

US EPA ARCHIVE DOCUMENT

**Tables**

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

<b>EABR Target Treatment Area (15 to 30 ft bgs)</b>		
Contaminant of Concern	Maximum Soil Concentration (mg/kg)	
<i>Depth</i>	<i>15 to 22 ft bgs</i>	<i>22 to 30 ft bgs</i>
Chlorobenzene	13,000	24,000
1,2-Dichlorobenzene	10,000	6,100
1,3-Dichlorobenzene	680	520
1,4-Dichlorobenzene	11,000	6,500
Benzene	6,400	7,500
1,2,4-Trichlorobenzene	660	1,600

COC - Contaminant of concern  
 EABR - Enhanced aerobic bioremediation  
 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

<b>EABR Target Treatment Area (15 to 30 ft bgs)</b>		
Contaminant	Contaminant Mass (lbs)	
<i>Depth</i>	<i>15 to 22 ft bgs</i>	<i>22 to 30 ft bgs</i>
Chlorobenzene	56,600	100,100
1,2-Dichlorobenzene	49,800	45,700
1,3-Dichlorobenzene	1,300	2,200
1,4-Dichlorobenzene	47,100	42,800
Benzene	10,300	11,600
1,2,4-Trichlorobenzene	8,100	10,100
<b>TOTAL CONTAMINANT MASS</b>	<b>386,000</b>	

EABR - Enhanced aerobic bioremediation  
 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**  
**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 <sup>[1]</sup> (ft)	Casing Elevation <sup>[1]</sup> (ft)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Top of Screen Elevation <sup>[1]</sup> (ft)	Bottom of Screen Elevation <sup>[1]</sup> (ft)	Depth to Water (ft btoc)	Water Elevation <sup>[1]</sup> (ft)
<b>Shallow Hydrogeologic Unit (SHU 395-380 feet NAVD 88)</b>										
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
<b>Deep Hydrogeologic Unit (DHU 350 feet NAVD 88 - Bedrock)</b>										
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**  
**EABR System Design Overview**  
 Former Chlorobenzene Process Area  
 W.G. Krummich Facility, Sauget, Illinois

Parameter	Value	Notes
Total Number of EABR Wells	191	71 shallow, 120 deep injection locations.
Total Number of Piezometers	23	11 shallow, 12 deep locations.
EABR Well Screens	Shallow = 21-23.5 feet bgs Deep = 29-31.5 feet bgs	Actual well screen placement will be adjusted based on actual geological conditions encountered.
Piezometer Well Screens	Shallow = 17-22 feet bgs Deep = 25-30 feet bgs	
EABR Well Spacing	40 feet between rows 30 feet center-to-center within rows	Rows are placed 40 feet apart in direction of groundwater flow (generally westerly). Wells have 30-foot center to center spacing within each row.
Oxygen Injection Rates	3 to 5 scfm per well (average). Maximum well head pulse rates up to 10 scfm can be applied, if needed to increase oxygen distribution.	Total system flow will be 30 scfm on average, with maximum total pulse capacity of 50 scfm.
Well Groups	30 groups containing 4 to 8 well each; only 1 well “on” from a group at a time; approximately 10 wells (1 each from 10 group) “on”, while others are “off”.	System manifolding will allow injecting and controlling flow into individual wells. At any given time, approximately 10 wells (one each from a group) will operate simultaneously.
Oxygen Injection Mode	Pulsing of between 10 and 30 minutes “on” and 2 to 8 hours “off” (Startup: 15 minutes “on” 6 hours “off”)	Oxygen injection will be conducted using a pulsing “on/off” cycle approach which involves injecting into 10 wells at a time.
Injection Pressure	Shallow 3 to 17 psig Deep 6 to 24 psig	Wellhead injection pressures will be limited to below the upper end of the pressure range to prevent the potential of subsurface fracturing.

