00**
MW-10 - 56.0 ft	"H_2O	**2.46**	**2.64**	**2.42**	**2.37**	**2.85**	**2.87**	**3.32**
MW-11 - 59.0 ft	"H_2O	**2.73**	**2.72**	**2.82**	**2.86**	**3.05**	**3.07**	**3.49**
MW-5 - 72.0 ft	"H_2O	**2.50**	**2.53**	**2.60**	**2.63**	**2.78**	**2.85**	**3.26**
MW-16 - 84.0 ft	"H_2O	**2.68**	**2.53**	**2.45**	**2.66**	**2.74**	**2.85**	**3.17**
MW-7 - 93.0 ft	"H_2O	**1.75**	**1.77**	**1.81**	**1.80**	**1.93**	**2.03**	**2.35**
MW-12 - 179.0 ft	"H_2O	**0.06**	**0.25**	**0.22**	**0.23**	**0.21**	**0.24**	**0.41**
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	**29.97**	**29.95**	**29.91**	**29.89**	**29.87**	**29.86**	**29.85**
Absolute Pressure	"Hg	**23.46**	**23.44**	**23.41**	**23.40**	**23.38**	**23.37**	**23.36**

( ) Indicates Well Pressure
ND - No Recorded Data

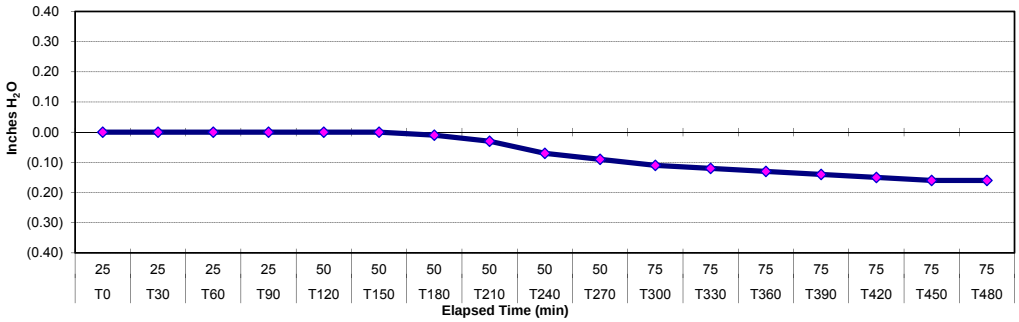
SCHEDULE A
TEST SVE-2
SUMMARY OF TEST DATA

10/22/2017	Units	DATA ELEMENT						
		14 15:00	15 15:30	16 16:00	17 16:30	Static 17:00	Average Data	Maximum Data
Influent Vapor Data								
Horiba TPH	ppmv	**ND**	**81,890**	**ND**	**ND**	**ND**	**81,565**	**86,750**
Horiba CO_2	%	**ND**	**2.10**	**ND**	**ND**	**ND**	**2.32**	**2.68**
Horiba CO	%	**ND**	**4.78**	**ND**	**ND**	**ND**	**4.83**	**5.80**
Lumidor O_2	%	**ND**	**5.4**	**ND**	**ND**	**ND**	**5.3**	**5.7**
Lumidor H_2S	ppm	**ND**	**2.0**	**ND**	**ND**	**ND**	**1.7**	**4.1**
Influent Vapor	°F	**62**	**60**	**60**	**60**	**OFF**	**61**	**62**
Extraction Well- Well SVE-1								
Well Flow	scfm	**17.18**	**17.21**	**17.21**	**17.21**	**OFF**	**15.91**	**17.21**
Well Vacuum	"H_2O	**75.0**	**75.0**	**75.0**	**75.0**	**OFF**	**54.4**	**75.0**
Observation Well Data- Vacuum (Pressure)								
MW-6 - 43.0 ft	"H_2O	**4.12**	**4.27**	**4.43**	**4.39**	**1.45**	**2.97**	**4.43**
MW-10 - 56.0 ft	"H_2O	**3.55**	**3.70**	**3.92**	**3.91**	**2.73**	**2.39**	**3.92**
MW-11 - 59.0 ft	"H_2O	**3.66**	**3.80**	**3.98**	**4.01**	**2.51**	**2.57**	**4.01**
MW-5 - 72.0 ft	"H_2O	**3.36**	**3.53**	**3.70**	**3.67**	**2.37**	**2.61**	**3.70**
MW-16 - 84.0 ft	"H_2O	**3.38**	**3.52**	**3.70**	**3.76**	**2.54**	**2.34**	**3.76**
MW-7 - 93.0 ft	"H_2O	**2.46**	**2.59**	**2.75**	**2.73**	**2.16**	**1.84**	**2.75**
MW-12 - 179.0 ft	"H_2O	**0.49**	**0.64**	**0.76**	**0.75**	**0.75**	**0.39**	**0.76**
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	**29.84**	**29.83**	**29.82**	**29.82**	**29.82**	**29.91**	**29.98**
Absolute Pressure	"Hg	**23.36**	**23.35**	**23.34**	**23.34**	**23.34**	**23.41**	**23.46**

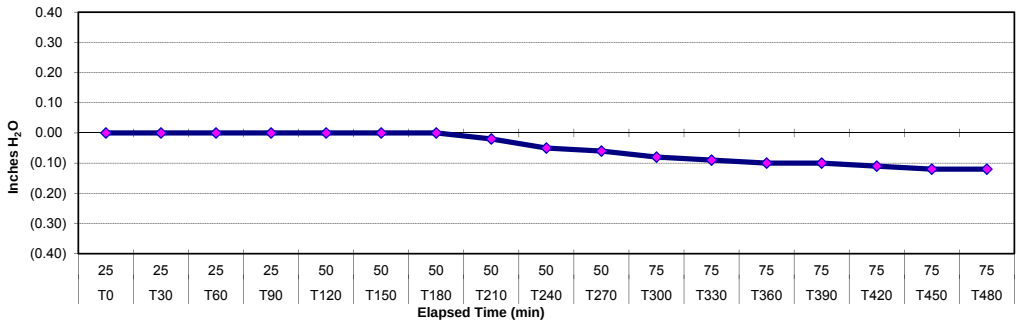
( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE B
Summary of TEST #SVE-2
Atmospheric Conditions

