

US EPA ARCHIVE DOCUMENT

TABLES

TABLE 1
MAXIMUM SOIL COC CONCENTRATIONS
 Former Chlorobenzene Process Area
 W.G. Krummrich Facility, Sauget, Illinois

T-SVE Target Treatment Area (0 to 15 ft bgs)	
Contaminant of Concern	Maximum Soil Concentration (mg/kg)
Chlorobenzene	95,000
1,2-Dichlorobenzene	200,000
1,3-Dichlorobenzene	1,300
1,4-Dichlorobenzene	20,000
Benzene	6,500
1,2,4-Trichlorobenzene	8,000

T-SVE - Thermally enhanced soil vapor extraction
 ft bgs - Feet below ground surface
 mg/kg - Milligrams per kilogram

Note:

1. Refer to the 2010 URS Corporation Former Chlorobenzene Process Area Characterization Report for comprehensive soil data tables.

TABLE 2
CONTAMINANT MASS ESTIMATES
 Former Chlorobenzene Process Area
 W.G. Krummrich Facility, Sauget, Illinois

T-SVE Target Treatment Area (0 to 15 ft bgs)	
Contaminant	Contaminant Mass
	(lbs)
Chlorobenzene	126,100
1,2-Dichlorobenzene	170,000
1,3-Dichlorobenzene	12,400
1,4-Dichlorobenzene	103,400
Benzene	14,500
1,2,4-Trichlorobenzene	13,400
TOTAL CONTAMINANT MASS	440,000

T-SVE - Thermally enhanced soil vapor extraction
 lbs - Pounds
 ft bgs - Feet below ground surface

Note:

1. Mass estimate is based on the estimated mass in the impacted area presented on Table D-3 of the 2010 URS Corporation Former Chlorobenzene Process Area Characterization report.

TABLE 3
SHU AND DHU MONITORING WELL GAUGING INFORMATION
 Former Chlorobenzene Process Area
 Solutia Inc., W.G. Krummrich Facility, Sauget, Illinois

Well ID	Location		Construction Details						April 25, 2011 Gauging	
	Northing	Easting	Ground Elevation ^[1] (ft)	Casing Elevation ^[1] (ft)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Top of Screen Elevation ^[1] (ft)	Bottom of Screen Elevation ^[1] (ft)	Depth to Water (ft btoc)	Water Elevation ^[1] (ft)
Shallow Hydrogeologic Unit (SHU 395-380 feet NAVD 88)										
CPA-A (SHU)	702505.2997	2296272.8624	413.97	416.35	28.00	33.00	385.97	380.97	13.82	402.53
CPA-B (SHU)	702577.2516	2295803.1970	409.16	408.84	21.00	25.40	388.16	383.76	6.86	401.98
CPA-C (SHU)	702811.6269	2295845.2644	408.86	408.46	21.00	25.80	387.86	383.06	6.20	402.26
CPA-D (SHU)	703069.0222	2295913.1320	409.73	412.38	21.00	25.40	388.73	384.33	9.90	402.48
Deep Hydrogeologic Unit (DHU 350 feet NAVD 88 - Bedrock)										
DNAPL-K-2	702516.4357	2295812.7125	407.94	407.72	97.63	112.63	310.31	295.31	6.25	401.47
DNAPL-K-3	702591.7474	2296185.8543	412.13	411.91	104.80	119.80	307.33	292.33	10.19	401.72
DNAPL-K-4	702975.9464	2296048.6878	409.48	409.15	102.55	117.55	306.93	291.93	7.75	401.40

ft - Feet
 ft bgs - Feet below ground surface
 ft btoc - Feet below top of casing
 SHU - Shallow Hydrogeologic Unit

DHU - Deep Hydrogeologic Unit
 CPA - Chlorobenzene Process Area
 DNAPL - Dense non-aqueous phase liquid

Notes:

- Elevation based upon North American Vertical Datum (NAVD) 88 datum.
- Well CPAMW-1D is located near DNAPL-K-4, but was not gauged on April 25, 2011.

TABLE 4
T-SVE WELL AND VAPOR PROBE GENERAL DESIGN PARAMETERS
 Former Chlorobenzene Process Area
 W.G. Krummrich Facility, Sauget, Illinois

Wells	Target Soil Layer	Typical Screen Interval ¹	Approximate Well Spacing	Configuration of Wells	
		(ft bgs)	(ft)	Single	Nested
SVE - Shallow	Sandy fill/Upper Silty Sand	3-8	40	39	NA
SVE - Deep	Lower Silty Sand	10 - 15		43	NA
Combination SVE/AI - Shallow	Sandy fill/Upper Silty Sand	3-8	40	61	NA
Combination SVE/AI - Deep	Lower Silty Sand	10 - 15		61	NA
Vapor Probe - Shallow	Sandy fill/Upper Silty Sand	5 - 6	NA	0	23
Vapor Probe - Deep	Lower Silty Sand	12 - 13		0	23

SVE - soil vapor extraction
 AI - air injection
 ft - feet

bgs - below ground surface
 scfm - standard cubic feet per minute
 in. H₂O - inches of water

NA - Not applicable

Notes:

1. The typical well screen interval will be up to 5 ft for the shallow and deep wells. The ranges presented in this table will be used as a guide; actual well screen intervals will be adjusted based on actual field conditions.
2. Select shallow and deep SVE wells are designed to operate in either vapor extraction or air injection modes (i.e., combination AI wells).

TABLE 5
T-SVE SYSTEM GENERAL OPERATING PARAMETERS
 Former Chlorobenzene Process Area
 W.G. Krummrich Facility, Sauget, Illinois

Target Depth	Target Soil Layer	SVE System ¹				AI System ¹						
		Well Count	Design Extraction Flow Rate per Well	Design Well Head Vacuum	Total System Flow Rate	Well Count ²	Design Injection Flow Rate per Well	Design Well Head Pressure	Steam Injection Flow Rate		Design Target Soil Temperature	Total System Flow Rate
			(scfm/well)						(in. H ₂ O)	(scfm)		
								(% by volume)				
Shallow	Sandy fill/Upper Silty Sand	39	25-30	up to 50	3,000	61	20-80	up to 60	>20	<20	40-60	2,000
Deep	Lower Silty Sand	43				61			>20	<20	40-60	

T-SVE - thermally enhanced soil vapor extraction

AI - air injection

ft - feet

bgs - below ground surface

scfm - standard cubic feet per minute

in. H₂O - inches of water

% - Percent

deg. C - Celsius

TBD - To be determined

Note:

- Maximum flow rate of the SVE/AI equipment is shown. Assumes that the well field will be optimized periodically to focus air flow in specific areas. The configuration of the individual combination SVE/AI wells (i.e., operating in SVE or AI mode) will affect the actual SVE/AI flow rates. The system capacity is designed to operate approximately half of the SVE/AI wells at a given time (based on the assumption that lower silty sand layer will be intermittently available for SVE/AI operations).
- Well count represents total number of combination SVE/AI wells. Not all of these wells will be operated in AI mode (approximately 40 will be operated in AI mode, initially, with the remaining configured as sve wells).

TABLE 6
T-SVE Well Construction Details
 W.G. Krummrich Facility, Sauget, Illinois

Well ID	Shallow Wells							Deep Wells						
	Top of Screen ^[1]	Bottom of Screen	Screen Length	Riser Length	Sand Filter Pack	Bentonite	Cement Grount	Top of Screen ^[2]	Bottom of Screen ^[3]	Screen Length	Riser Length	Sand Filter Pack	Bentonite	Cement Grount
	(ft bgs)		(ft)	(ft)	(ft bgs)	(ft bgs)	(ft to surface)	(ft bgs)		(ft)	(ft)	(ft bgs)	(ft bgs)	(ft to surface)
T-A 1S/D ^[4]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-A 2S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-A 3S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-A 4S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-A 5S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-B 1S/D ^[4]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-B 2S/D ^[4]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-B 3S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-B 4S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-B 5S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-B 6S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-C 1S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-C 2S/D ^[5]	3	4	1	3.5	2.5 to 4	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-C 3S/D ^[5]	6	10	4	6.5	5.5 to 10	5 to 5.5	5	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-C 4S/D	6	10	4	6.5	5.5 to 10	5 to 5.5	5	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-C 5S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-D 1S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-D 2S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-D 3S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-D 4S/D ^[6]	6	10	4	6.5	5.5 to 10	5 to 5.5	5	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-E 1S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-E 2S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-E 3S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-F 1S/D	3	6	3	3.5	2.5 to 6	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-F 2S/D	3	6	3	3.5	2.5 to 6	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-F 3S/D	3	6	3	3.5	2.5 to 6	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-F 4S/D	3	6	3	3.5	2.5 to 6	2 to 2.5	2	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-F 5S/D ^[6]	7	10	3	7.5	6.5 to 10	6 to 6.5	6	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-F 6S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-F 7S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-F 8S/D ^[6]	--	--	--	--	--	--	--	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-F 9D	--	--	--	--	--	--	--	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-F 10D	--	--	--	--	--	--	--	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-G 1S/D	3	6	3	3.5	2.5 to 6	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-G 2S/D	3	6	3	3.5	2.5 to 6	2 to 2.5	2	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-G 3S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-G 4S/D	3	7	4	3.5	2.5 to 7	2 to 2.5	2	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-G 5S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	--	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-G 6S/D ^[6]	3	10	7	3.5	2.5 to 10	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-G 7S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-G 8S/D ^[6]	7	10	3	7.5	6.5 to 10	6 to 6.5	6	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-G 9S/D ^[6]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5

TABLE 6
T-SVE Well Construction Details
 W.G. Krummrich Facility, Sauget, Illinois

Well ID	Shallow Wells							Deep Wells						
	Top of Screen ^[1]	Bottom of Screen	Screen Length	Riser Length	Sand Filter Pack	Bentonite	Cement Grount	Top of Screen ^[2]	Bottom of Screen ^[3]	Screen Length	Riser Length	Sand Filter Pack	Bentonite	Cement Grount
	(ft bgs)		(ft)	(ft)	(ft bgs)	(ft bgs)	(ft to surface)	(ft bgs)		(ft)	(ft)	(ft bgs)	(ft bgs)	(ft to surface)
T-G 10D	--	--	--	--	--	--	--	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-H 1S/D ^[7]	3	6	3	3.5	2.5 to 6	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-H 2S/D	3	7	4	3.5	2.5 to 7	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-H 3S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-H 4S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-H 5S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-H 6S/D ^[6]	--	--	--	--	--	--	--	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-H 7S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	12	15	3	12.5	11.5 to 15	10.5 to 11.5	10.5
T-H 8S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-H 9D	--	--	--	--	--	--	--	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-I 1S/D ^[7]	3	6	3	3.5	2.5 to 6	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-I 2S/D ^[7]	3	6	3	3.5	2.5 to 6	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-I 3S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-I 4S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-I 5S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-I 6S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-I 7S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-I 8S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-I 9S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-I 10S/D ^[6]	8	10	2	8.5	7.5 to 10	7 to 7.5	7	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-J 1S/D ^[7]	3	6	3	3.5	2.5 to 6	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-J 2S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-J 3S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	11	15	4	11.5	10.5 to 15	9.5 to 10.5	9.5
T-J 4S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-J 5S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	14	4	10.5	9.5 to 14	8.5 to 9.5	8.5
T-J 6S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	13	3	10.5	9.5 to 13	8.5 to 9.5	8.5
T-J 7S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-J 8S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-J 9S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-J 10S/D	3	10	7	3.5	2.5 to 10	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 1S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 2S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 3S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 4S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 5S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 6S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 7S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 8S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-K 9S/D ^[7]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-L 1S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5

TABLE 6
T-SVE Well Construction Details
 W.G. Krummrich Facility, Sauget, Illinois

Well ID	Shallow Wells							Deep Wells						
	Top of Screen ^[1]	Bottom of Screen	Screen Length	Riser Length	Sand Filter Pack	Bentonite	Cement Grout	Top of Screen ^[2]	Bottom of Screen ^[3]	Screen Length	Riser Length	Sand Filter Pack	Bentonite	Cement Grout
	(ft bgs)		(ft)	(ft)	(ft bgs)	(ft bgs)	(ft to surface)	(ft bgs)		(ft)	(ft)	(ft bgs)	(ft bgs)	(ft to surface)
T-L 2S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-L 3S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-L 4S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-L 5S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-L 6S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-L 7S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-L 8S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-M 1S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-N 1S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-N 2S/D ^[5]	3	7	4	3.5	2.5 to 7	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-N 3S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-N 4S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-O 1S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-O 2S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	13	3	10.5	9.5 to 13	8.5 to 9.5	8.5
T-O 3S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-O 4S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-O 5S/D ^[5]	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-P 1S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-P 2S/D	3	8	5	3.5	2.5 to 8	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-P 3S/D	3	5	2	3.5	2.5 to 5	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-Q 1S/D	3	6	3	3.5	2.5 to 6	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5
T-Q 2S/D	3	4	1	3.5	2.5 to 4	2 to 2.5	2	10	15	5	10.5	9.5 to 15	8.5 to 9.5	8.5

T-SVE = thermally enhanced soil vapor extraction
 ft bgs = feet below ground surface
 ft = feet

Notes:

Actual well construction details may be modified depending upon field conditions.

- [1] Shallow wells will have a minimum 2-foot high temperature Class H grout seal, 0.5-foot bentonite seal below the grout, and 0.5-foot sand pack above the well screen. Based on these specifications, the minimum starting depth for the shallow well screen interval is 3 ft bgs.
- [2] Deep well screens will have a minimum 0.5-foot sand pack below the bottom of the intermediate clay layer.
- [3] The deep wells will be screened to 15 ft bgs.
- [4] Screen depth interval needs to be verified in the field prior to installation; URS boring logs from nearby soil boring indicated concrete from 4 to 12 ft bgs.
- [5] Screen depth interval for deep well needs to be verified in the field prior to installation; URS boring logs from nearby soil borings indicated clay up to 15 ft bgs.
- [6] Screen depth interval for shallow well needs to be verified in the field prior to installation; URS boring logs from nearby soil borings indicates clay for a majority of the shallow (0-10 ft bgs) zone.
- [7] Screen depth intervals for both the shallow and deep wells need to be verified in the field prior to installation; URS boring logs from nearby soil borings indicates clay from 0 to 15 ft bgs.