Notes:

scfm = Standard cubic feet per minute

feet bgs = feet below ground surface

psig = pounds per square inch gauge pressure

**Table 5**  
**EABR Well Construction Details**  
Former Chlorobenzene Process Area  
Solutia Inc., W.G. Krummrich Facility, Sauget, Illinois

Oxygen Injection Well ID	Shallow EABR Wells				Proposed Drilling Method	Deep EABR Wells				Proposed Drilling Method
	Screened Interval (feet bgs)	Blind Sump Interval (feet bgs)	Filter Pack Interval (feet bgs)	Bentonite Seal Interval (feet bgs)		Screened Interval (feet bgs)	Blind Sump Interval (feet bgs)	Filter Pack Interval (feet bgs)	Bentonite Seal Interval (feet bgs)	
E-A1						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-A2						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-A3	18.5 - 21.0	21.0 - 23.0	17.5 - 23.0	14.5 - 17.5	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-A4	18.5 - 21.0	21.0 - 23.0	17.5 - 23.0	14.5 - 17.5	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-A5	19.0 - 21.5	21.5 - 23.5	18.0 - 23.5	15.0 - 18.0	DPT					
E-A6	19.0 - 21.5	21.5 - 23.5	18.0 - 23.5	15.0 - 18.0	DPT					
E-B1						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-B2						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-B3	18.5 - 21.0	21.0 - 23.0	17.5 - 23.0	14.5 - 17.5	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-B4						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-B5	18.5 - 21.0	21.0 - 23.0	17.5 - 23.0	14.5 - 17.5	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-B6	20.0 - 22.5	22.5 - 24.5	19.0 - 24.5	16.0 - 19.0	DPT					
E-C1						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-C2						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-C3						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-C4						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-C5						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-C6						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-C7						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D1						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D2						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D3						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D4						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D5	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D6	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D7						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D8						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-D9						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E1						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E2						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E3						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E4						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E5						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E6						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E7						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E8						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-E9						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F1*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT					
E-F2*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F3*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F4						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F5						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F6						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F7						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F8						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F9						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F10						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-F11						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G1	19.0 - 21.5	21.5 - 23.5	18.0 - 23.5	15.0 - 18.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G2						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G3						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G4	19.0 - 21.5	21.5 - 23.5	18.0 - 23.5	15.0 - 18.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G5*	19.0 - 21.5	21.5 - 23.5	18.0 - 23.5	15.0 - 18.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G6*	22.0 - 24.5	24.5 - 26.5	21.0 - 26.5	18.0 - 21.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G7						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-G8	18.5 - 21.0	21.0 - 23.0	17.5 - 23.0	14.5 - 17.5	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G9						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-G10*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-H1*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-H2*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-H3*	23.0 - 25.5	25.5 - 27.5	22.0 - 27.5	19.0 - 22.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-H4*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT

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**Table 5**  
**EABR Well Construction Details**  
Former Chlorobenzene Process Area  
Solutia Inc., W.G. Krummrich Facility, Sauget, Illinois

Oxygen Injection Well ID	Shallow EABR Wells					Proposed Drilling Method	Deep EABR Wells				Proposed Drilling Method
	Screened Interval (feet bgs)	Blind Sump Interval (feet bgs)	Filter Pack Interval (feet bgs)	Bentonite Seal Interval (feet bgs)	Screened Interval (feet bgs)		Blind Sump Interval (feet bgs)	Filter Pack Interval (feet bgs)	Bentonite Seal Interval (feet bgs)		
E-H5*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-H6*	22.0 - 24.5	24.5 - 26.5	21.0 - 26.5	18.0 - 21.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-H7*	22.0 - 24.5	24.5 - 26.5	21.0 - 26.5	18.0 - 21.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-H8	20.0 - 22.5	22.5 - 24.5	19.0 - 24.5	16.0 - 19.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-H9						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-H10						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-H11*	16.0 - 18.5	18.5 - 20.5	15.0 - 20.5	12.0 - 15.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-H12*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic						
E-I1*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-I2*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-I3*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-I4*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-I5*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-I6*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-I7						26.0 - 28.5	28.5 - 30.5	25.0 - 30.5	22.0 - 25.0	Sonic	
E-I8*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-I9*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-I10						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-I11*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-I12*	18.0 - 20.5	20.5 - 22.5	17.0 - 22.5	14.0 - 17.0	Sonic						
E-I13	18.0 - 20.5	20.5 - 22.5	17.0 - 22.5	14.0 - 17.0	Sonic						
E-J1*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-J2	22.0 - 24.5	24.5 - 26.5	21.0 - 26.5	18.0 - 21.0	Sonic	27.0 - 29.5	29.5 - 31.5	26.0 - 31.5	23.0 - 26.0	Sonic	
E-J3	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT						
E-J4	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT						
E-J5	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT						
E-J6						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-J7*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-J8*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-J9						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-J10						27.5 - 30.0	30.0 - 32.0	26.5 - 32.0	23.5 - 26.5	DPT	
E-J11*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	27.5 - 30.0	30.0 - 32.0	26.5 - 32.0	23.5 - 26.5	DPT	
E-J12	19.5 - 22.0	22.0 - 24.0	18.5 - 24.0	15.5 - 18.5	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-J13	20.5 - 23.0	23.0 - 25.0	19.5 - 25.0	16.5 - 19.5	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-K1*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic						
E-K2*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic						
E-K3*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT						
E-K4*	22.0 - 24.5	24.5 - 26.5	21.0 - 26.5	18.0 - 21.0	DPT						
E-K5	24.0 - 26.5	26.5 - 28.5	23.0 - 28.5	20.0 - 23.0	DPT						
E-K6*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-K7*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-K8*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-K9						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-K10						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-K11						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-K12						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-L1*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-L2*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	DPT	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-L3*	18.5 - 21.0	21.0 - 23.0	17.5 - 23.0	14.5 - 17.5	Sonic						
E-L4*	22.0 - 24.5	24.5 - 26.5	21.0 - 26.5	18.0 - 21.0	DPT						
E-L5*	23.0 - 25.5	25.5 - 27.5	22.0 - 27.5	19.0 - 22.0	DPT						
E-L6*	23.0 - 25.5	25.5 - 27.5	22.0 - 27.5	19.0 - 22.0	DPT						
E-L7*	23.0 - 25.5	25.5 - 27.5	22.0 - 27.5	19.0 - 22.0	DPT						
E-L8*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-L9*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-L10*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic	
E-L11						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-L12						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-L13						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-L14						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT	
E-M1*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic						
E-M2*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic						

