

9 September 2016

Mr. Bob Williams  
Oregon Department of Environmental Quality  
700 NE Multnomah St., Suite #600  
Portland, Oregon 97232

**Subject:** Work Plan for Soil Vapor Extraction System Expansion  
East Multnomah County Troutdale Sandstone Aquifer Remediation  
Fairview, Oregon  
(ECSI #1479)

Dear Bob:

Geosyntec Consultants (Geosyntec) has prepared this Work Plan on behalf of Cascade Corporation (Cascade) to describe the operation and performance of the current soil vapor extraction (SVE) system and recommend additional wells be added to the system. The SVE system is part of the East Multnomah County Troutdale Sandstone Aquifer (TSA) remedy being conducted jointly by Cascade Corporation (Cascade) and The Boeing Company (Boeing). The TSA remedy is being implemented under the Department of Environmental Quality's (DEQ's) Consent Order No. WMCSR-NWR-96-08 (DEQ, 1997). DEQ approved the December 2014 SVE system installation work plan (Geosyntec, 2014) and the SVE system has been effective at removing chlorinated solvents from the TSA.

## **CURRENT SVE SYSTEM**

The current SVE system was installed in March/April 2015 and utilized existing vapor monitoring wells with screens at depths of 42.5, 75, and 95.5 feet below ground surface (bgs). The shallow well (VW-17-42.5) was constructed with a 5-foot screen, while the two deep wells (VW-17-75 and VW-17-95.5) were constructed with 20-foot screens. The three wells are installed near the Central Treatment System (CTS) in the vicinity of groundwater monitoring well CMW-17ds. The three vapor wells, CMW-17ds, and the CTS are shown on Figure 1.

The SVE system contains a blower rated for 900 standard cubic feet per minute (scfm), a moisture separator prior to the blower, and an exhaust stack that discharges 10 feet above ground surface. Above-ground 2-inch diameter PVC piping connects the vapor wells to the blower.

## EXISTING SVE SYSTEM PERFORMANCE

The current SVE system has operated greater than 99.6% of the time since April 2015 and currently extracts approximately 225 scfm of soil vapor at a vacuum of 4 inches of mercury (in Hg). The initial target extraction rate of approximately 160 scfm was increased in November 2015 to the present flow (Figure 2) in order to maximize mass removal and vary subsurface flow patterns. System process data is collected weekly for vacuums, flowrates, temperatures, and field volatile organic compound (VOC) readings using a photoionization detector [PID] of the SVE effluent. Process data readings are provided in Appendix A.

Samples from the three individual wells are collected on a quarterly basis (Table 1) and SVE system effluent samples are collected on a monthly basis (Table 2) for laboratory analysis. Field and laboratory VOC concentrations over time are shown for the SVE effluent stack in Figure 3 and for the three vapor wells in Figure 4. Overall, VOC concentrations in the three vapor wells have decreased by more than 80% in each well since startup. Based on the extracted well vapor sampling it appears that significant chlorinated VOC (cVOC) mass is present within, and above, the former saturated zone above the current groundwater level. Significant mass is not believed to be present in the shallower vadose zone (above 60 feet bgs). Based on the decreased cVOC concentrations observed in VW-17d-42.5 and VW-17d-75, it is recommended that these wells be shut down.

Based on monthly laboratory data<sup>1</sup> approximately 23 pounds of chlorinated VOCs (cVOCs) have been removed through June 2016 (Figure 5). The removal efficiency is consistent with the removal efficiency of 10 to 20 pounds per year estimated in the original Work Plan (Geosyntec, 2014). These discharge rates have been below the DEQ's de minimis threshold for treatment of VOCs in air discharge effluent of one ton per year for total VOCs as hazardous air pollutants [OAR 340-200-0020]. As a result, treatment of vapor is not required, and the vapors are discharged directly to the atmosphere via the stack.

Groundwater samples were collected from monitoring well CMW-17ds on a monthly basis beginning in October 2015 to monitor changes in VOC groundwater concentrations in conjunction with operation of the SVE system. CMW-17ds is located adjacent to the SVE wells (Figure 1). TCE concentrations in CMW-17ds are shown on Figure 6. Results of the monthly sampling indicated decreases and increases in TCE concentrations in CMW-17ds, and are inconclusive as

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<sup>1</sup> Monthly laboratory data is used rather than weekly PID field measurements to estimate mass removal rates, since laboratory data is believed to be more accurate and reliable. Field PID removal rates are included for reference.

to the direct effect of the SVE on TCE concentrations at this well. As such, we recommend discontinuing monthly groundwater sampling and resuming quarterly sampling at this well.

## **PROPOSED SVE SYSTEM EXPANSION**

A phased installation of three to five additional soil vapor extraction wells is proposed to increase cVOC mass removal in the unsaturated zone above the TSA groundwater. The wells are proposed at locations extending from the existing soil vapor treatment system, in an area of historic, persistent high VOC concentrations in groundwater (known as the TSA Mound Area). Proposed Phase I vapor wells are shown on Figure 1.

### **Vapor Well Locations**

Due to the limited number of existing extraction and observation wells in the vicinity of the existing vapor wells, radius of influence (ROI) data is not available. A 50-foot ROI (100-foot spacing) is assumed for proposed well placement. This assumption will be verified following installation of the first vapor well, and subsequent locations may be adjusted based on ROI testing at the initial vapor well. The first phase of vapor well installation will include three wells at approximate locations as follows:

- Approximately 100 feet east of VW-17d-95.5;
- Approximately 100 feet west of VW-17d-95.5; and
- A third location either southeast or southwest of the first two wells.

### **Well Installation and Construction**

The well borings will be drilled using sonic drilling methods. Telescoping drilling methods (i.e. a stepdown) will be used at the contact between the Troutdale Gravel Aquifer (TGA) and underlying confining unit 1 (CU1). The boring will be drilled using 8-inch casing and a 6-inch diameter core barrel, stepped down to 6-inch casing with a 4-inch core barrel. Soil will be cored continuously and will be field screened for VOCs during drilling using a photoionization detector (PID). Target depths for the borings will be at first encountered groundwater in the TSA, which is estimated to occur at 100 to 105 feet bgs based on well, CMW-17ds. The depth to groundwater during the August 2016 monitoring event was 102 feet bgs at CMW-17ds. If groundwater is not encountered, the borings will be extended to a maximum depth of 110 feet bgs.

Grab groundwater samples will be collected from the TSA (approximately 105 feet bgs) during drilling at the first two vapor well locations and tested for VOCs. The groundwater samples will be collected using a stainless steel submersible pump inserted into a temporary stainless steel well screen placed into the boring (casing). If possible, the casing will be pulled back slightly to expose

the well screen. The groundwater samples will be submitted for analytical testing of VOCs by EPA Method 8260 on a rush turn around.

Based on the grab groundwater sample and field screening results, an additional SVE well will be installed either 200 feet southeast or 200 feet southwest of the existing well VW-17d-95.5 in the direction of the higher groundwater VOC concentrations. If groundwater is not encountered, field observations and field screening results (i.e. PID measurements) will be used to evaluate well locations and screen placement depths. Existing vapor wells VW-17d-42.5 and VW-17d-75 will shut down and utilized as vacuum monitoring (or observation) wells following installation of the Phase 1 wells

Following groundwater sampling, a monitoring well/vapor well will be installed in the boring. The well will be installed with a 20-foot screen from approximately 85 to 105 feet bgs and will span the water table to allow for groundwater sampling and vapor extraction. At this time, a packer system is not anticipated to be necessary to separate the vapor and groundwater well screens, since the proposed vacuum is not strong enough to pull water into the SVE system. The applied vacuum will be monitored and adjusted to prevent groundwater rise above the top of the vapor screen. The wells will be constructed of 2-inch diameter, schedule 40 polyvinyl chloride (PVC), with a 0.01-inch (10-slot) screen and 10/20 silica sand filter pack.

Investigation derived waste (IDW) will consist of soil cuttings and water generated during drilling and sampling/purging. Soil cuttings will be stored on-site in roll-off boxes, dewatered as necessary, pending characterization and off-site permitted disposal. Water will be stored on-site in totes or a larger water storage container and solids will be settled out. Water will be treated through the on-site water treatment system and ultimately discharged under the existing National Pollutant Discharge Elimination System permit. Remaining solids will be added to a soil roll off box prior to characterization and disposal.

### **Vapor Well Startup**

The new extraction wells will be connected to the SVE manifold with PVC piping buried approximately one-foot bgs (Figure 7). Valving and gauging will be installed to allow for vapor transfer and process data collection. Although significant water production is not expected, entrained water will be separated from the vapor with the current in-line moisture separator, and the collected liquids will be transferred to the CTS for treatment and disposal.