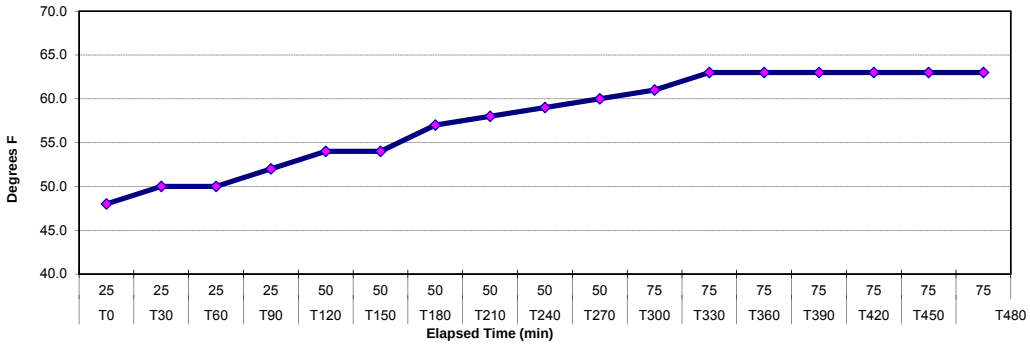
Barometric Pressure



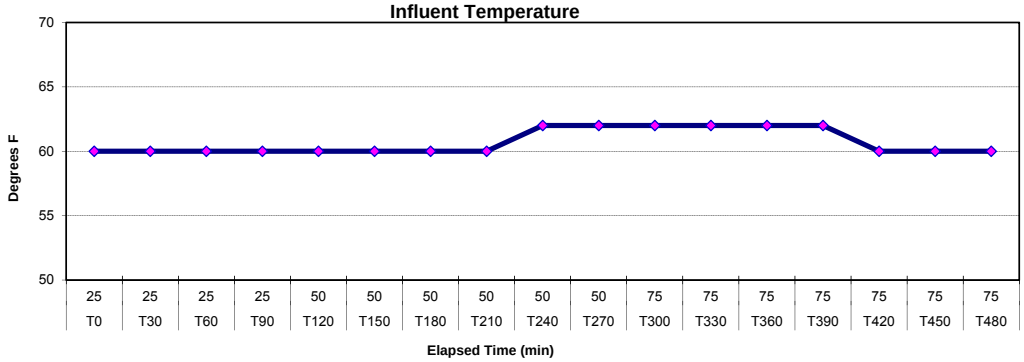
Absolute Pressure



Air Temperature

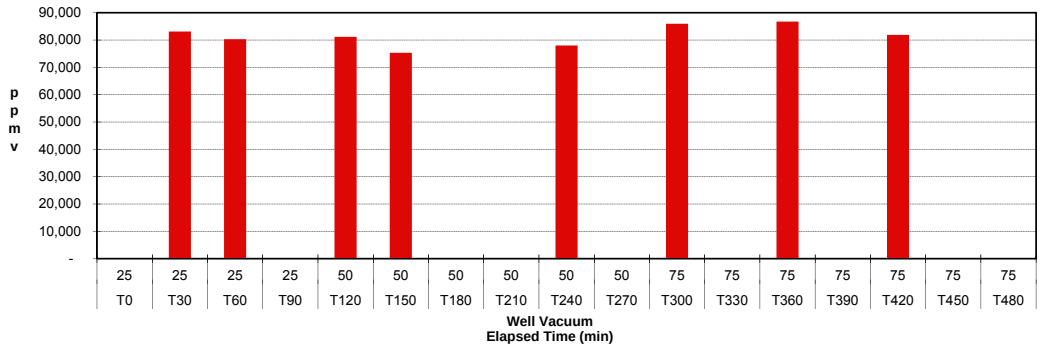


Influent Temperature

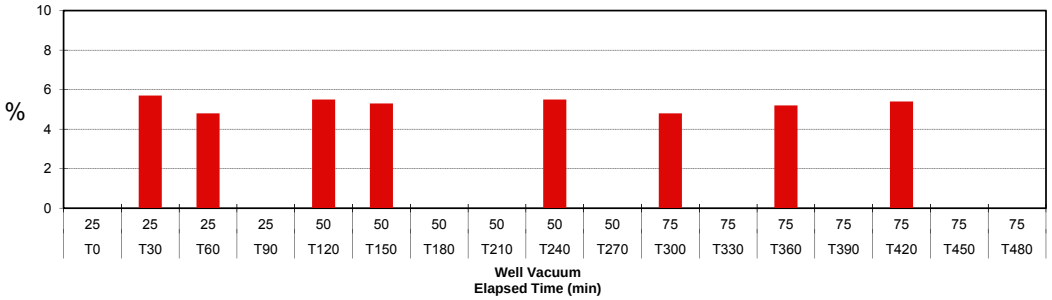


SCHEDULE B
Summary of TEST #SVE-1
Influent Vapors

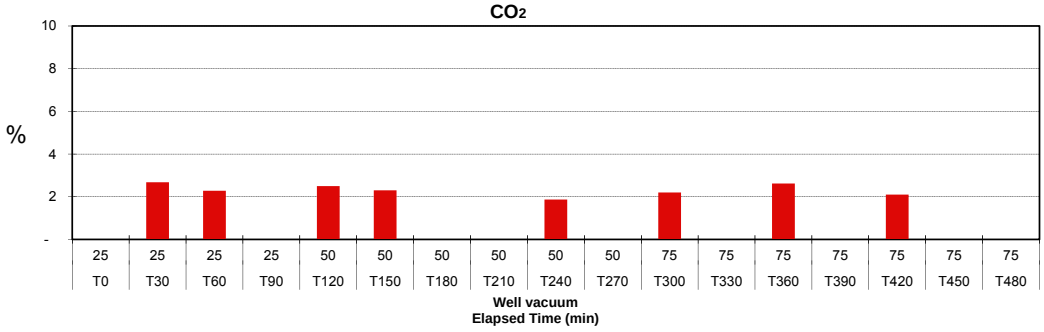
TPH Concentration



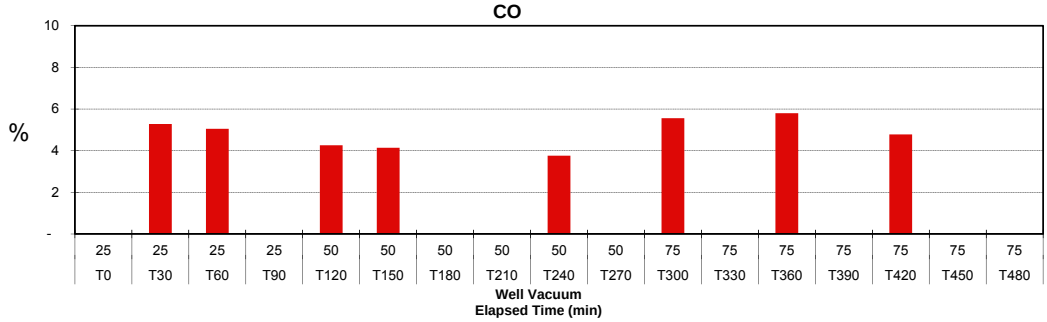
O_2



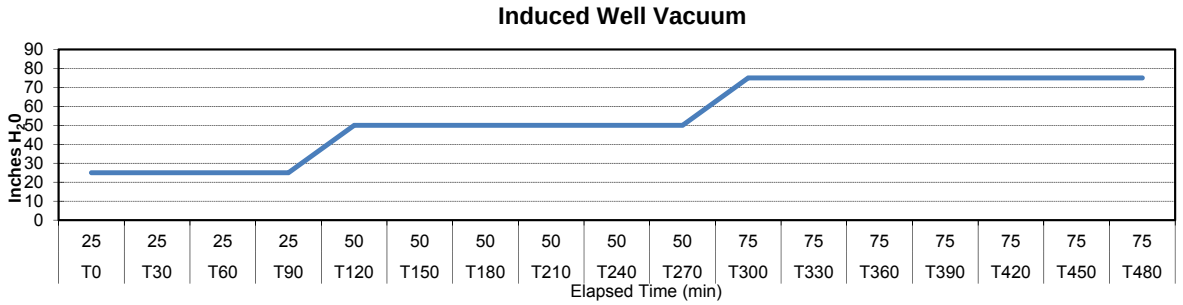
CO_2

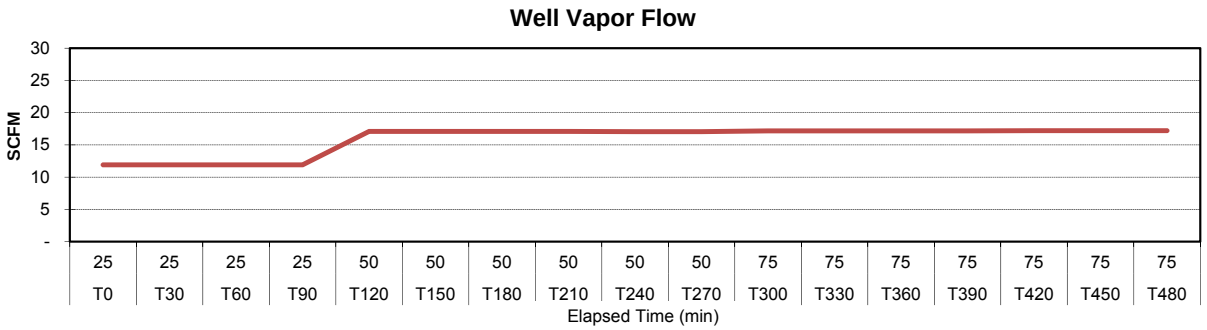


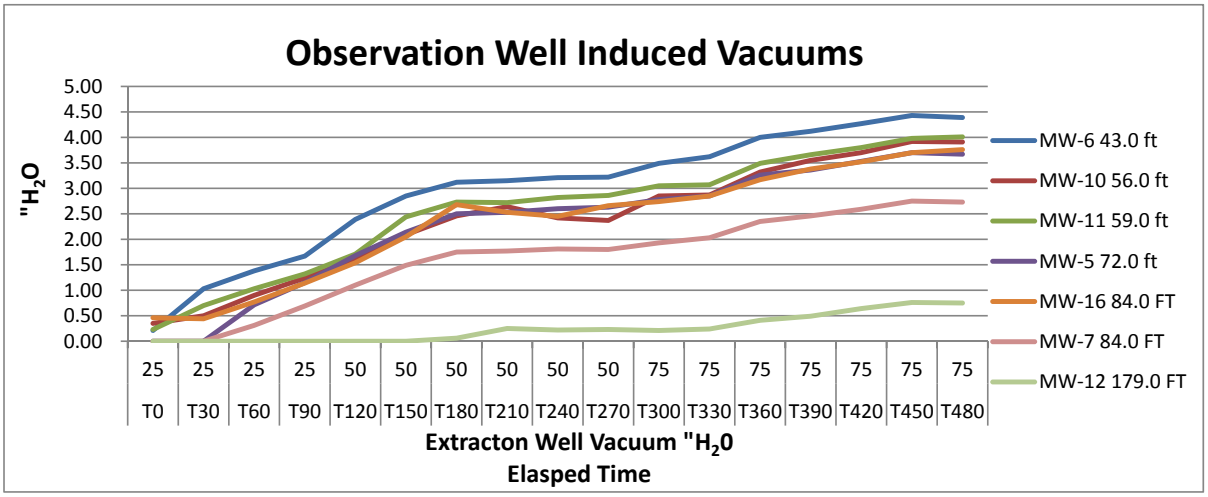
CO

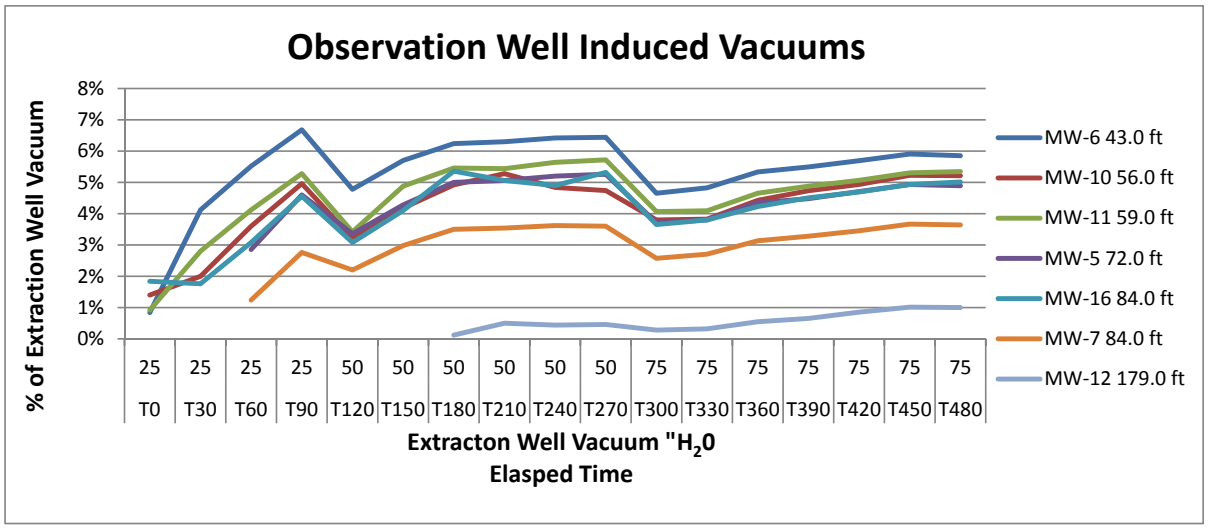


SCHEDULE B
Summary of ACUVAC TEST #SVE-1
Recorded Well Vacuums and/or Pressures

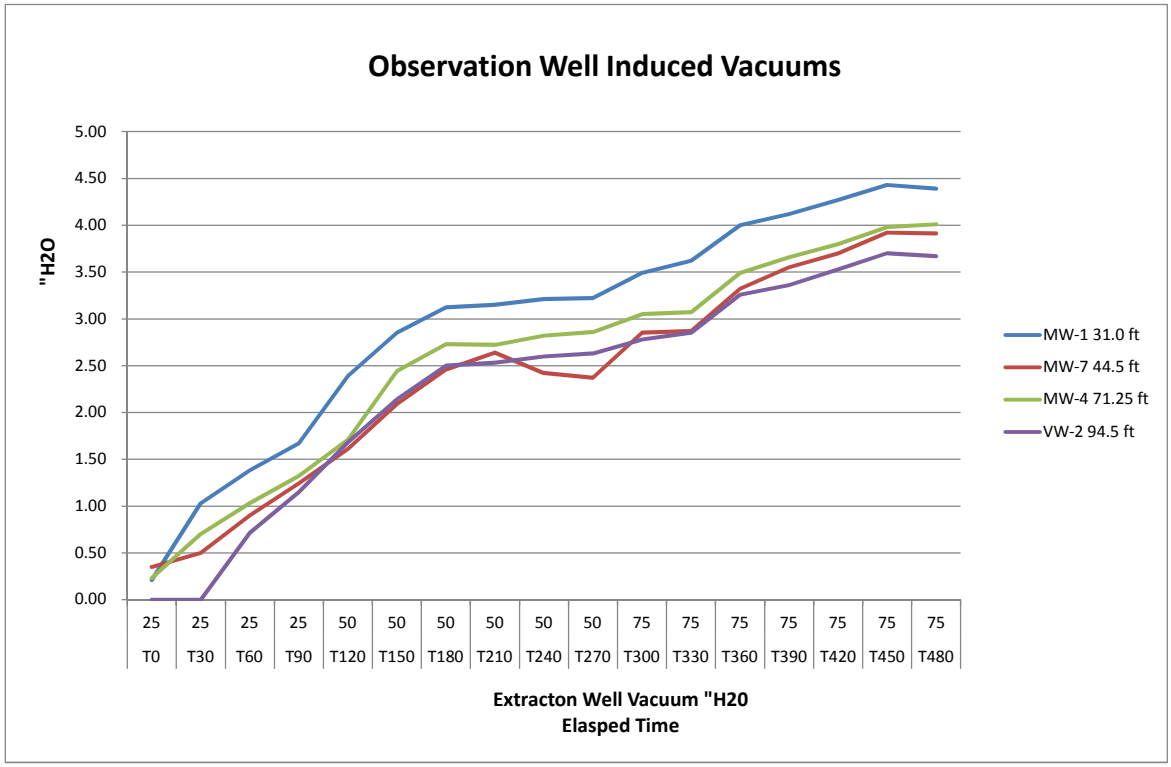


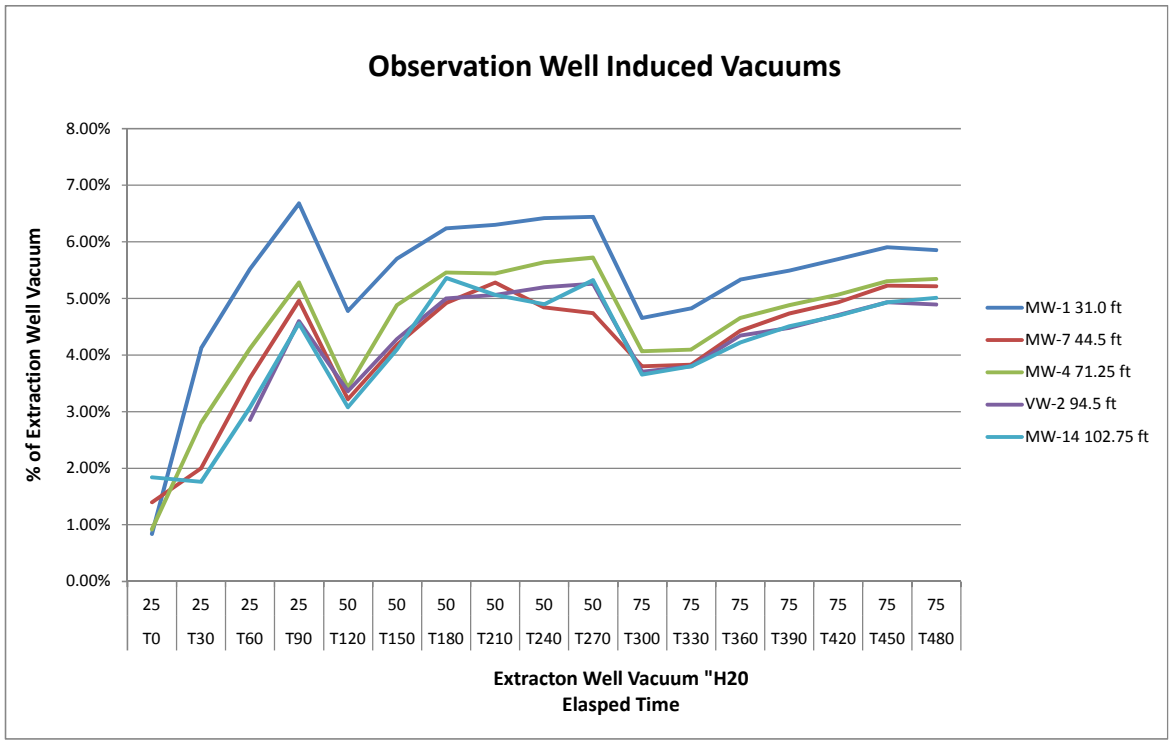






SCHEDULE B
Summary of ACUVAC TEST #SVE-2
Recorded Well Vacuums and/or Pressures





AcuVac Remediation

OPERATING DATA - TEST # SVE #2 **PAGE # 1** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/20/17					
Diameter- 2.0" TD- 92.0 Ft bgs Well Screen- 72.0 – 92.0 ft bgs EXTRACTION WELL- **MW-9**			Time 0820 / Hr Meter 8220.0	Time 0830 / Hr Meter 8220.0	Time 0900 / Hr Meter 8220.5	Time 0930 / Hr Meter 8221.0	Time 1000 / Hr Meter 8221.5	Time 1030 / Hr Meter 8222.0
ENGINE/BLOWER	Engine Speed	rpm		2000	2000	2000	2000	2100
	Oil Pressure	psi		50	50	50	50	50
	Water Temp	°F		125	125	125	130	130
	Alternator	Volts		14	14	14	14	14
	Intake Vac.	"Hg		14	14	14	14	14
	Propane	cfh		0	0	0	0	0
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O		25	25	25	25	50
	Extraction Well Flow	scfm		11.91	11.91	11.91	11.91	17.09
	Influent Vapor Temp.	°F	OFF	60	60	60	60	60
	Air Temp.	°F	48	48	50	50	52	54
	Barometric Pressure	"Hg	29.98	29.98	29.98	29.98	29.98	29.98
	Absolute Pressure	"Hg	23.46	23.46	23.46	23.46	23.46	23.46
MONITOR WELL VACUUM	**MW-6** 43.0 Ft	"H_2O	(.49)	.21	1.03	1.38	1.67	2.39
	MW-10 56.0 ft	"H_2O	0	.35	.50	.90	1.24	1.61
	MW-11 59.0 ft	"H_2O	(.06)	.23	.70	1.03	1.32	1.71
	MW-5 72.0 ft	"H_2O	ND	ND	ND	.71	1.15	1.68
	MW-16 84.0 **ft**	"H_2O	(.037)	.46	.44	.77	1.14	1.54
	MW-7 84.0 ft	"H_2O	ND	ND	ND	.31	.69	1.10
	MW-12 179.0 ft	"H_2O	ND	ND	ND	ND	ND	ND
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	SVE	ON/OFF	OFF	ON	ON	ON	ON	ON
	Data Logger	ft	13.08	14.92	14.83	14.95	14.89	17.01
	GW Upwelling	ft	–	1.84	1.75	1.87	1.81	3.93
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

( ) Indicates Well Pressure

AcuVac Remediation

OPERATING DATA SVE PILOT TEST #2 **PAGE 2** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM						Project Managers: Faucher/Hendley	
Date		10/20/17					
Time		0900	0930	1030			
TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA
	Well No.	MW-9	MW-9	MW-9			
VAPOR/INFLUENT	HC ppmv	83,120	80,300	81,160			
	CO_2 %	2.68	2.28	2.50			
	CO %	5.28	5.05	4.26			
	O_2 %	5.7	4.8	5.5			
	H_2S ppm	4.1	3.1	0			

0720 Hrs	ARRIVED ON SITE. POSITIONED THE ACUVAC SYSTEM NEAR WELL MW-9.
	OPENED WELLS MW-9 AND MW-6. GAUGED THE WELLS AND PLACED DATA
	LOGGERS IN EACH APPROXIMATELY 1.0" ABOVE WELL BOTTOM. OPENED ALL
	OUTER WELLS. GAUGED THE WELLS AND INSTALLED WELL PLUGS WITH A VENT.
0820 Hrs	OBTAINED STATIC DATA READINGS BP 29.98" H_g, AIR TEMP 48, RECORDED
	MANOMETER READINGS FROM ALL OUTER WELLS RANGING FROM < .49? TO 0" H_2O
0830 Hrs	TEST STARTED. BP STEADY AT 29.98" H_g. OBTAINED MANOMETER READINGS
	ON ALL OUTER WELLS AT 0835 HRS. ALL WELLS RECORDING VACUUM INFLUENCE
	RANGING FROM .21 TO .46" H_g. GW UPWELLING IN WELL MW-9 1.84 FT.
	AND INDICATES WELLS WERE NOT ACCESSIBLE
0900 Hrs	BP STEADY AT 29.98" H_g WVF STEADY AT 11.91 SCFM. OUTER WELL INDUCED
	VACUUM INFLUENCE INCREASING ALL WELLS RANGE FROM .40 TO 1.03" H_2O
0930 -	BP STEADY AT 29.98" H_g. WVF STEADY AT 11.91 SCFM. OUTER WELL CONTINUE
1000 Hrs	TO RESPOND TO SVE INDUCED VACUUM. AT 1000 HRS ALL WELL ACCESSIBLE
	EXCEPT MW-12.
1030 Hrs	BP STEADY AT 29.98" H_g INCREASED WELL VAC TO 60" H_2O, WVF↑ 17.09 SCFM
	OBTAINED MANOMETER READINGS AT 1035 HRS ALL OUTER WELLS RECORDED
	INCREASES IN VACUUM INFLUENCE RANGING FROM 1.10 TO 2.39" H_2O
	GW UPWELLING IN WELL MW-9 ↑ 17.01 FT, Δ 3.93 FT INCREASE
	FROM STATIC.

AcuVac Remediation

OPERATING DATA - TEST # SVE #2 **PAGE # 3** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/20/17					
Diameter- 2.0" TD- 92.0 Ft bgs Well Screen- 72.0 – 92.0 ft bgs EXTRACTION WELL- **MW-9**			Time 1100 Hr Meter 8222.5	Time 1130 Hr Meter 8223.0	Time 1200 Hr Meter 8223.5	Time 1230 Hr Meter 8224.0	Time 1300 Hr Meter 8224.5	Time 1330 Hr Meter 8225.0
ENGINE/BLOWER	Engine Speed	rpm	2100	2100	2100	2100	2100	2000
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	130	130	130	130	130	135
	Alternator	Volts	14	14	14	14	14	14
	Intake Vac.	"Hg	14	14	14	14	14	14
	Propane	cfh	0	0	0	0	0	0
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O	50	50	50	50	50	75
	Extraction Well Flow	scfm	17.09	17.09	17.09	17.06	17.06	17.18
	Influent Vapor Temp.	°F	60	60	60	62	62	62
	Air Temp.	°F	54	57	58	59	60	61
	Barometric Pressure	"Hg	29.98	29.97	29.95	29.91	29.89	29.87
	Absolute Pressure	"Hg	23.46	23.46	23.44	23.41	23.40	23.38
MONITOR WELL VACUUM	**MW-6 ~~34~~ 43.0 ft**	"H_2O	2.85	3.12	3.15	3.21	3.22	3.49
	MW-10 56.0 ft	"H_2O	2.09	2.46	2.64	2.42	2.37	2.85
	MW-11 59.0 ft	"H_2O	2.44	2.73	2.72	2.82	2.86	3.05
	MW-5 72.0 ft	"H_2O	2.14	2.50	2.53	2.60	2.63	2.78
	MW-16 ~~80~~ 84.0 ft	"H_2O	2.05	2.68	2.53	2.45	2.66	2.74
	MW-7 84.0 ft	"H_2O	1.49	1.75	1.77	1.81	1.80	1.93
	MW-12 179.0 ft	"H_2O	ND	.06	.25	.22	.23	.21
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	SVE	ON/OFF	ON	ON	ON	ON	ON	ON
	Data Logger	ft	17.20	16.95	16.97	17.00	16.90	19.45
	GW Upwelling	ft	4.12	3.87	3.89	3.92	3.82	6.37
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

( ) Indicates Well Pressure

AcuVac Remediation

OPERATING DATA SVE PILOT TEST #2 **PAGE 4** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM						**Project Managers: Faucher/Hendley**		
Date		10/20/17						
Time		1100	1230	1330				
TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	
	Well No.	MW-9	MW-9	MW-9				
VAPOR/INFLUENT	HC ppmv	75,330	78,010	85,960				
	CO_2 %	2.30	1.87	2.20				
	CO %	4.14	3.76	5.56				
	O_2 %	5.3	5.5	4.8				
	H_2S ppm	0	0	2.0				

1100 HRS	BP STEADY AT 29.58 "Hg TPH VAPORS ↓ 75.330 PPMV. ALL OUTER WELLS
	RECORDED INCREASED VACUUM INFLUENCE.
1130 HRS	BP ↓ 29.97 "Hg. ALL OUTER WELLS RECORDED INCREASED VACUUM INFLUENCE
1200 HRS	BP ↓ 29.95 "Hg ALL OUTER WELLS EXCEPT MW-11 RECORDED SLIGHT
	INCREASES IN VACUUM INFLUENCE
1230 HRS	BP ↓ 29.91 "Hg, TOTAL DECREASE SINCE 1100 HRS .08 "Hg. TPH VAPORS
	↑ 78,010 PPMV. OUTER WELLS CONTINUED TO RECORD INCREASED VACUUM
	INFLUENCE DESPITE THE .04 "Hg DECREASE IN BP.
1300 HRS	BP ↓ 29.89 "Hg WELLS MW-6 RECORDED A SLIGHT INCREASE IN VACUUM
	INFLUENCE MW-10, MW, MW-7 ↓ VACUUM INFLUENCE
1330 HRS	BP ↓ 29.87 "Hg VAC ↑ 75" H_2O, WELL FLOW ↑ 17.18 SCFM. ALL OUTER
	RECORDED INCREASE VACUUM RESPONSE RELATED TO INCREASE IN WELL VAC

AcuVac Remediation

OPERATING DATA - TEST # SVE #2 **PAGE # 5** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/20/17						
Diameter- 2.0" TD- 92.0 Ft bgs Well Screen- 72.0 – 92.0 ft bgs EXTRACTION WELL- **MW-9**			Time 1400 Hr Meter 8225.5	Time 1430 Hr Meter 8226.0	Time 1500 Hr Meter 8226.5	Time 1530 Hr Meter 8227.0	Time 1600 Hr Meter 8227.5	Time 1630 Hr Meter 8228.0	1700 STATIC
ENGINE/BLOWER	Engine Speed	rpm	2100	2100	2100	2100	2100	2100	
	Oil Pressure	psi	50	50	50	50	50	50	
	Water Temp	°F	135	140	135	135	135	135	
	Alternator	Volts	14	14	14	14	14	14	
	Intake Vac.	"Hg	14	12	12	12	12	12	
	Propane	cfh	0	0	0	0	0	0	
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O	75	75	75	75	75	75	
	Extraction Well Flow	scfm	17.18	17.18	17.18	17.21	17.21	17.21	
	Influent Vapor Temp.	°F	62	62	62	60	60	60	
	Air Temp.	°F	63	63	63	63	63	63	
	Barometric Pressure	"Hg	29.86	29.85	29.84	29.83	29.82	29.82	
	Absolute Pressure	"Hg	23.37	23.36	23.36	23.35	23.34	23.34	
MONITOR WELL VACUUM	**MW-6 34.0 ft** (43)	"H_2O	3.62	4.00	4.12	4.27	4.43	4.39	1.45
	MW-10 56.0 ft	"H_2O	2.87	3.32	3.55	3.70	3.92	3.91	2.73
	MW-11 59.0 ft	"H_2O	3.07	3.49	3.66	3.90	3.98	4.01	2.51
	MW-5 72.0 ft	"H_2O	2.85	3.26	3.36	3.53	3.70	3.67	2.37
	MW-16 80.0 ft (84)	"H_2O	2.85	3.17	3.38	3.52	3.70	3.76	2.54
	MW-7 84.0 ft	"H_2O	2.03	2.35	2.46	2.59	2.75	2.73	2.16
	MW-12 179.0 ft	"H_2O	.24	.41	.49	.64	.76	.75	.72
		"H_2O							
		"H_2O							
		"H_2O							
MANIFOLD	SVE	ON/OFF	ON	ON	ON	ON	ON	OFF	
	Data Logger	ft	18.61	19.46	18.94	18.81	19.06	18.58	12.80
	GW Upwelling	ft	5.53	6.38	5.86	5.73	5.58	5.47	(.29)
	Extraction Well	DTNAPL							
	Extraction Well	DTGW							

( ) Indicates Well Pressure

AcuVac Remediation

OPERATING DATA SVE PILOT TEST #2 **PAGE 6** **ACUVAC SVE SYSTEM**

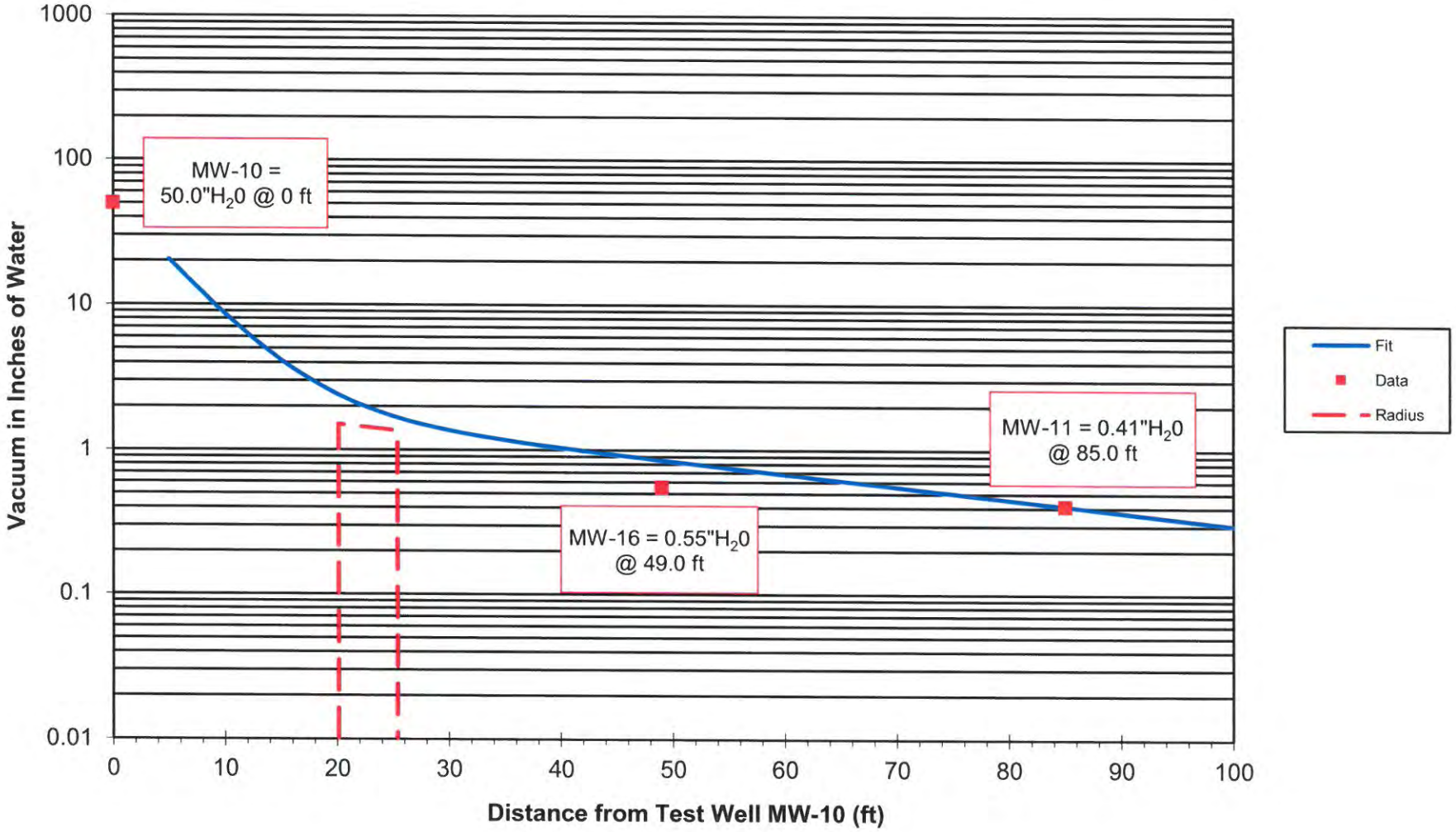
Location: Shamrock #63, Santa Fe, NM							Project Managers: Faucher/Hendley
Date		10/20/17					
Time		1430	1530				
TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA
	Well No.	MW-9	MW-9				
VAPOR/INFLUENT	HC ppmv	86,750	81,890				
	CO_2 %	2.62	2.10				
	CO %	5.80	4.78				
	O_2 %	5.2	5.4				
	H_2S ppm	2.0	2.0				

1400 HRS	BP↓ 29.86"Hg ALL OUTER WELLS RECORDED INCREASED IN VACUUM INFLUENCE
1430 HRS	BP↓ 29.85"Hg ALL OUTER WELLS RECORDED INCREASED VACUUM INFLUENCE
	TOTAL DECREASE IN BP FROM START OF TEST .13"Hg. TPH VAPORS ↑86,750 PPMV
1500 HRS	ALL OUTER WELLS RECORDED INCREASED VACUUM INFLUENCE.
1530 HRS	BP↓ 29.83"Hg TPH VAPORS↓ 81,890 PPMV. ALL OUTER WELLS RECORDED
	INCREASED VACUUM INFLUENCE.
1600 HRS	BP↓ 29.82"Hg ALL OUTER WELLS RECORDED INCREASED VACUUM INFLUENCE
	TOTAL DECREASE IN BP .04"Hg SINCE 1400 HRS.
1630 HRS	BP STEADY AT 29.82"Hg WELLS MW-6, 10, 5, 7 & 12 ↓ VACUUM INFLUENCE
	WELLS MW-11 & 16 ↑ VACUUM INFLUENCE. TEST CONCLUDED.
1645 HRS	STARTED WITH WELL MW-12, RECORDED STATIC WELL VAC AND THEN
	GAUGED WELL. WORKED FROM DISTANT WELLS TO WELLS MW-9 AND
	MW-6
1700	RECORDED STATIC DATA IN WELLS MW-6 AND 9.

