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Wisconsin Department of Natural Resources (WDNR)
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Subject: Summary of Soil Vapor Extraction Pilot Test – Former Spice Room (BRRTS# 02-13-580723) 910 Mayer Property Madison, WI

On behalf of 910 Mayer LLC, Environmental Resources Management Inc.(ERM) has prepared this letter to summarize the soil vapor extraction (SVE) pilot test completed in March of 2020 near the former Spice Room in Building 43 located at 910 Mayer Ave, Madison, WI (the Site). The Remediation Technology Screening for the Former Spice Room submitted to WDNR on December 9, 2019 indicated that SVE was the only retained remedial option, with a potential need for a supplemental sub-slab depressurization system (SSDS) in distal areas. This screening evaluation was completed prior to additional soil vapor sampling that indicated soil vapor concentrations in the distal areas require remediation with SVE; therefore, an SSDS is not being considered further at this time. This pilot test was performed to evaluate the feasibility of the SVE technology to meet the remedial goal of mitigating the vapor intrusion risk in Building 43 based on the presence of trichloroethylene (TCE) and other volatile organic compounds (VOCs). The remedial goal for TCE in soil vapor is 880 ug/m^3 for large commercial/industrial building use.

Pre-Pilot Testing Activities

In preparation for the SVE pilot test and to evaluate conditions in the northern portion of Building 43, ERM installed 12 sub-slab soil gas sampling locations (VP-21 through VP-32), three soil vapor probes (SP-01 through SP-03), and three soil vapor extraction wells (SVE-01 through SVE-03). **Figure 1** shows the SVE well, soil vapor probe and vapor monitoring point locations. The results of these additional investigation locations were provided in the 910 Mayer LLC, Madison, Wisconsin – 910 Mayer – Site Update letter dated April 17, 2020 and are provided as **Table 1**.

In total, three SVE wells (SVE), three soil probes (SP) and 32 vapor pins (VP) were used at the Site to evaluate whether SVE is appropriate and to collect necessary data required to design a full-scale SVE system. The SVE wells were installed near the three identified areas with soil vapor exceedances and the SPs and VPs were installed around the SVE wells to determine the Radius of Influence (ROI). The VPs were installed into the concrete building slab with protective covers. VPs were installed per manufacturer instruction with silicone sleeves. The SP locations were installed with stainless steel screens from 4 to 4.5 feet below the top of the building slab with polyethylene tubing to the concrete slab surface. During the initial vapor sampling event, SP-3 was observed to be installed into the groundwater and therefore no vapor sample was able to be collected. Based on this observation, SVE-1 and SVE-2 were installed with screened intervals from 1 to 4 feet below the concrete slab and SVE-3 from 0.5 to 3.5 feet below the concrete slab. The SVE wells were installed

using a vacuum excavator and air knife and constructed using 4-inch diameter, schedule 40 PVC with 0.01 inch slot screen.

SVE Pilot Testing Activities

The SVE pilot testing consisted of step tests, which were performed by incrementally closing the make-up air valve to determine the change in ROI at different applied vacuums and flow rates. Each of the three SVE wells were operated independently to determine the ROI in each zone at the site. After the completion of each individual test run, all three SVE wells were operated simultaneously. Flow was measured by differential pressure in the pilot treatment system stream.

Soil Vapor Extraction Pilot Test Results

The SVE-01 pilot test consisted of three step tests. Step one had the vacuum set at 5.4 inches of water (in.H2O) with an approximate flow rate ranging of 27 cubic feet per minute (cfm). The Step two vacuum was set at 24 in.H2O with an approximate flow rate of 44.2 cfm. The Step three vacuum exceeded the equipped pressure gauge and was conducted at greater than 30 in.H2O with a flow rate of approximately 60 cfm. SP and VP data are shown on **Table 2.** The third test was not used for design ROI and flow calculations since high vacuums were applied.

The SVE-02 pilot test consisted of three step tests. The Step one vacuum was set at 8.9 in.H2O with an approximate flow rate of 18.9 cfm. The Step two vacuum was set at 26 in.H20 with an approximate flow rate of 15.8 cfm. The Step three vacuum was set at 36 in.H2O with an approximate flow rate of 17.9 cfm. SP and VP data are shown on **Table 3.**

SVE-03 pilot test consisted of three step tests. Step one had vacuum pressures ranging from 26 to 32 in.H2O and Step two was conducted with reduced vacuum ranging from 14 to 16 in.H20. The differential pressure was below the detection capability of the instrumentation therefore a flow rate could not be determined for the first two test but is assumed to be less than 18.9 CFM. Step three vacuum ranged from 35 to 36 in.H2O with an approximate flow rate of 18.9 cfm. SP and VP data are shown on **Table 4.** Only step three was used for design ROI flow calculations.

An additional pilot test was conducted running SVE-1, SVE-2, and SVE-3 simultaneously. Data collected for all wells running are presented in **Table 5**.

Three SPs were installed adjacent to the three VP points to evaluate any differences in detected influence between the style of observations points. SP-01 was installed adjacent to VP-2, SP-02 was installed adjacent to VP-19, and SP-03 was installed adjacent to VP-23. As presented on **Table 2** and **Table 3**, the vacuums observed in the sub-slab vapor points (VP-2 and VP-19) were lower than the vacuum observed in the adjacent soil vapor probe (SP-01 and SP-02) for all of the Step Tests at SVE-01 and SVE-02. This demonstrates that short-circuiting of vacuum immediately beneath the building slab is not occurring, and that SVE is a viable remedial alternative for vadose zone soils. SP-03 was submerged under groundwater during the pilot test and pressure data could not be collected. Soil conditions at the SP-03 area are similar to the other locations and the floor is in similarly very good condition that will assist in estimating the ROI in the northern area.