TABLE 7
Vapor Probe Construction Details
 W.G. Krummrich Facility, Sauget, Illinois

Vapor Probe ID	Shallow Vapor Probes			Deep Vapor Probes		
	Top of screen	Bottom of screen	Riser/Sump	Top of screen	Bottom of screen	Riser/Sump
	(ft bgs)		(ft)	(ft bgs)		(ft)
VP-1	3	4	5	12.5	13.5	14.5
VP-2	5	6	7	12.5	13.5	14.5
VP-3	3	4	5	12.5	13.5	14.5
VP-4	4	5	6	12.5	13.5	14.5
VP-5	4	5	6	12.5	13.5	14.5
VP-6	3.5	4.5	5.5	12.5	13.5	14.5
VP-7	4.5	5.5	6.5	12.5	13.5	14.5
VP-8A	3	4	5	12.5	13.5	14.5
VP-8B	3	4	5	12.5	13.5	14.5
VP-9	5	6	7	12.5	13.5	14.5
VP-10A	5	6	7	12.5	13.5	14.5
VP-10B	5	6	7	12.5	13.5	14.5
VP-11A	5	6	7	11.5	12.5	13.5
VP-11B	5	6	7	11.5	12.5	13.5
VP-12	3.5	4.5	5.5	12	13	14
VP-13	5	6	7	12	13	14
VP-14	5.5	6.5	7.5	12	13	14
VP-15	5	6	7	12	13	14
VP-16	5	6	7	12	13	14
VP-17	5	6	7	12	13	14
VP-18	5	6	7	12	13	14
VP-19	4.75	5.75	6.75	12	13	14
VP-20	5	6	7	11.5	12.5	13.5

SVE = Soil Vapor Extraction
 ft bgs = feet below ground surface
 ft = feet

Notes:

1. Shallow and deep vapor probes will be nested within the same bore hole.
2. Vapor probes will be constructed with a minimum of a 1-foot cement grout seal, a 1-foot bentonite seal, and a 0.5-foot sand filter pack above the probe screen. The bentonite seal thickness between the shallow and deep vapor probes may vary.

TABLE 8
T-SVE Wells and Vapor Probes Materials List
 W.G. Krummrich Facility, Sauget, Illinois

Components	Details	Units	Specifications
General Specification	Total Shallow T-SVE Wells	100 ea.	Installed to a maximum of 10 ft bgs (see Table 6)
	Total Deep T-SVE Wells	104 ea.	Installed to a maximum of 15 ft bgs (see Table 6)
	Vapor Probes	46 ea.	Nested shallow and deep locations (see Table 6)
Shallow T-SVE Wells	Slotted Screen	360 ft	2-inch interior diameter, 0.02-inch machine slotted Type 304 or 316 stainless steel screen
	Screen Sandpack	na	Grade 2S (Holliston Sand Company) well sand
	Bentonite Seal	na	Baroid or similar bentonite pellet seal
	Cement Bentonite Grout Seal	na	High temperature specification cement grout
	Riser Pipe	370 ft	2-inch interior diameter carbon steel riser pipe; connections between sections completed using air-tight NPT couplings, completed with a 2-inch NPT cap.
Deep T-SVE Wells	Slotted Screens	450 ft	2-inch interior diameter, 0.02-inch machine slotted Type 304 or 316 stainless steel screen
	Screen Sandpack	na	Grade 2S (Holliston Sand Company) well sand
	Bentonite Seal	na	Baroid or similar bentonite pellet seal
	Cement Bentonite Grout Seal	na	High temperature specification cement grout
	Riser Pipe	1,160 ft	2-inch interior diameter carbon steel riser pipe; connections between sections completed using air-tight NPT couplings, completed with a 2-inch NPT cap.
Vapor Probes	Slotted Screens	46 ft	1-inch interior diameter, 0.02-inch machine slotted Type 304 or 316 stainless steel screen.
	Screen Sandpack	na	Well gravel grade 2S (Holliston Sand Company)
	Bentonite Seal	na	Baroid or similar bentonite pellet seal
	Cement Bentonite Grout Seal	na	High temperature specification cement grout
	Riser Pipe and Sump	500 ft	1-inch interior diameter carbon steel riser pipe; connections between sections completed using air-tight NPT couplings; vapor probes will be completed a minimum of 2 feet above ground surface, with a 1-inch NPT cap.

T-SVE = Thermally Enhanced Soil Vapor Extraction
 ft bgs = feet below ground surface
 cm/sec = centimeters per second
 ea. = each
 ft = feet
 na = not applicable (see note 3)

Notes:

1. Minimum borehole annulus is 6 inches.
2. Linear feet specified, volumes associated with sandpack, bentonite seal, and cement bentonite seal dependant upon final annulus of borehole.

Table 9
Summary of Exterior Headlosses in SVE and AI Piping
 W.G. Krummrich Facility, Sauget, Illinois

SVE System				
Location	System Flow Rate ^[1] (scfm)	Individual Well Subsurface Friction Losses ("Hg)	Exterior Piping Friction Losses ("Hg)	Estimated Maximum Friction Losses ^[2] ("Hg)
Deep and Shallow Manifoldded SVE Mainline Piping - Container Inlet	3,000	3.69	0.57	8.5
Air Injection System				
Location	System Flow Rate ^[1] (scfm)	Individual Well Subsurface Friction Losses (psi)	Exterior Piping Friction Losses (psi)	Estimated Maximum Friction Losses ^[2] (psi)
Air Injection Mainline Piping - Container Outlet	2,000	2.17	0.26	4.9

AI - Air injection

"Hg - Inches of mercury vacuum

psi - Pounds per square inch

scfm - Standard cubic feet per minute

SVE - Soil vapor extraction

Notes:

[1] SVE design flow - 3,000 scfm

AI design flow rate - 2,000 scfm

[2] A factor of safety equal to 2x the total minimum friction loss is incorporated

Table 10
Manifold Piping Specifications and Materials List

W.G. Krummrich Facility, Sauget, Illinois

Components	Details	Units	Specifications
Well to Wellhead Transitions			
T-SVE and AI Wellheads (from drilled well; Figure 10)	2" Coupler	204 ea.	Minimum Schedule 10 Carbon steel air tight threaded coupling; wellheads may be socket brazed or butt-welded to the well risers; vendor specified with approval
	2" Piping with coupler ^[2]	1,020 ft	
	2" standard Tee	204 ea.	
	2" Coupler	204 ea.	
	2" Screw cap	204 ea.	
Wellhead Sample Ports (Figure 10, Detail A)	1/2" to 3/8" reducing Bushing	204 ea.	Brass male NPT to female NPT bushing; bushing will be threaded or welded to the pipe
	Ball Valve/Sample Port	204 ea.	3/8" full bore Brass body ball valve with PTFE or Viton® seats/gaskets with 1/8" or 1/4" brass hose barb fitting (joined to well riser using the reducing bushing)
Wellhead Assemblies			
Piping Lateral (both T-SVE and AI; Figure 10)	2" Piping with coupler ^[2]	2,040 ft	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections to be air tight
T-SVE Wellheads (Figure 10)	2" Coupler	80 ea.	
Combination T-SVE/AI Wellheads (Figure 10)	2" standard Tee	122 ea.	
T-SVE Wellhead Assembly (Figure 10)	2" Male/Female Cam Lock and Hose Barb	408 ea.	316 Stainless steel, male/female NPT air tight threaded cam and groove hose coupling with hose barb; 2 per well; fittings may be stainless steel or carbon steel; shank fittings will be double band clamped/crimped with 316 Stainless steel bands; vendor specified with approval
	2" Steam Rated Flex Hose	510 ft	Flexible hoses will consist of inner tubes of XLPE, UHMWPE, PTFE, or other chemically compatible material for use with chlorobenzenes; outer protective cover will be EPDM, or equivalent casing with 316 stainless steel clamps; hose and connections must be rated for up to 200 psi at 250 deg. F; vendor specified with approval
	2" Gate Valve	122 ea.	Brass body construction with PTFE or Viton® seats/gaskets NPT threaded, flanged, butt-welded, or socket-brazed connections; vendor specified with approval
	2" Nipple	122 ea.	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections to be air tight (between gate valve to branch line tee)
AI Wellhead Assembly (Figure 10)	2" Male/Female Cam Lock and Hose Barb	248 ea.	316 Stainless steel, male/female NPT air tight threaded cam and groove hose coupling with hose barb; 2 per well; fittings may be stainless steel or carbon steel; shank fittings will be double band clamped/crimped with 316 Stainless steel bands; vendor specified with approval
	2" Steam Rated Flex Hose ^[3]	310 ft	Flexible hoses will consist of inner tubes of XLPE, UHMWPE, PTFE, or other chemically compatible material for use with chlorobenzenes; outer protective cover will be EPDM, or equivalent casing with 316 stainless steel clamps; hose and connections must be rated for up to 200 psi at 250 deg. F; vendor specified with approval
	2" Gate Valve	122 ea.	Brass body construction with PTFE or Viton® seats/gaskets NPT threaded, flanged, butt-welded, or socket-brazed connections; vendor specified with approval
	2" Nipple	122 ea.	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections to be air tight (between gate valve to branch line tee)
T-SVE System Manifold Piping			
T-SVE Branch Lines (Figure B-1)	4" Piping with coupler	4,400 ft	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections will be air tight
	4" Braided flexible/expansion hose	18 ft	Flexible hoses will consist of inner tubes of XLPE, UHMWPE, PTFE, or other chemically compatible material for use with chlorobenzenes; outer protective cover will be EPDM, or equivalent casing with 316 stainless steel clamps; hose and connections must be rated for up to 200 psi at 250 deg. F; vendor specified with approval
	4" to 2" Reducing Bushing	204 ea.	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded connections; all connections will be air tight
	4" standard Tee	204 ea.	
T-SVE Branch Line Cleanouts (Figure B-1)	4" Blind Flange	17 ea.	Carbon steel blind flange cleanout; vendor specified with approval
T-SVE Main Manifolding Lines (Figures B-1)	12" Piping with coupler	140 ft	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections will be air tight
	12" sweep Tee	3 ea.	
	12" to 8" Bell reducing coupling	3 ea.	
	8" Piping with coupler	660 ea.	
	8" sweep Tee	20 ea.	
	8" to 4" Bell reducing coupling	17 ea.	
	8" Expansion coupling	4 ea.	Flexible hoses will consist of inner tubes of XLPE, UHMWPE, PTFE, or other chemically compatible material for use with chlorobenzenes; outer protective cover will be EPDM, or equivalent casing with 316 stainless steel clamps; hose and connections must be rated for up to 200 psi at 250 deg. F; vendor specified with approval
12" valve (at the equipment building wall)	1 ea.	316 Stainless steel flanged butterfly valve; vendor specified with approval	

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Table 10
Manifold Piping Specifications and Materials List

W.G. Krummrich Facility, Sauget, Illinois

Components	Details	Units	Specifications
AI System Manifold Piping			
AI Branch Lines (Figure 8)	4" Piping with coupler	2,900 ft	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections will be air tight
	4" Braided connector hose	14 ft	Flexible hoses will consist of inner tubes of XLPE, UHMWPE, PTFE, or other chemically compatible material for use with chlorobenzenes; outer protective cover will be EPDM, or equivalent casing with 316 stainless steel clamps; hose and connections must be rated for up to 200 psi at 250 deg. F; vendor specified with approval
	4" to 2" Reducing Bushing	122 ea.	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections will be air tight
	4" standard Tee	122 ea.	
AI Branch Line Cleanouts (Figure 16)	4" Blind Flange	42 ea.	Carbon steel blind flange cleanout; vendor specified with approval
	1" Bushing	14 ea.	316 Stainless steel, male/female NPT air tight threaded bushing
	1" Male/Female Cam Lock and Hose Barb	28 ea.	316 Stainless steel, male/female NPT air tight threaded cam and groove hose coupling with hose barb; 2 per well; fittings may be stainless steel or carbon steel; shank fittings will be double band clamped/crimped with 316 Stainless steel bands; vendor specified with approval
	1" Steam Rated Flex Hose	70 ft	Flexible hoses will consist of inner tubes of XLPE, UHMWPE, PTFE, or other chemically compatible material for use with chlorobenzenes; outer protective cover will be EPDM, or equivalent casing with 316 stainless steel clamps; hose and connections must be rated for up to 200 psi at 250 deg. F; vendor specified with approval
	1" Gate Valve	42 ea.	Brass body construction with PTFE or Viton® seats/gaskets NPT threaded, flanged, butt-welded, or socket-brazed connections; vendor specified with approval
	1" Nipple	56 ea.	Minimum Schedule 10 carbon steel pipe with NPT threaded fittings; all connections to be air tight
	1" standard Tee	14 ea.	
	1" Plug	14 ea.	
	Condensate Trap	14 ea.	Mechanical float design (Spirax Sarco Model FA450, or equivalent) sized for anticipated steam capacity (up to 15 psi)
	2" to 1" reducing Bushing	14 ea.	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections to be air tight
	2" Plug	14 ea.	Minimum Schedule 10 carbon steel pipe with NPT threaded fittings; all connections to be air tight
	2" Piping with coupler	140 ft	Minimum Schedule 10 carbon steel pipe with flanged, threaded, or butt-welded fittings; all connections to be air tight; assume 10 ft per condensate drain
	2" Slotted Sump	28 ft	0.02-inch slotted stainless steel well screen with flanged, threaded, or butt-welded fittings; all connections to be air tight
	AI Main Manifolding Lines (Figure 8)	12" Piping with couplers	140 ft
12" sweep Tees		3 ea.	
12" to 8" Bell reducing couplings		3 ea.	
8" Piping with couplers		610 ea.	
8" sweep Tees		17 ea.	
8" to 4" Bell reducing couplings		14 ea.	Flexible hoses will consist of inner tubes of XLPE, UHMWPE, PTFE, or other chemically compatible material for use with chlorobenzenes; outer protective cover will be EPDM, or equivalent casing with 316 stainless steel clamps; hose and connections must be rated for up to 200 psi at 250 deg. F; vendor specified with approval
8" Expansion coupling		4 ea.	
12" valve (at the equipment building wall)		1 ea.	