SHAMROCK #63
TEST SVE #2
SANTA FE, NM

SHAMROCK #63
TEST SVE #2
SANTA FE, NM

Figure #1
Radius of Influence
Data from Pilot Test #SVE-3 at 3% of Induced Vacuum



STATIC WELL DATA
TEST #SVE-3
TABLE #1A

Location: Shamrock #63, Santa Fe, NM									
Project Date 10/22/2017		**MW-10**	**MW-16**	**MW-9**	**MW-17**	**MW-11**	**MW-6**	**MW-18**	**MW-19**
Well Data									
TD	ft	92.0	90.0	92.0	90.0	92.0	90.0	90.0	90.0
Screen	ft	72.0- 92.0	70.0 90.0	72.0- 92.0	70.0 90.0	72.0- 92.0	70.0 90.0	70.0 90.0	70.0 90.0
Well Size	in	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Distance From EW	ft	0.0	49.0	56.0	65.0	85.0	99.0	106.0	135.00
Static Basleine Data- Start	"H_2O	-	0.90	ND	ND	0.51	0.41	0.51	ND
Static Basleine Data- Start	"H2O	-	2.05	2.15	1.90	1.95	2.05	1.95	1.79

ND- No Data Recorded

EXTRACTION WELL MW-10
OPERATING DATA TEST #SVE-3
TABLE #1B

Location: Shamrock #63, Santa Fe, NM

					EXTRACTION WELL				OBSERVATION WELL	
					MW-10				MW-16	
Project Date 10/22/2017				**Units**	**DTGW**	**GWD GWU**	**Vacuum "H_2O**	**Vapor Flow SCFM**	**DTGW**	**GWD GWU**
Well Data										
TD				ft bgs	92.0	-	-	-	90.00	-
Screen				ft	72.0 - 92.0	-	-	-	70.0 - 90.0	-
Well Size				in	2.0	-	-	-	2.0	-
Static Data- 0750 Hrs										
DTGW				ft bgs	78.91	-	-		76.64	-
DTGW Hydro Equivalent				ft bgs	77.48	-	-		76.64	-
DTNAPL				ft bgs	78.09	-	-		-	-
NAPL				ft bgs	0.82	-	-		-	-
Drawdown Data										
Data Logger	0820	hrs	Start	ft	13.80	-	-	-	12.60	-
Data Logger	0830	hrs		ft	15.29	1.49	20	3.24	12.60	0.00
Data Logger	0900	hrs		ft	15.26	1.46	20	3.20	12.77	0.17
Data Logger	0930	hrs		ft	15.34	1.54	20	3.20	12.75	0.15
Data Logger	1000	hrs		ft	15.43	1.63	20	3.17	12.78	0.18
Data Logger	1030	hrs		ft	16.33	2.53	40	4.39	12.78	0.18
Data Logger	1100	hrs		ft	16.98	3.18	40	4.38	12.78	0.18
Data Logger	1130	hrs		ft	16.98	3.18	40	4.37	12.78	0.18
Data Logger	1200	hrs		ft	16.97	3.17	40	4.37	12.80	0.20
Data Logger	1230	hrs		ft	17.01	3.21	40	4.37	12.80	0.20
Data Logger	1300	hrs		ft	16.97	3.17	40	4.37	12.81	0.21
Data Logger	1330	hrs		ft	18.36	4.56	60	5.91	12.83	0.23
Data Logger	1400	hrs		ft	18.82	5.02	60	5.91	12.82	0.22
Data Logger	1430	hrs		ft	18.80	5.00	60	5.91	12.80	0.20
Data Logger	1500	hrs		ft	18.98	5.18	60	5.91	12.82	0.22
Data Logger	1530	hrs		ft	18.81	5.01	60	5.90	12.85	0.25
Data Logger	1600	hrs		ft	18.79	4.99	60	5.90	12.85	0.25
Data Logger	1630	hrs	Stop	ft	18.77	4.97	60	5.90	12.85	0.25
Data Logger	1700	hrs	Static	ft	13.86	0.06	-		12.67	0.07
DTGW	1700	hrs			78.42	-	-		78.42	-
DTGW Hydro Equivalent					78.39	-	-		78.42	-
DTNAPL					78.38	-	-		-	-
NAPL					0.04	-	-		-	-
Average GW Upwelling					-	3.488	-			0.192

OBSERVATION WELL DATA
TEST #SVE-3
TABLE #1C

Location: Shamrock #63, Santa Fe, NM									
Project Date 10/22/2017		**MW-10**	**MW-16**	**MW-9**	**MW-17**	**MW-11**	**MW-6**	**MW-18**	**MW-19**
Well Data									
TD	ft	92.0	90.0	92.0	90.0	92.0	90.0	90.0	90.0
Screen	ft	72.0- 92.0	70.0 90.0	72.0- 92.0	70.0 90.0	72.0- 92.0	70.0 90.0	70.0 90.0	70.0 90.0
Well Size	in	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Distance From EW	ft	0.0	49.0	56.0	65.0	85.0	99.0	106.0	135.00
Static Data - 0620 hrs									
DTGW	ft	78.91	76.64	80.21	78.95	77.95	82.38	76.64	76.30
DTGW - Hydro Equivalent	ft	78.30	76.64	79.60	78.95	77.95	81.67	76.64	76.30
DTNAPL	ft	78.09	-	79.39	-	-	81.42	-	-
NAPL	ft	0.82	-	0.82	-	-	0.96	-	-
Static Data - 1500 hrs									
DTGW	ft	78.42	76.62	80.11	78.82	77.82	82.34	76.62	76.23
DTGW - Hydro Equivalent	ft	78.39	76.62	79.51	78.82	77.82	81.64	76.62	76.23
DTNAPL	ft	78.38	-	79.30	-	-	81.39	-	-
LNAPL	ft	0.04	-	0.81	-	-	0.95	-	-
Change ion Hydro Equavalent	ft	(0.09)	0.02	0.09	0.13	0.13	0.03	0.02	0.07

Specific Gravity .74

SCHEDULE A
Test # SVE-3
SUMMARY OF TEST DATA

SHAMROCK #63
SANTA FE, NM
October 22, 2017

	Units	DATA ELEMENT						
		STATIC 8:20	START 8:30	1 9:00	2 9:30	3 10:00	4 10:30	5 11:00
Influent Vapor Data								
Horiba TPH	ppmv	ND	ND	82,100	ND	79,340	84,180	83,050
Horiba CO_2	%	ND	ND	1.30	ND	1.30	1.22	1.10
Horiba CO	%	ND	ND	5.22	ND	4.08	5	4.72
Lumidor O_2	%	ND	ND	5.9	ND	5.7	6.0	6.2
Lumidor H_2S	ppm	ND	ND	7	ND	6	6	3
Influent Vapor	°F	OFF	37.0	48.0	50.0	56.0	56.0	60.0
Extraction Well- Well SVE-1								
Well Flow	scfm	OFF	3.24	3.20	3.20	3.18	4.40	4.38
Well Vacuum	"H_2O	OFF	20.0	20.0	20.0	20.0	40.0	40.0
Observation Well Data- Vacuum (Pressure)								
MW-16 - 49.0 ft	"H_2O	1.43	2.07	2.17	2.25	2.27	2.32	2.41
MW-9 - 56.0 ft	"H_2O	2.27	2.60	2.66	2.69	2.73	2.70	2.83
MW-17 - 65.0 ft	"H_2O	1.11	2.22	2.42	2.47	2.49	2.49	2.68
MW-11 - 85.0 ft	"H_2O	1.95	2.48	2.64	2.63	2.64	2.64	2.77
MW-6 - 99.0 ft	"H_2O	2.30	2.61	2.68	2.71	2.73	2.70	2.78
MW-18 - 106.0 ft	"H_2O	ND	ND	ND	ND	ND	2.35	2.73
MW-19 - 135.0 ft	"H_2O	0.00	1.21	1.96	2.31	2.12	2.34	2.49
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	30.31	30.31	30.32	30.32	30.32	30.32	30.33
Absolute Pressure	"Hg	23.72	23.72	23.73	23.73	23.73	23.73	23.74

( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE A
TEST SVE-3
SUMMARY OF TEST DATA

SHAMROCK #63
SANTA FE, NM
October 22, 2017

		DATA ELEMENT						
	Units	7 11:30	8 12:00	9 12:30	10 13:00	11 13:30	12 14:00	13 14:30
Influent Vapor Data								
Horiba TPH	ppmv	**ND**	**89,380**	**ND**	**80,120**	**87,230**	**92,080**	**ND**
Horiba CO_2	%	**ND**	**1.33**	**ND**	**1.14**	**0.80**	**0.78**	**ND**
Horiba CO	%	**ND**	**5.92**	**ND**	**4.60**	**6**	**4.23**	**ND**
Lumidor O_2	%	**ND**	**6.8**	**ND**	**5.4**	**5.2**	**5.2**	**ND**
Lumidor H_2S	ppm	**ND**	**2**	**ND**	**2**	**2**	**2**	**ND**
Influent Vapor	°F	**62.0**	**62.0**	**62.0**	**62.0**	**64.0**	**64.0**	**64.0**
Extraction Well- Well SVE-1								
Well Flow	scfm	**4.37**	**4.37**	**4.37**	**4.37**	**5.91**	**5.91**	**5.91**
Well Vacuum	"H_2O	**40.0**	**40.0**	**40.0**	**40.0**	**60.0**	**60.0**	**60.0**
Observation Well Data- Vacuum (Pressure)								
MW-16 - 49.0 ft	"H_2O	**2.53**	**2.35**	**2.34**	**2.14**	**2.08**	**1.82**	**1.70**
MW-9 - 56.0 ft	"H_2O	**2.83**	**2.60**	**2.47**	**2.31**	**2.18**	**2.18**	**2.01**
MW-17 - 65.0 ft	"H_2O	**2.63**	**2.52**	**2.27**	**2.24**	**2.10**	**2.12**	**1.96**
MW-11 - 85.0 ft	"H_2O	**2.70**	**2.55**	**2.36**	**2.22**	**2.13**	**2.03**	**1.87**
MW-6 - 99.0 ft	"H_2O	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
MW-18 - 106.0 ft	"H_2O	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
MW-19 - 135.0 ft	"H_2O	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	**30.34**	**30.33**	**30.32**	**30.32**	**30.30**	**30.28**	**30.27**
Absolute Pressure	"Hg	**23.75**	**23.74**	**23.73**	**23.73**	**23.72**	**23.70**	**23.69**

( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE A
TEST SVE-3
SUMMARY OF TEST DATA

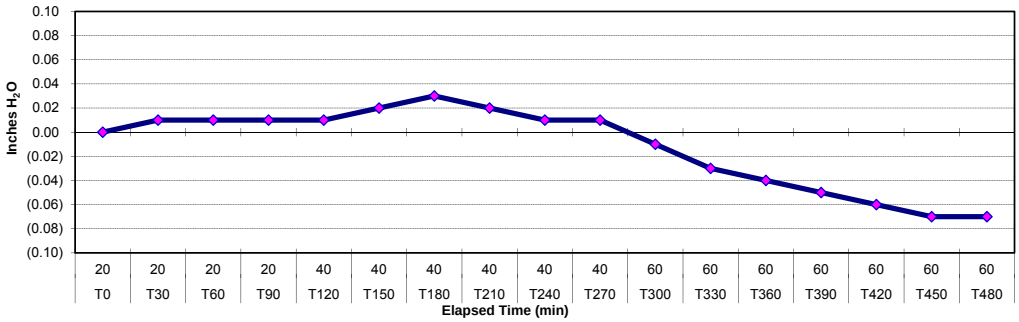
SHAMROCK #63
SANTA FE, NM
October 22, 2017

	Units	DATA ELEMENT						
		14 15:00	15 15:30	16 16:00	17 16:30	Static 17:00	Average Data	Maximum Data
Influent Vapor Data								
Horiba TPH	ppmv	**87,830**	**ND**	**91,690**	**ND**	**ND**	**85,700**	**92,080**
Horiba CO_2	%	**1.10**	**ND**	**1.32**	**ND**	**ND**	**1.14**	**1.33**
Horiba CO	%	**6.30**	**ND**	**5.69**	**ND**	**ND**	**5.24**	**6.46**
Lumidor O_2	%	**5.7**	**ND**	**5.6**	**ND**	**ND**	**5.8**	**6.8**
Lumidor H_2S	ppm	**2**	**ND**	**2**	**ND**	**ND**	**4**	**7**
Influent Vapor	°F	**64**	**66**	**66**	**66**	**OFF**	**59**	**66**
Extraction Well- Well SVE-1								
Well Flow	scfm	**5.91**	**5.90**	**5.90**	**5.90**	**OFF**	**4.73**	**5.91**
Well Vacuum	"H_2O	**60.0**	**60.0**	**60.0**	**60.0**	**OFF**	**43.5**	**60.0**
Observation Well Data- Vacuum (Pressure)								
MW-16 - 49.0 ft	"H_2O	**1.49**	**1.51**	**1.39**	**1.37**	**1.21**	**2.01**	**2.53**
MW-9 - 56.0 ft	"H_2O	**1.82**	**1.75**	**1.70**	**1.69**	**1.48**	**2.34**	**2.83**
MW-17 - 65.0 ft	"H_2O	**1.87**	**1.80**	**1.67**	**1.69**	**1.45**	**2.21**	**2.68**
MW-11 - 85.0 ft	"H_2O	**1.74**	**1.69**	**1.64**	**1.57**	**1.54**	**2.25**	**2.77**
MW-6 - 99.0 ft	"H_2O	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
MW-18 - 106.0 ft	"H_2O	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
MW-19 - 135.0 ft	"H_2O	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ATMOSPHERIC DATA								
Barometric Pressure	"Hg	**30.26**	**30.25**	**30.24**	**30.24**	**30.24**	**30.30**	**30.34**
Absolute Pressure	"Hg	**23.68**	**23.68**	**23.67**	**23.67**	**23.67**	**23.71**	**23.75**

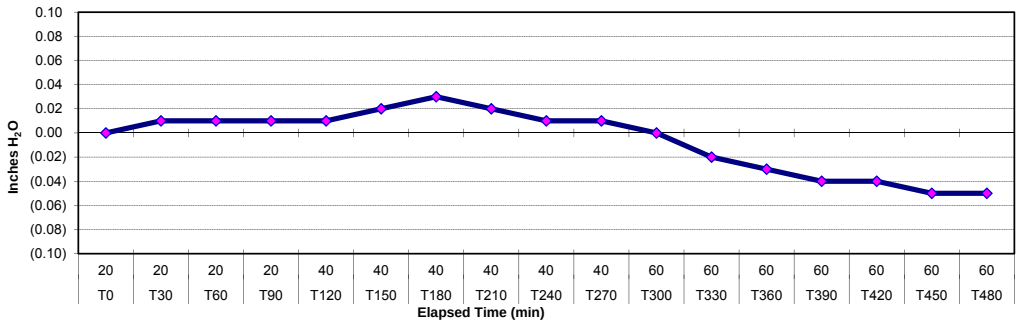
( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE B
Summary of TEST #SVE-3
Atmospheric Conditions