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**Table 5**  
**EABR Well Construction Details**  
Former Chlorobenzene Process Area  
Solutia Inc., W.G. Krummrich Facility, Sauget, Illinois

Oxygen Injection Well ID	Shallow EABR Wells				Proposed Drilling Method	Deep EABR Wells				Proposed Drilling Method
	Screened Interval (feet bgs)	Blind Sump Interval (feet bgs)	Filter Pack Interval (feet bgs)	Bentonite Seal Interval (feet bgs)		Screened Interval (feet bgs)	Blind Sump Interval (feet bgs)	Filter Pack Interval (feet bgs)	Bentonite Seal Interval (feet bgs)	
E-N1*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic					
E-N2*	22.0 - 24.5	24.5 - 26.5	21.0 - 26.5	18.0 - 21.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-N3*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-N4*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic					
E-O1*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-O2*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-O3	18.0 - 20.5	20.5 - 22.5	17.0 - 22.5	14.0 - 17.0	DPT					
E-O4	19.0 - 21.5	21.5 - 23.5	18.0 - 23.5	15.0 - 18.0	DPT					
E-P1*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-P2*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-P3*	21.0 - 23.5	23.5 - 25.5	20.0 - 25.5	17.0 - 20.0	Sonic	29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-P4*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
E-P5*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-P6*						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	Sonic
E-Q1						26.0 - 28.5	28.5 - 30.5	25.0 - 30.5	22.0 - 25.0	Sonic
E-Q2*						25.5 - 28.0	28.0 - 30.0	24.5 - 30.0	21.5 - 24.5	Sonic
E-Q3						24.5 - 27.0	27.0 - 29.0	23.5 - 29.0	20.5 - 23.5	Sonic
E-Q4*						25.5 - 28.0	28.0 - 30.0	24.5 - 30.0	21.5 - 24.5	Sonic
E-Q5*						25.5 - 28.0	28.0 - 30.0	24.5 - 30.0	21.5 - 24.5	DPT
E-Q6						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
EQ-7						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT
EQ-8						29.0 - 31.5	31.5 - 33.5	28.0 - 33.5	25.0 - 28.0	DPT

**Notes:**

All EABR wells will be finished with a stick-up casing approximately three feet above grade.

ft bg = feet below grade.

Well designations will end with an S or D to indicate whether they are screened in a shallow or deep depth interval.

ID = Identification

DPT = Direct Push Technique

Sonic = Rotosonic Drilling Method

= Boring Location

\* = Based on the results of the borings completed at the locations denoted with the orange shading, one of three actions will be taken

1. The well screen interval will be adjusted at this location.
2. The drilling method used to install the well at this location could be changed (DPT or Sonic).
3. A shallow or deep well at this location could be added or eliminated.