T-SVE = Thermally Enhanced Soil Vapor Extraction
AI = Air Injection
NPT = Nation pipe thread

* Hg = inches of mercury
PSI = pounds per square inch
ft = feet
ea. = each
deg. F = degrees Fahrenheit

ID = interior diameter
XLPE = Modified cross-linked polyethylene
UHMWPE = Ultra High Molecular Weight Polyethylene
PTFE = Polytetrafluoroethylene
EPDM = Ethylene Propylene Diene Monomer

Notes:

- All equipment to be installed according to manufacturer's required specifications. All pipe connections will be airtight and flanged, threaded, or butt-welded.
- Assume 5 ft of 2" Minimum Schedule 10 carbon steel per SVE wellhead assembly from the carbon steel coupling to the wellhead assembly and 10 ft from wellhead assembly to branch/manifold lines.
- If flanged connections are used, the flanges shall be equipped with full-faced Viton® or equivalent chemical/temperature compatible seats/gaskets.
- Wellhead riser/tee/sample-port and steel lateral assembly may be partially pre-fabricated using threaded, flanged, or butt-welded fittings. Steel lateral lengths and riser height will need to be adjusted in the field to accommodate the actual dimensions of the field assembly.
- Tee connections from the main mainline pipes to the flex-hose connections on the wellheads (see Figure 10) may be pre-fabricated using threaded, flanged, or butt-weld fittings.

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Table 11
T-SVE System Piping Pressure Testing Requirements
 W.G. Krummrich Facility, Sauget, Illinois

Step	Description
1	Secure any unrestrained pipe ends against uncontrolled movement during pressure testing. Ensure all fittings, caps, blind flanges, cam lock fittings, hose barbs, sample ports, etc. are secured and tightened to the proper specification prior to pressurizing the piping system.
2	Isolate piping section to be tested using existing shut off valves, if available. Appropriate air fittings, pressure gauges, and additional shut off valves will be temporarily installed, as required, to allow isolation and pressurization of the test section of pipe.
3	Pressurize the pipe to the desired test pressure using an air compressor. Once the piping system is at the desired test pressure, shut the air compressor inlet valve to contain the static pressure in the piping system.
4	Test the piping system at 1.1 times the system normal operating pressure.
5	Monitor the pressure in the line for a period of not less than two hours.
6	If at any time during the test the pressure drops to 5 psi below the test pressure, re-pressurize the pipe to bring the pressure back to the original test pressure.
7	If pressure loss is detected per Step #6 above, use appropriate leak check solutions to identify source of leakage and conduct appropriate corrective action.

Notes:
 psig = pounds per square inch gauge pressure

TABLE 12
SVE System Specifications
 General Parts List for Piping and Instrumentation with SVE Equipment
 W.G. Krummrich Facility, Sauget, Illinois

Item/Part	Description	Specification (Vendor may recommend an alternative item - requires prior approval)
AFS 101, 201, 301	Air Filter/Silencer	Solberg (or approved equivalent) - vendor selected
AMS 101, 201, 301	Air Moisture Separator	120-gallon effective capacity, 12" inlet/8" outlet, rated for 20" Hg., includes high efficiency demister (99% efficiency at 10 micron droplet size) and 6" clean out), must be electrically grounded - vendor selected
APF 101, 201, 301	Air Particulate Filter	Solberg (or approved equivalent) - vendor selected
AS 701	Air Stripper	Air stripper designed to treat 30 gpm at 300 cubic feet per minute air flow rate with a minimum of 99% removal of chlorobenzenes - vendor selected
BFV 101, 201, 301, 401, 402, 701	Butterfly Valve, 8"	Steel/Brass/Ductile Iron True Union/Flanged Butterfly Valve - vendor selected
BPF 701	Bag Particulate Filter	Sized and selected by vendor
BV 001, 002, 003	Ball Valve, 12"	Steel/Brass/Ductile Iron True Union Ball Valve - vendor selected
BV 004 - 007, 401 - 404	Ball Valve, 1/4"	Steel/Brass/Ductile Iron True Union Ball Valve - vendor selected
BV 101, 201, 301	Ball Valve, 8"	Steel/Brass/Ductile Iron True Union Ball Valve - vendor selected
BV 102 - 106, 202 - 206, 303 - 306, 701, 702, 705 - 709, 714, 715, 720, 725	Ball Valve, 1"	Steel/Brass/Ductile Iron True Union Ball Valve - vendor selected
BV 703, 704, 710 - 713, 716 - 719, 721 - 724, 726	Ball Valve, 2"	Steel/Brass/Ductile Iron True Union Ball Valve - vendor selected
CF 401, 701, 702	Carbon Filter, 2" pipe connection	Steel/Brass/Ductile Iron - vendor selected
CV 001, 002, 003	Vacuum Check Valve, Gate Type, 12"	Steel/Brass/Ductile Iron - vendor selected
CV 101, 201, 301, 704	Pressure Check Valve, Gate Type, 8"	Steel/Brass/Ductile Iron - vendor selected
CV 103, 203, 303, 705, 706	Water Check Valve, Gate Type, 1"	Steel/Brass/Ductile Iron - vendor selected
CV 701, 702, 703	Water Check Valve, Gate Type, 2"	Steel/Brass/Ductile Iron - vendor selected
DD 701, 702	Dry Disconnect Valve, 1"	vendor selected
FA 401, 701, 702	Flame Arrestor, 2" pipe connection	Steel/Brass/Ductile Iron - vendor selected
FC 101, 102, 201, 202, 301, 302	FC 101, 102, 201, 202, 301, 302	Pipe Joining Flex/Flange Coupling - vendor selected
FH 701	Flex Hose, 1"	vendor selected
FIA 401	Air Flow Indicator - Analog, 12" Stainless Steel pipe connection (monitor/record air flow rate/totalizer reading)	0-4,000 scfm; Compact air mass flow meter (or approved equivalent) producing 4-20 mA output signal directly proportional to the air flow rate (4mA - low flow rate and 20mA - high flow rate) operating on 10-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, flow/totalizer reading display required - vendor selected
FM 101, 201, 301	Air Flow Meter, 8" PVC pipe connection	0-1,500 scfm; Dwyer (or approved equivalent) Pitot Tube Assembly - Magnehelic gauge with mounting bracket and inline averaging pitot tube flow/differential pressure sensor, direct flow reading display of 0-1,500 scfm required - sized by vendor with approval
FM 102, 202, 302	Air Flow Meter, 8" Steel pipe connection	0-1,500 scfm; Dwyer (or approved equivalent) Pitot Tube Assembly - Magnehelic gauge with mounting bracket and inline averaging pitot tube flow/differential pressure sensor, direct flow reading display of 0-1,500 scfm required - sized by vendor with approval
FM 701	Air Flow Meter, 8" Steel pipe connection	0-500 scfm; Dwyer (or approved equivalent) Pitot Tube Assembly - Magnehelic gauge with mounting bracket and inline averaging pitot tube flow/differential pressure sensor, direct flow reading display of 0-500 scfm required - sized by vendor with approval
FM 001, 401	Air Flow Meter, 12" Steel pipe connection	0-4,000 scfm; Dwyer (or approved equivalent) Pitot Tube Assembly - Magnehelic gauge with mounting bracket and inline averaging pitot tube flow/differential pressure sensor, direct flow reading display of 0-4,000 scfm required - sized by vendor with approval
FS 101	Flow Sensor, Digital, 8" steel pipe (indicates minimum air flow)	Dwyer (or approved equivalent) - sized by vendor with approval
FS 201	Flow Sensor, Digital, 8" steel pipe (indicates minimum air flow)	Dwyer (or approved equivalent) - sized by vendor with approval
FS 301	Flow Sensor, Digital, 8" steel pipe (indicates minimum air flow)	Dwyer (or approved equivalent) - sized by vendor with approval

TABLE 12
SVE System Specifications
 General Parts List for Piping and Instrumentation with SVE Equipment
 W.G. Krummrich Facility, Sauget, Illinois

Item/Part	Description	Specification (Vendor may recommend an alternative item - requires prior approval)
FT 701	Water Flow Totalizer - Analog, 2" Steel pipe connection (monitor/record water flow rate/totalizer reading)	0-30 gpm; Analog totalizing liquid flow meter producing 4-20 mA output signal directly proportional to the flow, type 316 stainless steel; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, flow/totalizer reading display required - vendor selected
GV 001	12" Brass Gate Valve	Brass Gate Vales; Bleeds ambient air. vendor selected
GV 101, 201, 301	8" Brass Gate Valve	Brass Gate Vales; Bleeds ambient air. vendor selected
GV 102, 202, 302	1" Brass Gate Valve	Brass Gate Vales; Water recirculation line. vendor selected
HM 101, 201, 301	Total Runtime/ hour Meters for PDB 101, 201, and 301, respectively (provide calculate motor run time)	Total runtime/hour meter can either be an analog device or a digital input signal
HM 102, 202, 302, 701, 702, 703, 704	Total Runtime/ hour Meters for TP 101, 201, 301, 701, 702, 703, and 704, respectively (provide calculate motor run time)	Total runtime/hour meter can either be an analog device or a digital input signal
HM 705	Total Runtime/ hour Meters for AS 701 (provide calculate motor run time)	Total runtime/hour meter can either be an analog device or a digital input signal
LS 101, 201, 301, 701, 704, 706, 709, 712	AMS 101/AMS 201/AMS 301/OWS 701/NT 701/ET 701/AS 701 /NT 702- high, high level (alarm) float switch	GEMS (or approved equivalent), fails high - vendor selected
LS 102, 202, 302, 702, 705, 707, 710, 713	AMS 101/AMS 201/AMS 301/OWS 701/NT 701/ET 701/AS 701/NT 702 - high level float	GEMS (or approved equivalent), fails high - vendor selected
LS 103, 203, 303, 703, 708, 711	AMS 101/AMS 201/AMS 301/OWS 701/ET 701/AS 701 - low level float switch	GEMS (or approved equivalent), fails high - vendor selected
MD 101, 201, 301	Manual Drain Clean Out	Specified to fit AMS 101, AMS 201 and AMS 301 - vendor selected
MD 102, 103, 104, 202, 203, 204, 302, 303, 304, 703 - 708, 711 - 713, 715 - 717	Manual Drain Clean Out	Steel/Brass/Ductile Iron - vendor selected
MD 701	Manual Drain Clean Out	Specified to fit OWS 701 selected by vendor with approval
MD 709	Manual Drain Clean Out	Specified to fit BPF 701 selected by vendor with approval
MD 710	Manual Drain Clean Out	Specified to fit ET 701 selected by vendor with approval
MD 714	Manual Drain Clean Out	Specified to fit AS 701 selected by vendor with approval
MD 702	Manual Drain Clean Out	Specified to fit NT 701 selected by vendor with approval
MD 718	Manual Drain Clean Out	Specified to fit NT 702 selected by vendor with approval
MBFV 701	Motorized Butterfly Valve	ASAHI (or approved equivalent)
NS 701	NAPL Storage Drum	55-gallon drum, must be electrically grounded - vendor selected
NT 701	Oil Water Separator DNAPL Storage Tank	Oil/Water Separation Dense NAPL Tank, minimum 10 gal DNAPL storage capacity. Must be electrically grounded.
NT 702	Oil Water Separator LNAPL Storage Tank	Oil/Water Separation Light NAPL Tank, minimum 10 gal LNAPL storage capacity. Must be electrically grounded,
OWS 701	Oil Water Separation Unit	DNAPL/Water Separation Unit (Qty. 1) rated for 30 gpm and minimum 10 gal DNAPL storage capacity. Must be electrically grounded.
PDB 101, 201, 301	Positive Displacement Blower Unit	Each rated for 1,250 scfm at 10" of Hg total dynamic head measured at the trailer inlets and 0" Hg at the trailer outlet- with air intake filter and muffler (pulse control silencer at inlet and outlet); to be equipped with total run time/hour meters (HM 101, HM 201, HM 301)
PI 101, 201, 301	Pressure Indicator	0-100" H ₂ O, steel case (WIKA or approved equivalent)
PI 102, 202, 302, 701 - 704	Pressure Indicator	0-30 psi, steel case (WIKA or approved equivalent)
PI 401, 705	Combination Pressure/Vacuum Indicator	0-100 "H ₂ O pressure and 0-100 "H ₂ O vacuum, steel case (WIKA or approved equivalent)
PID 701	Volatile Organic Compound/Photoionization Detector Meter - Digital (monitor/transmit PPM reading) shuts down entire system when activated	0-15 ppm: High accuracy VOC/PID meter/transmitter assembly mounted on building/container exterior producing 4-20 mA output signal directly proportional to the building/container interior PID reading (4 mA - 0 ppm and 20 mA - high 15 ppm) operating on 5-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, PPM reading display required, also shuts down PDB 101/201/301, TP 101/201/301/701/703/704, TOX, AS 701, and AC 901/1001 in the event of high PPM detection - set at 15 ppm - vendor selected
PRV 101, 201, 301	Pressure Relief Valve, 6" Stainless Steel	Kunkle (or approved equivalent) pressure capacity set at PDB 101/201/301 pressure capacity, iron/bronze construction required - sized and selected by vendor with approval

TABLE 12
SVE System Specifications
 General Parts List for Piping and Instrumentation with SVE Equipment
 W.G. Krummrich Facility, Sauget, Illinois