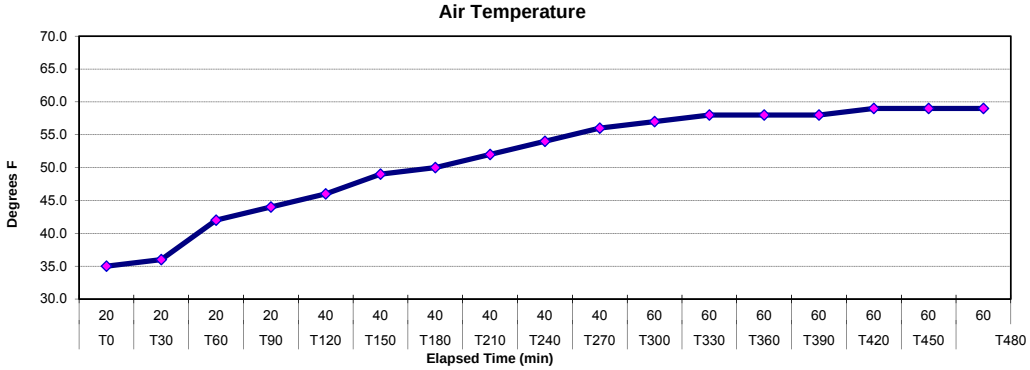
Barometric Pressure



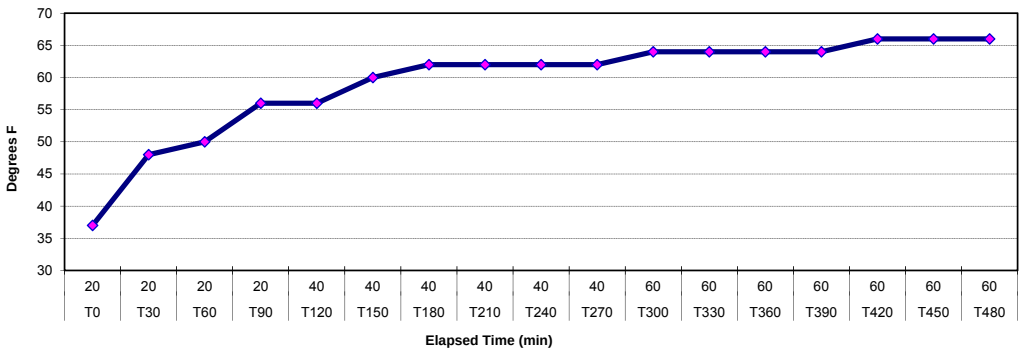
Absolute Pressure



Air Temperature

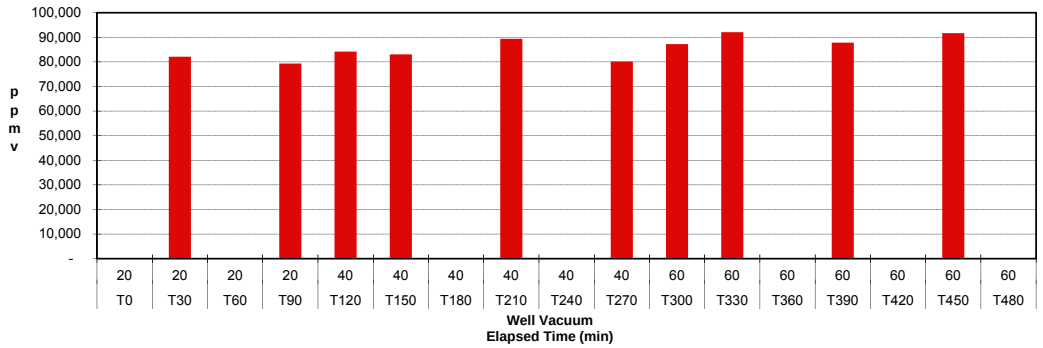


Influent Temperature

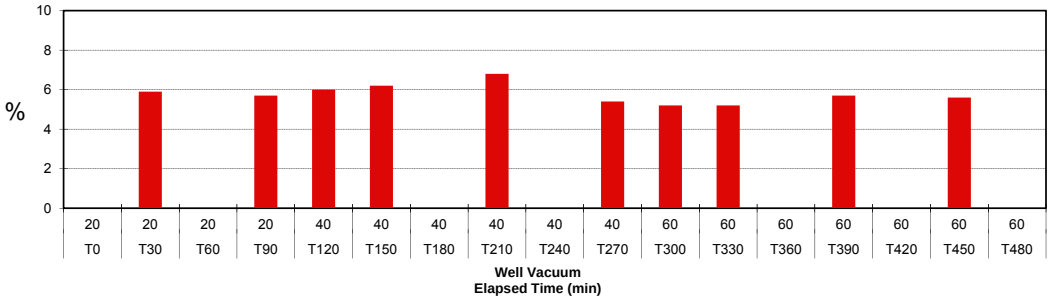


SCHEDULE B
Summary of TEST #SVE-3
Influent Vapors

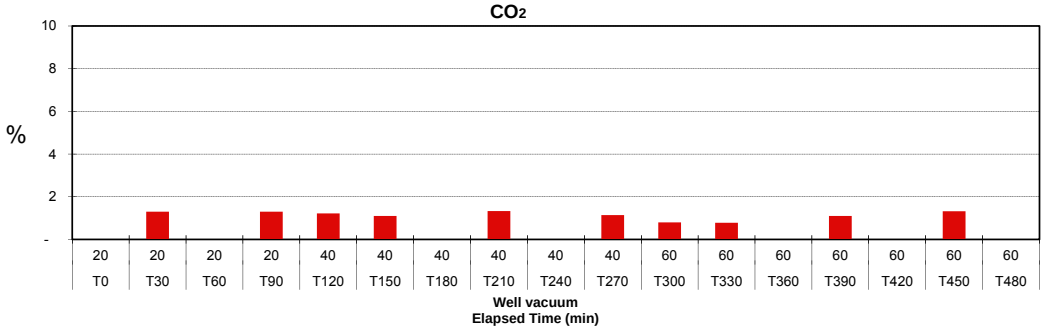
TPH Concentrations



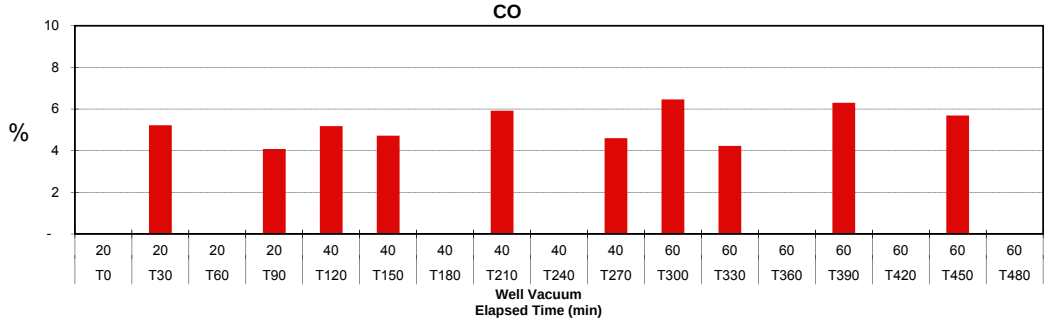
O_2



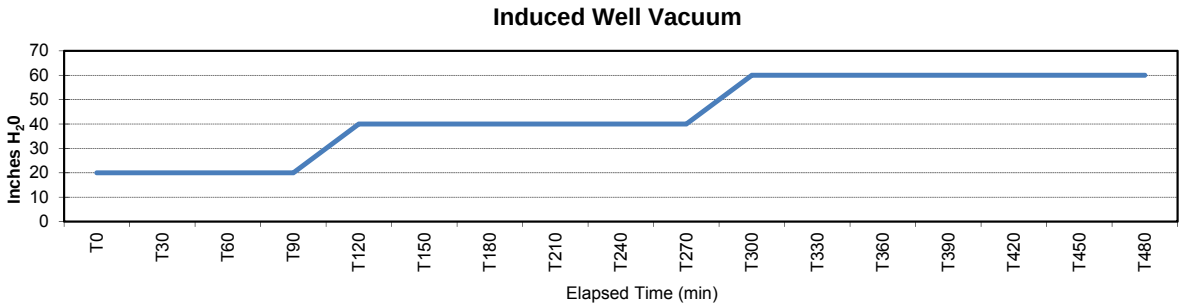
CO_2

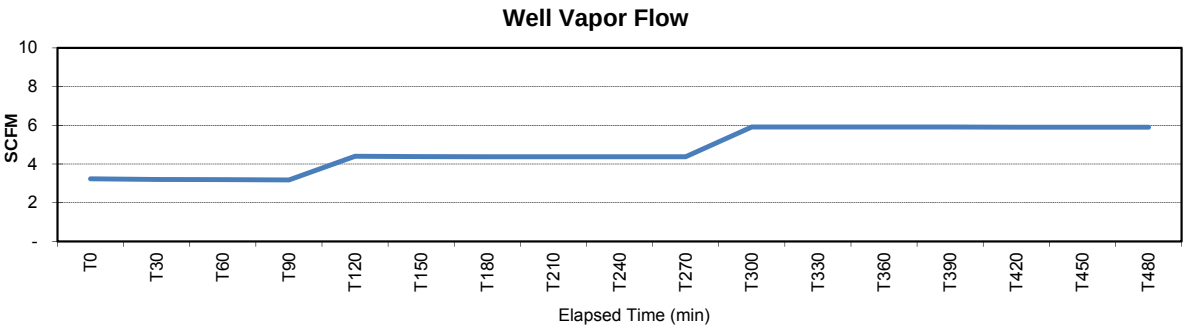


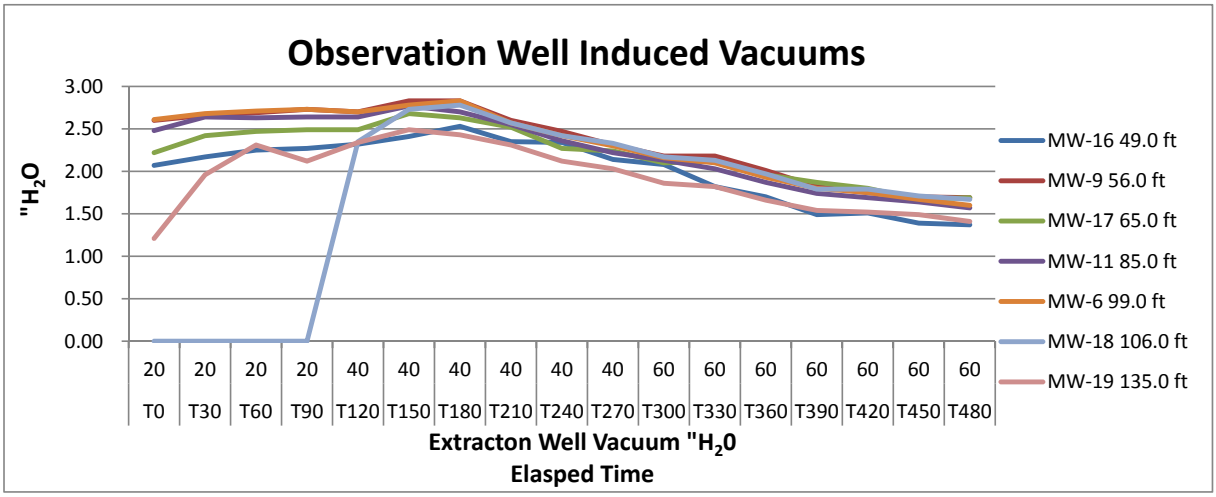
CO

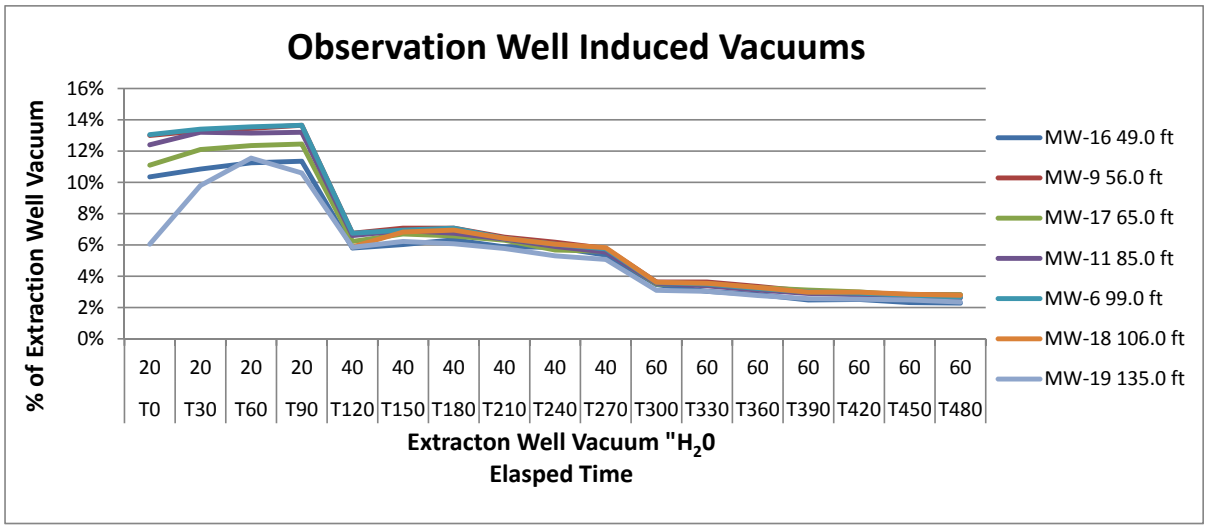


SCHEDULE B
Summary of TEST #SVE-3
Recorded Well Vacuums

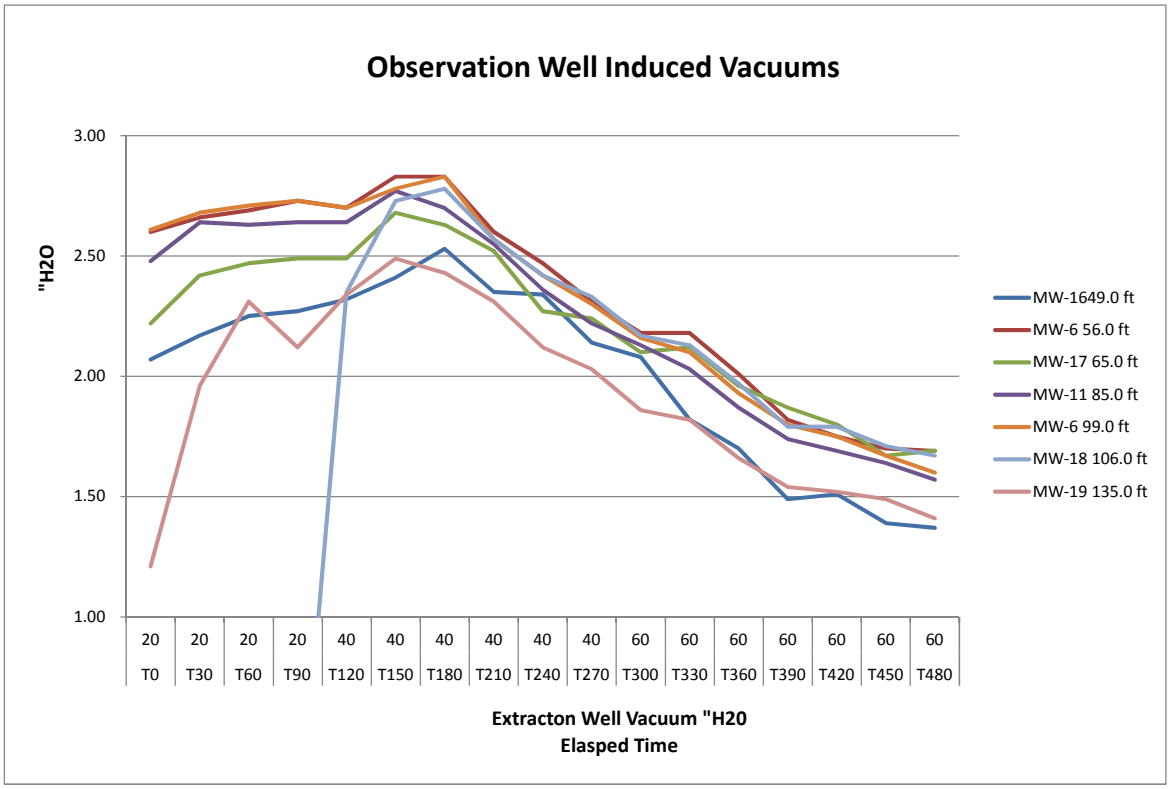


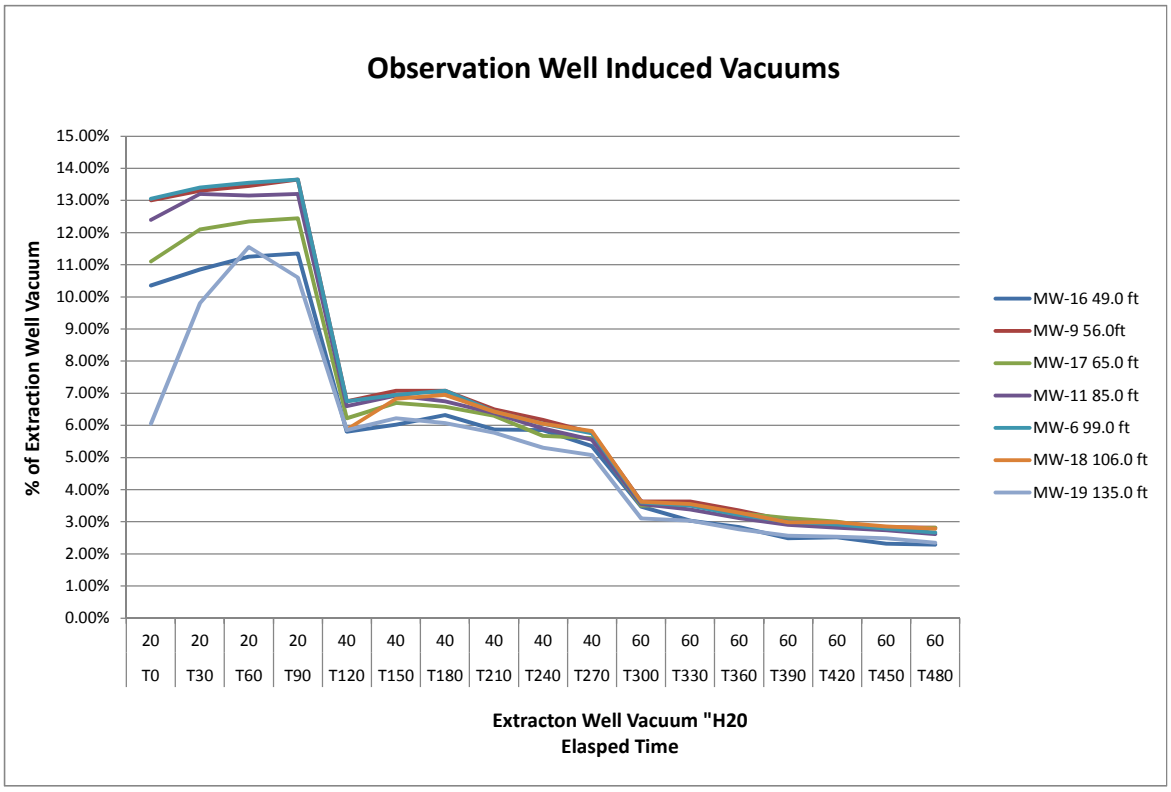






SCHEDULE B
Summary of TEST #SVE-3
Recorded Well Vacuums





AcuVac Remediation

OPERATING DATA - TEST # SVE #3 **PAGE # 1** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/22/17					
Diameter- 2.0" TD- 92.0 Ft bgs Well Screen- 72.0 – 92.0 ft bgs EXTRACTION WELL- **MW-10**			Time 0820 Hr Meter –	Time 0830 Hr Meter 8296.5	Time 0900 Hr Meter 8292.0	Time 0930 Hr Meter 8287.5	Time 1000 Hr Meter 8288.0	Time 1030 Hr Meter 8289.5
ENGINE/BLOWER	Engine Speed	rpm		1800	1800	1800	1800	1800
	Oil Pressure	psi		50	50	50	50	50
	Water Temp	°F		120	125	125	130	130
	Alternator	Volts		14	14	14	14	14
	Intake Vac.	"Hg		18	18	18	18	18
	Propane	cfh		105	105	105	105	90
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O		20	20	20	20	40
	Extraction Well Flow	scfm		3.24	3.20	3.20	3.18	4.39
	Influent Vapor Temp.	°F		37	48	50	56	58
	Air Temp.	°F	35	35	36	42	44	46
	Barometric Pressure	"Hg	30.31	30.31	30.32	30.32	30.32	30.32
	Absolute Pressure	"Hg	23.72	23.72	23.73	23.73	23.73	23.73
MONITOR WELL VACUUM	MW-16 - 49.0 ft	"H_2O	1.43	2.07	2.17	2.25	2.27	2.32
	MW-9 - 56.0 ft	"H_2O	2.27	2.60	2.66	2.69	2.73	2.70
	MW-17 65.0 Ft	"H_2O	1.11	2.22	2.42	2.47	2.49	2.49
	MW-11 85.0 Ft	"H_2O	1.55	2.48	2.64	2.63	2.64	2.64
	MW-6 59.0 Ft	"H_2O	2.30	2.61	2.68	2.71	2.73	2.70
	MW-18 106 Ft	"H_2O	ND	ND	ND	ND	ND	2.35
	MW-19 135.0 Ft	"H_2O	0	1.21	1.96	2.31	2.12	2.34
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	SVE	ON/OFF	OFF	ON	ON	ON	ON	ON
	Data Logger	ft	13.80	15.29	15.26	15.34	15.43	16.33
	GW Upwelling	ft		1.49	1.46	.54	1.63	2.53
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

( ) Indicates Well Pressure

AcuVac Remediation

OPERATING DATA SVE PILOT TEST # 3 **PAGE 2** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM			Project Managers: Faucher/Hendley					
Date			10/22/17					
Time			0900	1000	1030			
TEST	Instrument		HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA
	Well No.		MW-10	MW-10	MW-10			
VAPOR/INFLUENT	HC	ppm v	82,100	79,340	84,180			
	CO_2	%	1.30	1.30	1.22			
	CO	%	5.22	4.08	5.18			
	O_2	%	5.9	5.7	6.0			
	H_2S	ppm	7.4	6.3	6.1			

0630	ARRIVED ON SITE. ACUVAC SYSTEM PREVIOUSLY POSITIONED NEAR MW-10.
	OPENED MW-10 AND MW-16. GAUGED THE WELLS, INSTALLED DATA
	LOGGERS. OPENED ALL OTHER OUTER WELLS GAUGED THEM AND INSTALLED
	PLUGS WITH VENTS
0720	REMOVED PLUG VENTS AND OBTAINED MANOMETER READINGS. ALL WELLS
	RECORDING VACUUMS. RANGING FROM 1.27 TO 2.64 "H_2O. SVE WELL MW-10
	RECORDED 30 "H_2O VACUUM ON THE MAGNEHELIC GAUGE. THE DECISION
	WAS MADE TO REMOVE ALL WELL PLUGS AND RE-PLACE THEM AT 0820 HRS
	AND START THE TEST AT 0830 HRS.
0820	OBTAINED MANOMETER READINGS ON OUTER WELLS RANGING FROM .11 TO
	2.30 "H_2O VACUUM. BP 30.31 "Hg
0830	TEST STARTED. BP 30.31 "Hg OBTAINED MANOMETER READINGS AT 0835 HRS
	ALL WELLS RESPONDED TO INDUCED WELL OF 20 "H_2O. INITIAL WELL FLOW
	3.24 SCFM.
0900	BP ↑ 30.32 "Hg. OUTER WELLS CONTINUE TO INCREASE VACUUM INFLUENCE
	ALL WELLS RECORDING 1.96 TO 2.68 "Hg
1030	INDUCED WELL VAC ↑ 40 "H_2O, WVF ↑ TO 4.39 SCFM. WELL VAPOR OBTAINED
	IMMEDIATELY PRIOR TO VACUUM INCREASE. MANOMETER READINGS
	OBTAINED AT 1035 HRS. OUTER WELLS DID NOT RESPOND IMMEDIATELY
	TO THE INCREASE IN VACUUM. BP STEADY AT 30.32 "Hg

AcuVac Remediation

OPERATING DATA - TEST # SVE #3 **PAGE # 3** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/22/17					
Diameter- 2.0" TD- 92.0 Ft bgs Well Screen- 72.0 – 92.0 ft bgs EXTRACTION WELL- **MW-10**			Time 1100 Hr Meter 8298.0	Time 1130 Hr Meter 8298.5	Time 1200 Hr Meter 8300.0	Time 1230 Hr Meter 8301.5	Time 1300 Hr Meter 8302.0	Time 1330 Hr Meter 8302.5
ENGINE/BLOWER	Engine Speed	rpm	1800	1800	1800	1800	1800	1800
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	130	130	130	130	130	130
	Alternator	Volts	14	14	14	14	14	14
	Intake Vac.	"Hg	18	18	18	18	18	18
	Propane	cfh	90	90	90	90	90	65
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O	40	40	40	40	40	60
	Extraction Well Flow	scfm	4.38	4.37	4.37	4.37	4.37	5.91
	Influent Vapor Temp.	°F	60	62	62	62	62	64
	Air Temp.	°F	49	50	52	54	56	57
	Barometric Pressure	"Hg	30.33	30.34	30.33	30.32	30.32	30.30
	Absolute Pressure	"Hg	23.74	23.75	23.74	23.73	23.73	23.72
MONITOR WELL VACUUM	MW-16 - 49.0 ft	"H_2O	2.41	2.53	2.35	2.34	2.14	2.08
	MW-9 - 56.0 ft	"H_2O	2.83	2.83	2.60	2.47	2.31	2.18
	MW-17 - 65.0 ft	"H_2O	2.68	2.63	2.52	2.27	2.24	2.10
	MW-11 85.0 ft	"H_2O	2.77	2.70	2.55	2.36	2.22	2.13
	MW-6 98.0 ft	"H_2O	2.78	2.83	2.57	2.42	2.30	2.16
	MW-18 106.0 ft	"H_2O	2.73	2.78	2.57	2.42	2.33	2.17
	MW-19 136.0 ft	"H_2O	2.49	2.43	2.31	2.12	2.03	1.86
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	SVE	ON/OFF	ON	ON	ON	ON	ON	ON
	Data Logger	ft	16.98	16.98	16.97	17.01	16.97	18.36
	GW Upwelling	ft	3.18	3.18	3.17	3.21	3.17	4.56
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

( ) Indicates Well Pressure

AcuVac Remediation

OPERATING DATA SVE PILOT TEST #2 **PAGE 4** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM						Project Managers: Faucher/Hendley		
Date			10/22/17					
Time			1100	1200	1300	1330		
TEST	Instrument		HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA
	Well No.		MW-10	MW-10	MW-10	MW-10		
VAPOR/INFLUENT	HC	ppmv	83,050	89.380	80,120	87,230		
	CO_2	%	1.10	1.33	1.14	.80		
	CO	%	4.72	5.92	4.60	6.46		
	O_2	%	6.2	6.8	5.4	5.2		
	H_2S	ppm	3.4	2.0	2.0	2.0		

1100	BP ↑ TO 30.33" Hg. WVF ↓ 4.38 SCFM DUE TO RISING INFLUENT VAPOR TEMPS. OUTER WELL VAC INFLUENCE RESPONSE ON AN INCREASING TREND. GW UPWELLING IN WELL MW-10 ↑ TO 16.98 FT. GW UPWELLING IN WELL MW-16 ↑ TO 12.79 FT
1130	BP ↑ TO 30.34" Hg. OUTER WELLS RECORDED BOTH INCREASES AND DECREASES IN VACUUM INFLUENCE. GW UPWELLING IN WELL WAS STEADY.
1200 TO 1300 HRS	BP ↓ 1200 HRS TO 30.33" Hg AND ↓ TO 30.32" Hg AT 1230 HRS. ALL OUTER WELLS WERE ON A DECREASING MOST LIKELY AS A RESULT OF THE FALLING BP. GW UPWELLING IN WELL MW-10 ↑ TO 17.01 FT AT 1230 HRS AND THEN ↓ 16.97 AT 1300 HRS.
1330 HRS	BP ↓ TO 30.30" Hg. SVE WELL VAC ↑ 60" H_2O, WVF ↑ TO 5.91 SCFM.
1335 HRS	SVE WELL GW UPWELLING ↑ TO 18.36 FT OR 4.56 FT UPWELLING
	OUTER DID NOT RECORD INCREASES IN VACUUM AS EXPECTED, MOST LIKELY THE RESULT OF THE FALLING BP.

AcuVac Remediation

OPERATING DATA - TEST # SVE #3 **PAGE # 5** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM **Project Managers: Faucher/ Hendley**

			10/22/17						
Diameter- 2.0" TD- 92.0 Ft bgs Well Screen- 72.0 – 92.0 ft bgs EXTRACTION WELL- **MW-10**			Time 1400 Hr Meter 8303.0	Time 1430 Hr Meter 8303.5	Time 1500 Hr Meter 8304.0	Time 1530 Hr Meter 8304.5	Time 1600 Hr Meter 8305.0	Time 1630 Hr Meter 8305.5	STATIC 1700
ENGINE/BLOWER	Engine Speed	rpm	1800	1800	1800	1800	1800	1800	
	Oil Pressure	psi	50	50	50	50	50	50	
	Water Temp	°F	130	130	135	135	135	135	
	Alternator	Volts	14	14	14	14	14	14	
	Intake Vac.	"Hg	18	18	18	18	18	18	
	Propane	cfh	70	60	60	60	60	60	
ATMOSPHERE/ VAPOR/AIR	Extraction Well Vac.	"H_2O	60	60	66	60	60	60	
	Extraction Well Flow	scfm	5.91	5.91	5.91	5.50	5.90	5.50	
	Influent Vapor Temp.	°F	64	64	64	66	66	66	
	Air Temp.	°F	58	58	58	55	55	60	
	Barometric Pressure	"Hg	30.28	30.27	30.26	30.25	30.24	30.24	30.24
	Absolute Pressure	"Hg	23.70	23.69	23.68	23.68	23.67	23.67	23.67
MONITOR WELL VACUUM	MW-16 - 49.0 ft	"H_2O	1.82	1.70	1.49	1.51	1.39	1.37	1.21
	MW-9 - 56.0 ft	"H_2O	2.18	2.01	1.92	1.75	1.70	1.69	1.48
	MW-17 65.0 Ft	"H_2O	2.12	1.96	1.87	1.80	1.67	1.69	1.45
	MW-11 85.0 Ft	"H_2O	2.03	1.87	1.74	1.69	1.64	1.57	1.54
	MW-6 99.0 Ft	"H_2O	2.10	1.93	1.80	1.75	1.67	1.60	1.53
	MW-18 106 Ft	"H_2O	2.13	1.97	1.79	1.79	1.71	1.67	1.36
	MW-19 136.0 Ft	"H_2O	1.92	1.66	1.54	1.52	1.49	1.41	1.24
		"H_2O							
		"H_2O							
		"H_2O							
MANIFOLD	SVE	ON/OFF	ON	ON	ON	ON	ON	OFF	OFF
	Data Logger	ft	18.82	18.80	18.98	18.81	18.79	18.77	13.80
	GW Upwelling	ft	5.02	5.0	5.18	5.01	4.99	4.97	.06
	Extraction Well	DTNAPL							
	Extraction Well	DTGW							

( ) Indicates Well Pressure

AcuVac Remediation

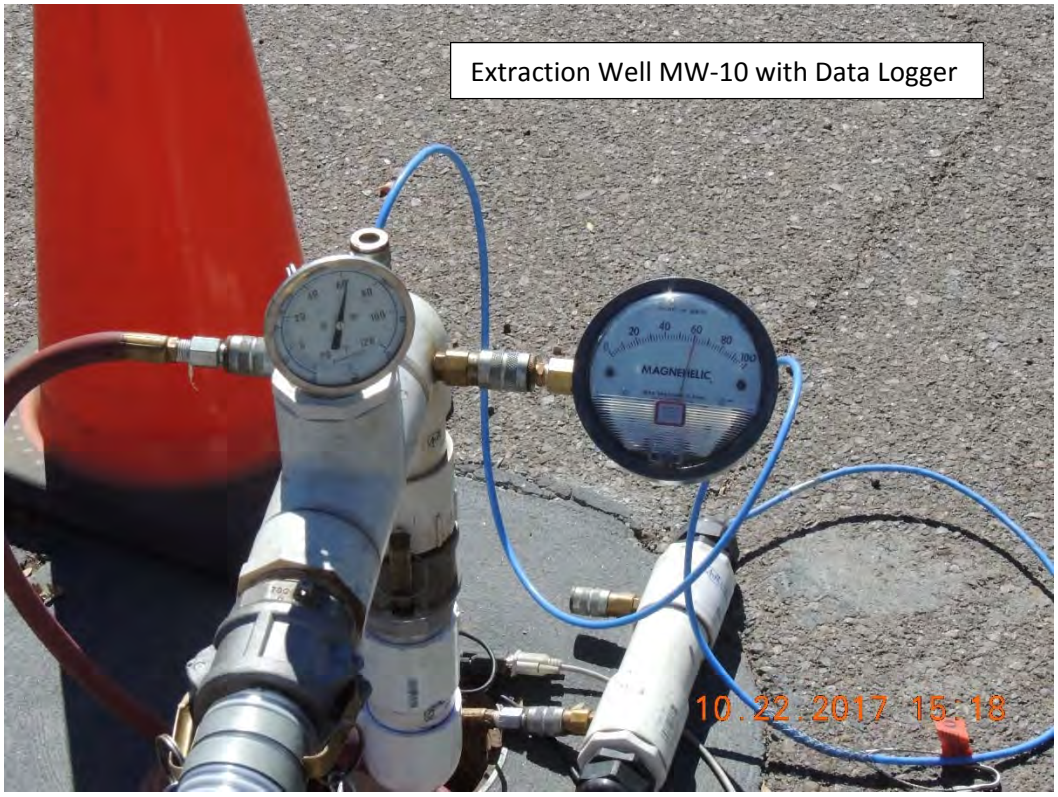
OPERATING DATA SVE PILOT TEST #2 **PAGE 6** **ACUVAC SVE SYSTEM**

Location: Shamrock #63, Santa Fe, NM							Project Managers: Faucher/Hendley	
Date		10/22/17		1600				
Time		1400	1500	1600				
TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	
	Well No.	MW-10	MW-10	MW-10				
VAPOR/INFLUENT	HC ppm v	92,080	87,830	91,690				
	CO_2 %	.78	1.10	1.32				
	CO %	4.23	6.30	5.69				
	O_2 %	5.2	5.1	5.6				
	H_2S ppm	2.0	2.0	2.0				

1400 HRS	BP↓ 30.28"Hg SVE WELL UPWELLING↑ TO 18.82 OR 5.02 FT UPWELLING,
	LEAVING APPROXIMATELY 1.0 FT OF AVAILABLE SCREEN. OUTER WELL
	VACUUM INFLUENCE DECREASING MOSTLY LIKE IN RESPONSE TO
	FALLING BP.
1430 HRS	BP↓ 30.27"Hg ALL OUTER WELLS RECORDED DECREASED VACUUM INFLUENCE
1500 HRS	BP↓ 30.26"Hg TPH VAPORS↓ 87,830 PPMV ALL OUTER WELLS CONTINUE
	TO RECORD DECREASED VACUUM INFLUENCE.
1530 HRS	BP↓ 30.25"Hg TOTAL DECREASE SINCE 1400 HRS .03"Hg. OUTER WELLS
	RECORDED DECREASED VACUUM INFLUENCE.
1600 HRS	BP↓ 30.24"Hg TPH VAPORS↑ 91,690 PPMV. ALL OUTER WELLS RECORDED
	DECREASED VACUUM INFLUENCE.
1630 HRS	BP STEADY AT 30.24"Hg ALL OUTER WELLS RECORDED DECREASED VACUUM
	INFLUENCE. TEST CONCLUDED.
1645 HRS	STARTED WITH WELL MW-19, RECORDED STATIC VAC/PRESSURE AT
	EACH WELL
1700	RECORDED STATIC DATA ON WELLS MW-10 AND MW-16.
	SECURED ALL WELLS.