**Table 6**  
**Piezometer Construction Details**  
 Former Chlorobenzene Process Area  
 Solutia Inc., W.G. Krummrich Facility, Sauget, Illinois

Oxygen Injection Well ID	Designation	Screened Interval (ft bg)	Bentonite Seal Interval (ft bg)	Filter Pack Interval (ft bg)	Blind Sump Interval (ft bg)
PZ-1	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-2	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-3	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-4	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-5	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	--	--	--	--	--
PZ-6	--	--	--	--	--
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-7	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-8	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	--	--	--	--	--
PZ-9	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	--	--	--	--	--
PZ-10	--	--	--	--	--
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-11	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-12	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-13	--	--	--	--	--
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-14	--	--	--	--	--
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0
PZ-15	S	17.0 - 22.0	12.0 - 15.0	15.0 - 24.0	22.0 - 24.0
	D	25.0 - 30.0	20.0 - 23.0	23.0 - 32.0	30.0 - 32.0

**Notes:**

All piezometers will be 2-inch diameter and finished with a stick-up casing approximately three foot above grade.  
 ft bg = feet below grade.  
 Well designations will end with an S or D to indicate whether they are screened in a shallow or deep depth interval.  
 ID = Identification

## Table 7 Injection Pressure Calculation Summary

Former Chlorobenzene Process Area  
Solutia Inc., W.G. Krummrich Facility, Sauget, Illinois

**Assumptions:**

Soil Density	100 lbs/ft.3	100 lbs/ft.3	100 lbs/ft.3
Density of Water	62.4 lbs/ft.3	62.4 lbs/ft.3	62.4 lbs/ft.3
Water Table Depth	5 feet	10 feet	15 feet
Injection Well Screen Intervals	21 to 23.5 and 29 to 31.5 feet bgs	21 to 23.5 and 29 to 31.5 feet bgs	21 to 23.5 and 29 to 31.5 feet bgs

**Soil Pressure:**

*Weight of Soil = (soil depth above screen x density of soil)/(144 in<sup>2</sup>/ft<sup>2</sup>)*

Shallow	(21 feet x 100 lbs/ft3)/144 in2/ft2	14.58 psi
Deep	(29 feet x 100 lbs/ft3)/144 in2/ft2	20.14 psi

**Pressure Due to Water Column:**

*Weight of Water = ((Top of Screen Interval - Water Table Depth) x Density of Water)/(144 in<sup>2</sup>/ft<sup>2</sup>)*

		5 FT	10 FT	15 FT
Shallow	((21 feet - 5 feet) x 62.4 lbs/ft.3)/144 in2/ft2	6.93 psi	4.77 psi	2.6 psi
Deep	((29 feet - 5 feet) x 62.4 lbs/ft.3)/144 in2/ft2	10.40 psi	8.23 psi	6.06 psi

**Total Overlying Pressure:**

		5 FT	10 FT	15 FT
Shallow	14.58 psi + 6.93 psi	21.51 psi	19.35 psi	16.64 psi
Deep	20.14 psi + 10.40 psi	30.54 psi	28.37 psi	26.20 psi

**Maximum Allowable Injection Pressure:**

*Total Pressure x Safety Factor of 0.8*

		5 FT	10 FT	15 FT
Shallow	21.51 psi x 0.8	17.21 psi	15.48 psi	13.31 psi
Deep	30.54 psi x 0.8	24.43 psi	22.7 psi	20.96 psi

**Minimum Pressure Required:**

	5 FT	10 FT	15 FT
Pressure at Shallow Well Due to Water	6.93 psi	4.77 psi	2.60 psi
Pressure at Deep Well Due to Water	10.40 psi	8.23 psi	6.06 psi

	5 FT	10 FT	15 FT
Range Shallow	7 psi to 17 psi	5 psi to 16 psi	3 psi to 13 psi
Range Deep	10 psi to 24 psi	8 psi to 23 psi	6 psi to 21 psi

Reference: Marley, M.C. & Bruell, C.J. 1995. "In Situ Air Sparging: Evaluation of petroleum Industry sites and considerations for applicability, design and operation." API Publication # 4609

**TABLE 8**  
**Nitrogen Purge Gas Requirements**  
 Enhanced Aerobic Bioremediation (EABR) Treatment System  
 Solutia Inc., W.G. Krummrich Facility, Sauget, Illinois