Item/Part	Description	Specification (Vendor may recommend an alternative item - requires prior approval)
PS/PT 401	Pressure Switch/Transmitter, Digital, 12" Steel pipe (monitor/record/transmit pressure reading) (shuts down PDB 101/201/301, TP 101/201/301/701/703/704, AS 701 and AC 901/1001 when activated)	0-15 psi: High accuracy pressure transmitter assembly producing 4-20 mA output signal directly proportional to the line pressure (4 mA - no pressure and 20 mA - high pressure) operating on 5-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, pressure reading display required, also shuts down PDB 101/201/301, TP 101/201/301/701/703/704, AS 701, and AC 901/1001 in the event of no/high pressure detection - set at b/w 0 and 5 psi - vendor selected
PS/PT 701	Pressure Switch/Transmitter, Digital, 2" Steel pipe (monitor/record/transmit pressure reading) (shuts down PDB 101/201/301, TP 101/201/301/701/703/704, AS 701, and AC 901/1001 when activated)	0-30 psi: High accuracy pressure transmitter assembly producing 4-20 mA output signal directly proportional to the line pressure (4 mA - no pressure and 20 mA - high pressure) operating on 5-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, pressure reading display required, also shuts down PDB 101/201/301, TP 101/201/301/701/703/704, AS 701, and AC 901/1001 in the event of no/high pressure detection while TP701 is in operation - set at b/w 0 and 5 psi - vendor selected
PS/PT 702	Pressure Switch/Transmitter, Digital, 2" Steel pipe (monitor/record/transmit pressure reading) (shuts down PDB 101/201/301, TP 101/201/301/701/703/704, AS 701, and AC 901/1001 when activated)	0-5 psi: High accuracy pressure transmitter assembly producing 4-20 mA output signal directly proportional to the line pressure (4 mA - no pressure and 20 mA - high pressure) operating on 5-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, pressure reading display required, also shuts down PDB 101/201/301, TP 101/201/301/701/703/704, AS 701, and AC 901/1001 in the event of no/high pressure detection - set at b/w 0 and 2 psi - vendor selected
OS/OT 001, 401	Oxygen Sensor, Digital (monitor/record/transmit percent oxygen) (shuts down PDB 101/201/301, TP 101/201/301/701/703/704, AS 701, and AC 901/1001 when activated)	0-25% oxygen (O2): High accuracy oxygen sensor and transmitter assembly producing a 4-20 mA output signal directly proportional to the line O2 concentration operating on 12-24 Volt DC supply; integrated controller, panel meter, system control panel, telemetry system, and data loggers, percent oxygen display required, also shuts down PDB 101/201/301, TP 101/201/301/701/703/704, AS 701, and AC 901/1001 in the event of high percent oxygen >23.5% - vendor selected (GPR-28 ATEX Explosion Proof Process percent O2 analyzer or similar)
SI 101, 201, 301	Silencer, 8" Steel pipe	Two-Chamber Acoustically Packed Design, 8" flanged inlet/outlet, rated for maximum flow
SP 001, 101, 201, 301	Air Sampling Port	1/4" - 1/2" brass ball valve with 3/16" brass or stainless steel barb fitting
SP 102, 202, 302, 401, 705	Air Sampling Port	1/4" - 1/2" brass ball valve with 3/16" brass or stainless steel barb fitting, spring controlled auto close
SP 103, 203, 303, 701, 702, 703, 704	Water Sampling Port	1/4" - 1/2" brass ball valve with 3/16" brass or stainless steel barb fitting, spring controlled auto close
SS 701	Seismic Sensor for system to shut down in a failsafe mode	Shut down entire system and provide alarm notification in the event of any seismic incident of magnitude 5.0 or greater within a 60 mile radius.
ST 101, 201, 301, 701, 702, 703	Sight Tube, 2"	Transparent/Clear PVC Schedule 80
TI 001, 101, 201, 301	Temperature Indicator	0-200°F, bimetal, stainless steel case (WIKA or approved equivalent)
TI 102, 202, 302, 401	Temperature Indicator	0-300°F, bimetal, stainless steel case (WIKA or approved equivalent)
TP 101, 201, 301	Water pump	Progressive Cavity Type pumps, 5-10 gpm at maximum vacuum. Each to be equipped with total run time/hour meter HM 102/202/302 - vendor selected
TP 701, 703, 704	Water pump	Progressive Cavity Type pumps, 15-30 gpm at maximum vacuum. Each to be equipped with total run time/hour meter HM 701, 703, 704 - vendor selected
TP 702	Water pump	Progressive Cavity Type pumps, 5-10 gpm at maximum vacuum. Each to be equipped with total run time/hour meter HM 702 - vendor selected
VI 001, 101, 102, 103, 201, 202, 203, 301, 302, 303	Vacuum Indicator	0-20" Hg vacuum, liquid filled, stainless steel case (WIKA or approved equivalent)
VIA 101, 201, 301	Vacuum Indicator & Switch - Analog (monitor/record/transmit vacuum reading)	0-20" Hg: High accuracy vacuum transmitter assembly producing 4-20 mA output signal directly proportional to the line vacuum (4 mA - low vacuum and 20 mA - high vacuum) operating on 5-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, vacuum reading display required, also shuts down PDB 101/201/301 respectively, in the event of low/no vacuum detection - set at b/w 0 and 2" Hg - vendor selected
VRV 101, 201, 301	Vacuum Relief Valve, 4"	Kunkle (or approved equivalent), set at 16" of Hg vacuum, iron/bronze construction required

SVE - Soil vapor extraction
 °F - Degrees Fahrenheit
 gpm - Gallons per minute
 LEL - Lower Explosive Limit
 lbs - Pounds

mA - milli Amps
 PLC - Programmable Logic Controller
 psi - pounds per square inch
 " Hg - Inches of Mercury
 " H₂O - Inches of Water

PVC - Polyvinyl Chloride
 scfm - Standard Cubic Feet per Minute
 SVE - Soil Vapor Extraction
 TDH - Total Dynamic Head

- Notes:**
1. All equipment (i.e., process monitoring devices) to be configured with all manufacturer required specifications.
 2. Refer to Figure 18 for the SVE process equipment schematic.
 3. All pipe measurements are interior diameter.
 4. All components will be compatible with benzene.

TABLE 13

AI System Specifications

General Parts List for Piping and Instrumentation Associated with AI Equipment
W.G. Krummrich Facility, Sauget, Illinois

Item/Part	Description	Specification
		(Vendor may recommend an alternative item - requires prior approval)
AC 901, 1001	Air Compressor	Air Compressors rated for 1,000 scfm each and 15 psi total dynamic head measured at container wall transitions, power requirements: 230/480 volts and 3-phase, with air intake filters, to be equipped with total run time/hour meters - vendor selected
AFS 901, 1001	Air Filter/Silencer	Solberg (or approved equivalent)
BV 901, 1001	6" Ball Valve	Brass, Flanged - common, rated for maximum temperature - vendor selected
BV 2001, 2002	6" Ball Valve	Steel, Flanged - rated for maximum temperature - vendor selected
BV 2003, 2004, 2005, 2006	6" Ball Valve	Steel, Flanged - rated for maximum temperature - Spirax Sarco M31S or equivalent
CT 2001	Liquid Condensate Trap, 2", Steel Construction	10,000 lb/hr discharge capacity - Spirax Sarco FA-450 or equivalent
CV 901, 1001	Air Vacuum/Pressure Check Valve, Gate Type, 6"	Brass/Ductile Iron - vendor selected
CV 2001, 2002, 2003	High temperature Air/Steam Check Valve, Disc Type, 4"	Stainless Steel - TLV CKF3MG or equivalent
FC 901, 902, 1001, 1002	6" Flex/Flange Coupling	Pipe Joining Flex/Flange Coupling - vendor selected
FIA 2001, 2002	Air Flow Indicator - Analog, 10" Steel pipe connection (monitor/record air flow rate)	0-2,000 scfm; Compact air mass flow meter (or approved equivalent) producing 4-20 mA output signal (to PLC) directly proportional to the air flow rate (4mA - low flow rate and 20mA - high flow rate) operating on 10-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers; flow reading display required - vendor selected
FM 901, 1001	Air Flow Meter, 6" Stainless Steel pipe connection	0-1,000 scfm; Dwyer (or approved equivalent) Pitot Tube Assembly - Magnehelic gauge with mounting bracket and inline averaging pitot tube flow/differential pressure sensor, direct flow reading display of 0-1,000 scfm required - vendor selected
FM 2001	Air Flow Meter, 10" Stainless Steel pipe connection	0-2,000 scfm; Dwyer (or approved equivalent) Pitot Tube Assembly - Magnehelic gauge with mounting bracket and inline averaging pitot tube flow/differential pressure sensor, direct flow reading display of 0-2,000 scfm required - vendor selected
FS 901, 1001	Flow Sensor, Digital, 6" steel pipe (indicates minimum air flow)(monitor/record air flow rate)	Dwyer (or approved equivalent)
GV 901, 1001	6" Gate Valve	Brass, NPT - common, rated for maximum temperature - vendor selected
GV 2005	10" Gate Valve	Steel, Flanged, rated for maximum temperature - vendor selected
HM 901, 1001	Total Runtime/Hour Meters for AC 901 and AC 1001 (provide/calculate motor run time)	Total runtime/hour meter provides a digital input signal (to PLC) to provide/calculate motor run time in hours for remote telemetry system - vendor selected
MV 2001	Motorized Control Valve, 2-Port Globe Style with Actuator (pneumatic or electropneumatic)	Spirax Sarco K-series (or approved equivalent) motorized/actuated valve assembly, provides a digital input signal (to PLC) to provide open/closed status and % open closed for remote telemetry system
MD 2001, 2002, 2003	Manual Drain Clean Out	Steel, rated for maximum temperature - vendor selected
PI 901, 1001, 2001, 2002	Pressure Indicator	0-30 psi, steel case (WIKA or approved equivalent)
PRV 901, 1001	Pressure Relief Valve	Kunkle (or approved equivalent) field adjustable from 5-30 psi, set at 16 psi (AC 901, 1001 pressure capacity), iron/bronze construction required
PRV 2001	Pressure Relief Valve	Spirax Sarco SV74 (or approved equivalent) field adjustable, set at 25 psi, steel construction required
PS/PT 2001, 2002	Pressure Switch/Pressure Transmitter, Digital, 10" steel pipe connection (shuts down AC 901/1001 when activated)	High accuracy pressure transmitter assembly producing 4-20 mA output signal (to PLC) directly proportional to the line pressure (4 mA - low pressure and 20 mA - high pressure) operating on 5-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, pressure reading display required, also shuts down the corresponding air compressors in the event of low/no pressure detection - field adjustable from 0-30 psi, set at 14 psi (below AC 901, 1001 pressure capacity) - vendor selected
REG 2001, 3001	Pressure Regulator, 6"	Spirax Sarco 25P Pilot Operated Pressure Regulator, Steel, Flanged - vendor selected
SI 901, 902, 1001, 1002	Silencer	Two-Chamber Acoustically Packed Design, 6" flanged inlet/outlet, rated for maximum flow - vendor selected
SV 2001	Safety Shutoff Valve	Safety shutoff valve (normally closed) - vendor selected
TI 901, 902, 1001, 1002	Temperature Indicator	0-200°F, bimetal, stainless steel case (WIKA or approved equivalent)
TI 2001, 2002	Temperature Indicator	0-500°F, bimetal, stainless steel case (WIKA or approved equivalent)
TIA 901, 1001	Temperature Indicator & Switch - Analog (monitor/record/transmit air temperature)	0-300°F; High accuracy temperature transmitter assembly producing 4-20 mA output signal (to PLC) directly proportional to the line temperature (4mA - low temperature and 20mA - high temperature) operating on 10-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, temperature reading display required, also shuts down AC 901/1001 in the event of high temperature detection - set at 200° F - Dwyer (or approved equivalent)
TIA 2001, 2002	Temperature Indicator & Switch - Analog (monitor/record/transmit air temperature)	0-500°F; High accuracy temperature transmitter assembly producing 4-20 mA output signal (to PLC) directly proportional to the line temperature (4mA - low temperature and 20mA - high temperature) operating on 10-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, temperature reading display required, also shuts down AC 901/1001 in the event of high temperature detection - set at 275° F - Dwyer (or approved equivalent)
TC/TT 2001, 2002	Temperature Controller/Temperature Transmitter	0-500°F; High accuracy temperature transmitter/controller assembly producing 4-20 mA output signal (to PLC) directly proportional to the line temperature (4mA - low temperature and 20mA - high temperature) operating on 10-40 Volt DC supply; integrated with controller, panel meter, system control panel, telemetry system, and data loggers, temperature reading display required, also controls temperature with MV 2001/3001 - Dwyer (or approved equivalent)
VI 901, 1001	Vacuum Indicator	0-100 "H ₂ O vacuum, liquid filled, stainless steel case (WIKA or approved equivalent)

AI - Air Injection "H₂O - inches of water PLC - Programmable Logic Controller
 DC - Direct current lb/hr - pounds per hour psi - pounds per square inch
 °F - Degrees Fahrenheit mA - milli Amps scfm - Standard Cubic Feet per Minute
 TBD - to be determined during 90% design

- Notes:**
1. All equipment (i.e., process monitoring devices) to be configured with all manufacturer required specifications.
 2. Refer to Figure 19 for the AI process equipment schematic.
 3. All pipe measurements are interior diameter.