SHAMROCK #63
TEST SVE #3
SANTA FE, NM

AcuVac SVE System



Extraction Well MW-10 with Data Logger

SHAMROCK #63
TEST SVE #3
SANTA FE, NM

AcuVac Remediation, LLC
1656-H Townhurst • Houston, Texas 77043
713 468 6688 • acuvac.com

October 27, 2017

Mr. John Casey P.E.
Daniel B. Stevens & Associates
125 Mercado Street, Suite 119
Durango, Colorado 81301

Re: Shamrock #63, 3624 Cerrlllos Road, Santa Fe, NM

Dear John:

At your request, we performed six 1.0-hour Soil Vapor Extraction (SVE) Quick Tests on the wells contained in Table #1, at the above referenced location on October 23, 2017. Following is the Report and a copy of the Operating Data collected during the Quick Tests. Table #1 is the Summary Data recorded. The contaminant is Non-Aqueous Phase Liquid (NAPL) which includes Light Non-Aqueous Phase Liquid (LNAPL).

SVE QUICK TEST OBJECTIVES

- Determine well vacuum and vapor flow of each well.
- Provide vapor phase total petroleum hydrocarbons concentrations in the influent vapors.
- Provide background data on the soil vapor plume area.

SVE QUICK TEST DESCRIPTION

A Quick Test is a short SVE Test of 0.5 to1.0 hours conducted from existing monitoring or observation wells located on-site and off-site. The test provides data on the soil vapor plume area, which may not totally conform to the groundwater plume. Each Quick Test provides well vacuum and well vapor flow data. From a soil gas sample (influent vapor), the HORIBA® Analyzer can provide total petroleum hydrocarbons in ppmv and the percent of CO_2 and CO. Additional instrumentation provides O_2 data. The depth to groundwater and depth to NAPL are also recorded. This informative data is very helpful as it confirms whether or not the outer wells are within the vapor plume area and are functional.

METHODS AND EQUIPMENT

AcuVac owns and maintains an inventory of equipment to perform MDPE events. The events at the above referenced site were conducted using the AcuVac I-6 System with Roots RAI-33 blower used as a vacuum pump and Roots RAI-22 positive displacement blower. The following table lists equipment and instrumentation employed in these events and the data recorded by each.

Instrumentation Employed by AcuVac	
Measurement Equipment	Data Element
Extraction Well Induced Vacuum and Flow	
Dwyer Magnehelic Gauges	Extraction Well Vacuum
Dwyer Averaging Pitot Tubes / Magnehelic Gauges	Extractions Well Vapor Flow
Well Vapor Samples	
V-1 vacuum box	Extraction Well Non-Diluted Vapor Samples
HORIBA® Analyzer	Extraction Well Vapor TPH Concentration
Lumidor MicroMax Pro O_2 Monitor	Extraction Well Vapor Oxygen Content
LNAPL Thickness (if present)	
Solinst Interface Probes Model 122	Depth to NAPL and Depth to Groundwater
Atmospheric Conditions	
Testo Model 511	Relative and Absolute Barometric Pressure

The vacuum extraction portion of the AcuVac System consists of a vacuum pump driven by an internal combustion (IC) engine. The vacuum pump is connected to the extraction well, and the vacuum created on the extraction well causes light hydrocarbons in the soil and on the groundwater to volatilize and flow through a moisture knockout tank to the vacuum pump and IC engine where they are burned as part of the normal combustion process. Propane is used as auxiliary fuel to help power the engine if the well vapors do not provide the required energy.

AcuVac utilizes a HORIBA® Analyzer to test the TPH concentrations contained in the extraction well vapors. A non-diluted vapor sample is obtained from the AcuVac well manifold. The non-diluted vapor sample is then processed by the HORIBA® to determine the TPH content. Well vapor samples are obtained throughout the event to calculate the TPH vapors burned as IC engine fuel. The manifold is designed to enable all of the induced well vacuum to be applied to the entire available well screen to ensure a representative vapor sample.

The AcuVac internal combustion engine is fully loaded for the maximum power necessary to achieve and maintain high induced vacuums and/or high well vapor flows required to maximize the vacuum radius of influence.

Emissions from the engine are passed through two of three catalytic converters to ensure maximum destruction of removed hydrocarbon vapors. The engine's fuel-to-air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for all equipment, all systems stop when the engine stops, thus eliminating any uncontrolled release of hydrocarbons. Since the AcuVac System is held entirely under vacuum, any leaks in the seals or connections are leaked into the AcuVac System and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure, over speed, or overheating.

SVE QUICK TEST PROCEDURES

- Gauge the extraction well for depth to NAPL and depth to groundwater and record static data.
- Calculate the hydro-equivalent of the static groundwater level.
- Record all baseline data.
- Install vacuum manifold and hose.
- Connect the AcuVac System to the extraction well and then apply vacuum. Record the well vacuum and well flow, all system data (including fuel flow of propane), ambient temperature, and barometric pressure.
- Collect non-diluted influent vapor (well gas) samples to provide on-site HORIBA® Analyzer and Lumidor analytical data consisting of TPH ppmv, CO_2%, CO%, and O_2% every 15 minutes during the Quick Test.
- The SVE Quick Test procedures are to provide variable rates of induced well vacuum and flow over the test period.

CONCLUSION

Although most Quick Tests include variable rates of induced well vacuum, it was decided for these Quick Tests that the vacuum would be set at 50"H_2O and remain constant as this is the approximate range of vacuum that would be applied by the SVE system contemplated for the site.

The SVE Quick Tests provided excellent data regarding the contaminant plume. The influent vapor TPH concentration levels from all wells except MW-17 indicated that weathered gasoline exists in the general site area of these wells. For tests #3, #4, #5 and #6 conducted from wells MW-5, MW-1, MW-7 and well MW-2, the TPH concentrations in the well vapors provided 100% of the fuel required for the IC engine. The well vapor flow rates of wells MW-5, MW-1, MW-7 and well MW-2 indicate the wells would function adequately in the contemplated SVE system at the site.

Should you have any questions, please give me a call.

Sincerely,

Paul D. Faucher
Vice President, Operations

TABLE #1

SVE QUICK TESTS

SUMMARY DATA

Quick Test Number		#1	#2	#3	#4	#5	#6
Well Number		**MW- 17**	**MW- 11**	**MW- 5**	**MW- 1**	**MW- 7**	**MW- 2**
Well Data							
TD	ft bgs	90.0	92.0	90.0	Unknown	90.0	90.0
Well Size	inches	2.0	2.0	2.0	2.0	2.0	2.0
Screen Interval	ft	70.0-90.0	72.0-92.0	75.0-90.0	Unknown	70.0-90.0	75.0-90.0
Site Elevation	ft	6,620	6,620	6,620	6,620	6,620	6,620
NAPL Data							
Start of Test							
Depth to Groundwater	ft BTOC	78.71	77.69	80.96	81.15	82.32	82.08
Depth to NAPL	ft BTOC	-	-	-	-	-	-
LNAPL	ft	-	-	-	-	-	-
Hydro Equivalent	ft	78.71	77.69	80.96	81.15	82.32	82.08
End of Test							
Depth to Groundwater	ft BTOC	79.66	77.23	81.11	81.18	81.18	82.43
Depth to NAPL	ft BTOC	-	-	-	-	-	-
LNAPL	ft	-	-	-	-	-	-
Hydro Equivalent	ft	79.66	77.23	81.11	81.18	81.18	82.43
Well Vacuum and Well Flow							
Max Extraction Well Vacuum	"H_2O	50.00	50.00	27.00	38.00	42.00	26.00
Avg Extraction Well Vacuum	"H_2O	50.00	50.00	25.60	36.40	35.60	24.80
Max Extraction Well Vapor Flow	scfm	3.05	3.46	35.61	27.54	34.22	38.64
Avg Extraction Well Vapor Flow	scfm	3.05	3.46	29.91	26.69	30.89	34.80
Vapor Data							
Maximum TPH	ppmv	2,920	81,160	43,370	58,090	64,290	50,920
Average TPH	ppmv	1,496	74,534	39,407	53,600	50,508	36,685
Minimum TPH	ppmv	28	67,560	37,890	49,880	43,470	41,820
Average CO2	%	0.09	2.50	2.06	2.30	2.06	2.03
Average CO	%	0.00	3.94	0.77	2.14	1.49	0.95
Average O_2	%	19.7	5.2	9.6	5.2	7.7	8.0
Average H_2S	ppm	0.0	3.0	1.4	0.4	0.0	0.0

AcuVac Remediation

OPERATING DATA - TEST # SVE QT-1 PAGE 1 ACUVAC SVE SYSTEM

Location: SHAMROCK #63, SANTA FE, NM **Project Managers:** FAUCHER/HENDLEY								
Date:			10/21/17					
Well/Parameters TD 92.0 FT SCREEN 72.0 - 92.0 FT 2.0" MW-17			Time 0700	Time 0715	Time 0730	Time 0745	Time 0800	Time
			Hr Meter –	Hr Meter –	Hr Meter –	Hr Meter –	Hr Meter –	Hr Meter –
INFLUENT VAPORS	TPH	ppmv	–	28	244	2790	2920	
	CO_2	%	–	0	0	.14	.20	
	CO	%	–	0	0	0	0	
	O_2	%	–	19.7	19.6	19.7	19.7	
	H_2S	%	–	0	0	0	0	
ENGINE	Fuel/Propane	cfh	120	120	120	120	120	
	Engine Speed	rpm	1800	1800	1800	1800	1800	
VACUUM/ FLOW	Well Vacuum	"H_2O	50	50	50	50	50	
	Well Flow	scfm	3.05	3.05	3.05	3.05	3.05	
OTHER	Air Temp	°F	48	48	48	48	48	
	Barometric Pressure	" Hg	29.88	29.88	29.88	29.90	29.91	
	DTLNAPL	ft	–				–	
	DTGW	ft	78.71				79.66	

OPERATING DATA AND NOTES

0645 POSITIONED ACUVAC SYSTEM NEAR WELL MW-17. GAUGED WELL, INSTALLED SVE QT MANIFOLD.

0700 SVE STARTED. VERY TIGHT FORMATION. VACUUM SPIKED TO 150"H_2O MOST LIKELY UPWELLING THE WATER IN THE WELL OCCLUDING THE SCREEN AND REDUCING THE WELL VAPOR FLOW. AS THE WATER LEVEL DECREASED, THE VAPOR CONCENTRATIONS INCREASED.

0800 TEST CONCLUDED. RELOCATE ACUVAC SYSTEM TO WELL MW-11

AcuVac Remediation

OPERATING DATA - TEST # SVE QT- 2 PAGE 1 **ACUVAC SVE SYSTEM**

Location: SHAMROCK #63, SANTA FE, NM			**Project Managers:**		FAUCHER / HENDLEY			
Date:			10/21/17					
Well/Parameters			Time	Time	Time	Time	Time	Time
TD 92.0 Ft SCREEN 72.0 - 92.0 Ft SIZE 2.0" MW-11			0830	0845	0900	0915	0930	
			Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
			-	-	-	-	-	
INFLUENT VAPORS	TPH	ppmv	81,160	67560	77420	74,690	71850	
	CO_2	%	2.56	2.10	2.66	256	2.22	
	CO	%	4.82	3.08	4.18	380	3.80	
	O_2	%	5.2	5.4	5.0	5.3	5.3	
	H_2S	%	4.1	3.0	3.0	3.1	2.0	
ENGINE	Fuel/Propane	cfh	120	120	90	90	90	
	Engine Speed	rpm	2100	2000	2000	2000	2000	
VACUUM/ FLOW	Well Vacuum	"H_2O	50	50	50	50	50	
	Well Flow	scfm	3.46	3.46	3.46	3.46	3.46	
OTHER	Air Temp	°F	48	48	50	51	52	
	Barometric Pressure	" Hg	29.91	29.92	29.94	29.94	29.94	
	Air Temp	°F	-	-	-			
	DTLNAPL	ft	-					
	DTGW	ft	77.69				77.23	

	OPERATING DATA AND NOTES
0820	POSITIONED ACUVAC SYSTEM NEAR WELL MW-11. GAUGED
	WELL, INSTALLED SVE MANIFOLD.
0830	GT STARTED TARGET INDUCED WELL VAC 50" H_2O.
	WELL VAC 50" H_2O, WVF 3.45 SCFM
	TPH VAPORS HIGH AND ON A MOSTLY DECREASING TREND.
	LOW WVF PROVIDED LITTLE FUEL FOR IC ENGINE AS 120CFH
	OF PROPANE WAS REQUIRED.
0930	EVENT CONCLUDED. ACUVAC RELOCATED TO WELL MW-5

AcuVac Remediation

OPERATING DATA - TEST # SVE QT-3 PAGE 1 **ACUVAC SVE SYSTEM**

Location: S HAMROCK #63, SANTA FE, NM **Project Managers:** FAUCHER/HENDLEY

Date:			10/21/17					
Well/Parameters TD 90.0 FT SCREEN 25.0 - 90.0 FT SIZE 2.0" MW-5			Time 1000 Hr Meter	Time 1015 Hr Meter	Time 1030 Hr Meter	Time 1045 Hr Meter	Time 1100 Hr Meter	Time Hr Meter
INFLUENT VAPORS	TPH	ppmv	33,366	40,500	37890	43,370	41,910	
	CO_2	%	4.20	1.57	1.36	1.61	1.58	
	CO	%	1.2	.66	.56	.78	.65	
	O_2	%	9.1	10.6	9.3	9.5	9.3	
	H_2S	%	2.0	1.0	2.0	1.0	1.0	
ENGINE	Fuel/Propane	cfh	0	0	0	0	0	
	Engine Speed	rpm	2000	2000	2000	2000	2000	
VACUUM/ FLOW	Well Vacuum	"H_2O	27	27	25	22	27	
	Well Flow	scfm	26.28	22.13	29.77	30.78	35.61	
OTHER	Air Temp	°F	51	51	51	53	53	
	Barometric Pressure	" Hg	29.95	29.95	29.95	29.95	29.95	
	DTLNAPL	ft	-				-	
	DTGW	ft	80.96				81.11	

	OPERATING DATA AND NOTES
0940	POSITIONED AcuVAC SYSTEM NEAR WELL MW-5. GAUGED
	WELL, INSTALLED SVE MANIFOLD.
0945	STARTED SVE. MAGNEHELIC GAUGES WERE NOT RECORDING
	THE SAME VACUUM. TESTED EQUIPMENT, DECIDED TO RELY
	ON GAUGE AT WELLHEAD.
1000	QT STARTED. INITIAL WELL VAC 22"H_2O, WVF 27.73 SCFM.
	INITIAL VAPOR SAMPLE OBTAINED AT 1005 HRS
1100	EVENT CONCLUDED. VACUUM HOSE RELOCATED TO WELL MW-5.

AcuVac Remediation

OPERATING DATA - TEST # SVE QT-4 PAGE 1 — ACUVAC SVE SYSTEM

Location: SHAMROCK #63 SANTA FE NM **Project Managers:** FAUCHER/HENDLEY

Date:			10/21/17					
Well/Parameters			Time	Time	Time	Time	Time	Time
			1100	1115	1130	1145	1200	
			Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
		MW-1	–	–	–	–	–	
INFLUENT VAPORS	TPH	ppmv	49,730	54700	58,090	49,990	55,600	
	CO_2	%	2.52	2.98	3.34	1.18	1.49	
	CO	%	1.30	1.81	2.18	2.46	2.94	
	O_2	%	5.7	5.3	4.8	5.1	5.3	
	H_2S	%	1.0	1.0	0	0	0	
ENGINE	Fuel/Propane	cfh	0	0	0	0	0	
	Engine Speed	rpm	2100	2200	2200	2200	2200	
VACUUM/ FLOW	Well Vacuum	"H_2O	38	36	36	36	36	
	Well Flow	scfm	25.78	25.87	26.71	27.54	27.54	
OTHER	Air Temp	°F	53	54	54	55	55	
	Barometric Pressure	" Hg	29.95	29.96	29.96	29.95	29.95	
	DTLNAPL	ft	–				–	
	DTGW	ft	81.15				81.18	

OPERATING DATA AND NOTES

1100 RELOCATED VACUUM HOSE ONLY FROM WELL MW-5 TO MW-1
WELL HAD BEEN PREVIOUSLY GAUGED.

1105 INITIAL WELL VAPOR SAMPLE OBTAINED. TPH CONCENTRATIONS IN THE GASOLINE RANGE
INITIAL WELL VAC 38 "H_2O, WVF 27.26 SCFM
WELL VAC TO 36 "H_2O AT 1115 HRS, THEN STEADY.
WVF ON A SLIGHTLY INCREASING TREND.

TPH VAPOR CONCENTRATIONS ON A MOSTLY INCREASING TREND.