Manifold Volume Calculations			
Pipe Size	Cross-Sectional Area	Length (Est.)	Manifold Volume
	(Square Feet, SF)	(feet)	(Cubic Feet, CF)
1/2-Inch Copper Pipe	0.0014	18,000	25
1.25-Inch Copper Pipe	0.0341	500	17
Total Manifold Volume =			42

Purge Volume Calculations				
Purge Time	Purge Volume	Pipe Volume Exchanges	6-Pack Use	12-Pack Use
(minutes)	(CF)	(Total No.)	(Total No.)	(Total No.)
10	50	1.20	4%	2%
60	300	7.2	22%	11%
240	1,200	28.9	88%	44%
480	2,400	57.7	175%	88%

Nitrogen (N<sub>2</sub>) Purge Rate = 5 standard cubic feet per minute (scfm)

Typical Cylinder Capacities		
Compressed Gas (6-pack) Cylinder	1368	CF
Compressed Gas (12-pack) Cylinder	2736	CF
Typical High Pressure Tube Trailer Capacities		
18-foot tube @ 2640 pounds per square inch gauge (psig)	27000	CF
36-foot tube @ 2,200 psig	53000	CF

**Table 9**  
**Thermal Expansion Calculation Summary**

Former Chlorobenzene Process Area  
W.G.Krummrich Facility, Sauget, Illinois

Temperature Change	Copper Expansion <sup>[1]</sup>	Approximate Length of Longest Pipe Run	Thermal Expansion of Pipe Run
(deg F)	(inches/100 ft)	(ft)	(inches)
25	0.28	670	1.9
50	0.56		3.7
75	0.84		5.6
100	1.12		7.5
150	1.67		11.2

Notes:

[1] Thermal linear expansion data are from:

[http://www.engineeringtoolbox.com/linear-expansion-coefficients-d\\_95.html](http://www.engineeringtoolbox.com/linear-expansion-coefficients-d_95.html)

**Table 10**  
**EABR System Detailed Specifications**

Former Chlorobenzene Process Area  
W.G. Krummrich Facility, Sauget, Illinois

Item/Part	Description	Specification
PR101, 102	Pressure Regulator	Stainless Steel/Brass Pressure Regulator with delivery pressure of 50 psi at flow rates of 50 CFM
CV101, 102	Check Valve, 1.5"	Stainless Steel/Brass/Copper Check Valve
BV001, BV002, BV101 to 110	Ball Valve, 1.5"	Stainless Steel/Brass/Copper Ball Valve
PRV101	Pressure Relief Valve	Stainless Steel/Brass Pressure Relief Valve set at 75 psi
SV001	Solenoid Valve, 1.25"	Stainless Steel/Brass Solenoid Valve - normally closed
SV101, 102	Solenoid Valve, 1.5"	Stainless Steel/Brass Solenoid Valve - normally closed
TT101	Temperature Transducer	Thermocouple temperature range 0 to 120 <sup>o</sup> F
TI101	Temperature Indicator	Thermocouple indicator/guage range 0 to 120 <sup>o</sup> F
FS/FT101	Mass Flow Transducer	Mass Flow Transducer range 0 to 70 SCFM
PT101	Pressure Transducer	Pressure Transducer range 0 to 75 psi
PI101	Pressure Indicator	Pressure Gauge range 0 to 60 psi
OS101, 102	Ambient Oxygen Sensor	Wall-Mounted Oxygen Gas Monitor range 0% to 25%
BV201 to 230	Ball Valve	Stainless Steel/Brass/Copper Ball Valve
MFC201 to 230	Mass Flow Controller	Mass Flow Controller range 0 to 20 SCFM
RM201 to 230	Rotometer	Rotometer flow rate range 1 to 10 CFM (valve open)
PT201 to 230	Pressure Transducer	Pressure Transducer range 0 to 75 psi
FS201 to 230	Flow Switch	Stainless Steel/Brass Flow Switch
SV401 to 591	Solenoid Valve	Stainless Steel/Brass Solenoid Valve
SV601 to 630	Solenoid Valve	SIL Rated Stainless Steel/Brass Solenoid Valve
BV401 to 591	Ball Valve	Stainless Steel/Brass Ball Valve
CV401 to 591	Check Valve	Stainless Steel/Brass Check Valve
VV401 to 591	Vent Ball Valve	Stainless Steel/Brass Ball Valve
PI401 to 591	Pressure Indicator	Pressure Gauge range 0 to 30 psi
PLC	Programmable Logic Control	GuardLogix by Allen-Bradley (or approved equivalent) with a minimum of: - Digital inputs - 38; Digital outputs - 195; Analog inputs - 77; Analog outputs - 30
Panel	Control Panel	With appropriate number of switches, control relays, electrical hook up, alarm strobe light, etc.
Fusible Plug	Temperature Dependent Pressure Relief Plug	1/2"brass NPT temperature dependent pressure relief-rated to 212°F
DO601 to 610	Optical DO Sensor and Transmitter	Stainless Steel Optical Dissolved Oxygen Probe with ~ 600 foot cable