The SVE system will remain within a chain-link fence to prevent unauthorized access. Process data and PID SVE effluent concentrations will continue to be recorded in the field on a weekly basis. Monthly SVE effluent and quarterly well vapor samples will be collected in evacuated 1.0-liter summa canisters for laboratory analysis. The summa canister samples will be analyzed for

cVOCs by EPA Method TO-15. Groundwater samples will be collected on a monthly basis from the new wells to evaluate initial and post-startup groundwater VOC concentrations. After 6 months of monthly sampling, the sampling frequency will be evaluated and possibly reduced to quarterly monitoring.

Based on observed cVOC mass removal in these three new vapor wells, one or two additional wells (Phase 2 vapor wells) may be installed to the north of the existing SVE wells within the poplar tree stand and in the vicinity of the former Shepard Spring and/or south of the existing system. These additional proposed locations are shown on Figure 1.

### **EXPECTED EXPANDED SVE SYSTEM PERFORMANCE**

The modified SVE system is expected to be operated for approximately twelve months, at a flow rate of approximately 475 scfm (100 scfm for VW-17d-95.5 and 125 scfm each for the three new wells), and an applied vacuum of 4 in Hg. Based on the long term cVOC concentrations observed in VW-17d-95.5, cVOC concentration are expected to stabilize around 2,500 micrograms per cubic meter. An additional 40 to 50 pounds of cVOC mass is expected to be removed with the SVE system during the first 12 months of operation, based on the expected flows and concentrations. These discharge rates are estimated to remain below DEQ's de minimis treatment threshold of one ton per year for total VOCs and, as a result, effluent treatment is not planned.

### **DATA EVALUATION AND REPORTING**

Data collected from the SVE system will be evaluated on a weekly basis to track and optimize system performance and to estimate cVOC mass removal. The extracted VOC concentration and mass removal levels over time will be used to assess system performance. Operation of the system will be modified or discontinued once mass removal rates reach asymptotic levels.

System performance data, along with recommendations for system modifications, continued operation of the system, and/or termination of system operation, will be included in the 2016 TSA annual report. Monthly/quarterly groundwater samples will also be included in the 2016 TSA annual report.

## CLOSURE

We look forward to your review and approval of this Work Plan. Please contact us at (503) 222-9518 with any questions regarding this Work Plan or if you need additional information.

Sincerely,

**Geosyntec Consultants, Inc.**



Cindy Bartlett, R.G.  
Senior Geologist/Project Manager



Brent A. Miller, P.E.  
Senior Principal

Cc: Jason Hegdahl, Cascade Corporation  
Michael Gleason, The Boeing Company  
Chris Kimmel, Landau Associates

### Reference:

Geosyntec, 2014. Work Plan for Soil Vapor Extraction System Installation and Operation East Multnomah County Troutdale Sandstone Aquifer Remediation Fairview, Oregon. 3 December 2014.

### Attachments:

Table 1	SVE Well cVOC Vapor Concentrations
Table 2	SVE Effluent cVOC Vapor Concentrations
Figure 1	Site and Well Locations
Figure 2	SVE Extracted Vapor Flow (Weekly Average)
Figure 3	SVE Effluent cVOC Vapor Concentration
Figure 4	SVE Well cVOC Vapor Concentrations
Figure 5	SVE System Mass Removal
Figure 6	TCE Concentration Profile CMW-17(ds)
Figure 7	Expanded SVE Equipment Diagram
<b>Appendix A</b>	<b>SVE Process Data</b>

# Tables

**Table 1 - SVE Well cVOC Vapor Concentrations**

**Well VW17D-42.5**

<i>Compound</i>	<i>4/28/15</i>	<i>7/28/15</i>	<i>10/27/15</i>	<i>11/30/15</i>	<i>1/26/16</i>	<i>3/15/16</i>	<i>6/21/16</i>
cis-1,2-Dichloroethene	390	150	130	4	<u>1.1</u>	3	72
Trichloroethene	2,800	1,200	1,200	31	<u>1.1</u>	17	440
Tetrachloroethene	97	54	53	<u>1.9</u>	<u>1.1</u>	13	25
TOTAL cVOCs	3,287	1,404	1,383	37	3	33	537

**Well VW17D-75**

<i>Compound</i>	<i>4/28/15</i>	<i>7/28/15</i>	<i>10/27/15</i>	<i>11/30/15</i>	<i>1/26/16</i>	<i>3/15/16</i>	<i>6/21/16</i>
cis-1,2-Dichloroethene	400	150	70	53	58	52	<u>1.1</u>
Trichloroethene	4,500	950	520	710	1,600	550	<u>1.1</u>
Tetrachloroethene	260	140	120	120	120	93	<u>1.1</u>
TOTAL cVOCs	5,160	1,240	710	883	1,778	695	3

**Well VW17D-95.5**

<i>Compound</i>	<i>4/28/15</i>	<i>7/28/15</i>	<i>10/27/15</i>	<i>11/30/15</i>	<i>1/26/16</i>	<i>3/15/16</i>	<i>6/21/16</i>
cis-1,2-Dichloroethene	750	180	44	140	160	160	170
Trichloroethene	11,000	2,500	530	2,000	2,100	2,100	1,800
Tetrachloroethene	660	200	49	150	170	140	140
TOTAL cVOCs	12,410	2,880	623	2,290	2,430	2,400	2,110

Notes:

- cVOCs = Chlorinated volatile organic compounds
- 400 = Concentration in micrograms per cubic meter
- 1.9 = Red, underlined values shown as U flagged
- 1.1 = Blue, underlined values shown as 1/2 MRL

**Table 2 - SVE Effluent cVOC Vapor Concentrations**

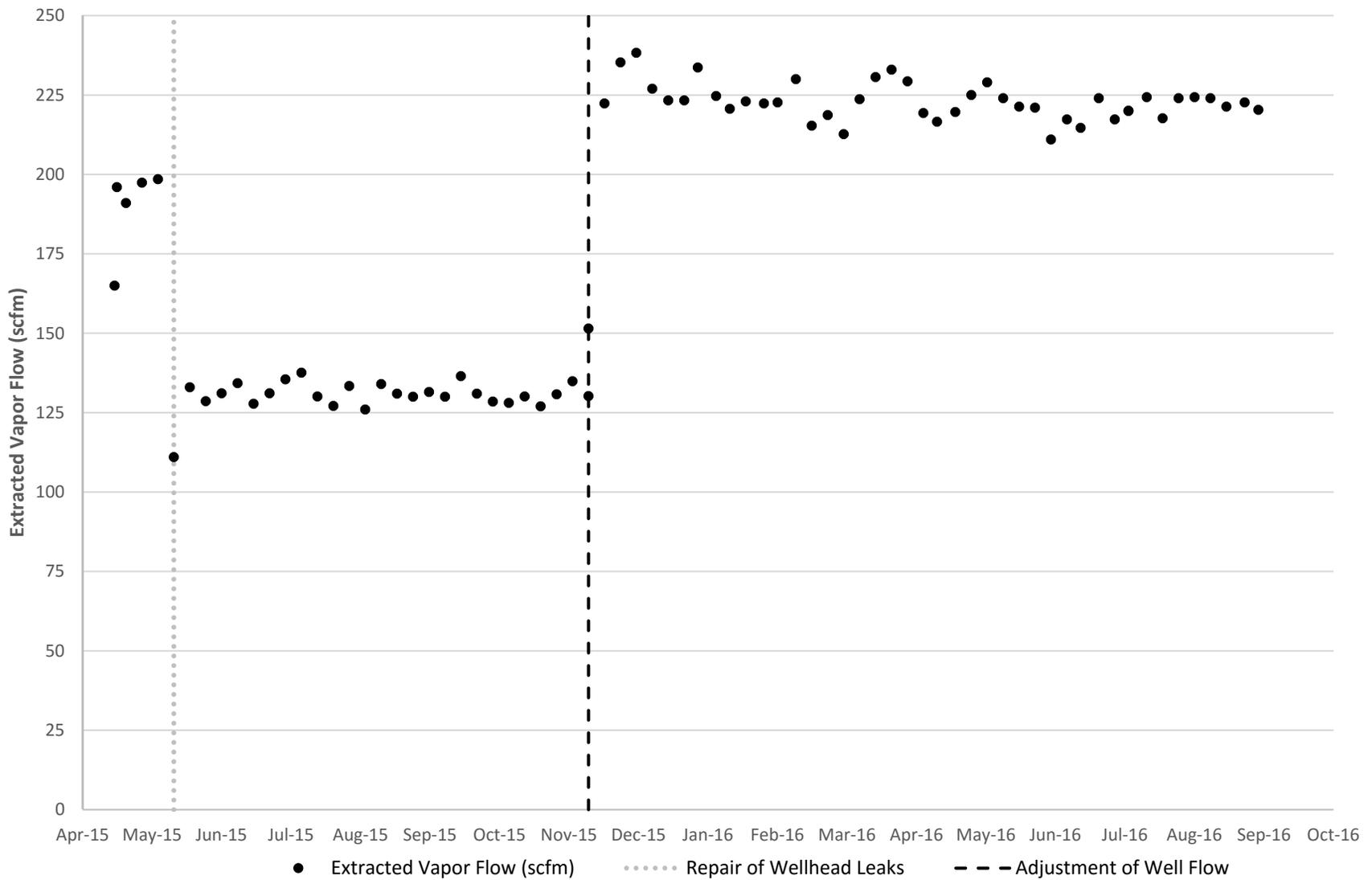
<b>Compound</b>	<b>cis-DCE</b>	<b>TCE</b>	<b>PCE</b>	<b>TOTAL cVOCs</b>
4/28/15	520	6,000	370	6,890
5/26/15	350	6,000	490	6,840
6/30/15	310	4,900	360	5,570
7/28/15	270	3,700	270	4,240
9/10/15	220	3,100	230	3,550
9/29/15	230	3,300	220	3,750
10/27/15	200	2,500	210	2,910
11/30/15	210	2,900	200	3,310
12/28/15	67	760	57	884
1/26/16	160	2,100	170	2,430
2/23/16	160	1,700	120	1,980
3/15/16	140	1,800	140	2,080
4/27/16	140	1,800	130	2,070
5/24/16	140	1,900	170	2,210
6/21/16	150	1,700	110	1,960