1200 EVENT CONCLUDED. VACUUM HOSE RELOCATED TO WELL MW-7

AcuVac Remediation

OPERATING DATA - TEST # SVE QT- 5 PAGE 1 **ACUVAC SVE SYSTEM**

Location: SHAMROCK #63, SANTA FE, NM **Project Managers:** FAULKNER / HENDLEY

Date:			10/21/17					
Well/Parameters			Time	Time	Time	Time	Time	Time
TD 90.0 FT SCREEN 70.0 - 90.0 FT SIZE 2.0" MW-7			1200	1215	1230	1245	1300	
			Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
			-	-	-	-	-	
INFLUENT VAPORS	TPH	ppmv	20390	43,470	60,690	63,700	64.290	
	CO_2	%	1.30	1.67	2.32	2.40	2.60	
	CO	%	.28	1.16	1.80	2.01	2.22	
	O_2	%	14.4	9.8	4.0	4.8	4.6	
	H_2S	%	0	0	0	0	0	
ENGINE	Fuel/Propane	cfh	120	0	0	0	0	
	Engine Speed	rpm	2000	2100	2100	2100	2100	
VACUUM/ FLOW	Well Vacuum	"H_2O	36	36	42	38	26	
	Well Flow	scfm	34.22	34.22	30.55	29.11	26.33	
OTHER	Air Temp	°F	55	55	55	55	57	
	Barometric Pressure	" Hg	29.95	29.95	29.94	29.94	29.94	
	DTLNAPL	ft	-				-	
	DTGW	ft	82.32				82.35	

	OPERATING DATA AND NOTES
1200	RELOCATED VAC HOSE FROM WELL MW-1 TO MW-7
	INITIAL WELL VAC 36 "H_2O, WELL VAPOR FLOW 36.17 SCFM
	INITIAL WELL VAPOR SAMPLE OBTAINED AT 1205 HRS.
1215	TPH VAPOR CONCENTRATIONS INCREASED TO 43,470 WHICH
	PROVIDED 100% OF IC ENGINE FUEL.
	TPH VAPOR CONCENTRATIONS ON AN INCREASING TREND
1300	EVENT CONCLUDED. REPOSITIONED ACUVAC SYSTEM TO WELL
	MW-2

AcuVac Remediation

OPERATING DATA - TEST # SVE QT-6 PAGE 1 **ACUVAC SVE SYSTEM**

Location: SHAMROCK #63 SANTA FE, NM **Project Managers:** GAUCHER/HENDLEY

Date:			10/2/17					
Well/Parameters			Time	Time	Time	Time	Time	Time
			1345	1400	1415	1430	1445	
			Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
		MW-2	-	-	-	-	-	-
INFLUENT VAPORS	TPH	ppmv	5670	-	50,820	48,330	41 820	
	CO_2	%	1.12	-	2.30	2.51	2.20	
	CO	%	0	-	1.18	1.52	1.08	
	O_2	%	7.9	-	8.4	8.0	7.8	
	H_2S	%	0	-	0	0	0	
ENGINE	Fuel/Propane	cfh	140	0	0	0	0	
	Engine Speed	rpm	2100	2200	2200	2200	2200	
VACUUM/ FLOW	Well Vacuum	"H_2O	26	26	24	24	24	
	Well Flow	scfm	33.64	38.22	32.38	32.38	32.38	
OTHER	Air Temp	°F	57	57	57	58	58	
	Barometric Pressure	" Hg	29.93	29.94	29.94	29.94	29.94	
	DTLNAPL	ft	-				-	
	DTGW	ft	82.08				82.43	

	OPERATING DATA AND NOTES
1330	RELOCATED ACUVAC SYSTEM NEAR WELL MW-2. GAUGED WELL
	AND INSTALLED SVE QT MANIFOLD.
1345	QT STARTED. INITAL WELL VAC 26 "H_2O, WVF 40.77 SCFM
	INITAL WELL VAPOR SAMPLE OBTAINED 1350 HRS.
	TPH VAPOR CONCENTRATIONS 5670 PPMV.
1415	TPH VAPOR CONCENTRATIONS ↑ 50,000+ SUFFICIENT TO PROVIDE
	100 % OF IC ENGINE FUEL
1445	EVENT CONCLUDED. SECURED WELLS. DEPARTED SITE

Appendix B

AcuVac Equipment Specifications

ACUVAC SYSTEM - SVE I-6

OPERATING SPECIFICATIONS
300 Cubic Inch/4.9 Liter/6 Cylinder IC Engine

Electrical Requirements		None
Engine RPM		1,800 RPM to 2,500 RPM/site specific. Calculations below based upon 2,200 RPM
Fuel Source		Well flow/contamination (or) natural gas (or) propane (or) combination well flow and alternate fuel
Fuel Consumption/Propane	1.	Maximum usage 4.8 gallons/hour Actual usage 3.0 gallons/hour
Fuel Consumption/Natural Gas	1.	Maximum usage 4.39 therms/hr Actual usage 2.74 therms/hr
Fuel Consumption/Well Flow		Site specific, 0 to 4.5 gal/hr projected
Fuel Consumption/BTUs	1.	Maximum usage 432,000 BTUs/hour Actual usage 274,000 BTUs/hour
Total Fresh Air/Fuel Flow		Maximum usage 160 cfm Actual usage 90 - 120 cfm
Well Flow		0 to 120/site specific
Fresh Air Flow		0 to 80/site specific
Combustion Efficiency	2.	87%
with Catalytic Converters	2.	99.9% (less than .9 lbs VOC/day)
Vacuum/Well Manifold		0" to 15" HG/site specific Actual 0.25" to 3.00" HG
Noise Level		Less than 50 db at 20 feet
Ambient Temperature		-20°F to + 120°F

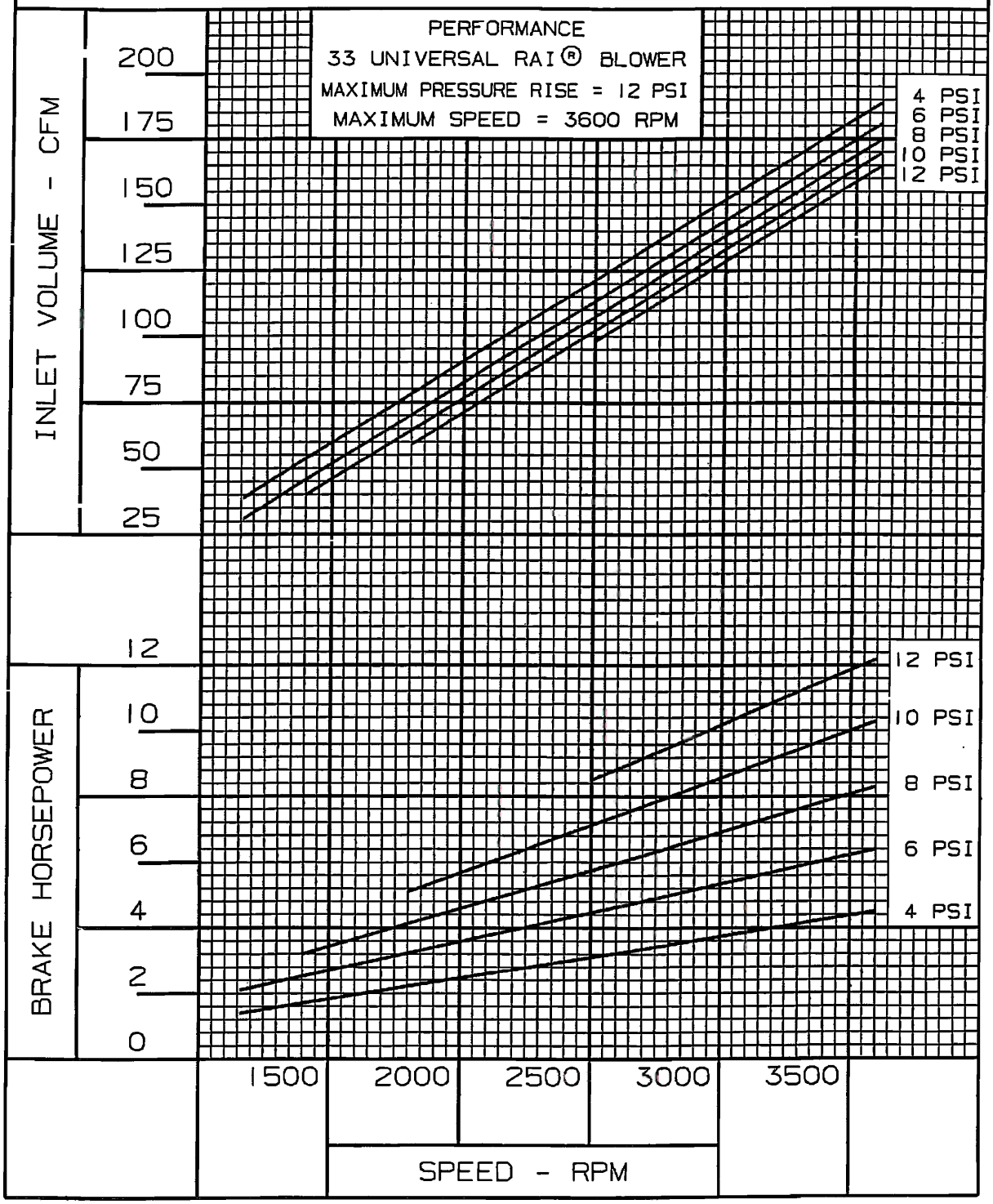
1. Maximum usage and actual usage differ because of the load factor on the engine. Actual information has been obtained from field data. Fuel usage stated for propane and natural gas assumes no BTU value from well flow.

2. This efficiency rating assumes the engine is maintained and tuned and the catalysts are in good working order.

ROOTS DIVISION
DRESSER INDUSTRIES, INC.
CONNERSVILLE, IN. 47331
PRINTED IN U.S.A.

PERFORMANCE BASED ON INLET AIR AT 14.7 PSIA & 68°F

JUNE 1990



PC-12-33

AcuVac System SVE I-6
Specifications

Engine - Power Source/Thermal Oxidizer

Make: Ford internal combustion engine with power with power take-off
Model: CSG-649P
300 cubic inch displacement (4.9), 120 HP, 6 cylinders
Propane or natural gas co-fired

Catalytic Converter

Make: NAPA
Model: ICEN 703
100 cfm, temperature 600-1500°F
Anticipated life 4,000 hours; performance examination recommended every 500 hours; three in series

Vacuum Pump

Make: Dresser-Roots Model: 33 RAI Universal
Engine driven, maximum flow 155 scfm,
Actual operating flow rates 20 - 70 scfm

*Air Injection Pump

Make: Dresser-Roots Model: 22 RAI Universal
Engine driven, maximum flow 55 scfm,
Actual operating flow rates 18 - 40 scfm
Heat Exchanger: Stainless Steel Fin Tube

System Dimensions

8.0′ length, 4.0′ width, 6.5′ height
(with trailer 12′ 6″ L X 4′ 9″ W x 8′ H; 2,900 lbs)
Tank size: 3.0′ diameter, 5.0′ height
Trailer: Custom made by Manufacturer

Stack

Height: 10′
Temperature: 700 - 850°F
Exhaust Pipe: 2 ½″

Other

Flow Gauges: Dwyer (including flow sensors)
Instrumentation & Safety Shut-off; Murphy Gauges
Electrical: 12 volts, HD battery
Air Intake Filter: Ford Industrial
Valves: Heavy Duty Brass
Moisture Knockout Tank: Custom made by Manufacturer
Moisture Knockout Filter: Custom made by Manufacturer
Leveling Jacks: Custom made by Manufacturer
Vacuum Connection Hose to SVE Manifold (2.0 inch HD)

*Optional Equipment

Measurement Instrumentation for SVE Pilot Test, Lovington, NM
(See attached sheets for equipment details)

Air flow will be measured using Dwyer Visi-Float VFC flow meters with ranges of 0-25 or 0-50 CFM.

Vacuum measurement at the SVE equipment will be performed using Dwyer magnehelic gauges with various ranges. Ranges include 0-50, 0-100, and 0-150 inches H2O. Additionally, one capsuhelic gauge with a range of 0-300" H2O will be available.

Vacuum measurement at the observation wells equipment using a Dwyer series 477 digital manometer with a range from 0-40" H2O.

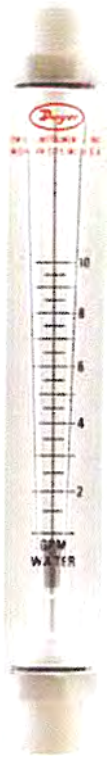
Temperature will be recorded using a Rattec Raynger ST3 Infrared non-contact thermometer with a range of -25°F to 750°F. (Similar to ST20 Pro)

Barometric pressure will be recorded using two FAA certified altimeters and knowing the site elevation. Changes in barometric pressure can then be directly read.

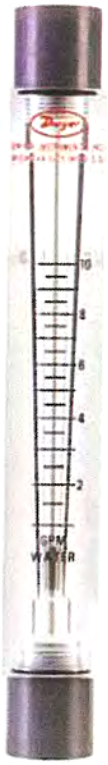
Series VFC & VFCII

Visi-Float® Flowmeters

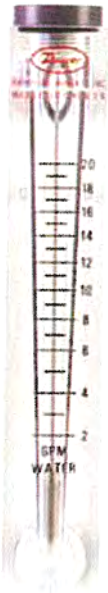
Used to Indicate Air or Water Flow



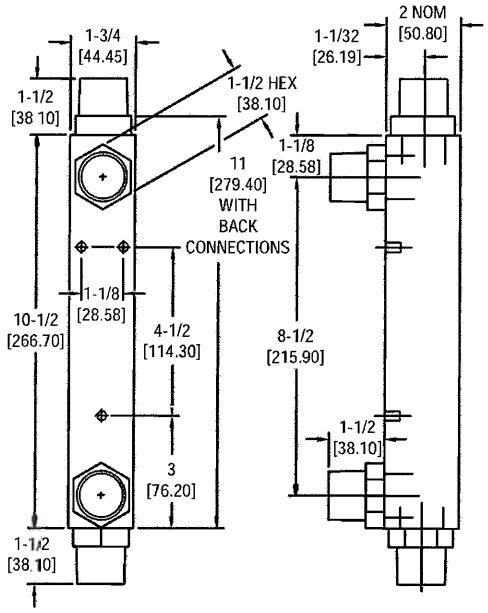
VFCII with End Connections



VFC with End Connections



VFC



The accurate and durable VFC Visi-Float® flowmeter contains a stainless steel guide rod and large diameter float for excellent stability and visibility in high flow rates. **The large 5″ scale provides a +/-2%** full scale accuracy for precision measurement required in medical or **laboratory applications. The VFC models have PVC 1″ female NPT connections. VFC II units are equipped with acetal thermoplastic 1″** male NPT fittings. VFC II fittings also include hex wrench flats to prevent stripped threads. All models have metal mounting inserts on the back for panel mounting. Units may also be supported directly by system piping.

How To Order

Series—Range No.—Option
Example: VFC-123-EC
Series VFC with 10-100 SCFM Air Range and 1″ female NPT End Connections

POPULAR RANGES

Model VFC — 5" Scale			
Range No.	Range SCFM Air	Range No.	Range GPM Water
121	4-25	141	.5-5
122	5-50	142	1-10
123	10-100	143	2-20
	LPM Air		LPM Water
131	60-700	151	2-20
132	200-1400	152	4-40
133	300-2800	153	10-75

SPECIFICATIONS

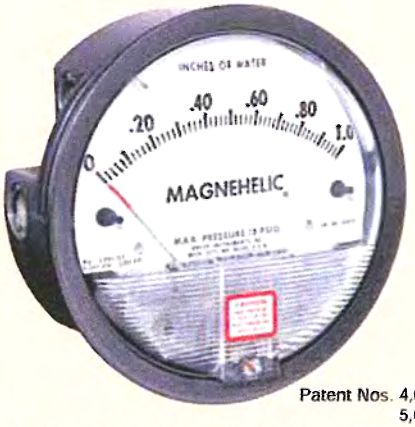
Service: Compatible gases & liquids.
Wetted Materials:
Body: Acrylic plastic.
O-Ring: Buna-N (Fluoroelastomer available).
Metal Parts: Stainless steel.
Float: Stainless steel.
Temperature & Pressure Limits: 100 psig (6.9 bar) @ 120°F (48°C).
Accuracy: 2% of full scale.
Process Connection: VFC: 1″ female NPT back connections. End connections optional. VFCII: 1″ male NPT back connections. End Connections optional.
Scale Length: 5″ typical length.
Mounting Orientation: Mount in vertical position.
Weight: 24-25 oz (.68-.71 kg).

Series VFC & VFCII Models

Options
-EC, End Connections
-VIT, Fluoroelastomer O-Rings
-FDA, 316 SS Float & Guide Rod (only available on VFCII with Fluoroelastomer O-Rings)

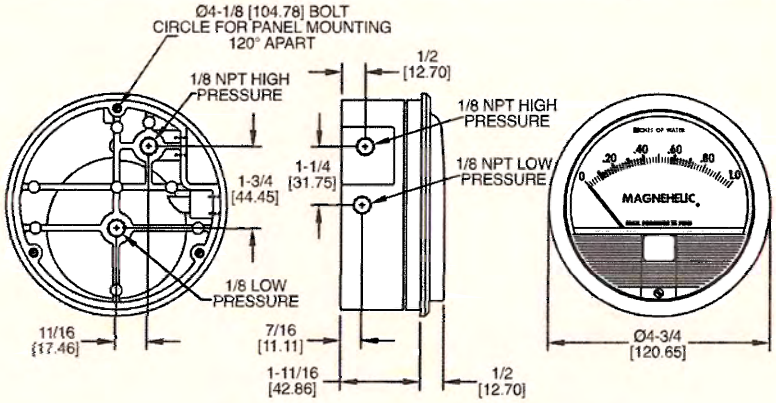
Series 2000 Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



Patent Nos. 4,030,365
5,012,678

Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer® Magnehelic® gage for high accuracy – guaranteed within 2% **of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly** indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Note: May be used with Hydrogen. When ordering a Buna-N diaphragm pressures must be less than 35 psi.

MOUNTING. A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1¼" - 2" pipe. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4⅝" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

Flush ...Surface...or Pipe Mounted

VENT VALVES

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4 13/16" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20" Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.
Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).
Size: 4" (101.6 mm) Diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8" female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g). MP & HP 2 lb 2 oz (963 g).
Standard Accessories: Two 1/8" NPT plugs for duplicate pressure taps, two 1/8" pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)

*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent Overlays

Furnished in red and green to highlight and emphasize critical pressures.

Adjustable Signal Flag

Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

LED Setpoint Indicator

Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

Portable Units

Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft. (2.7 m) of ⅛" I.D. rubber tubing, standhang bracket and terminal tube with holder.

Air Filter Gage Accessory Package

Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of ¼" aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

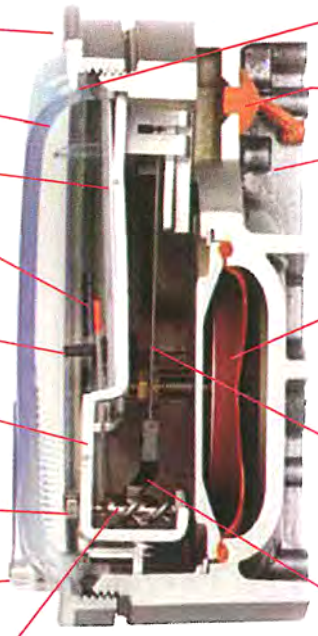
Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.



O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

Dual Scale English/Metric Models		
Model Number	Range, In. W.C.	Range, Pa or kPa
2000-0D	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa

SERIES 2000 MAGNEHELIC® GAGE — MODELS AND RANGES

The models below will fulfill most requirements. Page V also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range inches of Water
2000-00W†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2150	0-150

Model Number	Range Zero Center Inches of Water
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model Number	Range PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

*MP option standard
**HP option standard

Dual Scale Air Velocity Units

Model Number	Range in W.C. Velocity, F.P.M.
2000-00AV†••	0-.25/300-2000
2000-0AV†•	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2010AV	0-10/2000-12500

For use with pitot tube.

Model Number	Range MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-25MM	0-25
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
Zero Center Ranges	
2300-20MM†	10-0-10

Model Number	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

Model Number	Range, Pascals
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750

Model Number	Range, Pascals
Zero Center Ranges	
2300-60PA	30-0-30
2300-100PA	50-0-50
2300-120PA	60-0-60
2300-250PA	125-0-125
2300-500PA	250-0-250

Model Number	Range, Kilopascals
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-3KPA	1.5-0-1.5

Accessories

A-299, Surface Mounting Bracket
A-300, Flat Flush Mounting Bracket
A-310A, 3-Way Vent Valve
A-321, Safety Relief Valve
A-432, Portable Kit
A-605, Air Filter Kit
A-610, Pipe Mount Kit

Options — To order, add suffix: I.E. 2001-ASF
ASF (Adjustable Signal Flag)
HP (High Pressure Option)
LT (Low Temperatures to -20°F)
MP (Med. Pressure Option)
SP (Setpoint Indicator)

Scale Overlays — Red, Green, Mirrored or Combination, Specify Locations

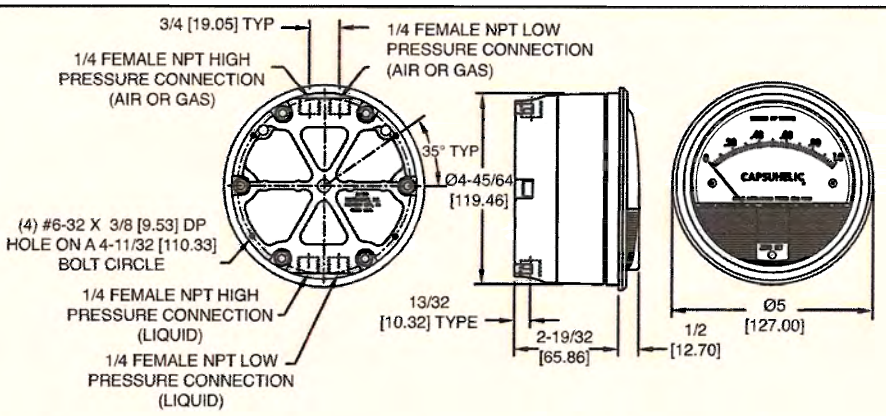
†These ranges calibrated for vertical scale position.
• Accuracy +/-3%. •• Accuracy +/-4%

1011R01-0298P

Series 4000 Capsuhelic® Differential Pressure Gages

Measures Pressure, Vacuum or Differential, Suitable for Internal Pressures to 500 psig

Capsuhelic® Pressure Gage has a large, easy-to-read 4" (102 mm) dial.



Dimensions, Series 4000 Capsuhelic® Pressure Gages.

The Capsuhelic® gage is designed to give fast, accurate indication of differential pressures. The gage may be used as a read-out device when measuring flowing fluids, pressure drop across filters, liquid levels in storage tanks and many other applications involving pressure, vacuum or differential pressure.

Using the basic design of Dwyer's time-proven Magnehelic® gage, the Capsuhelic® gage contains a simple, frictionless movement that permits full scale readings as low as 0.5 inch water column. The pressure being measured is held within a capsule which is an integral part of the gage. This containment of the pressure permits the use of the gage on system pressures of up to 500 psig, even when differentials to be read are less than 0.1 inch w.c.

The diaphragm-actuated Capsuhelic® gage requires no filling liquid which might limit its outdoor applications. Zero and range adjustments are made from outside the gage, and there is no need to disassemble the gage in normal service.

Note: May be used with hydrogen where pressures are less than 35 psi.

SPECIFICATIONS

Service: Aluminum Case: Air and compatible gases and oil based liquids. Brass Case: Air and compatible gases and water based liquids.
Wetted Materials: Consult factory.
Housing: Die cast aluminum with impregnated hard coating, standard. Optional forged brass housing is required for water or water based fluids. Special material diaphragms available, contact factory.
Accuracy: ±3% of full scale at 70°F (21.1°C). (±2% on 4000S models, ±4% on 4200, 4210, 4215, 4220, 4300, 4400, and 4500).
Pressure Limits: -20" Hg to 500 psig. (-0.677 bar to 34.4 bar).
Temperature Limits: 20 to 200°F (-6.67 to 93.3°C).
Size: 4" (101.6 mm) diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/4" female NPT high and low pressure taps, duplicated - one pair top for air and gas, and one pair bottom for liquids.
Weight: 3 lb, 3 oz (1.45 kg) aluminum case; 7 lb, 13 oz (3.54 kg) brass case.
Standard Accessories: Two 1/4" NPT plugs for duplicate pressure taps, four flush mounting adapters with screws and four surface mounting screws.

MOUNTING

Capsuhelic® gages may be flush mounted in a panel or surface mounted. Hardware is included for either. For flush mounting, a 4 13/16" diameter cutout in panel is required. Where high shock or vibration are problems, order optional A-496 Heavy Duty flush mount bracket. Optional A-610 kit provides simple means of attaching gage to 1¼"-2" horizontal or vertical pipe. Installation is same as Magnehelic® gage shown on page 4. All standard models are calibrated for vertical mounting. Gages with ranges above 5 in. w.c. can be factory calibrated for horizontal or inclined mounting on special order.

Flush mounted in panel.

Back view shows flush mounting adapters.

Back view for surface mounting.

OPTIONS AND ACCESSORIES

Adjustable Signal Flag — Integral with plastic gage cover, has external reset screw. May be ordered factory installed on gage or separately for field installation. Specify ASF suffix after model number.

A-314 Bleed Fitting — For easier, safer purging of trapped air when using gage with liquids. Also useful for draining condensate when installed in lower ports. To open, simply loosen hex nut. Solid brass.

Forged Brass Case — For applications involving water or water based liquids. To order, add suffix "B" after model number. Example: 4205B.

Transparent Scale Overlays — Available in bright red, green or yellow to accent critical pressure zones. Specify which color and portion of scale to be covered with each.

A-471 Portable Kit — Includes plastic case, mounting bracket, A-309 3-way manifold valve, (2) A-230 high pressure hoses and all necessary fittings. Assembly required. Gage not included.

Straightforward design assures maintenance-free performance

Top low pressure connection *(for Air or Gas)* connects to chamber in back of diaphragm. High pressure air or gas port (cut away; not shown) connects with chamber in front of diaphragm through passageways in case.