Four vapor samples were collected during the pilot testing. The vapor samples were collected using summa canisters and analyzed by Eurofins TestAmerica for volatile organic compound (VOCS)

using method TO-15. One sample was taken from each well during the individual step tests and one sample was taken when all wells operated simultaneously. **Table 6** shows the results from these soil gas samples. The SVE-01 and SVE-02 TCE concentrations were less than the nearby vapor pin concentrations collected prior to the pilot test, as expected due to dilution from cleaner areas. SVE-03 TCE concentrations were higher than nearby vapor pin concentrations, suggesting this location is situated in the most impacted area. SVE-03 also had a high cis-1,2-dichloroethylene concentration, which is a degradation product of TCE. The combined vapor sample had some petroleum-related VOCs such as trimethylbenzene isomers, and BTEX.

Calculated SVE Radius of Influence and Conceptual SVE Design

A design ROI was calculated for each of the three SVE wells to support conceptual and full-scale design of the SVE system (shown in table below). ROI and flow calculations are based on the SP and VP data collected during the pilot test and are presented in **Appendix A**.

Zone	ROI (ft)
1 (SVE-01)	50
2 (SVE-02)	35
3 (SVE-03)	25

Based on the design ROI, the recommended conceptual design includes installation of an additional 18 SVE wells to supplement the three existing SVE wells. The conceptual SVE system design and soil vapor and sub-slab concentrations are shown on **Figure 2**. The anticipated system flow under this conceptual design is approximately 215 cfm.

Recommendations

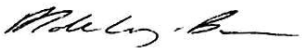
The SVE pilot test and sampling confirm that SVE is the appropriate approach to remediating the VOC concentrations in the subsurface near the Former Spice Room and in Building 43. A full-scale SVE system design and installation of an SVE system will be completed to address the vapor intrusion pathway near the Former Spice Room and in Building 43. The SVE system layout will be developed to account for the presence of sub-surface utilities such as storm sewers. The next steps and estimated timeline are presented in the table below.

Task	Estimated duration
System Design	Four Weeks
Final Contractor Pricing	Two Weeks
Install Extraction Wells	Two Weeks (following design approval)
SVE System Installation	Five Weeks
System Start-up	One-Two Weeks
Construction Completion Report	Eight Weeks

Note: This schedule assumes that no delays beyond ERM's control will be encountered, which may include subcontractor availability, unforeseen equipment problems, unforeseen Site conditions, Site access limitations, weather conditions, Covid-19 challenges, etc.

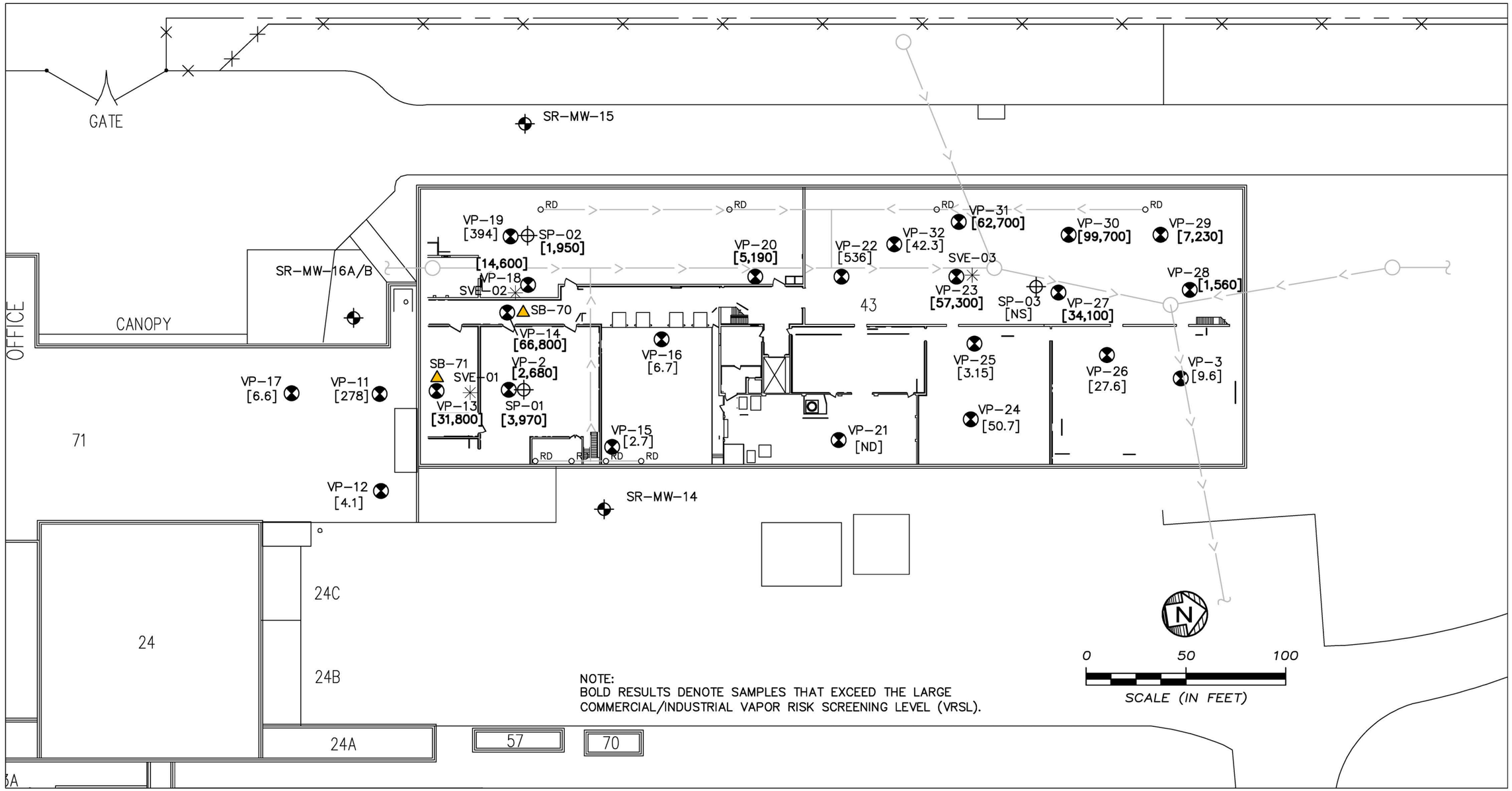
Please let us know if you have any questions or would like to schedule a call to discuss.