SCFM = Standard cubic feet per minute      psi = pounds per square inch      °F = degrees Fahrenheit

**Notes:**

1. All equipment (i.e., process monitoring devices) to be configured with all manufacturer required specifications.
2. Refer to Figures 13 and 17 for the piping and instrumentation diagrams.
3. All wetted components will be rated and/or cleaned for oxygen service.

**Table 11  
Summary of EABR Input-Output Schedule**

Former Chlorobenzene Process Area  
W.G. Krummrich Facility, Sauget, Illinois

Type	Data	Notes	Description	Function
Digital Inputs	Emergency Stop	[1]	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.
	General Power Failure	[1]	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.
	OS/OT101, 102	[1] [2]	Dual-channel oxygen level transmitter in the distribution building, high level set at 23%, low level set at 19% (alarm condition, also analog input)	Shut down entire system and provide alarm notification. Alarm conditions will need to be manually reset before the entire system can restart.
	PS/PT101	[1] [2]	Pressure switch/pressure transmitter, high level set at 75 psi; low level set at 20 psi (alarm condition, also an analog input)	Shut down EABR System and SV101 when alarm is activated, and notify operator in the event of high or low pressure detection.
	FS201 to 230	[1]	Flow sensor, indicates oxygen flow when solenoids are closed (alarm condition)	Indicates leak or breakage of piping. To ensure that there is no flow when SV401 to 591 are closed. Shall have ~15 second delay to allow oxygen flow to stop. In the event of this alarm, shut down SV101 and notify operator.
	OS/OT 001, 401 (from T-SVE system)	[1] [2]	Oxygen switch/Oxygen transmitter, set at 10% O <sub>2</sub> (alarm condition, also an analog input)	Shut down EABR and T-SVE Systems; SV101, PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, TP701, TP 702, TP 703, TP 704 and AS 701 when activated, and alarm notification in the event of high oxygen detection.
	SS701		Seismic switch for earthquake detection	Monitor and turn system off in the event of an earthquake.
Digital Outputs	SV001	[3]	SV001 main solenoid at O <sub>2</sub> supply tank	In the event of an alarm condition, turn off the the normally closed SV001 to end EABR system operation. Record "on" and "off" events with time stamp.
	SV101, 102		SV101 solenoid permissive operation	Turn on the normally-closed SV101 to start EABR system operation. Record "on" and "off" events with time stamp.
	SV401 to 591		SV401 to 591 solenoid permissive operation	Turn on the normally-closed solenoids for oxygen injection in respective wells. Record "on" and "off" events with time stamp.
	SV601 to 630		SV601 to 630 solenoid permissive operation	Turn on the normally-closed solenoids for oxygen injection in respective wells. Record "on" and "off" events with time stamp.
	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. Record events with time stamp.
	System Operational Status		System operational status to remote telemetry system	Under normal operating conditions, provide system operation status (on/off) to remote telemetry system.
Analog Inputs	TT101		Analog temperature transmitter	Monitor and record the temperature of oxygen being injected
	FT101		Analog oxygen mass flow transmitter (system total)	Monitor and record the total mass flow of oxygen being injected
	PT/PS101	[1] [2]	Analog oxygen header pressure transmitter, alarm set at 75 psi	Monitor and record the pressure of the oxygen header. If pressure exceeds 75 psi, shutdown EABR System and SVE101, and notify operator.
	OS/OT101, 102	[1] [2]	Analog oxygen level transmitter in the distribution building, high level alarm condition set at 23%	Monitor and record ambient oxygen level in the distribution building. If oxygen exceeds 23% in the distribution building, shutdown EABR System and SVE101, and notify operator.
	MFC201 to 230		Analog oxygen mass flow transmitter/controller (also analog output)	Monitor and record the mass flow of oxygen being injected in individual wells. Record along with SV401 to 591 "on" status and time stamps.
	PT201 to 230		Analog pressure transmitter	Monitor and record injection pressure at upstream end of the manifold laterals. Record along with SV401 to 591 "on" status and time stamps.
	OS/OT 001, 401 (from T-SVE system)	[1] [2]	Oxygen switch/Oxygen transmitter, set at 10% O <sub>2</sub> (alarm condition, also an analog input)	Shut down EABR and T-SVE Systems; SV101, PDB 101, PDB 201, PDB 301, AC 901, AC 1001, TP 101, TP 201, TP 301, TP701, TP 702, TP 703, TP 704 and AS 701 when activated, and alarm notification in the event of high oxygen detection.
	DO601 to 610		Analog groundwater dissolved oxygen (DO) level transmitter	Monitor and record groundwater DO via downhole DO loggers transmitting signal to the system.
Analog Outputs	MFC201 to 230		Analog oxygen mass flow controller/transmitter (also analog input)	Establish set point for the oxygen mass flow rate for individual sparge wells when specific SV401 to 591 are on. Also, an analog input to ensure that oxygen is flowing at the specified rate.