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TABLE 14
Summary of SVE and AI Input-Output Schedule
W.G. Krummrich Facility, Sauget, Illinois

Type	System	Data	Notes	Description	Function
Digital Inputs	SVE	AS 701	[1] [3] [4] [5] [6] [50]	AS 701 blower overload (motor fault)	AS 701 shut down/alarm notification in the event of motor overload (motor fault) detection. Also Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, and ThermOx and provide alarm notification when AS 701 has an overload motor fault.
		AS 701	[2] [3]	AS 701 blower operation	AS 701 on/off
		FS 101	[1] [5] [7] [8] [9] [50]	Flow sensor, indicates minimum/no air flow (alarm condition)	Allow blower PDB 101 operation when activated. Shall have ~30 second delay to allow PDB 101 to get up to speed. PDB 101, AC 901 and AC 1001 shut down/alarm condition in the event of low/no flow detection.
		FS 201	[1] [5] [7] [8] [9] [50]	Flow sensor, indicates minimum/no air flow (alarm condition)	Allow blower PDB 201 operation when activated. Shall have ~30 second delay to allow PDB 201 to get up to speed. PDB 201, AC 901 and AC 1001 shut down/alarm condition in the event of low/no flow detection.
		FS 301	[1] [5] [7] [8] [9] [50]	Flow sensor, indicates minimum/no air flow (alarm condition)	Allow blower PDB 301 operation when activated. Shall have ~30 second delay to allow PDB 301 to get up to speed. PDB 301, AC 901, and AC 1001 shut down/alarm condition in the event of low/no flow detection.
		LS 101	[1] [6] [9] [50]	Air moisture separator AMS 101 high, high level sensor (alarm condition)	Shut down PDB 101 and provide alarm notification when LS 101 gets wet.
		LS 102		Air moisture separator AMS 101 high level sensor	Activate transfer pump TP 101 when LS 102 gets wet.
		LS 103		Air moisture separator AMS 101 low level sensor	Shut off transfer pump TP 101 when LS 103 becomes dry.
		LS 201	[1] [6] [9] [50]	Air moisture separator AMS 201 high, high level sensor (alarm condition)	Shut down PDB 201 and provide alarm notification when LS 201 gets wet.
		LS 202		Air moisture separator AMS 201 high level sensor	Activate transfer pump TP 201 when LS 202 gets wet.
		LS 203		Air moisture separator AMS 201 low level sensor	Shut off transfer pump TP 201 when LS 203 becomes dry.
		LS 301	[1] [6] [9] [50]	Air moisture separator AMS 301 high, high level sensor (alarm condition)	Shut down PDB 301 and provide alarm notification when LS 301 gets wet.
		LS 302		Air moisture separator AMS 301 high level sensor	Activate transfer pump TP 301 when LS 302 gets wet.
		LS 303		Air moisture separator AMS 301 low level sensor	Shut off transfer pump TP 301 when LS 303 becomes dry.
		LS 701	[1] [6] [9] [50] [51]	Oil Water Separator OWS 701 high, high level sensor (alarm condition)	Shut down PDB 101, PDB 201, PDB 301, AC 901, and AC 1001 and provide alarm notification when LS 701 gets wet.
		LS 702		Oil Water Separator OWS 701 high level sensor	Activate transfer pump TP 701 when LS 702 gets wet.
		LS 703		Oil Water Separator OWS 701 low level sensor	Shut off transfer pump TP 701 when LS 703 becomes dry.
		LS 704	[1] [6] [9] [50] [51]	Oil Water Separator NAPL Tank NT 701 high, high level sensor (alarm condition)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and ThermOx and provide alarm notification when LS 704 gets wet (at 90% full).
		LS 705		Oil Water Separator NAPL Tank NT 701 high level sensor	Indicates the NAPL Tank NT 701 is 70% full.
		LS 706	[1] [6] [9] [50] [51]	Equilization tank ET 701 high, high level sensor (alarm condition)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and ThermOx, and provide alarm notification when LS 706 gets wet.
		LS 707		Equilization tank ET 701 high level sensor	Activate transfer pump TP 703, air stripper AS 701, and open MBFV 701 when LS 707 gets wet.
		LS 708		Equilization tank ET 701 low level sensor	Shut off transfer pump TP 703 when LS 708 becomes dry.
		LS 709	[1] [6] [9] [50] [51]	Air stripper AS 701 high, high level sensor (alarm condition)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and ThermOx, and provide alarm notification when LS 709 gets wet.
		LS 710		Air stripper AS 701 high level sensor	Open Motorized Butterfly Valve MBFV 701, and activate transfer pump TP 704 when LS 710 gets wet. MBFV 701 will have five seconds to open prior to TP 704 activation.
		LS 711		Air stripper AS 701 low level sensor	Shut off transfer pump TP 704, air stripper 701, and close MBFV 701 when LS 711 becomes dry.
		LS 712	[1] [6] [9] [50] [51]	Oil Water Separator NAPL Tank NT 702 high, high level sensor (alarm condition)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and ThermOx and provide alarm notification when LS 712 gets wet (at 90% full).
		LS 713		Oil Water Separator NAPL Tank NT 702 high level sensor	Indicates the NAPL Tank NT 702 is 70% full.
		MBFV 501	[4] [9] [10] [11] [50] [51] [52]	Motorized Butterfly Valve operation and open/close status (also a fault/alarm condition)	Open MBFV 501 under normal operating conditions without an alarm present. MBFV 501 to close in the event of any alarm condition. Provide general open/close and alarm/fault status. Opens five second prior to PBD 101/201/301 starting.
		MBFV 701	[4] [9] [10] [11] [41] [50]	Motorized Butterfly Valve operation and open/close status (also a fault/alarm condition)	Open MBFV 701 five seconds prior to AS 701 and TP 703 starting, provide general open/close and fault status.
		PDB 101	[1] [5] [7] [9] [12] [18] [50]	Blower PDB 101 overload (motor fault)	PDB 101 shut down/alarm notification in the event of motor overload (motor fault) detection.
		PDB 101	[4] [7] [13]	Blower PDB 101 operation	PDB 101 on/off
		PDB 201	[1] [5] [7] [9] [14] [25] [50]	Blower PDB 301 overload (motor fault)	PDB 201 shut down/alarm notification in the event of motor overload (motor fault) detection.
		PDB 201	[4] [7] [13]	Blower PDB 201 operation	PDB 201 on/off
		PDB 301	[1] [5] [7] [9] [15] [28] [50]	Blower PDB 301 overload (motor fault)	PDB 301 shut down/alarm notification in the event of motor overload (motor fault) detection.
		PDB 301	[4] [7] [13]	Blower PDB 301 operation	PDB 301 on/off
		OS/OT 001	[1] [6] [7] [9] [16] [50] [51]	Oxygen switch/Oxygen transmitter, set at 30% O2 (alarm condition, also an analog input)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, TP 701, TP 702, TP 703, TP 704 and AS 701 when activated, and alarm notification in the event of high oxygen detection.
		OS/OT 401	[1] [6] [7] [9] [16] [50] [51]	Oxygen switch/Oxygen transmitter, set at 30% O2 (alarm condition, also an analog input)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, TP 701, TP 702, TP 703, TP 704, and AS 701 when activated, and alarm notification in the event of high oxygen detection.
		PS/PT 401	[1] [6] [7] [9] [17] [50]	Pressure switch/pressure transmitter, set at 14 psi (alarm condition, also an analog input)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, TP 701, TP 702, TP 703, TP 704 and AS 701 when activated, and alarm notification in the event of high pressure detection.
		PS/PT 701	[1] [6] [7] [9] [17] [50]	Pressure switch/pressure transmitter, set at 1 psi (alarm condition, also an analog input)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, TP 701, TP 702, TP 703, TP 704 and AS 701 when activated, and alarm notification in the event of high pressure detection.
		PS/PT 702	[1] [6] [7] [9] [17] [50]	Pressure switch/pressure transmitter, set at 1 psi (alarm condition, also an analog input)	Shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, TP 701, TP 702, TP 703, TP 704 and AS 701 when activated, and alarm notification in the event of high pressure detection.
		TP 101	[1] [4] [18] [19] [20] [21] [22] [50]	Transfer pump TP 101 overload (motor fault)	TP 101 and PDB 101 shut down/alarm notification in the event of motor overload (motor fault) detection.
		TP 201	[1] [4] [21] [22] [23] [24] [25] [50]	Transfer pump TP 201 overload (motor fault)	TP 201 and PDB 201 shut down/alarm notification in the event of motor overload (motor fault) detection.
		TP 301	[1] [4] [21] [22] [26] [27] [28] [50]	Transfer pump TP 301 overload (motor fault)	TP 301 and PDB 301 shut down/alarm notification in the event of motor overload (motor fault) detection.
		TP 701	[1] [4] [29] [50]	Transfer pump TP 701 overload (motor fault)	TP 701, PDB 101, PDB 201, PDB 301, AC 901, and AC 1001 shut down/alarm notification in the event of motor overload (motor fault) detection.
		TP 702	[1] [4] [29] [31] [50]	Transfer pump TP 702 overload (motor fault)	TP 702, PDB 101, PDB 201, PDB 301, AC 901, and AC 1001 shut down/alarm notification in the event of motor overload (motor fault) detection.
TP 703	[1] [4] [29] [50]	Transfer pump TP 703 overload (motor fault)	TP 703, PDB 101, PDB 201, PDB 301, AC 901, and AC 1001 shut down/alarm notification in the event of motor overload (motor fault) detection.		
TP 704	[1] [4] [29] [50]	Transfer pump TP 704 overload (motor fault)	TP 704, PDB 101, PDB 201, PDB 301, AC 901, AC 1001, AS 701, and ThermOx shut down/alarm notification in the event of motor overload (motor fault) detection.		
AI	AI	FS 901	[1] [32] [50]	Flow sensor, indicates minimum/no air flow (alarm condition)	Allow air compressor AC 901 operation when activated. Shall have ~30 second delay to allow AC 901 to get up to speed. AC 901 shut down/alarm notification in the event of low/no flow detection.
		FS 1001	[1] [32] [50]	Flow sensor, indicates minimum/no air flow (alarm condition)	Allow air compressor AC 1001 operation when activated. Shall have ~30 second delay to allow AC 1001 to get up to speed. AC 1001 shut down/alarm notification in the event of low/no flow detection.
		AC 901	[1] [33] [34] [50]	Air compressor AC 901 overload (motor fault)	AC 901 shut down/alarm notification in the event of motor overload (motor fault) detection.
		AC 901	[4] [7] [13]	Compressor AC 901 operation	AC 901 on/off
		AC 1001	[1] [33] [35] [50]	Air compressor AC 1001 overload (motor fault)	AC 1001 shut down/alarm notification in the event of motor overload (motor fault) detection.
		AC 1001	[4] [7] [13]	Compressor AC 1001 operation	AC 1001 on/off
		MV 2001	[36] [50]	Motorized Valve operation and % open/close status (also a fault/alarm condition)	MV 2001 open/close status is dependant on reading from TS/TC/TT 2002. MV 2001 opens/closes by 5% increments if more/less steam is needed. Provide general open/close and fault status.
		MV 3001	[36] [50]	Motorized Valve operation and % open/close status (also a fault/alarm condition)	MV 3001 open/close status is dependant on reading from TC/TT 2001. MV 3001 opens/closes by 5% increments if more/less steam is needed. Provide general open/close and fault status.
		PS/PT 2001, 2002	[1] [6] [17] [50]	Pressure switch/pressure transmitter, set at 16 psi, or compressor pressure capacity (alarm condition, also analog input)	AC 901 and AC 1001 shut down/alarm notification in the event of high pressure detection. Also close MV 2001/2002.
		TIA 2001	[1] [6] [37] [50]	Temperature switch - high temp. set at 275°F (alarm condition)	Shut down AC 901 and AC 1001 when activated, and close MV 2001 and MV 3001, and alarm notification in the event of sustained high temperature detection.
		TIA 2002	[1] [6] [37] [50]	Temperature switch - high temp. set at 275°F (alarm condition)	Shut down AC 901 and AC 1001 when activated, and close MV 2001 and MV 3001, and alarm notification in the event of sustained high temperature detection.
		Digital Inputs	General	Scrubber pH Sensor	[1] [6] [50] [51]
Scrubber Pressure Sensor	[1] [6] [50] [51]			Pressure switch/transmitter, set at XX psi (alarm condition, also analog input)	Entire system shutdown/alarm notification in the event of high/low scrubber spray pressure.
Scrubber Sump Level	[1] [6] [50] [51]			Sump level detection (alarm condition, also an analog input)	Shut down scrubber, Thermox and T-SVE system in the event of high sump level detection.
Scrubber Air Pressure Sensor	[1] [6] [50] [51]			Pressure sensor, indicates high pressure (alarm condition, also analog input)	Shut down scrubber and entire system in the event of a high pressure detection. Indicates when scrubber packing material getting plugged.

TABLE 14
Summary of SVE and AI Input-Output Schedule
W.G. Krummrich Facility, Sauget, Illinois