Yours sincerely,



David de Courcy-Bower P.E.
Partner

TCE SUB-SLAB SAMPLE RESULTS
BUILDING 43 AND 71



NOTE:
BOLD RESULTS DENOTE SAMPLES THAT EXCEED THE LARGE COMMERCIAL/INDUSTRIAL VAPOR RISK SCREENING LEVEL (VRSL).

LEGEND

- SUB-SLAB LOCATION
- [927] TCE SOIL GAS RESULTS (MICROGRAMS PER CUBIC METER – ug/m^3)
- SOIL VAPOR EXTRACTION WELL
- SOIL VAPOR PROBES
- STORM SEWER
- STORM MANHOLE
- RD ROOF DRAIN
- MONITORING WELL
- SOIL BORING

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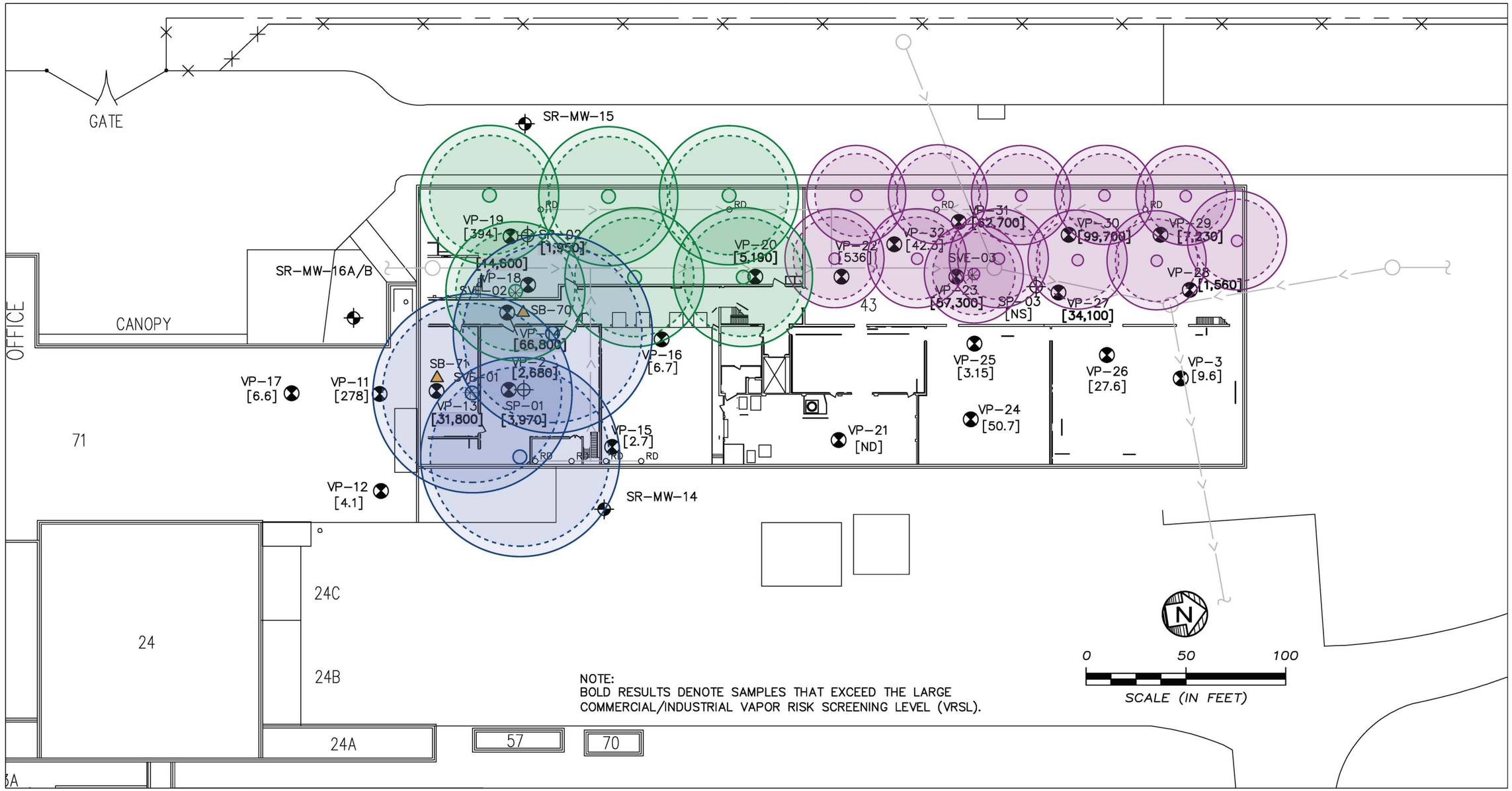
CADD Review FGB			0441161
Date Drawn/Rev'd 8/14/17 – 4/9/20		Environmental Resources Management	FIGURE 1