Precision made case is offered in two materials. Standard is die cast aluminum coated inside for resistance to most oils and similar fluids. Optional forged brass case is recommended when using water or water based liquids. One case size for all pressure ranges — can be either surface or flush mounted.

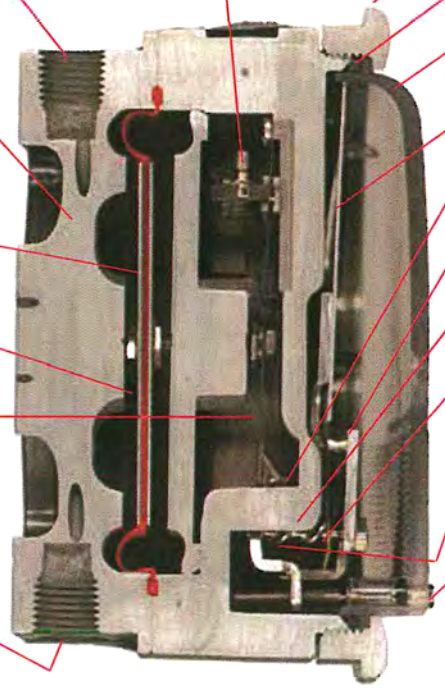
Silicone rubber diaphragm with integrally molded O-ring is sealed between the case and backplate. Diaphragm motion is restricted to prevent damage due to over-pressure.

Diaphragm support plate of stainless steel minimizes position or attitude sensitivity.

Calibrated range spring is a flat leaf of nickel plated spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length factory adjusted for calibration.

Bottom high pressure connection *(for Liquids)* connects to chamber in front of diaphragm. Low pressure liquid connection (not visible) connects with chamber in back of diaphragm through passageways in case.

Range spring calibration is set by custom camlock. Rate adjust and rate adjust lock are coaxial and are factory set and sealed.



Bezel provides flange for flush mounting in panel

O-ring seal for cover assures dust tight integrity of case.

Clear plastic front cover is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision scale, screen printed on aluminum, is accurate and easy to read.

Samarium cobalt magnet mounted at end of range spring rotates helix without mechanical linkages.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Thin wall magnetic "window" is well braced and of minimum area for maximum pressure capability.

Jeweled bearings for helix are shock resistant mounted. They provide virtually friction-free rotation for helix. Rotation is damped with high viscosity silicone fluid.

Helix is precision milled from an alloy of high magnetic permeability, mounted in jeweled bearings, and rotates to align with magnetic field of magnet and transmit pressure indication to pointer.

Zero adjustment screw is conveniently located in plastic cover, accessible without removing cover. "O" ring seal provides dust seal.

Patent Nos. 4,011,759
4,030,365

SERIES 4000 CAPSUHELIC® GAGE

Scales reading directly in flow, heights, etc., are also available.

Model Number	Range, Inches of Water
*4000-0	0-.50
*4001	0-1.0
*4002	0-2.0
*4003	0-3.0
*4004	0-4.0
*4005	0-5.0
4006	0-6.0
4008	0-8.0
4010	0-10
4015	0-15
4020	0-20
4025	0-25
4030	0-30
4040	0-40
4050	0-50
4060	0-60
4080	0-80
4100	0-100
4150	0-150
4200	0-200
4300	0-300
4400	0-400
4500	0-500

Model Number	Range Feet of Water
4616B	0-16
4635B	0-35
Available with brass case only	

Model Number	Range Zero Center Inches of Water
*4302	1-0-1
*4304	2-0-2
4310	5-0-5
4320	10-0-10
4330	15-0-15

Model Number	Range PSI
4201	0-1
4202	0-2
4203	0-3
4204	0-4
4205	0-5
4210	0-10
4215	0-15
4220	0-20
†4230S	0-30
†4240S	0-40
†4260S	0-60
†4280S	0-80
†42100S	0-100
†42200S	0-200
†42300S	0-300

Model Number	Range MM of Water
*4000-25MM	0-25
*4000-50MM	0-50
*4000-80MM	0-80
*4000-100MM	0-100

Special Purpose Ranges

Scale No. 4401
Square Root
Specify Range

Scale No. 4402
Blank Scale
Specify Range

Model Number	Range, CM of Water
4000-15CM	0-15
4000-20CM	0-20
4000-25CM	0-25
4000-40CM	0-40
4000-50CM	0-50
4000-80CM	0-80
4000-100CM	0-100
4000-150CM	0-150
4000-200CM	0-200
4000-250CM	0-250
4000-300CM	0-300
Zero Center Ranges	
*4300-4CM	2-0-2
*4300-10CM	5-0-5
4300-30CM	15-0-15

Model Number	Range, Pascals
*4000-125PA	0-125
*4000-250PA	0-250
*4000-500PA	0-500
*4000-750PA	0-750
Zero Center Ranges	
*4300-500PA	250-0-250

Model Number	Range, Kilopascals
*4000-1KPA	0-1
4000-1.5KPA	0-1.5
4000-2KPA	0-2
4000-3KPA	0-3
4000-4KPA	0-4
4000-5KPA	0-5
4000-8KPA	0-8
4000-10KPA	0-10
4000-15KPA	0-15
4000-20KPA	0-20
4000-25KPA	0-25
4000-30KPA	0-30
Zero Center Ranges	
*4300-1KPA	.5-0-.5
4300-3KPA	1.5-0-1.5

Accessories

A-298 Flat Flush Mounting Bracket
A-309 3-way Manifold Valve
A-314 Bleed Fitting
A-370 Mounting Bracket
A-471 Portable Kit
A-496 Flush Mount Bracket
A-610 Pipe Mount Kit

Options

Add Options as Suffix, Example 4001-ASF
-ASF (Adjustable Signal Flag)
B (Brass Case)
Scale Overlays - Red, Green, Mirrored or combination. Specify Locations

*These ranges available for vertical scale position only. †These ranges use Spirahelic® gage movement.

Series 477

Handheld Digital Manometer

Selectable Pressure Units, ±0.5% Accuracy, FM Approved Intrinsically Safe for Hazardous Locations, Class 1, Div. 1, Group A, B, C, D, T4

- New Low Pressure Ranges
- USB Option Comes with Cable and Software for Easy Data Downloading.
- Instant Selection from up to Nine English/Metric Units.
- Stores 40 Readings in Memory for Later Reference.
- Measure Positive, Negative or Differential Pressures.
- Large Easy-to-Read 0.4" LCD Display Includes Switchable Backlight for Great Visibility — Anywhere!
- Both Audible and Visual Overpressure Alarms.
- Includes + and - Indicators plus Low Battery Warning.
- Operates up to 100 Hours on a Single 9 Volt Battery.

FM APPROVED CE

New USB Connection Capability

Series 477 Handheld Digital Manometers are packed with features you need to make pressure measurement and recording faster, easier and more accurate than ever. First, you can instantly select from up to nine of the most widely used pressure units without having to waste time and risk mistakes with tedious conversions. Next, a non-volatile memory function enables storage of up to 40 readings – perfect for HVAC technicians making Pitot tube traverses of airflow readings across a duct. The FM approved models are intrinsically safe for hazardous locations, Class 1, Div. 1, Group A, B, C, D, T4.

When working in poorly lighted areas, just switch on the handy backlight feature. It automatically shuts itself off after 20 minutes to minimize battery drain. Electronic zeroing means you simply touch a single key to perfectly null out any minor pressure differences. A display HOLD key freezes the current pressure for those all-too-common situations where readings fluctuate. We even included an audible alarm to warn you of overpressure plus a visual alarm warning in case ambient noise levels are too high to hear the alarm. Audible alarm also confirms a value has been stored, eliminating the need to observe display during a duct traverse.

A new option for the Series 477 is a USB interface. Combined with the 477's datalogging capability, a user can now quickly and conveniently download the stored readings to any USB compatible device. Data manipulation can be easily accomplished in a multitude of word processing or spreadsheet programs. USB models come with a USB cable and a software CD.

SPECIFICATIONS

Service: Air and compatible gases. FM models air and compatible combustible gases.
Wetted Materials: Consult factory.
Accuracy: ±0.5% F.S., 60 to 78°F (15.6 to 25.6°C); ±1.5% F.S. from 32 to 60°F and 78 to 104°F (0 to 15.6°C and 25.6 to 40°C)
Pressure Hysteresis: ±0.1% of full scale.
Pressure Limits: See chart.
Temperature Limits: 0 to 140°F (-17.8 to 60°C).
Compensated Temperature Limits: 32 to 104°F (-0 to 40°C).
Storage Temperature Limits: -4 to 176°F (-20 to 80°C).
Display: 0.42" (10.6 mm) 4 digit LCD.
Response Time: 1 seconds.
Resolution: See chart.
Power Requirements: 9 volt alkaline battery. Battery included but not connected.
Weight: 10.2 oz (289 g).
Connections: Two barbed connections for use with 1/8" (3.18 mm) or 3/16" (4.76 mm) I.D. tubing. Two compression fittings for use with 1/8" (3.18 mm) I.D. x 1/4" (6.35 mm) O.D. tubing for 477-7-FM & 477-8-FM only.
Agency Approvals: CE and FM, USB models are not FM approved Intrinsically safe.

A-402A Carrying Case — Tough gray nylon pouch protects any Series 477 Manometer. Double zippered for quick and easy access. With belt loop that snaps closed.
7-1/2"H x 3"W x 2-1/4"D (191 x 76 x 57 mm)

Model Number*	Range	Available Pressure Units									Maximum Pressure
		bar	psi	in Hg	kPa	in w.c.	mm Hg	mbar	mm w.c.	Pa	
477-000-FM	0-1.000 in w.c.			.0736	.2491	1.000	1.868	2.491	25.40	249.1	5 psig
477-00-FM	0-4.000 in w.c.		.1445	.2942	0.996	4.000	7.473	9.96	101.6	996	5 psig
477-0-FM	0-10.00 in w.c.		.3613	.7355	2.491	10.00	18.68	24.91	254.0	2491	5 psig
477-1-FM	0-20.00 in w.c.	.0498	.7225	1.471	4.982	20.00	37.36	49.82	508.0	4982	10 psig
477-2-FM	0-40.00 in w.c.	.0996	1.445	2.942	9.96	40.00	74.73	99.6	1016	9964	10 psig
477-3-FM	0-200.0 in w.c.	.4982	7.225	14.71	49.82	200.0	373.6	498.2	5080		30 psig
477-4-FM	0-10.00 psi	.6895	10.00	20.36	68.95	276.8	517.1	689.5	7031		30 psig
477-5-FM	0-20.00 psi	1.379	20.00	40.72	137.9	553.6	1034	1379			60 psig
477-6-FM	0-30.00 psi	2.069	30.00	61.08	206.9	830.4	1551	2069			60 psig
477-7-FM	0-100.0 psi	6.895	100.0	203.6	689.5	2768	5171	6895			150 psig
477-8-FM	0-150.0 psi	10.34	150.0	305.4	1034	4152	7757				200 psig

*Note: USB models include a software CD and cable. Change "FM" to "USB". Example: 477-2-FM becomes 477-2-USB

RAYNGER® ST™ 20/30 PRO

THE PROFESSIONAL'S CHOICE FOR VALUE AND PRECISION

Raytek's ST20 and ST30 Pro Infrared Non-Contact Thermometers offer accurate readings in a compact and reliable design. The ST20 Pro has a user selectable temperature range of -25 to 750°F (-32 to 400°C) and the ST30 has a range of -25 to 950°F (-32 to 510°C). They both have a 500 msec reading response time and a weight of 11 ounces. These thermometers are safe to use as they require no contact with the surface measured so long as it is within the thermometer's range (D:S=12:1).

With ST 20's single-point laser sighting, ST 30's 8-point circular laser sighting, their MAX temperature displays and rugged rubber over molding, they can prevent downtime by permitting preventative and predictive maintenance by simply pointing, shooting and reading temperature measurements. These thermometers are perfect for automotive and diesel applications, facility maintenance, fire safety, marine maintenance, electrical and industrial, asphalt work and HVAC systems, and these are just of few of the applications in which ST20s and ST30s can be utilized.

- **Wide Temperature Range**
- **Low Cost**
- **Max Temperature Display**
- **Choice of Laser Sighting Options**
- **Tripod Mountable**
- **Applications**

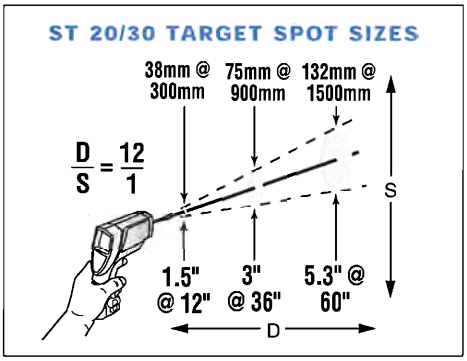
Automotive and Diesel
HVAC/R Systems
Electrical and Industrial
Facility Maintenance
Food Safety
Asphalt Work
Fire Safety
Marine Maintenance

- **ST20 Pro with laser**

-25 to 750°F (-32 to 400°C); °F/°C, backlight

- **ST30 Pro with circular laser**

-25 to 950°F (-32 to 510°C); °F/°C, backlight



RAYNGER® ST™ SERIES

SPECIFICATIONS

ACCURACY	±1% of reading or ±2°F (±1°C), whichever is greater, at 73°F (23°C) ambient temperature
REPEATABILITY	±0.5% of reading or ±2°F (±1°C), whichever is greater
RESPONSE TIME	(95%) 500 mSec
AMBIENT OPERATING RANGE	32 to 122°F (0 to 50°C)
POWER	9V Alkaline or NiCad battery
DIMENSIONS	8 x 6 x 2 in. (200 x 160 x 55 mm)
WEIGHT	11 oz. (320g)
OPTIONS/ACCESSORIES	Hard Case and Wrist Strap (standard) Nylon Holster with Belt Clip NIST/DKD Certification Contact Probe (ST60/80)

	ST20	ST30	ST60	ST80
TEMPERATURE RANGE	-25 to 750°F (-32 to 400°C)	-25 to 950°F (-32 to 545°C)	-25 to 1100°F (-32 to 600°C)	-25 to 1400°F (-32 to 760°C)
DISPLAY RESOLUTION	0.5°F (0.2°C)	0.5°F (0.2°C)	0.1°F/C	0.1°F/C
MAX, MIN, DIF AND AVG TEMPERATURE	No	No	Yes	Yes
RECALL LAST READING	No	No	Yes	Yes
DISPLAY HOLD	Yes	Yes	Yes	Yes
HIGH AND LOW AUDIBLE AND VISIBLE ALARMS	No	No	Yes	Yes
LCD BACKLIGHT	Yes	Yes	Yes	Yes
LASER (CLASS II)*	Yes	Yes	Yes	Yes
EMISSIVITY	Pre-set 0.95	Pre-set 0.95	0.1 to 1.0 digitally adjustable	0.1 to 1.0 digitally adjustable
CONTACT PROBE INPUT	No	No	Yes	Yes
DISTANCE TO SPOT RATIO	12:1	12:1	30:1	50:1

** ST20 and ST80-IS have a single spot laser; ST30, ST60, and ST80 have an eight point circular laser.*

CE

Appendix C

Laboratory Analytical Reports

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

November 08, 2017

John Casey

Daniel B. Stephens & Assoc.
6020 Academy NE Suite 100
Albuquerque, NM 87109
TEL: (505) 822-9400
FAX (505) 822-8877

RE: Shamrock 63 OrderNo.: 1710C22

Dear John Casey:

Hall Environmental Analysis Laboratory received 6 sample(s) on 10/23/2017 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Analytical Report
Lab Order **1710C22**
Date Reported: **11/8/2017**

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-17 SVE Pilot Quick Test
Project: Shamrock 63
Collection Date: 10/21/2017 8:15:00 AM
Lab ID: 1710C22-001 **Matrix:** AIR **Received Date:** 10/23/2017 4:20:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	28000	1000		µg/L	200	11/1/2017 11:45:17 AM	D46792
Surr: BFB	106	80.2-145		%Rec	200	11/1/2017 11:45:17 AM	D46792
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/1/2017 11:45:17 AM	B46792
Benzene	58	20		µg/L	200	11/1/2017 11:45:17 AM	B46792
Toluene	14	10		µg/L	200	11/1/2017 11:45:17 AM	B46792
Ethylbenzene	ND	10		µg/L	200	11/1/2017 11:45:17 AM	B46792
Xylenes, Total	ND	20		µg/L	200	11/1/2017 11:45:17 AM	B46792
Surr: 4-Bromofluorobenzene	110	81.9-144		%Rec	200	11/1/2017 11:45:17 AM	B46792

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-11 SVE Pilot Quick Test
Project: Shamrock 63
Collection Date: 10/21/2017 9:15:00 AM
Lab ID: 1710C22-002 **Matrix:** AIR **Received Date:** 10/23/2017 4:20:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	200000	2500		µg/L	500	11/2/2017 8:52:03 AM	G46838
Surr: BFB	110	80.2-145		%Rec	500	11/2/2017 8:52:03 AM	G46838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/1/2017 12:07:55 PM	B46792
Benzene	890	20		µg/L	200	11/1/2017 12:07:55 PM	B46792
Toluene	300	20		µg/L	200	11/1/2017 12:07:55 PM	B46792
Ethylbenzene	34	20		µg/L	200	11/1/2017 12:07:55 PM	B46792
Xylenes, Total	260	40		µg/L	200	11/1/2017 12:07:55 PM	B46792
Surr: 4-Bromofluorobenzene	114	81.9-144		%Rec	200	11/1/2017 12:07:55 PM	B46792

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-5 SVE Pilot Quick Test
Project: Shamrock 63
Collection Date: 10/21/2017 10:45:00 AM
Lab ID: 1710C22-003 **Matrix:** AIR **Received Date:** 10/23/2017 4:20:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	79000	1000		µg/L	200	11/2/2017 8:29:27 AM	G46838
Surr: BFB	107	80.2-145		%Rec	200	11/2/2017 8:29:27 AM	G46838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/2/2017 8:29:27 AM	B46838
Benzene	340	20		µg/L	200	11/2/2017 8:29:27 AM	B46838
Toluene	130	20		µg/L	200	11/2/2017 8:29:27 AM	B46838
Ethylbenzene	12	10		µg/L	200	11/2/2017 8:29:27 AM	B46838
Xylenes, Total	63	40		µg/L	200	11/2/2017 8:29:27 AM	B46838
Surr: 4-Bromofluorobenzene	113	81.9-144		%Rec	200	11/2/2017 8:29:27 AM	B46838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-1 SVE Pilot Quick Test
Project: Shamrock 63
Collection Date: 10/21/2017 11:45:00 AM
Lab ID: 1710C22-004 **Matrix:** AIR **Received Date:** 10/23/2017 4:20:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	130000	1000		µg/L	200	11/2/2017 9:37:04 AM	G46838
Surr: BFB	132	80.2-145		%Rec	200	11/2/2017 9:37:04 AM	G46838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/2/2017 9:37:04 AM	B46838
Benzene	430	20		µg/L	200	11/2/2017 9:37:04 AM	B46838
Toluene	76	20		µg/L	200	11/2/2017 9:37:04 AM	B46838
Ethylbenzene	20	20		µg/L	200	11/2/2017 9:37:04 AM	B46838
Xylenes, Total	120	40		µg/L	200	11/2/2017 9:37:04 AM	B46838
Surr: 4-Bromofluorobenzene	115	81.9-144		%Rec	200	11/2/2017 9:37:04 AM	B46838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-7 SVE Pilot Quick Test
Project: Shamrock 63
Collection Date: 10/21/2017 12:45:00 PM
Lab ID: 1710C22-005 **Matrix:** AIR **Received Date:** 10/23/2017 4:20:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	120000	1000		µg/L	200	11/2/2017 9:59:22 AM	G46838
Surr: BFB	113	80.2-145		%Rec	200	11/2/2017 9:59:22 AM	G46838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/2/2017 9:59:22 AM	B46838
Benzene	380	20		µg/L	200	11/2/2017 9:59:22 AM	B46838
Toluene	50	20		µg/L	200	11/2/2017 9:59:22 AM	B46838
Ethylbenzene	13	10		µg/L	200	11/2/2017 9:59:22 AM	B46838
Xylenes, Total	40	40		µg/L	200	11/2/2017 9:59:22 AM	B46838
Surr: 4-Bromofluorobenzene	115	81.9-144		%Rec	200	11/2/2017 9:59:22 AM	B46838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-2 SVE Pilot Quick Test
Project: Shamrock 63
Collection Date: 10/21/2017 2:30:00 PM
Lab ID: 1710C22-006
Matrix: AIR
Received Date: 10/23/2017 4:20:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	77000	1000		µg/L	200	11/2/2017 10:21:41 AM	G46838
Surr: BFB	106	80.2-145		%Rec	200	11/2/2017 10:21:41 AM	G46838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/2/2017 10:21:41 AM	B46838
Benzene	220	20		µg/L	200	11/2/2017 10:21:41 AM	B46838
Toluene	15	10		µg/L	200	11/2/2017 10:21:41 AM	B46838
Ethylbenzene	ND	10		µg/L	200	11/2/2017 10:21:41 AM	B46838
Xylenes, Total	ND	20		µg/L	200	11/2/2017 10:21:41 AM	B46838
Surr: 4-Bromofluorobenzene	112	81.9-144		%Rec	200	11/2/2017 10:21:41 AM	B46838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1710C22**
08-Nov-17

Client: Daniel B. Stephens & Assoc.
Project: Shamrock 63

Sample ID **1710C22-003ADUP** SampType: **DUP** TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **MW-5 SVE Pilot Qui** Batch ID: **G46838** RunNo: **46838**
Prep Date: Analysis Date: **11/2/2017** SeqNo: **1493886** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	77000	1000						2.80	20	
Surr: BFB	430000		400000		107	80.2	145	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1710C22**

08-Nov-17

Client: Daniel B. Stephens & Assoc.