Type	System	Data	Notes	Description	Function
Digital Inputs	General	Building Temperature Alarm	[1] [6] [38] [50] [51]	Building high temperature switch/transmitter, set at 120° F (alarm condition, also analog input)	Shut down entire system and provide alarm notification in the event of building high temperature shutdown/shutoff condition. Alarm conditions for the high temperature alarm will need to be manually reset before the entire system can restart. Thermostat to be adjustable between 0-150° F, and will control the building central HVAC system.
		Building Oxygen Sensor Alarm	[1] [6] [38] [50] [51]	Building high oxygen switch/transmitter, set at >23.5% or <19% (alarm condition, also analog input)	Shut down entire system and provide alarm notification in the event of building high oxygen detection (>23%) or building low oxygen detection (<19%) shutdown/shutoff condition. Alarm conditions for the high/low oxygen alarm will need to be manually reset before the entire system can restart.
		Building Smoke/Heat Detector	[1] [6] [50] [51]	Building smoke/Heat detector (alarm condition)	Shut down entire system and provide alarm notification in the event of building smoke/heat alarm condition. Heat detector will alarm at temps >120°F. Alarm condition for smoke/heat detection will need to be manually reset (after fire department inspection), and before the entire system can restart.
		Emergency Stop		Manual emergency stop power interruption (alarm condition)	Shut down entire system and provide alarm notification in the event of interior/exterior emergency stop activation and send alarm notification. Alarm will need to be manually reset, and emergency stop deactivated, before the entire system can restart. An emergency stop will be located in the control room on the control panel, one will be located outside the control room but inside the treatment building, and one will be mounted outside on an external wall on the treatment building.
		General Power Failure		Power failure/interruption (alarm condition)	Shut down entire system and provide alarm notification in the event of power failure/interruption, send alarm notification when power is restored.
		General ThermOx Alarm - Therm 501	[1] [6] [8] [39] [50] [51]	Alarm condition/signal from thermal oxidizer ThermOx control panel	Shut down Thermox, Scrubber, and T-SVE system and provide alarm notification in the event of thermal oxidizer ThermOx shutdown/shutoff conditions. Alarm conditions for the general thermal oxidizer ThermOx alarm will need to be manually reset before the entire system can restart. Also close thermox inlet valve MBFV 501.
		General Thermox Ready Signal	[55]	Thermox Ready Signal	Ready signal sent from thermox to PLC/telemetry system when thermox has reached operating temperature, that allows the SVE system to operate, and open inlet valve MBFV 501.
		General ThermOx Emergency Stop		Manual emergency stop power interruption (alarm condition)	Shut down entire system and provide alarm notification in the event of interior/exterior emergency stop activation and send alarm notification. Alarm will need to be manually reset, and emergency stop deactivated, before the entire system can restart. Emergency stop will be located in the control room on the control panel.
		Oxygen Distribution Trailer O2 Sensor	[1] [6] [38] [50] [51]	O2 Distribution Trailer high oxygen switch/transmitter, set at >23.5% or <19% (alarm condition)	Shut down entire system (Oxygen, Thermox, Scrubber, T-SVE) and provide alarm notification in the event of trailer high oxygen detection (>23.5%) or trailer low oxygen detection (<19%) shutdown/shutoff condition. Alarm conditions for the high/low oxygen alarm will need to be manually reset before the entire system can restart. Analog data provided to Oxygen Distribution PLC.
		PID 701	[1] [6] [38] [50] [51]	High VOC PPM switch/VOC PPM transmitter, set at 15 ppm (alarm condition, also analog input)	Shut down entire system and provide alarm notification in the event of building/container high VOC PPM shutdown/shutoff condition. Alarm will sound for detection levels between 1.0 - 15 ppm, and system will shutdown at any level >15 ppm. Alarm conditions for the high VOC PPM alarm will need to be manually reset before the entire system can restart.
		SS 701	[1] [6] [38] [50] [51]	Seismic Sensor for system to shut down in a failsafe mode	Shut down entire system and provide alarm notification in the event of any seismic incident of magnitude 5.0 or greater within a 60 mile radius.
		SV 401-SV 591		Individual Well head solenoid valves	Solenoid valves are normally closed and open when signal is sent O2 Distribution trailer PLC. Open/closed status will be sent to O2 Distribution System PLC.
Digital Outputs	SVE	AS 701	[4] [10] [11] [39] [40]	AS 701 blower permissive operation	AS 701 permissive on/off
		AS 701	[31] [36] [37] [44] [50]	AS 701 blower operation and alarm shut down	AS 701 on/off
		MBFV 501	[52]	Motorized butterfly valve MBFV 501 operation, flow permissive	MBFV 501 permissive on/off, opens when the signal is sent out from PDB 101/201/301. Stays open until signal is sent from PDB 101/201/301.
		MBFV 701	[41]	Motorized butterfly valve MBFV 701 operation, flow permissive	MBFV 701 permissive on/off, opens when the signal is sent out from LS 710. Stays open until signal is sent from LS 711.
		PDB 101	[4] [8] [10] [30] [39] [40] [42] [55]	Blower PDB 101 permissive operation	PDB 101 permissive on/off
		PDB 101	[39] [43] [44] [50]	Blower PDB 101 operation and alarm shut down	PDB 101 on/off
		PDB 201	[4] [8] [10] [30] [39] [40] [42] [55]	Blower PDB 201 permissive operation	PDB 201 permissive on/off
		PDB 201	[39] [43] [44] [50]	Blower PDB 201 operation and alarm shut down	PDB 201 on/off
		PDB 301	[4] [8] [10] [30] [39] [40] [42] [55]	Blower PDB 301 permissive operation	PDB 301 permissive on/off
		PDB 301	[39] [43] [44] [50]	Blower PDB 301 operation and alarm shut down	PDB 301 on/off
	TP 101, 201, 301, 701, 702, 703, 704	[4] [30] [40]	Transfer pumps TP 101, TP 201, TP 301, TP 701, TP 702 permissive operation	TP 101, TP 201, TP 301, TP 701, TP 702 permissive on/off	
	TP 101, 201, 301, 701, 702, 703, 704	[43] [50]	Transfer pump TP 101, TP 201, TP 301, TP 701, TP 702 operation and alarm shut down	TP 101, TP 201, TP 301, TP 701, TP 702 on/off	
	AI	AC 901	[4] [10] [13] [32] [39] [40] [42]	Air Compressor AC 901 permissive operation	AC 901 permissive on/off
		AC 901	[7] [9] [39] [43] [44] [45] [46] [50]	Air Compressor AC 901 operation and alarm shut down	AC 901 on/off
		AC 1001	[4] [10] [13] [32] [39] [40] [42]	Air Compressor AC 1001 permissive operation	AC 1001 permissive on/off
		AC 1001	[7] [9] [39] [43] [44] [45] [46] [50]	Air Compressor AC 1001 operation and alarm shut down	AC 1001 on/off
		MV 2001	[36]	Motorized valve MV 2001 operation, flow permissive	MV 2001 permissive on/off, opens when the signal is sent out from TS/TC/TT 2002. Stays open until % open/close signal is sent from TS/TC/TT 2001.
		MV 3001	[36] [54]	Motorized valve MV 3001 operation, flow permissive	MV 3001 permissive on/off, opens when the signal is sent from TC/TT 2001. Stays open until % open/close signal is sent from TC/TT 2001.
	General	SV 2001, 3001	[4] [6] [53]	Safety Valve operation and open/close status (also a fault/alarm condition)	Open SV 2001/3001 five seconds after SV 2001/3001 switch is activated. Provide general open/close and fault status. Normally closed. Close in the event of a power failure, or any AI alarm condition.
		System Alarm Notification		System alarm notification to auto dialer/security system/remote telemetry system	In the event of any system alarm condition, provide alarm notification to autodialer/security system/remote telemetry system.
System Operational Status			System operational status to remote telemetry system	Under normal operating conditions, provide system operation status (on/off) to remote telemetry system.	
		SS 701	[1] [6] [38] [50] [51]	Seismic Sensor for system to shut down in a failsafe mode	Shut down entire system and provide alarm notification in the event of any seismic incident of magnitude 5.0 or greater within a 60 mile radius.
Analog Inputs/Outputs	SVE	FIA 401	[47]	Analog air flow rate indicator	Provide SVE system air flow rate data to remote telemetry system
		FT 701	[47]	Analog liquid totalizing flow meter	Provide discharge water flow rate/totalizer reading to the remote telemetry system.
		HM 101	[47] [48]	Total run time/hour meter	Provide blower PDB 101 total run time/hour data to remote telemetry system.
		HM 102	[47] [48]	Total run time/hour meter	Provide AMS 101 transfer pump TP 101 total run time/hour data to remote telemetry system.
		HM 201	[47] [48]	Total run time/hour meter	Provide blower PDB 201 total run time/hour data to remote telemetry system.
		HM 202	[47] [48]	Total run time/hour meter	Provide AMS 201 transfer pump TP 201 total run time/hour data to remote telemetry system.
		HM 301	[47] [48]	Total run time/hour meter	Provide blower PDB 301 total run time/hour data to remote telemetry system.
		HM 302	[47] [48]	Total run time/hour meter	Provide AMS 301 transfer pump TP 301 total run time/hour data to remote telemetry system.
		HM 701	[47] [48]	Total run time/hour meter	Provide oil water separator transfer pump TP 701 total run time/hour data to remote telemetry system.
		HM 702	[47] [48]	Total run time/hour meter	Provide oil water separator NAPL tank transfer pump TP 702 total run time/hour data to remote telemetry system.
		HM 703	[47] [48]	Total run time/hour meter	Provide oil water separator transfer pump TP 703 total run time/hour data to remote telemetry system.
		HM 704	[47] [48]	Total run time/hour meter	Provide oil water separator NAPL tank transfer pump TP 704 total run time/hour data to remote telemetry system.
		HM 705	[47] [48]	Total run time/hour meter	Provide Air Stripper blower AS 701 total run time/hour data to remote telemetry system.
		OS/OT 001	[1] [6] [16] [47] [50] [51]	Oxygen switch/Oxygen transmitter, set at 30% O2 (analog input, also an alarm condition)	Provide combined SVE oxygen inlet percent data to telemetry system. Also shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, and ThermOx when activated, and alarm notification in the event of high oxygen detection.
		OS/OT 401	[1] [6] [16] [47] [50] [51]	Oxygen switch/Oxygen transmitter, set at 30% O2 (analog input, also an alarm condition)	Provide combined SVE oxygen inlet percent data to telemetry system. Also shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, and ThermOx when activated, and alarm notification in the event of high oxygen detection.
	PS/PT 401	[1] [6] [17] [47] [50] [51]	Pressure switch/pressure transmitter, set at 16 psi or blower pressure capacity (analog input, also an alarm condition)	Provide combined SVE discharge pressure data to telemetry system. Also shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, and ThermOx when activated, and alarm notification in the event of high pressure detection.	
	PS/PT 701	[1] [6] [17] [47] [50] [51]	Pressure switch/pressure transmitter, set at 30 psi or LGAC pressure capacity (analog input, also an alarm condition)	Provide combined SVE water discharge pressure data to telemetry system. Also shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and ThermOx when activated, and alarm notification in the event of high pressure detection.	
	PS/PT 702	[1] [6] [17] [47] [50] [51]	Pressure switch/pressure transmitter, set at 30 psi or LGAC pressure capacity (analog input, also an alarm condition)	Provide combined SVE water discharge pressure data to telemetry system. Also shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and ThermOx when activated, and alarm notification in the event of high pressure detection.	
	VIA 101	[1] [6] [47] [50]	Analog vacuum indicator and switch - set b/w 0 and 2" Hg (also an alarm condition)	Provide PDB 101 line vacuum data to remote telemetry system. Also shut down PDB 101, and provide alarm notification in the event of low/no vacuum detection.	
	VIA 201	[1] [6] [47] [50]	Analog vacuum indicator and switch - set b/w 0 and 2" Hg (also an alarm condition)	Provide PDB 201 line vacuum data to remote telemetry system. Also shut down PDB 201, and provide alarm notification in the event of low/no vacuum detection.	
VIA 301	[1] [6] [47] [50]	Analog vacuum indicator and switch - set b/w 0 and 2" Hg (also an alarm condition)	Provide PDB 301 line vacuum data to remote telemetry system. Also shut down PDB 301, and provide alarm notification in the event of low/no vacuum detection.		
AI	FIA 2001	[47]	Analog air flow rate indicator	Provide Air Injection system total air flow rate data to remote telemetry system.	
	FIA 2002	[47]	Analog air flow rate indicator	Provide Air Injection system total air flow rate data to remote telemetry system.	
	HM 901	[47]	Total run time/hour meter	Provide air compressor AC 901 total run time/hour data to remote telemetry system.	
	HM 1001	[47]	Total run time/hour meter	Provide air compressor AC 1001 total run time/hour data to remote telemetry system.	
	PS/PT 2001, 2002	[1] [6] [17] [47] [50]	Pressure switch/pressure transmitter, set at 16 psi or AC pressure capacity (analog input, also an alarm condition)	Provide air compressor AC 901 and AC 1001 (AI system) discharge pressure data to telemetry system. Also shut down AC 901 and AC 1001 when activated, and alarm notification in the event of high pressure detection.	

TABLE 14
Summary of SVE and AI Input-Output Schedule
W.G. Krummrich Facility, Sauget, Illinois

Type	System	Data	Notes	Description	Function
Analog Inputs/Outputs	AI	TIA 901	[1] [6] [47] [50]	Analog temperature indicator and switch - set at 175° F (also an alarm condition)	Provide air compressor AC 901 discharge temperature data to remote telemetry system. Also shut down AC 901 and provide alarm notification in the event of high temperature detection.
		TIA 1001	[1] [6] [47] [50]	Analog temperature indicator and switch - set at 175° F (also an alarm condition)	Provide air compressor AC 1001 discharge temperature data to remote telemetry system. Also shut down AC 1001 and provide alarm notification in the event of high temperature detection.
		TC/TT 2001	[47]	Temperature Controller/Temperature transmitter	Provide temperature data to remote telemetry system, and controls MV 3001, regulating the amount of steam entering the heat exchanger.
		TC/TT 2002	[47]	Temperature Controller/Temperature transmitter	Provide temperature data to remote telemetry system, and controls MV 2001, regulating the amount of steam entering the heat exchanger.
	General	PID 701	[1] [6] [38] [47] [50] [51]	High Building VOC PPM switch/VOC PPM transmitter, set at 15.0 ppm (analog input, also an alarm condition)	Provide VOC PPM data to telemetry system. Also shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, ThermOx, and scrubber when activated, and alarm notification in the event of high VOC PPM detection.
		SS 701	[1] [6] [38] [50] [51]	Seismic Sensor for system to shut down in a failsafe mode	Shut down entire system and provide alarm notification in the event of any seismic incident of magnitude 5.0 or greater within a 60 mile radius.
		Scrubber pH Sensor	[1] [6] [47] [50] [51]	pH Sensor, indicates high/low pH (alarm condition and analog input)	Provide scrubber quench pH data to remote telemetry system. Shut down Scrubber, Thermox and SVE system in the event of an alarm condition.
		Scrubber Temperature Sensor	[47] [49]	Analog temperature indicator	Provide acid gas scrubber quench temperature data to remote telemetry system.
		Scrubber Pressure Sensor	[1] [6] [47] [50] [51]	Pressure switch/transmitter (analog input, also an alarm condition)	Provide acid gas scrubber spray pressure data to telemetry system. Also shut down entire system in the event of a pressure alarm condition.
		Scrubber Sump Level	[1] [6] [47] [50] [51]	High/low sump level status (analog input, also an alarm condition)	Provide scrubber sump level status to telemetry system. Also shut down entire system in the event of high sump detection.
		Scrubber Air Pressure Sensor	[1] [6] [38] [50] [51]	Pressure sensor, indicates high pressure (alarm condition, also analog input)	Shut down scrubber and entire system in the event of a high pressure detection. Indicates when scrubber packing material getting plugged.
		TV 601-611	[47] [49]	Vapor Probe Temperature Sensors	Provide vapor probe temperature data to remote telemetry system. Data to be monitored via telemetry system and stored on internal hard drive for download.
		DO 601-610	[47] [49]	Dissolved Oxygen Probes	Provide dissolved oxygen data to remote telemetry system. Data to be monitored via telemetry system and stored on internal hard drive for download.
		WT 601-604	[47] [49]	Water Level Pressure Transducers	Provide water level pressure data to remote telemetry system. Data to be converted to water level measurements, monitored via telemetry system, and stored on an internal hard drive for download.