CONCEPTUAL SVE EXTRACTION WELL LAYOUT
BUILDING 43 AND 71



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Date Drawn/Rev'd 8/14/17 – 4/9/20		Environmental Resources Management	FIGURE 2

Q:\Team\DMMV\CIntM-P\910 Mayer LLC\0441161\0441161-02.dwg, TCE SOIL GAS SAMPLE, 4/24/2020 2:18:18 PM, FAK - Holland, Mi.

TABLE 1 - Subslab Soil Vapor Sampling Results

BRRTS # 02-13-580723

SITE NAME: Former Spice Room - 910 Mayer Facility

SITE ADDRESS: 910 Mayer Avenue Madison, WI 53704

				Location ID	VP-02	VP-03	VP-11	VP-12	VP-13	VP-14	VP-15	VP-16
				Date	02/12/2019	8/2/2017	02/12/2019	02/12/2019	02/12/2019	02/12/2019	02/12/2019	02/12/2019
				Sample Type	N	N	N	N	N	N	N	N
Parameter	**Units**	**Residential VRSL**	**Small Commerical VRSL**	**Large Commercial/Industrial**								
Trichloroethene	ug/m3	*70*	**290**	880	***2680***	9.6	*278*	4.1	***31800***	***66800***	2.7	6.7

Notes:

Results reported in micrograms per cubic meter (ug/m3).

Underlined values exceed the Large Commerical/Industrial Vapor Risk Screening Levels

Bold values exceed Small Commercial Vapor Risk Screening Levels

Italicized values exceed the Residential Vapor Risk Screening Level

N = Normal sample

TABLE 1 - Subslab Soil Vapor Sampling Results

BRRTS # 02-13-580723

SITE NAME: Former Spice Room - 910 Mayer Facility

SITE ADDRESS: 910 Mayer Avenue Madison, WI 53704

				Location ID	VP-17	VP-18	VP-19	VP-20	VP-21	VP-22	VP-23	VP-24	VP-25
				Date	02/12/2019	02/12/2019	02/12/2019	02/12/2019	01/27/2020	01/27/2020	01/27/2020	01/27/2020	02/24/2020
				Sample Type	N	N	N	N	N	N	N	N	N
Parameter	**Units**	**Residential VRSL**	**Small Commerical VRSL**	**Large Commercial/Industrial**									
Trichloroethene	ug/m3	*70*	**290**	880	6.6	***14600***	***394***	***5190***	< 0.975 U	***536***	***57300***	50.7	3.15

Notes:

Results reported in micrograms per cubic meter (ug/m3).

Underlined values exceed the Large Commerical/Industrial Vapor Risk Screening Levels

Bold values exceed Small Commercial Vapor Risk Screening Levels

Italicized values exceed the Residential Vapor Risk Screening Level

N = Normal sample

TABLE 1 - Subslab Soil Vapor Sampling Results

BRRTS # 02-13-580723

SITE NAME: Former Spice Room - 910 Mayer Facility

SITE ADDRESS: 910 Mayer Avenue Madison, WI 53704

				Location ID	VP-26	VP-27	VP-28	VP-29	VP-30	VP-31	VP-32	SP-01	SP-02
				Date	02/24/2020	02/24/2020	02/24/2020	02/21/2020	02/21/2020	02/21/2020	02/21/2020	02/24/2020	02/24/2020
				Sample Type	N	N	N	N	N	N	N	N	N
Parameter	**Units**	**Residential VRSL**	**Small Commerical VRSL**	**Large Commercial/Industrial**									
Trichloroethene	ug/m3	*70*	**290**	880	27.6	***34100***	***1560***	***7230***	***99700***	***62700***	42.3	***3970***	***1950***

Notes:

Results reported in micrograms per cubic meter (ug/m3).