Notes:

cis-DCE = cis-1,2-Dichloroethene  
 TCE = Trichloroethene  
 PCE = Tetrachloroethene  
 cVOCs = Chlorinated volatile organic compounds  
 3,300 = Concentration in micrograms per cubic meter

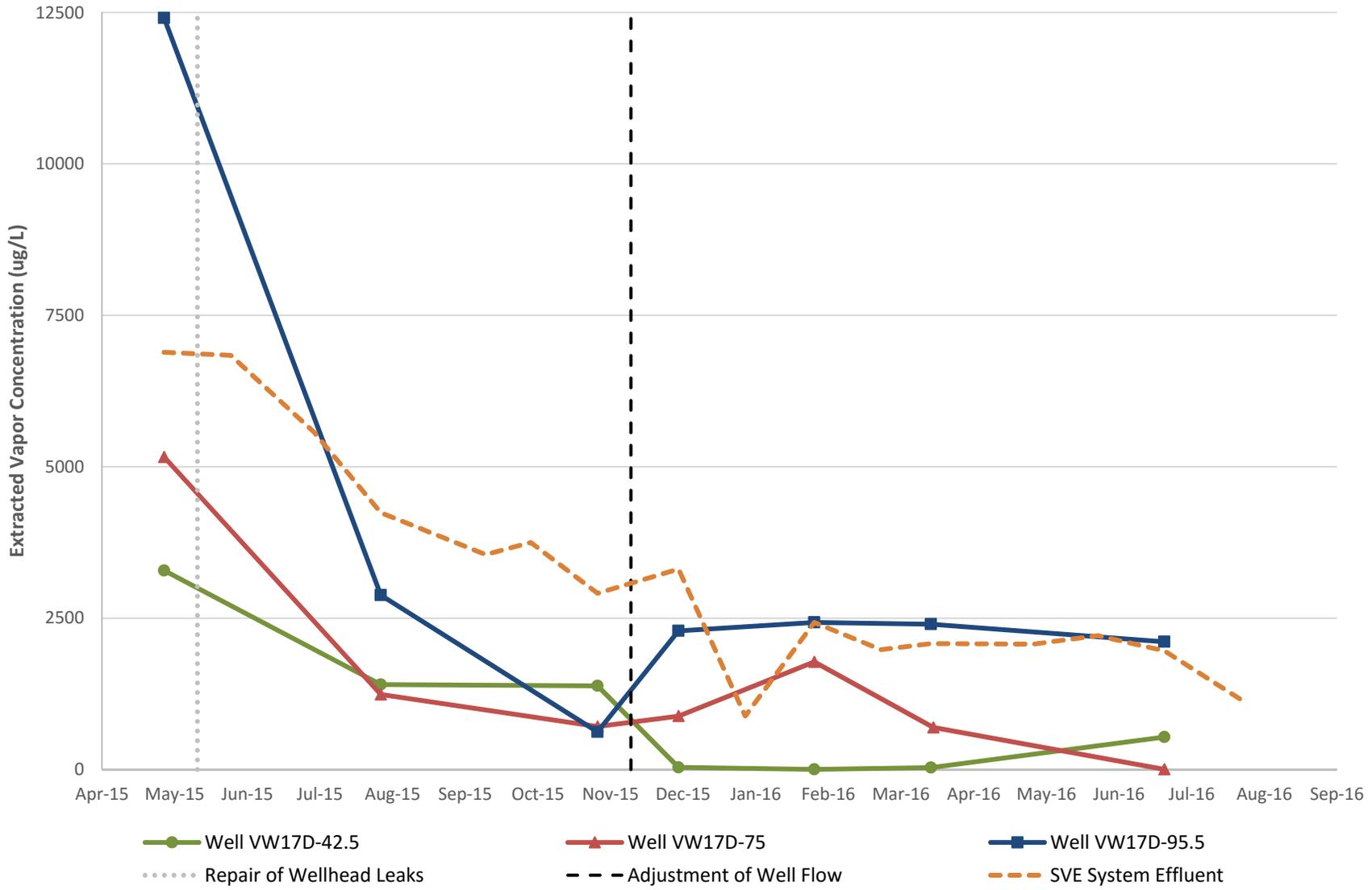
# Figures





Cascade Corporation Gresham, Oregon	<b>SVE Extracted Vapor Flow (Weekly Average)</b> <b>TSA Remedy</b>	Figure <b>2</b>
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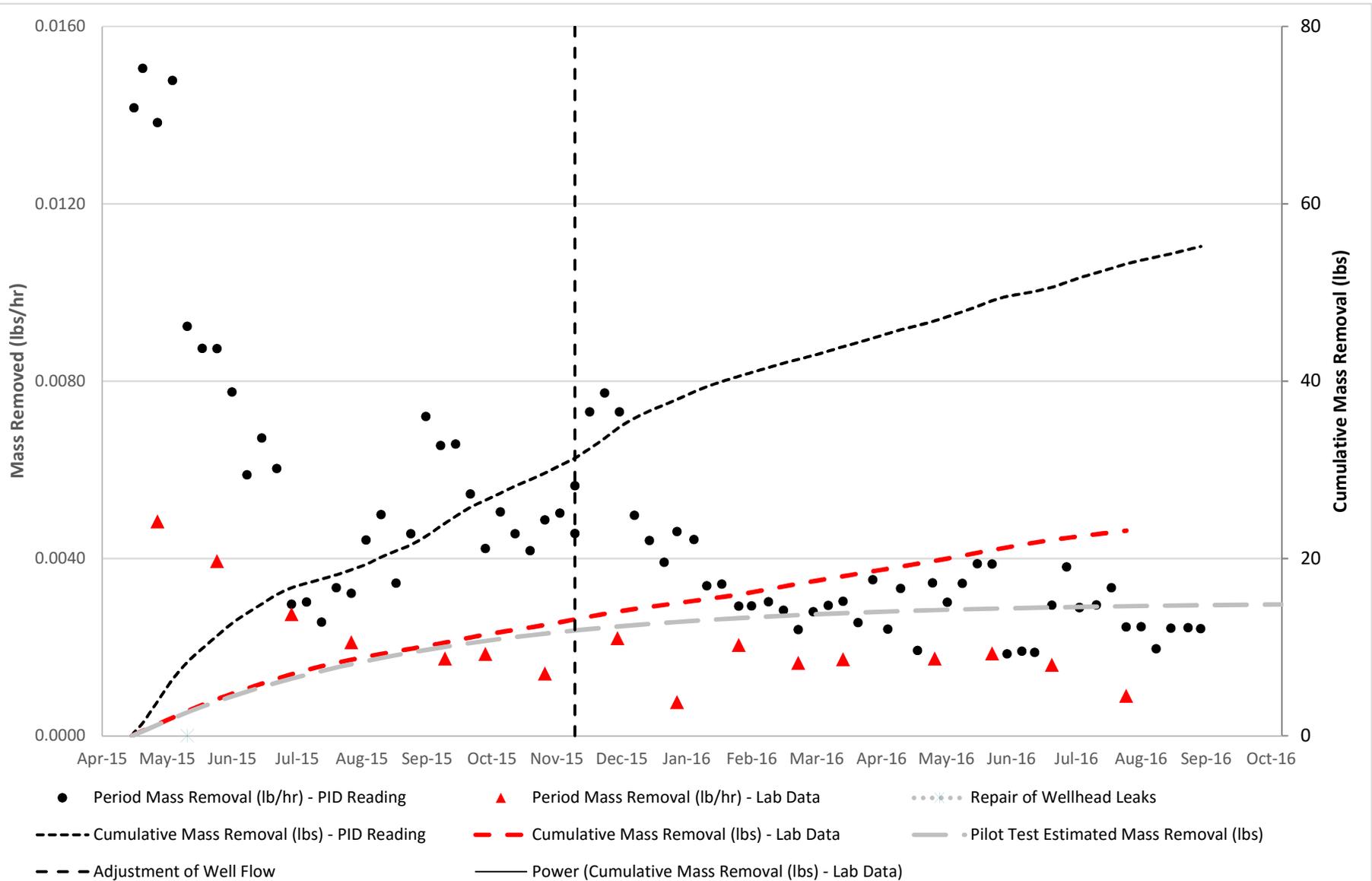