**Design Notes:**

- [1] Reset for all the alarm conditions will be located on the control panel.
- [2] Alarm conditions for high oxygen level in the building (OS/OT101), high oxygen header pressure (PT/PS101) and T-SVE high oxygen level (OS/OT001, 401) will need to be manually reset before restarting EABR system.
- [3] SV101 shall be controlled with HOA (Hand/Off/Auto) switch.

**General Notes:**

- 1. Refer to Figures B-4 and C-1 for the piping and instrumentation diagrams.
- 2. All system controls are to be housed in one or two control panels.
- 3. Indicator lights on the control panel shall indicate all alarm conditions.
- 4. All digital/analog inputs/outputs (including alarms) will be recorded with in a personal computer (PC) in the Oxygen Distribution Building. The logging frequency/interval for the analog inputs/outputs is to be determined.
- 5. The PC will be capable of dial-out and notify operator of all alarm conditions/system shutdown events. The PC will also have remote-log-in capability to monitor in real-time system operation and alarm events.

**Table 12**  
**Pipe Sizing Calculation Summary**  
 Former Chlorobenzene Process Area  
 Solutia Inc., W.G. Krummrich Facility, Sauget, Illinois


<b>Copper Tubing (Type K)</b>	<b>Inner Diameter</b>	<b>0.527</b>	<b>Tube Size</b>	<b>1/2</b>	<b>inches</b>	<b>Temperature</b>	<b>70</b>	<b>°F</b>
	<b>Maximum velocity</b>	<b>100</b>						
	<b>Maximum flow</b>	<b>9.09</b>	<b>actual cubic feet per minute (ACFM)</b>					

**Calculated SCFM for the above ACFM**

Shallow Wells		Deep Wells	
Injection Pressure (psi)	Maximum Flow (SCFM)	Injection Pressure (psi)	Maximum Flow (SCFM)
3	10.94	6	12.80
4	11.56	7	13.42
5	12.18	8	14.04
6	12.80	9	14.66
7	13.42	10	15.28
8	14.04	11	15.89
9	14.66	12	16.51
10	15.28	13	17.13
11	15.89	14	17.75
12	16.51	15	18.37
13	17.13	16	18.99
14	17.75	17	19.61
15	18.37	18	20.23
16	18.99	19	20.84
17	19.61	20	21.46
18	20.23	21	22.08
19	20.84	22	22.70
20	21.46	23	23.32
21	22.08	24	23.94
22	22.70	25	24.56

**Calculated Maximum and Minimum Injection Pressures**

Depth to Water (ft bgs)	Deep Well		Shallow Well	
	Minimum Pressure (psi)	Maximum Pressure (psi)	Minimum Pressure (psi)	Maximum Pressure (psi)
5	10	24	7	17
10	8	23	5	16
15	6	21	3	13