Underlined values exceed the Large Commerical/Industrial Vapor Risk Screening Levels

Bold values exceed Small Commercial Vapor Risk Screening Levels

Italicized values exceed the Residential Vapor Risk Screening Level

N = Normal sample

Table 2 - SVE-01 Step Test
Former Spice Room

SVE-01		Step-1	Step-2	Step-3
Wellhead Vacuum	**(in H_2O)**	5.4	24	>30*
Differential Pressure	**(in H_2O)**	0.02	0.055	0.1
Air Flow Rate (Conversion)	**(cfm)**	24	44.2	60
Observation Point	**Distance (ft)**	**(in H_2O)**	**(in H_2O)**	**(in H_2O)**
VP-13	15.3	1.8	6.6	9.2
SP-1	16.3	0.79	2.7	3.6
VP-2	17.2	0.72	2.0	2.6
VP-14	39.5	1.7	5.7	8.0
VP-11	45.4	0.00	0.08	0.00
VP-18	61.3	0.09	0.22	0.30
VP-12	66.4	0.00	0.00	0.00
VP-16	76.1	0.02	0.00	0.00
VP-19	81.9	0.05	0.04	0.02
SP-2	83.4	0.79	2.7	3.6
VP-17	88.9	0.01	0.03	0.00
VP-15	99.1	0.04	0.00	0.01
VP-20	153.0	0.00	0.00	0.00

*Pressure Exceeded Wellhead Vacuum Gauge

Table 3 - SVE-01 Step Test
Former Spice Room

SVE-02		Step-1	Step-2	Step-3
Wellhead Vacuum	**(in H_2O)**	8.9	26	36
Differential Pressure	**(in H_2O)**	0.01*	0.007	0.009
Air Flow Rate (Conversion)	**(cfm)**	18.9	15.8	17.9
Observation Point	**Distance**	**(in H_2O)**	**(in H_2O)**	**(in H_2O)**
VP-14	8.0	0.05	1.4	1.4
VP-18	16.0	0.25	0.76	0.76
SP-2	31.3	0.01	0.05	0.96
VP-19	35.0	0	0.01	0.02
VP-2	46.4	0.01	0.06	0.06
SP-1	48.3	0.02	0.02	0.35
VP-2	51.0	0.01	0.08	0.06
VP-13	63.1	0.03	0.02	0.08
VP-16	78.2	0	0	0
VP-11	84.9	0	0	0
VP-15	92.7	0	0	0
VP-12	120.0	0	0	0
VP-17	122.5	0	0	0
VP-20	124.5	0	0	0

*Step 1 was conducted with less sensitive diffrential pressure instrumentations

Table 4 - SVE-03 Step Test
Former Spice Room

SVE-03		Step-1	Step-2	Step-3
Wellhead Vacuum	**(in H_2O)**	32	16	36
Differential Pressure	**(in H_2O)**	<0.01*	<0.01*	0.01
Air Flow Rate (Conversion)	**(cfm)**	<18.9	<18.9	18.9
Observation Point	**Distance (ft)**	**(in H_2O)**	**(in H_2O)**	**(in H_2O)**
VP-23	14.1	3.5	1.8	3.5
VP-31	23.4	0.15	0.05	0.13
SP-03**	33.8	0.00	0.00	0.00
VP-27	38.5	0.10	0.01	0.03
VP-25	40.5	0.04	0.00	0.00
VP-30	44.5	0.05	0.00	0.00
VP-26	68.0	0.00	0.00	0.00
VP-24	77.7	0.00	0.00	0.00
VP-29	81.4	0.00	0.00	0.00
VP-28	90.8	0.00	0.00	0.00

*Step 1 and 2 Flow was below threshold of instrumentation
** SP-03 was submerged

Table 5 - All Well Step Test
Former Spice Room

	All wells		Step-1	Step-2
	Wellhead Vacuum SVE-01	**(in H_2O)**	4	16
	Wellhead Vacuum SVE-02	**(in H_2O)**	8.5	24.25
	Wellhead Vacuum SVE-03	**(in H_2O)**	8.5	16.5
	Differential Pressure	**(in H_2O)**	0.03	0.12
	Air Flow Rate (Conversion)	**(cfm)**	32.6	65.3
Influence	Observation Point	**Distance (ft)**	**(in H_2O)**	**(in H_2O)**
SVE-1	VP-13	15.33	1.15	4.80
	*SP-1**	*16.33*	*0.44*	*2.00*
	*VP-2**	*17.17*	*0.41*	*1.80*
	*VP-14**	*39.50*	*1.20*	*4.80*
	VP-16	76.10	0.00	0.00
	VP-15	99.10	0.00	0.00
SVE-2	*VP-14**	*8.00*	*1.20*	*4.80*
	VP-18	16.00	0.19	0.60
	SP-2	31.25	0.01	0.13
	VP-19	35.00	0.00	0.00
	*VP-2**	*46.42*	*0.41*	*1.80*
	*SP-1**	*48.25*	*0.44*	*2.00*
	VP-20	124.50	0.00	0.00
SVE-3	VP-23	14.13	0.80	1.60
	VP-31	23.42	0.02	0.09
	SP-03	33.83	0.00	0.00
	VP-27	38.54	0.04	0.06
	VP-25	40.50	0.00	0.00
	VP-30	44.50	0.00	0.00
	VP-26	68.00	0.00	0.00
	VP-24	77.67	0.00	0.00
	VP-29	81.38	0.00	0.00
	VP-28	90.83	0.00	0.00