Cascade Corporation  
Gresham, Oregon

SVE Well cVOC Vapor Concentrations  
TSA Remedy

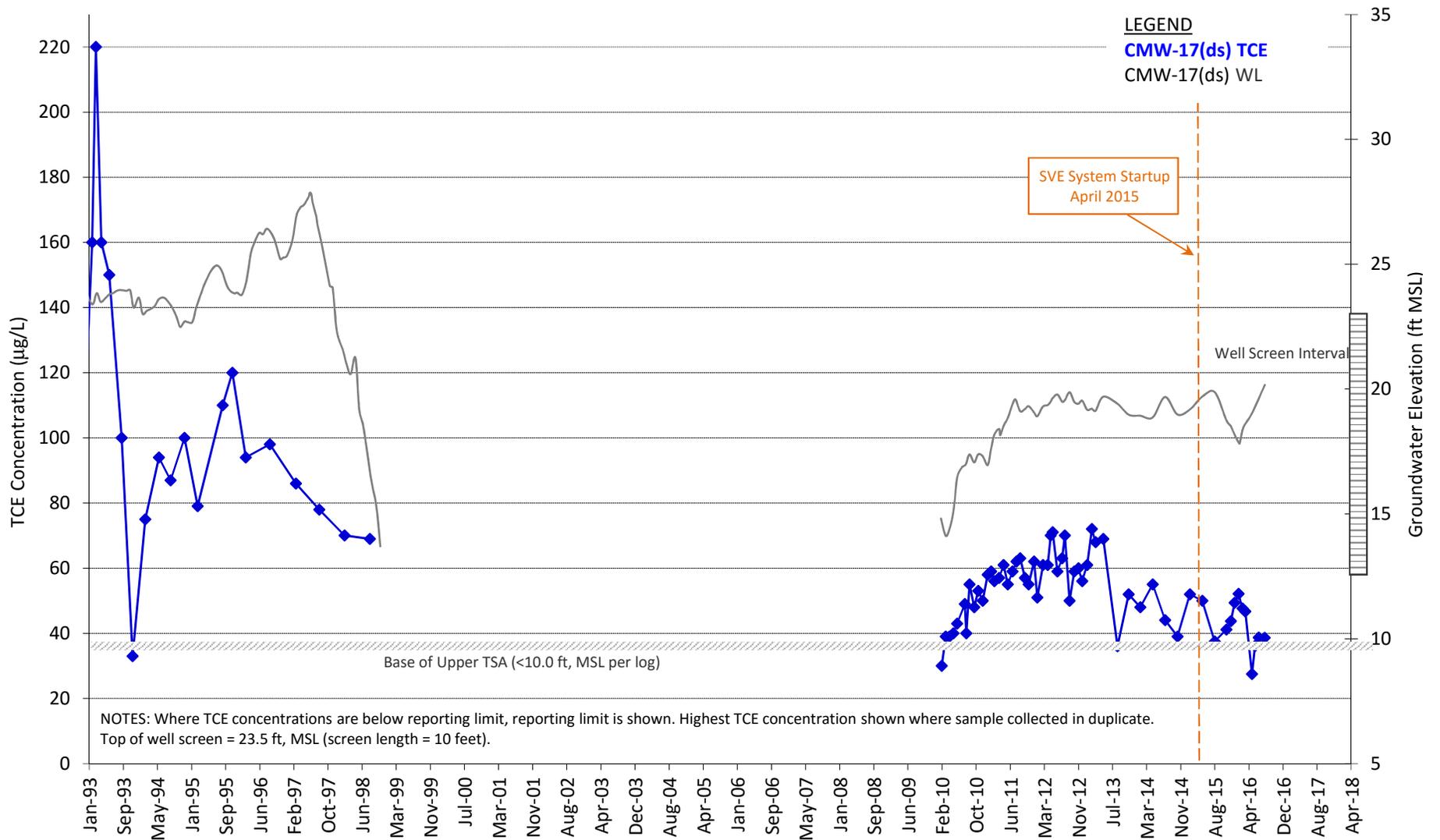
Figure  
4



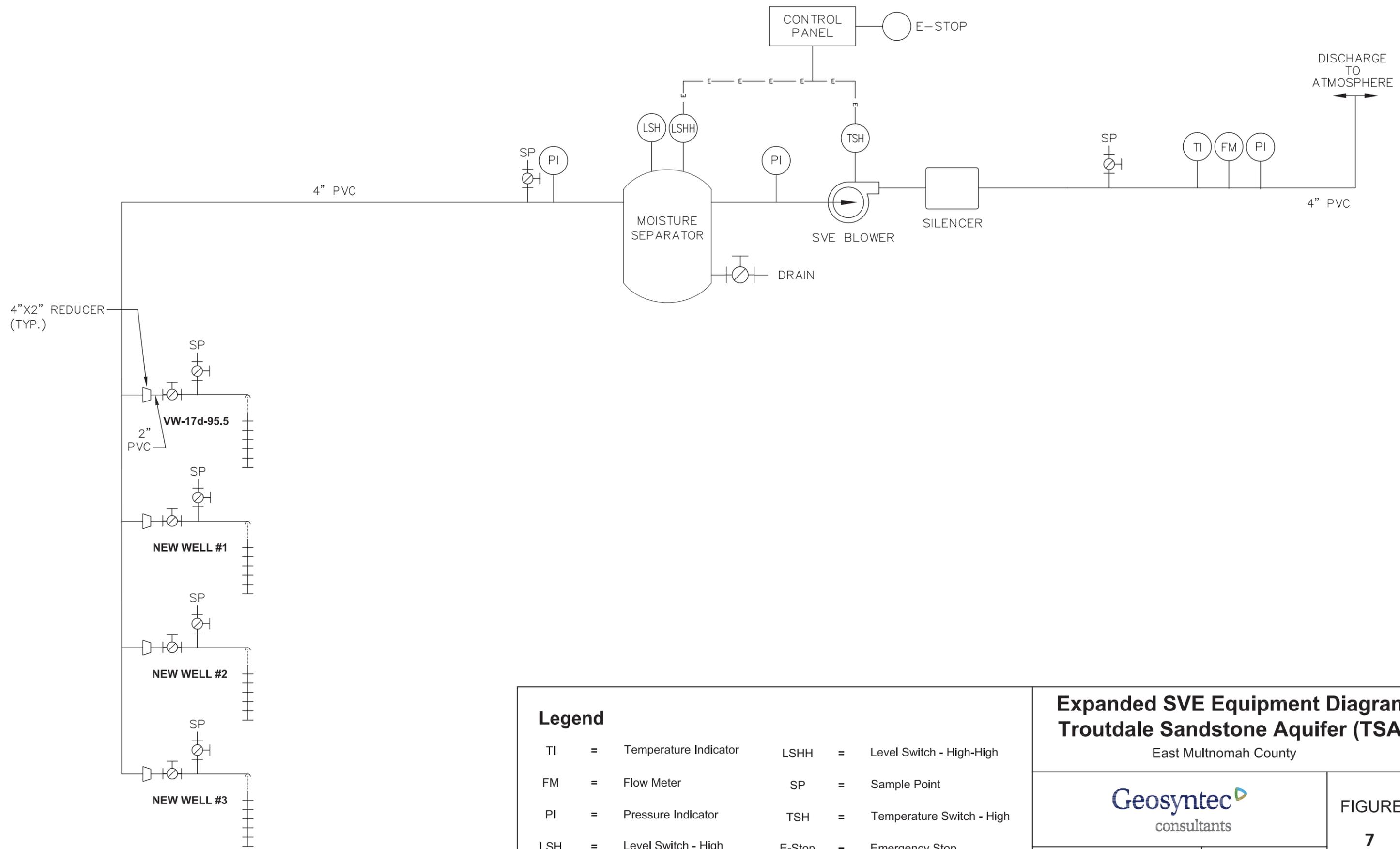
Cascade Corporation  
Gresham, Oregon

SVE System Mass Removal  
TSA Remedy

Figure  
5



O:\Clients\Cascade\_Corporation\Projects\PNG0564S\_TSA\_Analysees\_Technical\SVE\Proposed SVE System Equipment TSA Fig 1.dwg