Design Notes:

- [1] Reset for all the alarm conditions will be located on the control panel.
- [2] Air stripper AS 701 will operate with no alarm conditions present. Under normal operating mode (on "AUTO"), air stripper will only operate if MBFV 701 has opened and is not displaying a fault condition, and the ThermOx unit is operating.
- [3] If AS 701 switch is in "HAND" or "AUTO" position, an AS 701 overload shutdown conditions will shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, and ThermOx respectively, if they are in "AUTO" position.
- [4] PDB 101, PDB 201, PDB 301, AC 901, AC 1001, AS 701, SV 2001, SV 3001, TP 101, TP 201, TP 301, TP 701, TP 702, TP 703, TP 704, MBFV 501 and MBFV 701 shall be controlled with HOA (Hand/Off/Auto) switches.
- [5] Alarm condition for PDB 101, PDB 201, and PDB 301 overload will need to be manually reset before PDB 101, PDB 201, PDB 301, AC 901, AC 1001, AS 701 and ThermOx can restart.
- [6] Alarm conditions for the general building general temperature alarm, building oxygen sensor alarm, distribution trailer oxygen sensor, thermal oxidizer ThermOx alarm, building smoke detector, Scrubber pH sensor, Scrubber Pressure sensor, Scrubber Sump Level, Scrubber Air Pressure, PID 701, LS 101, LS 201, LS 301, LS 701, LS 704, LS 706, LS 709, LS 712, PS 301, OS/OT 001, OS/OT 401, PS/PT 401, PS/PT 701, PS/PT 702, PS/PT 2001, PS/PT 2002, SS 701, VIA 101, VIA 201, VIA 301, TIA 901, TIA 1001, TIA 2001, TIA 2002, faulty SV 2001/3001 will need to be manually reset before PDB 101, PDB 201, PDB 301 AC 901 and AC 1001 and ThermOx can restart.
- [7] Air compressors AC 901 and AC 1001 will operate continually with no alarm conditions present. Under normal operating mode (on "AUTO"), air compressors AC 901 and AC 1001 will only operate if two or more PDBs (PDB 101, PDB 201, PDB 301) are operating. Under normal operating mode, any shutdown/shutoff condition or more of the PDB's will shut down AC 901 and AC 1001.
- [8] Alarm condition for FS 101, FS 201, and FS 301 will need to be manually reset before PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and the ThermOx can restart.
- [9] If PDB 101, 201, and 301 switch is in "HAND" or "AUTO" position, any shutdown/shutoff condition of any two PDBs (PDB 101, PDB 201, PDB 301) will shut down AC 901 and AC 1001, if AC 901 and AC 1001 are in "AUTO" position.
- [10] Faulty MBFV 701 alarm condition - If MBFV 701 is faulty, shut down entire system. Also, if MBFV 701 is detected to be normally closed/closed, shutdown entire system.
- [11] Air stripper AS 701 will only operate if MBFV 701 is open.
- [12] If PDB 101 switch is in "HAND" or "AUTO" position, PDB 101 overload shutdown condition will shut down PDB 101.
- [13] If PDB 101, PDB 201, and PDB 301 switch is in "OFF" position, AC 901 and AC 1001 will operate in "HAND" position, not in "AUTO" position.
- [14] If PDB 201 switch is in "HAND" or "AUTO" position, PDB 201 overload shutdown condition will shut down PDB 201.
- [15] If PDB 301 switch is in "HAND" or "AUTO" position, PDB 301 overload shutdown condition will shut down PDB 301.
- [16] Alarm condition for OS/OT 001 and OS/OT 401 will need to be manually reset before PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and thermal oxidizer ThermOx can restart.
- [17] Alarm condition for PS/PT 401, PS/PT 701, PS/PT 702 and PS/PT 2001 and PS/PT 2002 will need to be manually reset before PDB 101, PDB 201, PDB 301, AC 901, AC 1001 and ThermOx can restart.
- [18] Alarm condition for TP 101 overload will need to be manually reset before TP 101 and PDB 101 can restart.
- [19] If TP 101 switch is in "HAND" or "AUTO" position, TP 101 overload shutdown condition will shut down PDB 101.
- [20] If TP 101 switch is in "OFF" position, PDB 101 will operate in "HAND" position, not in "AUTO" position.
- [21] If TP 101, TP 201, and TP 301 switches are in "OFF" position, PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, and ThermOx will operate in "HAND" position, not in "AUTO" position.
- [22] If any two transfer pump (TP 101, TP 201, TP 301) switches are in "HAND" or "AUTO" position, an overload shutdown condition (from any two TP's) will shut down the corresponding PDB's, AC 901 and AC 1001, if they are in "AUTO" position.
- [23] If TP 201 switch is in "HAND" or "AUTO" position, TP 201 overload shutdown condition will shut down PDB 201.
- [24] If TP 201 switch is in "OFF" position, PDB 201 will operate in "HAND" position, not in "AUTO" position.
- [25] Alarm condition for TP 201 overload will need to be manually reset before TP 201 and PDB 201 can restart.
- [26] If TP 301 switch is in "HAND" or "AUTO" position, TP 301 overload shutdown condition will shut down PDB 301.
- [27] If TP 301 switch is in "OFF" position, PDB 301 will operate in "HAND" position, not in "AUTO" position.
- [28] Alarm condition for TP 301 overload will need to be manually reset before TP 301 and PDB 301 can restart.
- [29] If TP 701, TP 702, TP 703, and TP 704 switches are in "HAND" or "AUTO" position, any TP 701, TP 702, TP 703 or TP 704 overload shutdown conditions will shut down PDB 101, PDB 201, PDB 301, AC 901, AC 1001, and ThermOx respectively, if they are in "AUTO" position.
- [30] If TP 701, TP 703, or TP 704 switch is in "OFF" position, PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, and thermal oxidizer ThermOx will operate in "HAND" position, not in "AUTO" position.
- [31] TP 702 will only run under manual operation, and will be controlled with an On/Off switch.
- [32] Alarm condition for FS 901, FS 1001 will need to be manually reset before AC 901 and AC 1001 can restart.
- [33] Alarm conditions for AC 901 and AC 1001 overload will need to be manually reset before AC 901 and AC 1001 can restart.
- [34] If AC 901 switch is in "HAND" or "AUTO" position, AC 901 overload shutdown condition will shut down AC 901.
- [35] If AC 1001 switch is in "HAND" or "AUTO" position, AC 1001 overload shutdown condition will shut down AC 1001.
- [36] Faulty MV 2001/MV 3001 alarm condition - If MV 2001/MV 3001 is faulty, shut down AC 901 and AC 1001, and send alarm notification. Also, MV 2001 receives a signal to open/close sent from TS/TC/TT 2002.
- [37] Alarm condition for TT/TC/TS 2001 will need to be manually reset before AC 901, AC 1001 can restart.
- [38] The General alarm condition for PID 701, high building temperature alarm, the trailer oxygen sensor alarm, and SS 701, will need to be manually reset before the entire system (both the T-SVE and EABR systems) can restart. Also, under normal operating mode (on "AUTO"), the entire system will only operate if the PID meter/transmitter is reading 15 ppm, the building temperature alarm is reading <120° F, and the building oxygen sensor alarm is reading <23% or >19% oxygen.
- [39] The General alarm condition for thermal oxidizer Therm 501 will need to be manually reset before the entire system (both the SVE and AI systems) can restart. Also, under normal operating mode (on "AUTO"), the entire system will only operate if thermal oxidizer ThermOx is operating.
- [40] When TP 101 or TP 201, TP 301, TP 701, TP 702, TP 703, TP 704, PDB 101, PDB 201, PDB 301, AC 901, AC 1001, and AS 701 switch is in "OFF" position, the corresponding motor will remain off.
- [41] MBFV 701 has a five second delay in opening/closing after the open closed signal sent from LS 710 or LS 711, with no alarm conditions present.
- [42] When PDB 101, PDB 201 and PDB 301 switches are in "AUTO" position, operation of AC 901 or AC 1001 will start PDB 101, PDB 201, and PDB 301, unless PDB 101, PDB 201, or PDB 301 is shut down due to any alarm condition that requires manual reset.
- [43] On power up with no active alarms and all HOA switches in "AUTO" position.
- [44] Shut down of AC 901 and AC 1001 (AI system), will not shut down PDB 101, PDB 201, and PDB 301 (SVE system).
- [45] AC 901 and AC 1001 will only operate if two or more PDBs (PDB 101, PDB 201, PDB 301) are operating.
- [46] Shutdown of AC 901 will not shutdown AC 1001, and vice versa.
- [47] All analog data signals will be sent to the remote telemetry system through the control panel.
- [48] Total run time/hour meter can either be an analog device or a digital input signal (to PLC) to provide/calculate motor run time in hours for remote telemetry system.
- [49] Analog data signals from DO, TV's and WT's, and TAH 403 will be sent to the remote telemetry system through the control panel and recorded to a hard drive.
- [50] Beacon/strobe light will signal for all alarm conditions. One to be mounted inside treatment building, and another to be mounted external to the treatment building.
- [51] Audible alarm will be mounted inside the building, and will sound when the system alarms and shuts down.
- [52] Entire system will only operate if MBFV 501 is open.
- [53] Faulty SV2001/3001 alarm condition - If SV2001/3001 is faulty, shut down entire system.
- [54] Faulty MV 3001 alarm condition - If MV 3001 is faulty, shut down AC 901 and AC 1001, and send alarm notification. Also, MV 3001 receives a signal to open/close sent from TC/TT 2001.
- [55] PDB 101, 201, 301 cannot operate without a ready signal from the thermox unit, indicating it is at operating temperature.
- [56] TC/TT 2001 controls MV 3001, increasing/decreasing the amount of steam entering HE 3001, with a desired operational temp of 212°C. MV 3001 adjustment is made in 5% increments, each with a 60 second delay.
- [57] TC/TT 2002 controls MV 2001, increasing/decreasing the amount of steam entering the AI line with a desired operational temp of 212°C. MV 2001 adjustment is made in 5% increments, each with a 60 second delay.

General Notes:

1. Refer to Figure 19 for the SVE system process equipment details.
2. Refer to Figure 20 for the Air Injection (AI) system process equipment details.
3. All system controls are to be housed in one or two control panels.
4. Indicator lights on the control panel shall indicate all alarm conditions.
5. All alarm conditions/system shutdown events and analog inputs/outputs are to be logged via the remote telemetry system. The logging frequency/interval for the analog inputs/outputs is to be determined.

General Control Logic:

1. The SVE and AI systems will have independent system skids interlocked with each other, as specified in this table.
2. The AI system will be interlocked with the SVE system and will not operate without the SVE system operating. Under normal operating mode, any shutdown/shutoff condition of the SVE will shut down the AI system. Under normal operating mode, shutdown of the AI system will not shutdown the SVE system.
3. The AI and SVE system will include an air stripper for treatment of moisture generated by the SVE system and a Thermal Oxidation unit to be located near the exterior of the equipment container will treat the vapor stream.
4. The entire system (both the SVE and the AI systems) will be interlocked with the thermal oxidizer and will not operate without the thermal oxidizer operating. Under normal operating mode, any shutdown/shutoff condition of the thermal oxidizer will shut down the entire system. Also, the Thermal Oxidizer will not operate for more than 30 minutes without at least one of the SVE blowers operating. Shut down of all three SVE blowers, simultaneously, will shut down the Thermal Oxidizer.

TABLE 15
General System Control Specifications
 W.G. Krummrich Facility, Sauget, Illinois