Potentially Influenced from multiple SVE points

Table 6 - Pilot Test Analytical
Former Spice Room

	Location ID Sample ID Sample Date	SR-SVE-01 SR-SVE-01-SSA-20200310 03-10-2020	SR-SVE-02 SR-SVE-02-SSA-20200310 03-10-2020	SR-SVE-03 SR-SVE-03-SSA-20200310 03-10-2020	SR-SVE-01-02-03 SR-SVE-01-02-03-SSA-20200311 03-11-2020
TO15 Volatile Organic Compounds in Ambient Air					
1,1,1-Trichloroethane	ug/m3	< 43	< 17	< 460	< 54
1,1,2,2-Tetrachloroethane	ug/m3	< 20	< 8.0	< 220	< 26
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	ug/m3	< 13	< 5.1	< 140	< 16
1,1,2-Trichloroethane	ug/m3	< 8.1	< 3.2	< 87	< 10
1,1-Dichloroethane	ug/m3	< 6.0	< 2.4	< 64	< 7.6
1,1-Dichloroethene	ug/m3	< 6.7	< 2.7	< 72	< 8.5
1,2,4-Trichlorobenzene	ug/m3	< 100	< 40	< 1100	< 130
1,2,4-Trimethylbenzene	ug/m3	< 21	< 8.2	< 220	**360**
1,2-dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	ug/m3	< 18	< 7.0	< 190	< 22
1,2-Dichlorobenzene	ug/m3	< 39	< 16	< 420	< 50
1,2-Dichloroethane	ug/m3	< 8.5	< 3.4	< 92	< 11
1,2-Dichloropropane	ug/m3	< 9.8	< 3.9	< 110	< 12
1,3,5-Trimethylbenzene	ug/m3	< 23	< 9.0	< 250	**130**
1,3-Dichlorobenzene	ug/m3	< 20	< 8.0	< 220	< 26
1,4-Dichlorobenzene	ug/m3	< 20	< 8.0	< 220	< 26
Benzene	ug/m3	< 5.4	< 2.1	< 58	< 6.8
Benzyl chloride	ug/m3	< 42	< 16	< 450	< 52
Carbon tetrachloride	ug/m3	< 9.3	< 3.7	< 100	< 12
Chlorobenzene	ug/m3	< 5.8	< 2.3	< 63	< 7.4
Chloroethane	ug/m3	< 16	< 6.4	< 170	< 20
Chloroform	ug/m3	< 7.2	< 2.9	< 78	< 9.1
cis-1,2-Dichloroethene	ug/m3	< 8.4	< 3.3	**110,000**	**5,400**
cis-1,3-Dichloropropene	ug/m3	< 15	< 6.1	< 170	< 19
Dichlorodifluoromethane (Freon 12)	ug/m3	< 15	**38**	< 160	< 18
Ethylbenzene	ug/m3	< 12	< 4.7	< 130	**150**
Ethylene dibromide	ug/m3	< 11	< 4.5	< 120	< 14
Hexachlorobutadiene	ug/m3	< 72	< 29	< 780	< 91
m,p-Xylenes	ug/m3	< 27	< 11	< 290	**690**
Methyl bromide	ug/m3	< 18	< 7.1	< 190	< 23
Methyl chloride	ug/m3	< 29	< 11	< 310	< 36
Methylene chloride	ug/m3	< 120	< 47	< 1300	< 150
o-Xylene	ug/m3	< 14	< 5.4	< 150	**240**
Styrene	ug/m3	< 22	< 8.6	< 230	< 27
Tetrachloroethene	ug/m3	< 10	< 4.0	< 110	< 13
Toluene	ug/m3	< 62	< 25	< 670	**120**
trans-1,3-Dichloropropene	ug/m3	< 8.6	< 3.4	< 93	< 11
Trichloroethene	ug/m3	**6,900**	**4,500**	**180,000**	**11,000**
Trichlorofluoromethane (Freon 11)	ug/m3	< 13	< 5.2	< 140	< 16
Vinyl chloride	ug/m3	< 14	< 5.6	< 150	< 18

Notes:
< = Compound not detected at concentrations above the laboratory method detection limit. The laboratory method detection limit is shown. If the method detection limit is not available, the reporting dection limit is shown (RDL).
Units are in µg/m3 = micrograms per cubic meter
All analyses performed by TestAmerica - Knoxville, TN.

Appendix A.1
Former Spice Room

Extraction Well SVE-01

Observation Point:	Volumetric Flow Rate	Extraction Well Radius	Distance to Observation Point	Vadose Zone Thickness	Vacuum at Extraction Well	Vacuum at Observation Point	Vaccume Difference	Volume-Based Pneumatic Conductivity
	Q_V	r	b	D	P_a	P_b	$\Delta P = P_a - P_b$	K_a
SVE Step #1	(ft^3/min)	(ft)	(ft)	(ft)	("H_2O)	("H_2O)	(g/(cm*sec^2))	(cm/sec)
VP-13	-27.0	0.25	15.33	4.00	5.40	1.8	8.96E+03	9.36E-03
SP-1	-27.0	0.25	16.33	4.00	5.40	0.79	1.15E+04	7.42E-03
VP-2	-27.0	0.25	17.17	4.00	5.40	0.72	1.16E+04	7.39E-03
VP-14	-27.0	0.25	39.50	4.00	5.40	1.70	9.21E+03	1.12E-02
VP-16	-27.0	0.25	76.10	4.00	5.40	0.02	1.34E+04	8.70E-03
VP-15	-27.0	0.25	99.10	4.00	5.40	0.04	1.33E+04	9.13E-03
							Geomean Pneumatic Conductivity:	**8.66E-03**
SVE Step #2								
SP-1	-44.2	0.25	16.33	4.00	24.00	2.70	5.30E+04	2.63E-03
VP-13	-44.2	0.25	15.33	4.00	24.00	6.6	4.33E+04	3.17E-03
VP-14	-44.2	0.25	39.50	4.00	24.00	5.70	4.55E+04	3.71E-03
VP-15	-44.2	0.25	99.10	4.00	24.00	0.00	5.97E+04	3.34E-03
VP-16	-44.2	0.25	76.10	4.00	24.00	0	5.97E+04	3.19E-03
VP-2	-44.2	0.25	17.17	4.00	24.00	2.00	5.48E+04	2.57E-03
							Geomean Pneumatic Conductivity:	**3.08E-03**