Legend					
TI	=	Temperature Indicator	LSHH	=	Level Switch - High-High
FM	=	Flow Meter	SP	=	Sample Point
PI	=	Pressure Indicator	TSH	=	Temperature Switch - High
LSH	=	Level Switch - High	E-Stop	=	Emergency Stop

<b>Expanded SVE Equipment Diagram</b> <b>Troutdale Sandstone Aquifer (TSA)</b> East Multnomah County	
PNG0564S	November 2014
<b>FIGURE</b> <b>7</b>	

# **Appendix A**

## **SVE Process Data**

**Appendix A. SVE Process Data**

	Units	Target	4/16/2015	4/17/2015	4/21/2015	4/28/2015	5/5/2015	5/12/2015	5/19/2015
<b>Time</b>	---	---	12:30	15:30	10:00	11:45	16:00	12:30	13:30
System shutdown time	hrs	---	0	0	18	0	0	1	0
<b>Vacuums</b>									
SVE System Inlet	in Hg	~9	4	3.03	3.2	3.9	3.3	5	5
VW-17d-42.5	in Hg	6-7	<1	0.03	0.02	2	1.8	1.2	1.2
VW-17d-75	in Hg	6-7	1	1	1	2.9	2.1	5	5
VW-17d-95.5	in Hg	5-6	2	2	2	3.5	3.1	1.4	2
SVE System Outlet	PSI	--	--	1	1	2	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	--	NA	NA	NA	60	61	57	60
SVE System Inlet	Degrees F	--	~80	NA	74.4	68.9	69.8	63.1	64.7
VW-17d-42.5	Degrees F	--	~80	76.1	74.2	77.1	70.5	62.9	68.7
VW-17d-75	Degrees F	--	~80	75.5	73.3	77.8	72.1	63.1	70.6
VW-17d-95.5	Degrees F	--	~80	73.3	70.4	77.9	73.4	63.2	64
SVE System Outlet	Degrees F	--	126	145	140	118.8	118	124	180
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	--	--	3.3	3.6	3.2	3.4	3.8	3
VW-17d-42.5: Lab Data	ppm	--	--	--	--	0.6	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	1.0	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	2.4	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	1.3	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	150-160	165	159	168	164.1	174.1	130	133.1
VW-17d-42.5 (2" pipe)	scfm	15-20	16.5	15.1	15.8	18.5	18.2	17	17.5
VW-17d-75 (2" pipe)	scfm	65-75	73	72.5	67.5	67.5	69.1	70.3	65.2
VW-17d-95.5 (2" pipe)	scfm	70-80	72	72.1	79.5	72.5	74.1	74.5	78
SVE System Outlet (3" pipe)	scfm	150-160	165	196	191	197.4	198.5	111	133
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	---	---	27.00	72.50	169.75	172.25	163.50	169.00
Period Time	hrs	---	---	27.00	90.50	169.75	172.25	164.50	169.00
Period Operating %	%	---	---	100%	80%	100%	100%	99%	100%
Cumulative Operating Time	hrs	---	---	27.00	99.50	269.25	441.50	605.00	774.00
Cumulative Time Since Startup	hrs	---	---	27.00	117.50	287.25	459.50	624.00	793.00
Cumulative Operating %	%	---	---	100.0%	84.7%	93.7%	96.1%	97.0%	97.6%
<b>Flow Rates</b>									
Well Flow Rate	scfm			159.70	162.80	158.50	161.40	161.80	160.70
Outlet Flow Rate	scfm			196.00	191.00	197.40	198.50	111.00	133.00
Well/Outlet Comparison	%			81%	85%	80%	81%	146%	121%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	--	--	19.29	21.04	18.71	19.88	22.21	17.54
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	--	--	0.0142	0.0151	0.0138	0.0148	0.0092	0.0087
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	--	--	0.38	1.06	2.45	2.46	1.96	1.52
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	--	--	0.38	1.44	3.89	6.36	8.32	9.84

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>5/26/2015</b>	<b>6/2/2015</b>	<b>6/9/2015</b>	<b>6/16/2015</b>	<b>6/23/2015</b>	<b>6/30/2015</b>	<b>7/7/2015</b>	<b>7/14/2015</b>
<b>Time</b>	---	12:30	13:20	12:10	10:10	8:40	10:05	13:00	11:30
System shutdown time	hrs	0	0	0	0	0	0	0	0
<b>Vacuums</b>									
SVE System Inlet	in Hg	5	5	5	5	5	5	5	5
VW-17d-42.5	in Hg	2.52	1	1.1	1	1	1	0.9	0.08
VW-17d-75	in Hg	5.11	5	5	5	4.9	5	4.9	4.8
VW-17d-95.5	in Hg	2.65	1.9	1.8	1.4	1.4	1.3	1.2	1
SVE System Outlet	PSI	1	1	1	1	1	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	63	60	81	68	63	74	82	75
SVE System Inlet	Degrees F	66.9	65.3	90.2	74.5	77.8	76.3	81	76
VW-17d-42.5	Degrees F	70.1	67.1	90.1	75.6	76.4	75.1	78	74
VW-17d-75	Degrees F	72	69.9	90.2	75.2	77.3	76.9	80	77
VW-17d-95.5	Degrees F	68.1	62.8	88.8	74.8	76.4	76	74	70
SVE System Outlet	Degrees F	148.1	180	190	185	188	180	190	138
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	3.1	2.7	2	2.4	2.1	1	1	0.9
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	1.3	--	--	--	--	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	130.3	129.8	130.3	129.2	129.8	133.1	130.4	127.8
VW-17d-42.5 (2" pipe)	scfm	17	17.1	19.8	19.1	22.2	24.2	22.1	19.9
VW-17d-75 (2" pipe)	scfm	64.1	65.8	68.5	68.1	70.5	72.5	70.8	66.1
VW-17d-95.5 (2" pipe)	scfm	75.3	76.5	79.5	72.3	80.3	78.1	76.3	73.4
SVE System Outlet (3" pipe)	scfm	128.6	131.1	134.3	127.8	131.1	135.5	137.6	130.1
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	167.00	168.83	166.83	166.00	166.50	169.42	170.92	166.50
Period Time	hrs	167.00	168.83	166.83	166.00	166.50	169.42	170.92	166.50
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	941.00	1109.83	1276.67	1442.67	1609.17	1778.58	1949.50	2116.00
Cumulative Time Since Startup	hrs	960.00	1128.83	1295.67	1461.67	1628.17	1797.58	1968.50	2135.00
Cumulative Operating %	%	98.0%	98.3%	98.5%	98.7%	98.8%	98.9%	99.0%	99.1%
<b>Flow Rates</b>									
Well Flow Rate	scfm	156.40	159.40	167.80	159.50	173.00	174.80	169.20	159.40
Outlet Flow Rate	scfm	128.60	131.10	134.30	127.80	131.10	135.50	137.60	130.10
Well/Outlet Comparison	%	122%	122%	125%	125%	132%	129%	123%	123%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	18.12	15.78	11.69	14.03	12.28	5.85	5.85	5.26
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0087	0.0078	0.0059	0.0067	0.0060	0.0030	0.0030	0.0026
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	1.46	1.39	1.14	1.05	1.06	0.76	0.51	0.46
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	11.30	12.69	13.83	14.87	15.93	16.69	17.20	17.67