Project: Shamrock 63

Sample ID **1710C22-003ADUP** SampType: **DUP** TestCode: **EPA Method 8021B: Volatiles**

Client ID: **MW-5 SVE Pilot Qui** Batch ID: **B46838** RunNo: **46838**

Prep Date: Analysis Date: **11/2/2017** SeqNo: **1493921** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Methyl tert-butyl ether (MTBE)	ND	50						0	20	
Benzene	330	20						2.63	20	
Toluene	120	20						3.25	20	
Ethylbenzene	11	10						5.78	20	
Xylenes, Total	61	40						3.19	20	
Surr: 4-Bromofluorobenzene	450		400.0		113	81.9	144	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
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HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: DBS | Work Order Number: 1710C22 | RcptNo: 1

Received By: Erin Melendrez 10/23/2017 4:20:00 PM

Completed By: Ashley Gallegos 10/24/2017 8:06:55 AM

Reviewed By: 10/24/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Client		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	NA	Good	Not Present			

Chain-of-Custody Record

Client: DBS&A

Mailing Address: 6020 Academy Rd NE ABQ 87109

Phone #: 505-822-9400

email or Fax#: tgolden@dbstephens.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☒ Standard ☐ Rush _____

Project Name: Shamrock #63

Project #: BE14.0021.00.00005.0005

Project Manager: J. Casey

Sampler: T. Golden

On Ice: ☐ Yes ☐ No

Sample Temperature: N/A

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1710622	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
10/21/17	8:15	AIR	MW-17 SVE PILOT QUICK TEST	1L Teflar	None	-001		X	X													
	9:15		MW-11 SVE PILOT QUICK TEST			-002																
	10:45		MW-5 SVE PILOT QUICK TEST			-003																
	11:45		MW-1 SVE PILOT QUICK TEST			-004																
	12:45		MW-7 SVE PILOT QUICK TEST			-005																
	14:30		MW-2 SVE PILOT QUICK TEST			-006																

Date	Time	Relinquished by:	Received by:	Date	Time
10/23/17	4:20			10/23/17	1620
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

November 08, 2017

John Casey

Daniel B. Stephens & Assoc.
6020 Academy NE Suite 100
Albuquerque, NM 87109
TEL: (505) 822-9400
FAX (505) 822-8877

RE: Shamrock 63 OrderNo.: 1710C23

Dear John Casey:

Hall Environmental Analysis Laboratory received 9 sample(s) on 10/23/2017 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1710C23**
Date Reported: **11/8/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-9 SVE Pilot
Project: Shamrock 63
Collection Date: 10/20/2017 9:30:00 AM
Lab ID: 1710C23-001 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	180000	2500		µg/L	500	11/1/2017 8:44:37 AM	D46792
Surr: BFB	108	80.2-145		%Rec	500	11/1/2017 8:44:37 AM	D46792
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	120		µg/L	500	11/1/2017 8:44:37 AM	B46792
Benzene	980	50		µg/L	500	11/1/2017 8:44:37 AM	B46792
Toluene	260	50		µg/L	500	11/1/2017 8:44:37 AM	B46792
Ethylbenzene	42	25		µg/L	500	11/1/2017 8:44:37 AM	B46792
Xylenes, Total	190	100		µg/L	500	11/1/2017 8:44:37 AM	B46792
Surr: 4-Bromofluorobenzene	110	81.9-144		%Rec	500	11/1/2017 8:44:37 AM	B46792

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-9 SVE Pilot
Project: Shamrock 63
Collection Date: 10/20/2017 12:30:00 PM
Lab ID: 1710C23-002 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	140000	1000		µg/L	200	11/1/2017 10:59:59 AM	D46792
Surr: BFB	112	80.2-145		%Rec	200	11/1/2017 10:59:59 AM	D46792
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/1/2017 10:59:59 AM	B46792
Benzene	760	20		µg/L	200	11/1/2017 10:59:59 AM	B46792
Toluene	230	20		µg/L	200	11/1/2017 10:59:59 AM	B46792
Ethylbenzene	36	20		µg/L	200	11/1/2017 10:59:59 AM	B46792
Xylenes, Total	200	40		µg/L	200	11/1/2017 10:59:59 AM	B46792
Surr: 4-Bromofluorobenzene	115	81.9-144		%Rec	200	11/1/2017 10:59:59 AM	B46792

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-9 SVE Pilot
Project: Shamrock 63
Collection Date: 10/20/2017 3:30:00 PM
Lab ID: 1710C23-003 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	150000	1000		µg/L	200	11/1/2017 11:22:37 AM	D46792
Surr: BFB	109	80.2-145		%Rec	200	11/1/2017 11:22:37 AM	D46792
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/1/2017 11:22:37 AM	B46792
Benzene	800	20		µg/L	200	11/1/2017 11:22:37 AM	B46792
Toluene	230	20		µg/L	200	11/1/2017 11:22:37 AM	B46792
Ethylbenzene	26	20		µg/L	200	11/1/2017 11:22:37 AM	B46792
Xylenes, Total	140	40		µg/L	200	11/1/2017 11:22:37 AM	B46792
Surr: 4-Bromofluorobenzene	112	81.9-144		%Rec	200	11/1/2017 11:22:37 AM	B46792

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-10 SVE Pilot
Project: Shamrock 63
Collection Date: 10/22/2017 9:30:00 AM
Lab ID: 1710C23-004 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	200000	2500		µg/L	500	11/3/2017 9:03:58 AM	G46868
Surr: BFB	110	80.2-145		%Rec	500	11/3/2017 9:03:58 AM	G46868
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/2/2017 10:44:00 AM	B46838
Benzene	980	20		µg/L	200	11/2/2017 10:44:00 AM	B46838
Toluene	970	20		µg/L	200	11/2/2017 10:44:00 AM	B46838
Ethylbenzene	56	20		µg/L	200	11/2/2017 10:44:00 AM	B46838
Xylenes, Total	260	40		µg/L	200	11/2/2017 10:44:00 AM	B46838
Surr: 4-Bromofluorobenzene	113	81.9-144		%Rec	200	11/2/2017 10:44:00 AM	B46838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-10 SVE Pilot
Project: Shamrock 63
Collection Date: 10/22/2017 12:30:00 PM
Lab ID: 1710C23-005 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	220000	2500		µg/L	500	11/3/2017 9:28:23 AM	G46868
Surr: BFB	113	80.2-145		%Rec	500	11/3/2017 9:28:23 AM	G46868
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/2/2017 11:28:42 AM	B46838
Benzene	880	20		µg/L	200	11/2/2017 11:28:42 AM	B46838
Toluene	930	20		µg/L	200	11/2/2017 11:28:42 AM	B46838
Ethylbenzene	69	20		µg/L	200	11/2/2017 11:28:42 AM	B46838
Xylenes, Total	370	40		µg/L	200	11/2/2017 11:28:42 AM	B46838
Surr: 4-Bromofluorobenzene	116	81.9-144		%Rec	200	11/2/2017 11:28:42 AM	B46838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-10 SVE Pilot
Project: Shamrock 63
Collection Date: 10/22/2017 3:30:00 PM
Lab ID: 1710C23-006 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	230000	2500		µg/L	500	11/3/2017 9:50:58 AM	G46868
Surr: BFB	112	80.2-145		%Rec	500	11/3/2017 9:50:58 AM	G46868
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/2/2017 11:51:02 AM	B46838
Benzene	860	20		µg/L	200	11/2/2017 11:51:02 AM	B46838
Toluene	840	20		µg/L	200	11/2/2017 11:51:02 AM	B46838
Ethylbenzene	56	20		µg/L	200	11/2/2017 11:51:02 AM	B46838
Xylenes, Total	300	40		µg/L	200	11/2/2017 11:51:02 AM	B46838
Surr: 4-Bromofluorobenzene	113	81.9-144		%Rec	200	11/2/2017 11:51:02 AM	B46838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-6 SVE Pilot
Project: Shamrock 63
Collection Date: 10/23/2017 7:30:00 AM
Lab ID: 1710C23-007 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	150000	1000		µg/L	200	11/2/2017 12:13:24 PM	G46838
Surr: BFB	112	80.2-145		%Rec	200	11/2/2017 12:13:24 PM	G46838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/2/2017 12:13:24 PM	B46838
Benzene	830	20		µg/L	200	11/2/2017 12:13:24 PM	B46838
Toluene	670	20		µg/L	200	11/2/2017 12:13:24 PM	B46838
Ethylbenzene	39	20		µg/L	200	11/2/2017 12:13:24 PM	B46838
Xylenes, Total	190	40		µg/L	200	11/2/2017 12:13:24 PM	B46838
Surr: 4-Bromofluorobenzene	113	81.9-144		%Rec	200	11/2/2017 12:13:24 PM	B46838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-6 SVE Pilot
Project: Shamrock 63
Collection Date: 10/23/2017 10:30:00 AM
Lab ID: 1710C23-008 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	120000	1000		µg/L	200	11/3/2017 8:41:27 AM	G46868
Surr: BFB	113	80.2-145		%Rec	200	11/3/2017 8:41:27 AM	G46868
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/3/2017 8:41:27 AM	B46868
Benzene	670	20		µg/L	200	11/3/2017 8:41:27 AM	B46868
Toluene	390	20		µg/L	200	11/3/2017 8:41:27 AM	B46868
Ethylbenzene	37	20		µg/L	200	11/3/2017 8:41:27 AM	B46868
Xylenes, Total	200	40		µg/L	200	11/3/2017 8:41:27 AM	B46868
Surr: 4-Bromofluorobenzene	115	81.9-144		%Rec	200	11/3/2017 8:41:27 AM	B46868

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-6 SVE Pilot
Project: Shamrock 63
Collection Date: 10/23/2017 1:30:00 PM
Lab ID: 1710C23-009 **Matrix:** AIR **Received Date:** 10/23/2017 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	130000	1000		µg/L	200	11/3/2017 10:35:57 AM	G46868
Surr: BFB	110	80.2-145		%Rec	200	11/3/2017 10:35:57 AM	G46868
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Methyl tert-butyl ether (MTBE)	ND	50		µg/L	200	11/3/2017 10:35:57 AM	B46868
Benzene	740	20		µg/L	200	11/3/2017 10:35:57 AM	B46868
Toluene	340	20		µg/L	200	11/3/2017 10:35:57 AM	B46868
Ethylbenzene	19	10		µg/L	200	11/3/2017 10:35:57 AM	B46868
Xylenes, Total	99	40		µg/L	200	11/3/2017 10:35:57 AM	B46868
Surr: 4-Bromofluorobenzene	113	81.9-144		%Rec	200	11/3/2017 10:35:57 AM	B46868

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1710C23**

08-Nov-17

Client: Daniel B. Stephens & Assoc.

Project: Shamrock 63

Sample ID	**1710C23-001ADUP**	SampType:	**DUP**		TestCode:	**EPA Method 8015D: Gasoline Range**				
Client ID:	**MW-9 SVE Pilot**	Batch ID:	**D46792**		RunNo:	**46792**				
Prep Date:		Analysis Date:	**11/1/2017**		SeqNo:	**1492582**	Units:	**µg/L**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	150000	2500						16.7	20	
Surr: BFB	1100000		1000000		107	80.2	145	0	0	

Sample ID	**1710C23-008ADUP**	SampType:	**DUP**		TestCode:	**EPA Method 8015D: Gasoline Range**				
Client ID:	**MW-6 SVE Pilot**	Batch ID:	**G46868**		RunNo:	**46868**				
Prep Date:		Analysis Date:	**11/3/2017**		SeqNo:	**1495152**	Units:	**µg/L**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	150000	1000						19.5	20	
Surr: BFB	460000		400000		115	80.2	145	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1710C23**

08-Nov-17

Client: Daniel B. Stephens & Assoc.

Project: Shamrock 63

Sample ID	**1710C23-001ADUP**	SampType:	**DUP**	TestCode:	**EPA Method 8021B: Volatiles**
Client ID:	**MW-9 SVE Pilot**	Batch ID:	**B46792**	RunNo:	**46792**
Prep Date:		Analysis Date:	**11/1/2017**	SeqNo:	**1492623** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Methyl tert-butyl ether (MTBE)	ND	120						0	20	
Benzene	830	50						16.4	20	
Toluene	250	50						3.71	20	
Ethylbenzene	45	25						7.32	20	
Xylenes, Total	220	100						13.2	20	
Surr: 4-Bromofluorobenzene	1100		1000		111	81.9	144	0	0	

Sample ID	**1710C23-008ADUP**	SampType:	**DUP**	TestCode:	**EPA Method 8021B: Volatiles**
Client ID:	**MW-6 SVE Pilot**	Batch ID:	**B46868**	RunNo:	**46868**
Prep Date:		Analysis Date:	**11/3/2017**	SeqNo:	**1495168** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Methyl tert-butyl ether (MTBE)	ND	50						0	20	
Benzene	830	20						21.7	20	R
Toluene	500	20						24.4	20	R
Ethylbenzene	39	20						4.44	20	
Xylenes, Total	220	40						10.1	20	
Surr: 4-Bromofluorobenzene	460		400.0		115	81.9	144	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: DBS | Work Order Number: 1710C23 | RcptNo: 1

Received By: Erin Melendrez 10/23/2017 4:15:00 PM

Completed By: Ashley Gallegos 10/24/2017 8:14:20 AM

Reviewed By: 10/24/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Client		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	NA	Good	Not Present			

Chain-of-Custody Record

Client: DBS&A

Mailing Address: 6020 Academy Rd NE ABQ 87109

Phone #: 505-822-9400

email or Fax#: tgolden@dbstephens.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☒ Standard ☐ Rush _____

Project Name: ~~Hot~~ Shamrock #63

Project #: BE14.0021.00.00005.0003

Project Manager: J. Casey

Sampler: T. Golden

On Ice: ☒ Yes ☐ No

Sample Temperature: N/A

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1710C23	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	Air Bubbles (Y or N)
10/20/17	9:30	AIR	MW-9 SVE PILOT	1L Tedlar	None	-001		X	X									
"	12:30	"	MW-9 SVE PILOT	"	"	-002		"	"									
"	15:30	"	MW-9 SVE PILOT	"	"	-003		"	"									
10/22/17	9:30	"	MW-10 SVE PILOT	"	"	-004		"	"									
"	12:30	"	MW-10 SVE PILOT	"	"	-005		"	"									
"	15:30	"	MW-10 SVE PILOT	"	"	-006		"	"									
10/23/17	7:30	"	MW-6 SVE PILOT	"	"	-007		"	"									
"	10:30	"	MW-6 SVE PILOT	"	"	-008		"	"									
"	13:30	"	MW-6 SVE PILOT	"	"	-009		"	"									

Analysis Request

Date	Time	Relinquished by:	Received by:	Date	Time
10/23/17	4:15			10/23/17	1615
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Appendix D

Field Notes

10/20/17 — SVE PILOT TESTING — TG

50° mostly sunny, slight northerly breeze

0745 DBS&A on-site.
AcuVac is already set up on MW-9
Hotel manager requested that MW-6 be tested on Monday due to traffic through parking lot. Will do quick tests Saturday and MW-10 Sunday.
Discuss access in Manny's auto lot.

0800 Conduct tailgate health and safety
Discuss traffic, altitude, sun, and hospital location.

0830 Begin test on MW-9.
Measure / verify distances between wells. Mark up table from work plan.

0845 Getting decent flow at applied vacuum of 25" H_2O. High concentration (no propane usage). Plan to run at steps of 25, 50, 75" H_2O.

0930 Collect MW-9 SVE pilot lab sample after 1-hour testing. Will analyze all samples for 8015D / 8021B.

1030 PSTB on-site. Susan von Gontien, Chris Hamilton.
Step vacuum up to 50" H_2O.

1245 PSTB off-site.

1230 Collect MW-9 SVE pilot test sample.

TG — 10/20/17

1330 Increase applied well vacuum to about 75" H_2O.

1430 Discuss quick testing with Jesus @ Manny's Auto Sales. They have already moved vehicles off of MW-1 and MW-2 locations. MW-5 and MW-7 have vehicles around but should be available for testing.
MW-1 well vault is 6" below grade. Surrounded by stone pavers to keep dirt out...

1500 Flow relatively unchanged @ 17 scfm, but have 6 feet upwelling. Assuming 4 feet open screen, 4 scfm/ft.

1530 75" H_2O applied vacuum.
Collect MW-9 SVE pilot test.

1545 Status updates for Casey and Raucci.

1630 Shut down test on MW-9.
Collecting final vacuum, residual vacuum, and final water levels.
Secure well vaults. Except for MW-12, bolts hand-tightened in preparation for testing tomorrow.

1700 Packing, move forward, will start on MW-17 tomorrow.

1730 "Off-site."

10/21/17 TG

48°F, partly cloudy, southerly breeze

0630 AcuVac on-site warming up equipment and setting up on MW-17

0700 Start quick test on MW-17. Running at 50" H_2O. All quick tests will be run at this vacuum.

0705 Daily tailgate health and safety. Discuss traffic, kill switch, trips and falls, and critters on car lot.

0720 Vacuum spikes at 100"+, open dilution to let water table settle back down.

0730 Pulling about 3.5 cfm @ 50" H_2O. Tighter formation. Only 20 ppmv in Horiba screening sample.

0745 ~~X~~Collect MW-17 quick test sample~~X~~ Will continue to collect samples every 15 minutes.

0815 Hydrocarbons climbing back up. ~2,000 ppmv Assume vacuum spike submerged smear zone and well screen, but now returning to static. Collect MW-17 quick test sample

0820 Shut off MW-17 quick test. Set up on MW-11.

TG 10/21/17

0825 Place cones around truck and rig.

0830 Begin test on MW-11. Pulling about 4 cfm @ 50" H_2O. Hydrocarbon vapors ~ 80,000 ppmv.

0915 Collect MW-11 quick test sample.

0930 Shut off MW-11 quick test. Mobilize rig into Manny's auto lot.

0935 Set up on MW-5. Apparently have maxed system flow (~35 cfm) at only 22" to 23" H_2O.

1000 Official start of MW-5 quick test. Vacuum creeping up slightly (~27" H_2O). Flow also up. HC ~ 40,000 ppmv.

1025 Vacuum back down to ~ 24-25" H_2O. Flow around 30 cfm.

1045 Collect MW-5 quick test sample.

1100 Shut down MW-5 test. Move hose and gauge to MW-1. Begin test. Maxing out around 38" H_2O.

1130 Getting max flow @ ~35" H_2O. With 4' open screen, ~ 8 cfm/ft.

1145 Collect MW-1 quick test sample

1200 Stop test on MW-1. Move hose and fittings to MW-7. Max flow at ~36" H_2O.

10/21/17 TG

1210 DBS&A off-site to pick up lunch for all. AcuVac pushing to finish testing.

1245 DBS&A on-site.
Collect MW-7 quick test sample
HC concentrations rising quickly. Started at 20,000 ppmv. Now 60,000 ppmv.

1300 Complete quick test on MW-7.
Break for lunch.

1330 Will move rig to set up on MW-2

1345 Begin test on MW-2. 26" H_2O vacuum
Another high flow, low vacuum test.

1415 Flow started at 40 cfm, has dropped to 34 cfm as they mix in dilution air due to rising HC values.

1430 Collect MW-2 quick test sample
PSTB on-site (Susan).

1445 Complete last quick test on MW-2
Close and secure all wells.
Notify Jesus w/ Manny's that testing is done for the day.

1500 NMED, AcuVac, and DBS&A off-site.

10/21/17 TG

TG 10/22/17

36°F, clear, calm

0740 DBS&A on-site. AcuVac is already set up on MW-10. Significant residual vacuum in surrounding observation wells (1-3" H_2O), and MW-10 is holding ~30" H_2O without engine vacuum. Decide to pull plugs, vent to atmosphere, and restart test at 0830. Will vent overnight for next test tomorrow.

0830 Begin test on MW-10. Due to limited open screen, will attempt to run steps of 20, 40, 60" H_2O vacuum.

0900 About 3.5 cfm @ 20" H_2O. With upwelling, have about 4 ft open screen.

0930 Collect MW-10 SVE pilot test lab sample
Will analyze TPH/BTEX by 8021/8015

1030 Increase applied well vacuum to 40" H_2O. Flow at ~5 cfm.

1130 Maintaining 5 cfm @ 40" vacuum. Not seeing immediate rise in observation well vacuum - potential sign of tighter formation at MW-10.

1230 Collect MW-10 SVE pilot test
DBS&A off-site to pick up lunch.

10/22/17 TG

1250 DBS&A back on-site.

1330 Increase vacuum to 60" H_2O. Well flow up to 6.5 cfm, despite increased upwelling. Approximately 4 to 5 cfm/ft open screen.

1500 System stable at 6.5 cfm @ 60" H_2O. Don't have a clear picture of R.o.I on this test as observation well vacuum are all similar, regardless of distance from well. Believed to be related to residual vacuum in the formation from previous testing last 2 days.

1515 Changes in observed well vacuum tracking barometric pressure, not necessarily applied well vacuum.

1530 Collect MW-10 SVE pilot test sample. Discuss plan for tomorrow. Will block entire entrance / driveway near MW-6 for safety reasons. South driveway will remain open for hotel access. Plan to start test at 0630.

1630 Conclude test on MW-10. Secure well vaults. Leaving caps off MW-6, 9 and 11 due to residual vac.

1700 DBS&A off-site.

TG 10/23/17

42°F, clear, slight northerly breeze

0630 DBS&A on-site. AcuVac already set up on MW-6 with observation wells ready and static data collected. Despite well caps off overnight, there is still residual vac.

0630 Begin MW-6 SVE pilot test. Plan to run steps at 25, 50, 75" H_2O vac. Have about 12' open screen at static.

0630 Daily tailgate health and safety. Discuss pedestrian traffic, since truck is pulled up close to sidewalk. Will need to secure valuables more closely. Despite cones and caution tape, already had a cyclist cut through exclusion zone. Reposition cones. Will need to man the rig closely.

0700 5.5 cfm @ 25" H_2O. Initial HC Concentration ~ 56K ppmv.

0730 Collect MW-6 SVE pilot test lab sample.

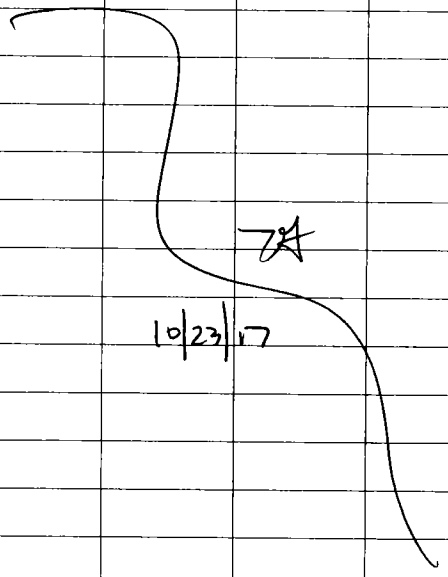
0830 Step vacuum up to 50" H_2O.

1000 6 cfm @ 50" H_2O. After step, cut off propane. Enough flow and HC. Concentration ~ 75K ppmv.

1030 Collect MW-6 SVE pilot test sample

10/23/17 TG

1130	Step vacuum up to 75" H_2O. Flow increases to 9.5 cfm
1230	PSTB on-site. (Susan, Chris)
1330	Collect MW-6 SVE pilot test.
1400	10 cfm @ 75" H_2O applied vacuum.
1415	PSTB off-site
1430	Stop MW-6 SVE pilot test. Lock and secure monitor wells. Pack up equipment and trailer.
1515	DBS+A off-site.
1600	Drop samples at lab.



Appendix E

Photographic Documentation

1. Equipment set up for SVE pilot test, well MW-10.

2. Wellhead configuration for SVE pilot test.

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Photographs

3. Vapor flow gauge.

4. Wellhead configuration for quick test.

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Photographs

5. Vacuum monitoring port installed at well MW-6; well MW-9 in background.

6. Wellhead configuration with transducer for monitoring vacuum and fluid upwelling.

SHAMROCK #63
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SANTA FE, NEW MEXICO
Photographs