Average	***Maximum Pneumatic Conductivity:***	**1.12E-02**
	Geomean Pneumatic Conductivity:	**5.87E-03**
	Minimum Pneumatic Conductivity:	**2.57E-03**

Appendix A.2
Former Spice Room

Extraction Well SVE-02

Observation Point:	Volumetric Flow Rate	Extraction Well Radius	Distance to Observation Point	Vacuum at Extraction Well	Vacuum at Observation Point	Vaccume Difference	Mass-Based Pneumatic Conductivity	Volume-Based Pneumatic Conductivity
	Q_V	r	b	P_a	P_b	$\Delta P = P_a - P_b$	K_{air}	K_a
SVE Step #1	(ft^3/min)	(ft)	(ft)	("H_2O)	("H_2O)	(g/(cm*sec^2))	(sec)	(cm/sec)
SP-1	-18.9	0.25	48.25	8.90	0.02	2.21E+04	3.46E-06	3.39E-03
SP-2	-18.9	0.25	31.25	8.90	0.01	2.21E+04	3.17E-06	3.11E-03
VP-14	-18.9	0.25	8.00	8.90	0.05	2.20E+04	2.29E-06	2.24E-03
VP-18	-18.9	0.25	16.00	8.90	0.25	2.15E+04	2.81E-06	2.75E-03
VP-19	-18.9	0.25	35.00	8.90	0	2.22E+04	3.24E-06	3.18E-03
VP-20	-18.9	0.25	124.50	8.90	0	2.22E+04	4.08E-06	4.00E-03
VP-2	-18.9	0.25	46.42	8.90	0.01	2.21E+04	3.43E-06	3.37E-03
						Maximum Pneumatic Conductivity:	**4.08E-06**	**4.00E-03**
						Geomean Pneumatic Conductivity:	**3.17E-06**	**3.11E-03**
						Minimum Pneumatic Conductivity:	**2.29E-06**	**2.24E-03**
SVE Step #2								
SP-1	-15.8	0.25	48.25	26.00	0.02	6.47E+04	9.90E-07	9.70E-04
SP-2	-15.8	0.25	31.25	26.00	0.05	6.46E+04	9.09E-07	8.91E-04
VP-14	-15.8	0.25	8.00	26.00	1.42	6.12E+04	6.89E-07	6.75E-04
VP-18	-15.8	0.25	16.00	26.00	0.76	6.28E+04	8.05E-07	7.89E-04
VP-19	-15.8	0.25	35.00	26.00	0.01	6.47E+04	9.29E-07	9.10E-04
VP-20	-15.8	0.25	124.50	26.00	0	6.47E+04	1.17E-06	1.14E-03
VP-2	-15.8	0.25	46.42	26.00	0.06	6.46E+04	9.84E-07	9.64E-04
						Maximum Pneumatic Conductivity:	**1.17E-06**	**1.14E-03**
						Geomean Pneumatic Conductivity:	**9.14E-07**	**8.96E-04**
						Minimum Pneumatic Conductivity:	**6.89E-07**	**6.75E-04**
SVE Step #3								
SP-1	-17.9	0.25	48.25	36.00	0.35	8.87E+04	8.17E-07	8.01E-04
SP-2	-17.9	0.25	31.25	36.00	0.96	8.72E+04	7.63E-07	7.47E-04
VP-14	-17.9	0.25	8.00	36.00	1.35	8.62E+04	5.54E-07	5.43E-04
VP-18	-17.9	0.25	16.00	36.00	0.76	8.77E+04	6.53E-07	6.40E-04
VP-19	-17.9	0.25	35.00	36.00	0.02	8.96E+04	7.60E-07	7.45E-04
VP-20	-17.9	0.25	124.50	36.00	0	8.96E+04	9.55E-07	9.36E-04
VP-2	-17.9	0.25	46.42	36.00	0.06	8.95E+04	8.05E-07	7.88E-04
						Maximum Pneumatic Conductivity:	**9.55E-07**	**9.36E-04**
						Geomean Pneumatic Conductivity:	**7.48E-07**	**7.34E-04**
						Minimum Pneumatic Conductivity:	**5.54E-07**	**5.43E-04**

	Maximum Pneumatic Conductivity:	**4.08E-06**	**4.00E-03**
Average	***Geomean Pneumatic Conductivity:***	**8.31E-07**	**1.58E-03**
	Minimum Pneumatic Conductivity:	**5.54E-07**	**5.43E-04**