 = Typical Injection Pressures observed during the EABR Field Testing



## Table 13 Head Loss Calculation Summary

Former Chlorobenzene Process Area  
W.G. Krummrich Facility, Sauget, Illinois

<b>Typical EABR System</b>				
Location	Flow Rate for Individual Injection Line (acfm)	Interior Piping Friction Losses (psi)	Exterior Piping Friction Losses (psi)	Estimated Maximum Friction Losses <sup>[3]</sup> (psi)
Head Loss For 1 1/2" Header Pipe	13.4 <sup>[1]</sup>	0.764	NA	<b>1.527</b>
Typical Head Loss For Longest Pipe Run	3 <sup>[2]</sup>	0.006	0.079	<b>0.169</b>
Maximum Head Loss For Longest Pipe Run	9.12	0.022	0.301	<b>0.65</b>

Total Typical Head Loss                      **1.7**

Total Maximum Head Loss                      **2.2**

psi - pounds per square inch  
acfm - actual cubic feet per minute  
scfm - standard cubic feet per minute

**Notes:**

- [1] Equal to 50 scfm at 40 psi injection pressure
- [2] Equal to 5 scfm at 10 psi injection pressure
- [3] A factor of safety equal to 2x the total minimum friction loss is incorporated

**Table 14**  
**General Specifications**  
 Former Chlorobenzene Process Area  
 W.G. Krummrich Facility, Sauget, Illinois

Item	Action	Notes
<b>General</b>		
Trip hazards	Mark pipes or other obstructions that are a potential trip hazard with high visibility paint or tape.	Most piping will be elevated 1-3 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.	
<b>Building/Container</b>		
Doors	Two routes in egress (minimum) will be provided.	
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.	
Fire Suppression (Optional)	A fire suppression system can be installed if desired by Solutia. One hydrant is within 60 feet from the northeast corner from the proposed equipment area.	If requested by Solutia.
Alarm Beacon	Mounted outside 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.
Atmosphere check	An oxygen monitor will be installed in the building to allow for an atmosphere check prior to building entry.	Specified as part of the equipment specifications.
Site telephone	Cellular phones.	A wireless internet connection will be provided for the autodialer/telemetry connection. A full-time hard line for phone is optional.
<b>Equipment</b>		
Battery backup on PC/autodialer	Vendor specified.	Specified in the Construction and Equipment RFP stage.
Cam locks/quick disconnect fittings	Zip-tie fittings (or similar) all flex hose connections to prevent accidental disconnection.	Zip-ties specified in the Construction and Equipment RFP stage.
External resets for control panels	All control panels must have a reset button accessible on the outside of the panel.	
Earthquake	System container will be tied down. Siesmic monitor located in T-SVE building.	System shut down in the event of an earthquake.
Grounding	All equipment will be grounded; vendor specified.	
Pipe flow direction and labels	All piping will be labeled with contents (oxygen/nitrogen), flow direction (arrows), temperature (Cold); vendor to label.	
Pipe insulation	Pipes that will be cold will be insulated; vendor specified.	
<b>Manifold Piping, Well, and Piezometer Installation</b>		
Expansion joints	1.5" Manifold runs will be provided with expansion/flex joints to allow for thermal expansion/contraction of piping materials (avoid breakage)	Metraflex loop or equivalent
Pipe supports	Pipe supports will be placed to prevent significant sagging of pipeline and pipes will be secured to allow for thermal expansion/contraction of manifold	Pipe supports have been specified
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.

OM&M - Operations, maintenance, and monitoring  
 RFP - Request for proposals  
 P&ID - Process and Instrumentation Diagram

**Table 15**  
**Electrical Load Summary**  
 Former Chlorobenzene Process Area  
 W.G. Krummrich Facility, Sauget, Illinois

LOAD DESCRIPTION	WATTS	VOLTAGE <sup>[1]</sup>	TOTAL AMPS
<b>Oxygen Injection System</b>			
Liquid Oxygen Tank Telemetry System		120 VAC	20
XP Building Heater	3600W	460	13
Control Panel and Instrumentation		120 VAC, 24 VDC	10
Building Lights and Ventilation Fan		120 VAC	15
<b>Miscellaneous Equipment</b>			
5kVA Transformer for Secondary Loads	5000VA	460	10.4
Area Lights		230	6.0
<b>TOTAL AMPERAGE - 460V</b>		<b>29</b>	
<b>TOTAL AMPERAGE - 120V</b>		<b>45</b>	

VAC = voltage alternate current  
 VDC = voltage direct current  
 VA = voltage-amps  
 W = Watts  
 A = amps

**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.