Component	Specifications
Programmable Logic Controller (PLC) & System Control Panel	The operation of the AI and SVE system will be controlled through a PLC. The PLC will be housed in a wall-mounted control panel. Controls/interlocks/alarm conditions for all the AI and SVE process equipment, will be located in the control panel. The emergency shut-off for the AI and SVE system will also be provided on the control panel, and inside the treatment building, and on an external wall of the treatment building.
	The control panel is required to be Underwriter Laboratories, Inc. (UL) listed. All major equipment will be installed with Hand/Off/Auto (HOA) switches and panel lights to indicate operational status. Alarm indicator lights with first fault lockout will be provided for all major equipment and process sensors/switches. These alarm lights for the SVE and AI systems should be arranged separately and labeled on the control panel. All resets for motors/alarm/switches etc. must be accessible on the front of the panel if power is required to be reset.
	All AI and SVE process equipment will be powered by the control panel. The SVE and AI systems will have independent system skids interlocked with each other, as specified in Table D-3.
	The AI system will be interlocked with the SVE system and will not operate without the SVE system operating (at a minimum, 2 of the 3 SVE blowers need to be operating). Under normal operating mode, any shutdown/shutoff condition of more than one of the SVE blowers will shut down the AI system. Under normal operating mode, any shutdown/shutoff condition of the AI system, will not shut down the SVE system.
	The control panel will be powered by an independent electrical panel. The electrical panel will be installed by others (not included in this RFP). The electrical power requirements (i.e., total amperage, voltage, and phase requirements) for the control panel and the process equipment and all field wiring shall be clearly indicated and specified by the vendor.
	The entire system (both the SVE and the AI systems) will be interlocked with the thermal oxidizer and scrubber (installed by others) and will not operate without the thermal oxidizer operating. Under normal operating mode, any shutdown/shutoff condition of the thermal oxidizer will shut down the entire system. Also, the Thermal Oxidizer will not operate for more than one (1) hour without at least one of the SVE blowers operating. Shut down of all three SVE blowers will shut down the Thermal Oxidizer and scrubber.
	The AI system will also utilize steam (provided by others) to increase subsurface temperatures in the injection treatment area. A motorized valve will be controlled by an analog temperature transmitter/controller, and will open/close the motorized valve in 5% increments, to adjust the injection temperature. If the motorized valves are faulty, this will shut the AI system down.
	The entire system (both the SVE and the AI systems) will be interlocked with the Thermox %LEL meter and will not operate without a %LEL reading of <25%. Under normal operating mode, any reading >25% (over a 5 minute period) will trigger a shutdown/shutoff condition of the entire AI and SVE system. Also, the entire system (both the SVE and the AI systems) will be interlocked with the O2 Sensor and will not operate without an O2% reading of <30%. Under normal operating mode, any reading >23.5% (over a 5 minute period) will trigger a shutdown/shutoff condition of the entire AI and SVE system.
	The entire system (both the SVE and the AI systems) will be interlocked with the Building General Temperature Alarm and will not operate without a temperature reading of <120° F. Under normal operating mode, any reading >120° F (over a 5 minute period inside the equipment building) will trigger a shutdown/shutoff condition of the entire AI and SVE system. The alarm thermostat needs to be adjustable between 0-150° F.
The entire system (both the SVE and the AI systems) will be interlocked with high VOC sensor/transmitter PID701 and will shut down entire system and provide alarm notification in the event of building/container high VOC PPM shutdown/shutoff condition. Alarm will sound for detection levels between 1.0 - 15 ppm, and system will shutdown at any level >15 ppm. Alarm conditions for the high VOC PPM alarm will need to be manually reset before the entire system can restart.	
The entire system (both the SVE and the AI systems) will be interlocked with Seismic Sensor SS701 and will shut down and provide alarm notification in the event of any seismic incident of magnitude 5.0 or greater within a 60 mile radius.	
Remote Telemetry System	The AI and SVE system operational status and process analog data (i.e., air flow rate, vacuum, pressure, and temperature, etc.) will be monitored remotely via a telemetry system (graphical operator interface package) installed in the system control panel. The remote telemetry system will also have the ability to log all the process analog data, change the logging frequency, and allow the process analog data to be downloaded/emailed. The telemetry system will be interfaced using a cell phone line connection.
Autodialer	A system alarm autodialer with battery backup will be provided to callout in event of system shutdown/alarm conditions. The autodialer will be housed in the control panel with inputs for all alarm conditions for the system.

AI - Air Injection
 HOA - Hand/Off/Auto
 PLC - Programmable Logic Controller
 RFP - Request for Proposal
 SVE - Soil Vapor Extraction
 UL - Underwriter Laboratories

Notes:

1. System control panel, PLC, remote telemetry system, and autodialer will be selected and designed by the vendor with approval.
2. Refer to Figures C-1 & C-2 for the SVE and AI process equipment schematics, respectively.

Table 16
ThermOx System Specifications
 W.G. Krummyrich Facility, Sauget, Illinois

Specification	ThermOx Unit
Flow Capacity	4,000 scfm
Minimum Air Flow Rate	2,000 scfm
Target COCs	Chlorobenzenes ^[1]
Maximum Operating Temperature	1,650 deg F
Design Temperatures:	
Minimum Operating Temperature	1,500 deg F
Thermal Operating	1,550 deg F
Theoretical Maximum Chlorobenzene Concentrations ^[2]	2,600 ppmv (20% LEL)
Natural Gas Consumption Rate:	
With Heat Exchanger	1.7 MM BTUH
Destruction Efficiency:	
Thermal Mode	98%

ThermOx - Thermal oxidizer
 scfm - Standard cubic feet per minute
 COC - Constituent of concern
 deg F - degrees Fahrenheit

ppmv - Parts per million by volume
 % - Percent
 LEL - Lower explosion limit
 MM BTUH - Million British thermal units per hour

Notes:

[1] The target COCs include monochlorobenzene, 1,2-dichlorobenzene (1,2-DCB), 1,3-DCB, 1,4-DCB, 1,2,4-trichlorobenzene (1,2,4-TCB), and benzene.

[2] The theoretical maximum treatment concentration is determined by the LEL capacity of the ThermOX unit. The LEL for chlorobenzene is 13,000 ppmv; typical operating capacity is 20% LEL under thermal conditions (2,600 ppmv).

- Thermox must be designed in accordance with NFPA 86.
- Burner Management System (BMS) must be design in accordance with NFPA 85. BMS must also include a "self checking" flame strength/flame scanner that shuts the system down if a flame issue exists.
- Thermox will be designed to <85dBA at 10 feet.
- A natural gas meter is required at the burner inlet.
- If the LEL meter fails for any reason, this will trigger a shutdown condition.

**Table 17
General Specifications**

Solutia Inc. W.G. Krummrich Facility, Sauget, Illinois

Item	Action	Notes
General		
Trip hazards	Mark pipes or other obstructions that are a potential trip hazard with high visibility paint or tape.	Most piping will be elevated 2-3 ft above grade, or will be installed below grade, and will not present a tripping hazard
P&ID drawings	Laminated copies (C or D size as needed) on-site.	P&IDs will be posted inside the equipment enclosure for reference
Equipment/site security and access	All control panels, gates, doors, etc. will have capability to be locked.	Extra keys Specified in the Construction and Equipment RFP stage. Copies of all keys will be provided to the facility.
Fire Extinguishers	Fire Extinguishers will be located both indoors and outdoors and will be of appropriate type and capacity for minor fires	Equipment will be inspected regularly per OM&M manual.
Outdoor area lighting	Area lights provided outside equipment container/building.	
Equipment labels	All equipment, valves, gauges, ports, etc. will be labeled in accordance with the P&ID.	
Building/Container		
Doors	Two routes in egress (minimum) will be provided.	36" minimum per NFPA101
Emergency flash light	Mounted battery or rechargeable flash light.	
Emergency lights inside container/building	Emergency lights and glow-in-the-dark egress route outlined on floor.	
Eyewash stations	Eyewash stations will be provided.	
Alarm Beacon	Mounted outside and inside of containers/building.	If system is in alarm, flashing beacon can notify area personnel. System autodialer will provide notification to system operators remotely.
Safety shower (Optional)	Safety shower with reservoir.	If requested by Solutia. Very low splash potential.
Sample port/atmosphere check	A VOC monitor will be installed in the building to allow for an atmosphere check prior to building entry.	PID 701
Cellular telephone	Cellular phone line in the building. If phone line connection is interrupted, shut system down.	A cellular type telemetry connection will be provided for the autodialer/telemetry connection. A full-time hard line for phone will be supplied.
Equipment		
Battery backup on autodialer	Vendor specified.	
Cam locks/quick disconnect fittings	Zip-tie fittings (or similar) all flex hose connections to prevent accidental disconnection.	
Carbon filter and flame arrestor on passive vapor vents	All vapor vents to a carbon filter affixed with a flame arrestor; vendor selected with approval.	
Coupling guards on transfer pumps	Rotating pump parts will have coupling guards; vendor selected with approval and installed.	
Drain plugs	Plug all drain valves (AMS, OWS, bag filter).	
External resets for control panels	All control panels must have a reset button accessible on the outside of the panel.	
Earthquake	ThermOx units and containers will be tied down	SS701
Flow totalizer on AS discharge	Digital flow totalizer available via telemetry	
Grounding	All equipment and NAPL drum(s) will be grounded; vendor specified.	
Level switch labels	All level switches will be clearly labeled.	
Lightning rod	ThermOx must be affixed with a lightning rod; vendor specified.	
Lock combustion air valve on ThermOx unit	Bolt installed on the combustion air valve with "DO NOT ADJUST" signage; vendor installed.	
NAPL drum(s) secondary containment	NAPL drum storage to include secondary containment.	
Noise levels	Noise levels will be measured and areas exceeding 85 dB (@ 10 feet) will be placarded and "Hearing Protection Required" placarding will be placed	ThermOx area and inside equipment building required hearing protection.
Pipe flow direction and labels	All piping will be labeled with contents (air/water), flow direction (arrows), temperature (HOT); vendor to label.	
Pipe insulation	Pipes that will be HOT (i.e. blower discharge, air compressor discharge) will be insulated; vendor specified.	
Sample ports accessibility	All sample ports will be accessible without the use of ladder, extend sample ports if necessary.	
Manifold Piping, Well, and Vapor Probe Installation.		
High visibility vapor probe markings	Vapor probes will be clearly marked with high visibility tape/paint to prevent slips/trips/falls hazard.	Vapor probes will be constructed via flush mount manholes or as stick-ups and marked accordingly.
Well labels	All wells will be permanently labeled (tag or similar).	Field mark able metal tags (or similar) to be used to mark all wells.

AI - Air Injection
AMS - Air moisture separator
"Hg - inches of mercury
LEL - Lower explosive limit

NAPL - Non-aqueous phase liquids
OWS - Oil water separator
P&ID - Process and Instrumentation Diagram
RFP - Request for proposals

SVE - Soil vapor extraction
ThermOx - Thermal oxidation treatment unit
OM&M - Operations, maintenance, and monitoring

TABLE 18
Electrical Load Summary Table
 W.G. Krummrich Facility, Sauget, Illinois

LOAD DESCRIPTION	HP	VOLTAGE ^[1]	TOTAL AMPS	L1 AMPS	L2 AMPS	L3 AMPS	Notes
SP-1 (Supplied by Others)							
T-SVE EQUIPMENT PANEL							
High Flow SVE Blower 1 (1,000 scfm @ 10" Hg to 12" Hg)	60	460	77	77	77	77	FLA
High Flow SVE Blower 2 (1,000 scfm @ 10" Hg to 12" Hg)	60	460	77	77	77	77	FLA
High Flow SVE Blower 3 (1,000 scfm @ 10" Hg to 12" Hg)	60	460	77	77	77	77	FLA
AWS Transfer Pumps - 3 pumps (2 hp each)	2	460	10.2	10.2	10.2	10.2	
OWS Transfer Pump	2	460	3.4	3.4	3.4	3.4	
NAPL Transfer Pump	0.75	460	1.4	1.4	1.4	1.4	
Equalization Tank Transfer Pump	2	460	3.4	3.4	3.4	3.4	
Air Stripper Blower	3	460	4.8	4.8	4.8	4.8	
Air Stripper Transfer Pump	2	460	3.4	3.4	3.4	3.4	
AI Blower 1 (1,000 scfm capacity @ 10 PSI)	100	460	124	124	124	124	FLA
AI Blower 1 (1,000 scfm capacity @ 10 PSI)	100	460	124	124	124	124	FLA
XP Building Heater	3600W	460	12.9	12.9	12.9	12.9	
XP Building Heater	3600W	460	12.9	12.9	12.9	12.9	
5kVA Transformer for Secondary Loads	5000VA	460	10.4	10.4	--	10.4	Controls/outlets, etc. at 110V
Total 460V Amperage			542	542	531	542	
SP-2 (Supplied By Contractor)							
OUTDOOR LIGHTING PANEL							
Outdoor Area Light (High Pressure Sodium/400W/277V)	400W	277	6.0	6.0	--	--	
Outdoor Area Light (High Pressure Sodium/400W/277V)	400W	277	6.0	--	6.0	--	
Outdoor Area Light (High Pressure Sodium/400W/277V)	400W	277	6.0	--	--	6.0	
Outdoor Area Light (High Pressure Sodium/400W/277V)	400W	277	6.0	--	6.0	--	
Total 460V Amperage			12	6	12	6	
SP-3 (Supplied By Contractor)							
HEAT TRACE PANEL							
Heat Trace (1,000 feet total pipe length @ 3-5 Wat/Ft)	5,000W	277	20.0	20.0	--	--	Estimation conservatively based on 5 watts/ft.
Heat Trace (1,000 feet total pipe length @ 3-5 Wat/Ft)	5,000W	277	20.0	--	20.0	--	Estimation conservatively based on 5 watts/ft.
Heat Trace (1,000 feet total pipe length @ 3-5 Wat/Ft)	5,000W	277	20.0	--	--	20.0	Estimation conservatively based on 5 watts/ft.
Heat Trace (1,000 feet total pipe length @ 3-5 Wat/Ft)	5,000W	277	20.0	20.0	--	--	Estimation conservatively based on 5 watts/ft.
Heat Trace (1,000 feet total pipe length @ 3-5 Wat/Ft)	5,000W	277	20.0	--	20.0	--	Estimation conservatively based on 5 watts/ft.
Heat Trace (1,000 feet total pipe length @ 3-5 Wat/Ft)	5,000W	277	20.0	--	--	20.0	Estimation conservatively based on 5 watts/ft.
Heat Trace (1,000 feet total pipe length @ 3-5 Wat/Ft)	5,000W	277	20.0	20.0	--	--	Estimation conservatively based on 5 watts/ft.
Heat Trace (1,000 feet total pipe length @ 3-5 Wat/Ft)	5,000W	277	20.0	--	--	20.0	Estimation conservatively based on 5 watts/ft.
Total 460V Amperage			60	60	40	60	
SP-4 & SP-5 (Supplied By Others)							
THERMOX and SCRUBBER PANEL							
ThermOx / Scrubber Fans (4,000 scfm)	40	460	52	52	52	52	FLA. Total hp includes process blower (30 hp), combustion air (5 hp) and cooling air (5 hp) fans.
5kVA Transformer for Secondary Loads	5000VA	460	10.4	10.4	--	10.4	Controls, heat trace, etc. at 110V
Total 460V Amperage			62	62	52	62	
SP-6 (Supplied By Others)							
EABR PANEL							
Total 460V Amperage			35	35	35	35	
460V Loads							
SP-1			542				
SP-4 & 5			62				
SP-6			35				
277V Loads							
SP-2 & 3 (277V)			72				
kVA of SP-2 & 3			35				
460V Current from 277V Loads			43				
Total 460V Load			683				

SVE = soil vapor extraction
 scfm = standard cubic feet per minute
 " Hg = inches of mercury
 FLA = full load amps
 hp = horse power

W/ft = watts per foot
 A = amps
 VA = voltage-amps
 PSI = pounds per square inch
 W = watts

Note:
 [1] Electrical utility service voltage available in the vicinity of the treatment area is 480 Volt, 3 phase, power. Actual system design electrical specifications to be determined.