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>7/21/2015</b>	<b>7/28/2015</b>	<b>8/4/2015</b>	<b>8/11/2015</b>	<b>8/18/2015</b>	<b>8/25/2015</b>	<b>9/1/2015</b>	<b>9/8/2015</b>
<b>Time</b>	---	9:30	14:30	7:15	12:00	11:30	14:40	13:20	10:45
System shutdown time	hrs	0	0	0	0	0	0	2	0
<b>Vacuums</b>									
SVE System Inlet	in Hg	5	5	5	5	5	5	5	5
VW-17d-42.5	in Hg	1	1	1	1	1	1	1	1
VW-17d-75	in Hg	4.6	4.8	4.7	4.8	4.7	4.8	4.8	4.9
VW-17d-95.5	in Hg	1	1	1	1	1	1	1.2	1.1
SVE System Outlet	PSI	1	1	1	1	1	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	71	82	60	73	79	77	78	63
SVE System Inlet	Degrees F	73	76	66.8	72	75	74	76	72
VW-17d-42.5	Degrees F	70	74	74.3	78	79	77	77	69
VW-17d-75	Degrees F	73	77	70.6	81	80	79	78	70
VW-17d-95.5	Degrees F	70	74	69.3	73	74	73	73	68
SVE System Outlet	Degrees F	140	145	160	150	180	185	160	158
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	1.2	1.1	1.6	1.7	1.2	1.6	2.5	2.3
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	--	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	124.1	128.9	127	131	128	134	130.5	128.5
VW-17d-42.5 (2" pipe)	scfm	18	21.1	17.2	18	17.5	18.1	17.5	16.5
VW-17d-75 (2" pipe)	scfm	65	68.1	66.5	65.5	65	66	60.5	68
VW-17d-95.5 (2" pipe)	scfm	72.1	75.4	76.5	77.1	78.5	80	78.5	74.5
SVE System Outlet (3" pipe)	scfm	127.1	133.4	126	134	131	130	131.5	130
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	166.00	173.00	160.75	172.75	167.50	171.17	164.67	165.42
Period Time	hrs	166.00	173.00	160.75	172.75	167.50	171.17	166.67	165.42
Period Operating %	%	100%	100%	100%	100%	100%	100%	99%	100%
Cumulative Operating Time	hrs	2282.00	2455.00	2615.75	2788.50	2956.00	3127.17	3291.83	3457.25
Cumulative Time Since Startup	hrs	2301.00	2474.00	2634.75	2807.50	2975.00	3146.17	3312.83	3478.25
Cumulative Operating %	%	99.2%	99.2%	99.3%	99.3%	99.4%	99.4%	99.4%	99.4%
<b>Flow Rates</b>									
Well Flow Rate	scfm	155.10	164.60	160.20	160.60	161.00	164.10	156.50	159.00
Outlet Flow Rate	scfm	127.10	133.40	126.00	134.00	131.00	130.00	131.50	130.00
Well/Outlet Comparison	%	122%	123%	127%	120%	123%	126%	119%	122%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	7.01	6.43	9.35	9.94	7.01	9.35	14.61	13.44
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0033	0.0032	0.0044	0.0050	0.0034	0.0046	0.0072	0.0065
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	0.49	0.57	0.61	0.81	0.71	0.68	0.97	1.14
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	18.16	18.73	19.34	20.15	20.86	21.54	22.51	23.65

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>9/15/2015</b>	<b>9/22/2015</b>	<b>9/29/2015</b>	<b>10/6/2015</b>	<b>10/13/2015</b>	<b>10/20/2015</b>	<b>10/27/2015</b>	<b>11/3/2015</b>
<b>Time</b>	---	12:00	14:00	9:00	11:55	13:20	8:05	8:00	10:00
System shutdown time	hrs	0	0	0	0	0	0	0	0
<b>Vacuums</b>									
SVE System Inlet	in Hg	4.9	5	5	4.9	5	4.9	5	5
VW-17d-42.5	in Hg	0.8	0.6	0.8	1	1	1	1	1
VW-17d-75	in Hg	4.7	4.8	4.8	4.9	4.7	4.9	5	4.8
VW-17d-95.5	in Hg	1.2	1.1	1	1	1	1	1	1
SVE System Outlet	PSI	1	1	1	1	1	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	60	69	62	69	71	56	46	47
SVE System Inlet	Degrees F	70	74	64	70	72	60	55	56
VW-17d-42.5	Degrees F	62	70	62	68	70	58	54	56
VW-17d-75	Degrees F	68	77	66	72	75	62	56	52
VW-17d-95.5	Degrees F	60	65	62	67	70	62	58	56
SVE System Outlet	Degrees F	162	184	160	170	170	135	128	170
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	2.2	1.9	1.5	1.8	1.6	1.5	1.7	1.7
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	--	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	128	132	126	130	128.3	126.5	128.3	127.6
VW-17d-42.5 (2" pipe)	scfm	18.5	17.5	17	16.5	17.5	16.3	15.8	23.7
VW-17d-75 (2" pipe)	scfm	73	74.5	71.3	70.5	74	70.1	68.8	68
VW-17d-95.5 (2" pipe)	scfm	78	80	78.5	75.8	77.3	72	75.1	72.5
SVE System Outlet (3" pipe)	scfm	136.5	131	128.5	128.1	130.1	127	130.8	134.9
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	169.25	170.00	163.00	170.92	169.42	162.75	167.92	170.00
Period Time	hrs	169.25	170.00	163.00	170.92	169.42	162.75	167.92	170.00
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	3626.50	3796.50	3959.50	4130.42	4299.83	4462.58	4630.50	4800.50
Cumulative Time Since Startup	hrs	3647.50	3817.50	3980.50	4151.42	4320.83	4483.58	4651.50	4821.50
Cumulative Operating %	%	99.4%	99.4%	99.5%	99.5%	99.5%	99.53%	99.55%	99.56%
<b>Flow Rates</b>									
Well Flow Rate	scfm	169.50	172.00	166.80	162.80	168.80	158.40	159.70	164.20
Outlet Flow Rate	scfm	136.50	131.00	128.50	128.10	130.10	127.00	130.80	134.90
Well/Outlet Comparison	%	124%	131%	130%	127%	130%	125%	122%	122%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	12.86	11.11	8.77	10.52	9.35	8.77	9.94	9.94
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0066	0.0054	0.0042	0.0050	0.0046	0.0042	0.0049	0.0050
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	1.11	1.02	0.79	0.79	0.81	0.71	0.76	0.84
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	24.76	25.78	26.57	27.36	28.17	28.88	29.64	30.48

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>11/10/2015</b>	<b>11/10/2015</b>	<b>11/17/2015</b>	<b>11/24/2015</b>	<b>12/1/2015</b>	<b>12/8/2015</b>	<b>12/15/2015</b>	<b>12/22/2015</b>
<b>Time</b>	---	12:40	13:55	14:15	12:50	12:50	8:15	13:40	12:40
System shutdown time	hrs	0	0	0	12	0	0	0	0
<b>Vacuums</b>									
SVE System Inlet	in Hg	5	4	4	4.2	4	4	4	4
VW-17d-42.5	in Hg	1.1	1.2	1.1	2	2	2	2	2.1
VW-17d-75	in Hg	4.8	3.2	3.1	4.2	4	4	4	4
VW-17d-95.5	in Hg	1.3	3.2	3	4.1	4	4	4	4
SVE System Outlet	PSI	1	1	1	1	1	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	47	47	57	40	33	57	40	44
SVE System Inlet	Degrees F	56	56	56	50	40	51	50	48
VW-17d-42.5	Degrees F	55	56	56	50	40	50	50	48
VW-17d-75	Degrees F	55	56	56	48	38	52	47	48
VW-17d-95.5	Degrees F	56	56	56	50	43	50	50	48
SVE System Outlet	Degrees F	130	148	125	150	138	130	135	135
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	1.6	1.7	1.5	1.5	1.4	1	0.9	0.8
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	--	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	128.1	135.1	213.0	229.1	225.1	218.0	219.0	215.7
VW-17d-42.5 (2" pipe)	scfm	18.6	26.1	25.2	26.3	25.2	25.2	24.8	24.7
VW-17d-75 (2" pipe)	scfm	68.7	101.4	100.8	96.8	95.4	98.7	97.7	98.3
VW-17d-95.5 (2" pipe)	scfm	71.5	103.6	102.1	103.1	101.5	104	101.2	100.5
SVE System Outlet (3" pipe)	scfm	130.2	151.5	222.3	235.3	238.3	227.0	223.3	223.3
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	170.67	1.25	168.33	154.58	168.00	163.42	173.42	167.00
Period Time	hrs	170.67	1.25	168.33	166.58	168.00	163.42	173.42	167.00
Period Operating %	%	100%	100%	100%	93%	100%	100%	100%	100%
Cumulative Operating Time	hrs	4971.17	4972.42	5140.75	5295.33	5463.33	5626.75	5800.17	5967.17
Cumulative Time Since Startup	hrs	4992.17	4993.42	5161.75	5328.33	5496.33	5659.75	5833.17	6000.17
Cumulative Operating %	%	99.58%	99.58%	99.59%	99.38%	99.40%	99.42%	99.43%	99.45%
<b>Flow Rates</b>									
Well Flow Rate	scfm	158.80	231.10	228.10	226.20	222.10	227.90	223.70	223.50
Outlet Flow Rate	scfm	130.20	151.50	222.33	235.30	238.30	227.00	223.33	223.33
Well/Outlet Comparison	%	122%	153%	103%	96%	93%	100%	100%	100%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	9.35	9.94	8.77	8.77	8.18	5.85	5.26	4.68
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0046	0.0056	0.0073	0.0077	0.0073	0.0050	0.0044	0.0039
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	0.82	0.01	1.09	1.16	1.26	1.00	0.81	0.69
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	31.30	31.31	32.40	33.56	34.82	35.82	36.64	37.33