Appendix A.3
Former Spice Room

Extraction Well: SVE Step #3

Observation Point:	Volumetric Flow Rate	Extraction Well Radius	Distance to Observation Point	Vadose Zone Thickness	Vacuum at Extraction Well	Vacuum at Observation Point	Vaccume Difference	Mass-Based Pneumatic Conductivity	Volume-Based Pneumatic Conductivity
	Q_V	r	b	D	P_a	P_b	$\Delta P = P_a - P_b$	K_{air}	K_a
(b)	(ft^3/min)	(ft)	(ft)	(ft)	("H_2O)	("H_2O)	(g/(cm*sec^2))	(sec)	(cm/sec)
Step 3									
SP-03	-18.9	0.25	33.83	4.00	36.00	0.00	8.96E+04	7.97E-07	7.81E-04
VP-23	-18.9	0.25	14.13	4.00	36.00	3.50	8.09E+04	7.25E-07	7.11E-04
VP-24	-18.9	0.25	77.67	4.00	36.00	0.00	8.96E+04	9.32E-07	9.13E-04
VP-25	-18.9	0.25	40.50	4.00	36.00	0.00	8.96E+04	8.26E-07	8.09E-04
VP-26	-18.9	0.25	68.00	4.00	36.00	0.00	8.96E+04	9.10E-07	8.92E-04
VP-27	-18.9	0.25	38.54	4.00	36.00	0.03	8.95E+04	8.19E-07	8.02E-04
VP-28	-18.9	0.25	90.83	4.00	36.00	0.00	8.96E+04	9.57E-07	9.38E-04
VP-29	-18.9	0.25	81.38	4.00	36.00	0.00	8.96E+04	9.39E-07	9.20E-04
VP-30	-18.9	0.25	44.50	4.00	36.00	0.00	8.96E+04	8.41E-07	8.24E-04
VP-31	-18.9	0.25	23.42	4.00	36.00	0.13	8.93E+04	7.40E-07	7.25E-04

Maximum Pneumatic Conductivity:	**9.57E-07**	**9.38E-04**
Geomean Pneumatic Conductivity:	**8.45E-07**	**8.33E-04**
Minimum Pneumatic Conductivity:	**7.25E-07**	**7.11E-04**

Appendix A.4
Former Spice Room

Effective Extraction Well/Wellbore Radius (a):	0.50	(feet)
Pneumatic Conductivity (K_{air}):	5.9E-03	(cm/sec)
Desired SVE ROI (b):	50.0	(feet)
Desired Pore Volume Exchange Rate (ER):	4.0	(PV/day)
Vadose Zone Thickness/Sreened Interval (h):	4.0	(feet)
Soil Porosity (η):	0.30	(Void Ratio)
Air Density (ρ_{air}):	1.3E-03	(g/cm^3)

Flow Rate per SVE well location (Q): **26.2** (scfm)

$$Q = \frac{\pi \cdot ER \cdot (b^2 - a^2) \cdot \eta \cdot \rho_{air} \cdot h}{1440 \cdot 60}$$

Applied Vacuum (Pressure Drop from a to b):	1.6E+04	($g/cm/sec^2$)
Applied Vaccum	**6.2**	(IWC)

$$\Delta P = \left(\frac{Q}{2 \cdot \pi \cdot K_{air} \cdot h} \right) \cdot \ln\left(\frac{b}{a} \right)$$

Appendix A.5
Former Spice Room

Effective Extraction Well/Wellbore Radius (a):	0.50	(feet)
Pneumatic Conductivity (K_{air}):	1.6E-03	(cm/sec)
Desired SVE ROI (b):	30.0	(feet)
Desired Pore Volume Exchange Rate (ER):	4.0	(PV/day)
Vadose Zone Thickness/Sreened Interval (h):	4.0	(feet)
Soil Porosity (η):	0.30	(Void Ratio)
Air Density (ρ_{air}):	1.3E-03	(g/cm^3)

Flow Rate per SVE well location (Q): **9.4** (scfm)

$$Q = \frac{\pi \cdot ER \cdot (b^2 - a^2) \cdot \eta \cdot \rho_{air} \cdot h}{1440 \cdot 60}$$

Applied Vacuum (Pressure Drop from a to b):	1.8E+04	($g/cm/sec^2$)
Applied Vaccum	**7.4**	(IWC)

$$\Delta P = \left(\frac{Q}{2 \cdot \pi \cdot K_{air} \cdot h} \right) \cdot \ln\left(\frac{b}{a} \right)$$

Appendix A.6
Former Spice Room

Effective Extraction Well/Wellbore Radius (a):	0.50	(feet)
Pneumatic Conductivity (K_{air}):	8.3E-04	(cm/sec)
Desired SVE ROI (b):	25.0	(feet)
Desired Pore Volume Exchange Rate (ER):	4.0	(PV/day)
Vadose Zone Thickness/Sreened Interval (h):	4.0	(feet)
Soil Porosity (η):	0.30	(Void Ratio)
Air Density (ρ_{air}):	1.3E-03	(g/cm^3)
Flow Rate per SVE well location (Q):	**6.5**	(scfm)

$$Q = \frac{\pi \cdot ER \cdot (b^2 - a^2) \cdot \eta \cdot \rho_{air} \cdot h}{1440 \cdot 60}$$

Applied Vacuum (Pressure Drop from a to b):	2.3E+04	($g/cm/sec^2$)
Applied Vaccum	**9.3**	(IWC)

$$\Delta P = \left(\frac{Q}{2 \cdot \pi \cdot K_{air} \cdot h} \right) \cdot \ln\left(\frac{b}{a} \right)$$