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>12/28/2015</b>	<b>1/5/2016</b>	<b>1/11/2016</b>	<b>1/18/2016</b>	<b>1/26/2016</b>	<b>2/1/2016</b>	<b>2/9/2016</b>	<b>2/16/2016</b>
<b>Time</b>	---	12:40	9:30	14:10	17:15	12:00	13:55	9:40	10:00
System shutdown time	hrs	0	0	0	0	0	0	0	0
<b>Vacuums</b>									
SVE System Inlet	in Hg	4.2	4.2	4.1	4.1	4	4	4.1	4
VW-17d-42.5	in Hg	2.2	2.1	2.1	2	1.9	2	2	2
VW-17d-75	in Hg	4.2	4	4.1	4	4	4	4	4
VW-17d-95.5	in Hg	4.2	4	4.1	4.1	1	4	4.1	4
SVE System Outlet	PSI	1	1	1	1	1	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	38	36	48	48	50	41	51	57
SVE System Inlet	Degrees F	47	49	51	48	49	48	54	52
VW-17d-42.5	Degrees F	49	47	51	49	48	48	52	54
VW-17d-75	Degrees F	48	45	48	47	48	48	56	52
VW-17d-95.5	Degrees F	48	47	51	50	50	50	50	50
SVE System Outlet	Degrees F	138	135	138	148	140	145	154	145
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	0.9	0.9	0.7	0.7	0.6	0.6	0.6	0.6
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	--	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	222.0	215.0	209.0	210.0	213.0	214.7	220.3	218.7
VW-17d-42.5 (2" pipe)	scfm	25.1	25	25	24.8	24.6	24.5	25.1	24.9
VW-17d-75 (2" pipe)	scfm	99.6	97.55	96.35	96.1	97.8	96.3	99.8	97.8
VW-17d-95.5 (2" pipe)	scfm	103.1	100.3	99.8	99.1	100.3	99.8	100.1	99.7
SVE System Outlet (3" pipe)	scfm	233.7	224.7	220.7	223.0	222.3	222.7	230.0	215.3
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	144.00	188.83	148.67	171.08	186.75	145.92	187.75	168.33
Period Time	hrs	144.00	188.83	148.67	171.08	186.75	145.92	187.75	168.33
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	6111.17	6300.00	6448.67	6619.75	6806.50	6952.42	7140.17	7308.50
Cumulative Time Since Startup	hrs	6144.17	6333.00	6481.67	6652.75	6839.50	6985.42	7173.17	7341.50
Cumulative Operating %	%	99.46%	99.48%	99.49%	99.50%	99.52%	99.53%	99.54%	99.55%
<b>Flow Rates</b>									
Well Flow Rate	scfm	227.80	222.85	221.15	220.00	222.70	220.60	225.00	222.40
Outlet Flow Rate	scfm	233.67	224.67	220.67	223.00	222.33	222.67	230.00	215.33
Well/Outlet Comparison	%	97%	99%	100%	99%	100%	99%	98%	103%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	5.26	5.26	4.09	4.09	3.51	3.51	3.51	3.51
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0046	0.0044	0.0034	0.0034	0.0029	0.0029	0.0030	0.0028
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	0.61	0.85	0.58	0.58	0.59	0.43	0.56	0.49
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	37.94	38.80	39.38	39.96	40.55	40.98	41.53	42.03

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>2/23/2016</b>	<b>3/1/2016</b>	<b>3/8/2016</b>	<b>3/15/2016</b>	<b>3/22/2016</b>	<b>3/29/2016</b>	<b>4/5/2016</b>	<b>4/11/2016</b>
<b>Time</b>	---	10:30	8:10	10:00	11:40	9:40	9:50	9:30	15:00
System shutdown time	hrs	0	0	0	0	0	0	0	0
<b>Vacuums</b>									
SVE System Inlet	in Hg	4.5	4.1	4.2	4.1	4	4.1	4.1	4
VW-17d-42.5	in Hg	2.1	2	2	2	2	2.1	2.1	2
VW-17d-75	in Hg	4.1	4	4.1	4	4	4	4	4
VW-17d-95.5	in Hg	4.1	4	4.1	4	4	4	4.1	4
SVE System Outlet	PSI	1	1	1	1	1	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	51	48	43	44	48	52	50	63
SVE System Inlet	Degrees F	50	48	45	47	49	50	50	54
VW-17d-42.5	Degrees F	52	50	45	48	49	50	50	54
VW-17d-75	Degrees F	51	50	46	48	50	52	52	56
VW-17d-95.5	Degrees F	50	50	47	49	50	51	52	55
SVE System Outlet	Degrees F	130	128	125	125	128	134	130	138
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	0.5	0.6	0.6	0.6	0.5	0.7	0.5	0.7
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	--	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	222.7	218.7	221.0	218.3	219.0	223.7	215.7	217.7
VW-17d-42.5 (2" pipe)	scfm	25.2	24.8	24.3	25.1	25	24.95	24.3	23.8
VW-17d-75 (2" pipe)	scfm	99.9	98.9	99.1	99.4	98.5	99.9	99.5	98.9
VW-17d-95.5 (2" pipe)	scfm	100.8	100.1	99.9	100.1	100.6	100.1	100.9	99.9
SVE System Outlet (3" pipe)	scfm	218.7	212.7	223.7	230.7	233.0	229.3	219.3	216.6
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	168.50	165.67	169.83	169.67	166.00	168.17	167.67	149.50
Period Time	hrs	168.50	165.67	169.83	169.67	166.00	168.17	167.67	149.50
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	7477.00	7642.67	7812.50	7982.17	8148.17	8316.33	8484.00	8633.50
Cumulative Time Since Startup	hrs	7510.00	7675.67	7845.50	8015.17	8181.17	8349.33	8517.00	8666.50
Cumulative Operating %	%	99.56%	99.57%	99.58%	99.59%	99.60%	99.60%	99.61%	99.62%
<b>Flow Rates</b>									
Well Flow Rate	scfm	225.90	223.80	223.30	224.63	224.05	224.90	224.70	222.55
Outlet Flow Rate	scfm	218.67	212.67	223.67	230.67	233.00	229.33	219.33	216.60
Well/Outlet Comparison	%	103%	105%	100%	97%	96%	98%	102%	103%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	2.92	3.51	3.51	3.51	2.92	4.09	2.92	4.09
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0024	0.0028	0.0029	0.0030	0.0026	0.0035	0.0024	0.0033
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	0.44	0.43	0.49	0.51	0.46	0.51	0.50	0.43
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	42.47	42.90	43.38	43.89	44.35	44.86	45.36	45.79

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>4/19/2016</b>	<b>4/26/2016</b>	<b>5/3/2016</b>	<b>5/10/2016</b>	<b>5/17/2016</b>	<b>5/24/2016</b>	<b>5/31/2016</b>	<b>6/7/2016</b>
<b>Time</b>	---	8:15	8:30	9:50	12:00	9:00	10:50	9:40	8:00
System shutdown time	hrs	0	0	0	0	0	0	0	10
<b>Vacuums</b>									
SVE System Inlet	in Hg	4	4	4	4	4.1	4	4.1	4
VW-17d-42.5	in Hg	2.1	2	2.1	2	2	2.1	2	2
VW-17d-75	in Hg	4	4	4	4	4	4	3.9	4
VW-17d-95.5	in Hg	4.1	4	4.1	4	4	4	4	4
SVE System Outlet	PSI	1	1	1	1	1	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	62	50	65	70	63	60	66	61
SVE System Inlet	Degrees F	56	54	57	68	59	54	55	56
VW-17d-42.5	Degrees F	56	54	54	58	54	52	54	54
VW-17d-75	Degrees F	57	55	65	69	60	56	62	58
VW-17d-95.5	Degrees F	56	51	54	58	56	52	54	52
SVE System Outlet	Degrees F	150	138	150	152	138	138	147	135
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	0.4	0.7	0.6	0.7	0.8	0.8	0.4	0.4
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	--	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	216.0	216.0	220.7	216.3	217.7	220.7	215.7	211.7
VW-17d-42.5 (2" pipe)	scfm	24.1	25.1	25.2	24.8	25.1	25.2	25	25.1
VW-17d-75 (2" pipe)	scfm	99.4	100.3	100.4	98.9	100.1	100.2	99.3	100.1
VW-17d-95.5 (2" pipe)	scfm	100.3	100.6	100.6	100.1	100.4	100.4	100.3	100.4
SVE System Outlet (3" pipe)	scfm	219.7	225.0	229.0	224.0	221.3	221.0	211.0	217.3
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	185.25	168.25	169.33	170.17	165.00	169.83	166.83	156.33
Period Time	hrs	185.25	168.25	169.33	170.17	165.00	169.83	166.83	166.33
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	94%
Cumulative Operating Time	hrs	8818.75	8987.00	9156.33	9326.50	9491.50	9661.33	9828.17	9984.50
Cumulative Time Since Startup	hrs	8851.75	9020.00	9189.33	9359.50	9524.50	9694.33	9861.17	10027.50
Cumulative Operating %	%	99.63%	99.63%	99.64%	99.65%	99.65%	99.66%	99.67%	99.57%
<b>Flow Rates</b>									
Well Flow Rate	scfm	223.75	226.00	226.20	223.80	225.60	225.80	224.55	225.60
Outlet Flow Rate	scfm	219.67	225.00	229.00	224.00	221.33	221.00	211.00	217.33
Well/Outlet Comparison	%	102%	100%	99%	100%	102%	102%	106%	104%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	2.34	4.09	3.51	4.09	4.68	4.68	2.34	2.34
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0019	0.0034	0.0030	0.0034	0.0039	0.0039	0.0018	0.0019
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	0.49	0.45	0.55	0.55	0.60	0.66	0.48	0.29
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	46.27	46.72	47.27	47.82	48.42	49.08	49.56	49.85

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>6/13/2016</b>	<b>6/21/2016</b>	<b>6/28/2016</b>	<b>7/4/2016</b>	<b>7/4/2016</b>	<b>7/12/2016</b>	<b>7/19/2016</b>	<b>7/26/2016</b>
<b>Time</b>	---	8:00	7:30	6:50	13:00	13:00	14:00	8:10	11:40
System shutdown time	hrs	0	0	0	0	0	0	0	0
<b>Vacuums</b>									
SVE System Inlet	in Hg	4	4.1	4	4.1	4.1	3.9	3.9	4.4
VW-17d-42.5	in Hg	1.9	1.9	2	1.9	1.9	1.8	2	2.2
VW-17d-75	in Hg	3.9	3.9	3.8	4	4	3.8	4	4
VW-17d-95.5	in Hg	4	4	4	4.1	4.1	3.8	4	4.2
SVE System Outlet	PSI	1	1	1	1	1	1	1	1
<b>Temperatures</b>									
Ambient	Degrees F	60	60	58	64	64	73	63	70
SVE System Inlet	Degrees F	54	52	53	56	56	68	58	60
VW-17d-42.5	Degrees F	52	50	52	56	56	59	57	54
VW-17d-75	Degrees F	57	54	57	62	62	70	62	64
VW-17d-95.5	Degrees F	50	50	52	54	54	58	57	52
SVE System Outlet	Degrees F	128	130.1	130	140	140	144	130	145
<b>Concentrations</b>									
VW-17d-42.5: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet: Field Data	ppm	0.4	0.6	0.8	0.6	0.6	0.6	0.7	0.5
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	--	--	--	--
<b>Flow Rates</b>									
SVE System Inlet (3" pipe)	scfm	208.7	218.0	216.7	216.3	216.3	213.7	218.7	216.3
VW-17d-42.5 (2" pipe)	scfm	24.8	24.3	25.1	25.1	25.1	24.8	25	25.1
VW-17d-75 (2" pipe)	scfm	97.8	100.1	98.8	100.0	100.0	99.6	100.1	102.4
VW-17d-95.5 (2" pipe)	scfm	99.8	102.1	101.2	100.1	100.1	100	100.4	102.8
SVE System Outlet (3" pipe)	scfm	214.7	224.0	217.3	220.0	220.0	224.3	217.7	224.0
<b>Calculations</b>									
<b>Operating Time</b>									
Period Operating Time	hrs	144.00	191.50	167.33	150.17	0.00	193.00	162.17	171.50
Period Time	hrs	144.00	191.50	167.33	150.17	0.00	193.00	162.17	171.50
Period Operating %	%	100%	100%	100%	100%	#DIV/0!	100%	100%	100%
Cumulative Operating Time	hrs	10128.50	10320.00	10487.33	10637.50	10637.50	10830.50	10992.67	11164.17
Cumulative Time Since Startup	hrs	10171.50	10363.00	10530.33	10680.50	10680.50	10873.50	11035.67	11207.17
Cumulative Operating %	%	99.58%	99.59%	99.59%	99.60%	99.60%	99.60%	99.61%	99.62%
<b>Flow Rates</b>									
Well Flow Rate	scfm	222.40	226.50	225.10	225.20	225.20	224.40	225.50	230.30
Outlet Flow Rate	scfm	214.67	224.00	217.33	220.00	220.00	224.33	217.67	224.00
Well/Outlet Comparison	%	104%	101%	104%	102%	102%	100%	104%	103%
<b>SVE Effluent VOC Conc.</b>									
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	2.34	3.51	4.68	3.51	3.51	3.51	4.09	2.92
<b>Mass Removal Rate</b>									
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0019	0.0029	0.0038	0.0029	0.0029	0.0029	0.0033	0.0025
<b>Period Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	0.27	0.46	0.56	0.50	0.00	0.56	0.51	0.50
<b>Cumulative Mass Removal</b>									
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	50.12	50.58	51.15	51.65	51.65	52.22	52.73	53.22

**Appendix A. SVE Process Data**

	<b>Units</b>	<b>8/2/2016</b>	<b>8/9/2016</b>	<b>8/16/2016</b>	<b>8/24/2016</b>	<b>8/30/2016</b>
<b>Time</b>	---	9:50	10:10	9:40	13:30	10:40
System shutdown time	hrs	0	0	0	0	0
<b>Vacuums</b>						
SVE System Inlet	in Hg	4.2	4.1	4	3.9	4.1
VW-17d-42.5	in Hg	2	1.9	2	1.9	2
VW-17d-75	in Hg	4.1	4	4	3.9	4
VW-17d-95.5	in Hg	5.1	4	4	3.9	4
SVE System Outlet	PSI	1	1	1	1	1
<b>Temperatures</b>						
Ambient	Degrees F	64	64	61	86	60
SVE System Inlet	Degrees F	54	52	50	80	54
VW-17d-42.5	Degrees F	54	52	50	54	52
VW-17d-75	Degrees F	60	61	60	86	57
VW-17d-95.5	Degrees F	52	53	51	54	52
SVE System Outlet	Degrees F	135	138	140	160	130
<b>Concentrations</b>						
VW-17d-42.5: Field Data	ppm	--	--	--	--	--
VW-17d-75: Field Data	ppm	--	--	--	--	--
VW-17d-95.5: Field Data	ppm	--	--	--	--	--
SVE System Outlet: Field Data	ppm	0.5	0.4	0.5	<b>0.5</b>	<b>0.5</b>
VW-17d-42.5: Lab Data	ppm	--	--	--	--	--
VW-17d-75: Lab Data	ppm	--	--	--	--	--
VW-17d-95.5: Lab Data	ppm	--	--	--	--	--
SVE System Outlet; Lab Data	ppm	--	--	--	--	--
<b>Flow Rates</b>						
SVE System Inlet (3" pipe)	scfm	221.7	222.0	215.0	217.7	216.3
VW-17d-42.5 (2" pipe)	scfm	25.1	25.3	24.9	24.9	25.1
VW-17d-75 (2" pipe)	scfm	100.0	99.7	99.8	98.8	100.0
VW-17d-95.5 (2" pipe)	scfm	101.1	102.1	100.3	99.1	100.3
SVE System Outlet (3" pipe)	scfm	224.3	224.0	221.3	222.7	220.3
<b>Calculations</b>						
<b>Operating Time</b>						
Period Operating Time	hrs	166.17	168.33	167.50	195.83	141.17
Period Time	hrs	166.17	168.33	167.50	195.83	141.17
Period Operating %	%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	11330.33	11498.67	11666.17	11862.00	12003.17
Cumulative Time Since Startup	hrs	11373.33	11541.67	11709.17	11905.00	12046.17
Cumulative Operating %	%	99.62%	99.63%	99.63%	99.64%	99.64%
<b>Flow Rates</b>						
Well Flow Rate	scfm	226.20	227.05	225.00	222.80	225.40
Outlet Flow Rate	scfm	224.33	224.00	221.33	222.67	220.33
Well/Outlet Comparison	%	101%	101%	102%	100%	102%
<b>SVE Effluent VOC Conc.</b>						
VW-17d-42.5 (2" pipe)	ug/L	--	--	--	--	--
VW-17d-75 (2" pipe)	ug/L	--	--	--	--	--
VW-17d-95.5 (2" pipe)	ug/L	--	--	--	--	--
SVE System Outlet (3" pipe)	ug/L	2.92	2.34	2.92	2.92	2.92
<b>Mass Removal Rate</b>						
VW-17d-42.5 (2" pipe)	lb/hr	--	--	--	--	--
VW-17d-75 (2" pipe)	lb/hr	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lb/hr	--	--	--	--	--
SVE System Outlet (3" pipe)	lb/hr	0.0025	0.0020	0.0024	0.0024	0.0024
<b>Period Mass Removal</b>						
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	0.41	0.37	0.37	0.48	0.34
<b>Cumulative Mass Removal</b>						
VW-17d-42.5 (2" pipe)	lbs	--	--	--	--	--
VW-17d-75 (2" pipe)	lbs	--	--	--	--	--
VW-17d-95.5 (2" pipe)	lbs	--	--	--	--	--
SVE System Outlet (3" pipe)	lbs	53.63	54.00	54.37	54.84	55.19