



Monitoring & Maintenance Engineering, Inc.

PHOSter Performance Update

Former Crown #38

UST041002

Opelika, Alabama

Project Management

The management team for this project includes Mitch Oliver for ADEM and Fareed Ahmed of PELA GeoEnvironmental, Inc.

Site Description:

This site is located on Pepperell Parkway about one-half mile from the center of Opelika. Soils are characterized as silty and sandy clay. Slug tests indicate 4×10^{-7} cm/sec. permeability. The water table fluctuates between seven and fourteen feet below grade. Fractured saprolitic bedrock varies between seventeen and thirty-five feet below grade.

PHOSter System

The PHOSter application is through a twelve point injector layout as shown in Figure 1. Injection wells were extended to the top of bedrock. This system was built with independent TEP (10% dilution) injection, independent nitrous oxide injection, as well as the standard independent air injection system (See P&ID Figure 2). Injection wells were screened at the top of bedrock (between 17' and 35' bgs).

Start-up

The PHOSter system was mobilized to the site, connected to the electrical service and the site piping on August 24, 2014. The system has used a total of 33,600 kW-hrs of power and has supplied over 43,400 pounds of dissolved oxygen through the bio-spargers of 12.5 million cubic feet of air.

Remediation Progress

After two months of operation LNAPL was detected in MW-1. Over four months of operation measured product thickness increased to 0.13'. Over the next three months the thickness decreased until December of 2014 when none was detected. The site sampling of October 2016 indicated CoC in all wells below the State's SSTLs. The system was shut-down at the end of October 2016 to check for rebounding concentrations.

VDW-9 and VDW-14 both contained MTBE concentrations exceeding SSTLs at the start of the treatment with little to no measureable BTEX. The aerobic treatment of MTBE is known to be a co-metabolic process but these two wells were reduced with no additional carbon. The carbon for bacterial population growth may have been provided by soil carbon, by longer chain hydrocarbons not detected in the 8260 method or by the tri-ethyl component of the TEP.

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Website: www.bioremediationsmme.com

TABLE

TABLE 1

CHEMICALS OF CONCERN								
Groundwater Remediation P E LaMoreaux, Inc. Former Crown 38: ADEM Facility ID 14543-081-001463 Opelika, Alabama; Release UST 041002								
Site Name							12/8/2016	
Site ID #								
Location	Date	Chemical of Concern, ppb						Total Mass> Target
		Benzene	Toluene	Ethylb.	Xylenes	MTBE	Lead	
MW-1	04/24/14	167	349	987	5,480	16.9	NS	
	10/24/14	975	1,620	2,380	13,800	1,170	NS	
	01/19/15	447	557	1,450	7,440	9,380	NS	
	04/28/15	79.2	79.6	236	1,694	52.0	NS	
	08/04/15	94.3	164	651	3,180	581	NS	
	10/29/15	2,920	<1,000	1,750	8,520	19,200	NS	
	01/25/16	3.35	6.33	21.6	265	9.96	NS	
	05/02/16	11.7	7.83	17.8	630	10.8	NS	
	07/13/16	254	157	244	4,230	245	NS	
	10/31/16	121	150	822	12,300	492	NS	
Target		165	33,100	23,200	175,000	662	496	
MW-2	04/24/14	2,980	124	2,890	2,860	233	108	
	10/24/14	1.06	<5	13.6	5.2	3.65	33	
	01/19/15	57.4	<5	65.7	5	23.5	33	
	04/28/15	18.7	<5	73.7	14	13.6	35	
	08/04/15	1.0	<5	2.74	<1	1.0	NS	
	10/29/15	2.7	<5	13.30	<1	<1	NS	
	01/25/16	1.0	<5	3.83	<1	<1	684	
	05/02/16	2.13	<5	5.45	<1	<1	1,340	
	07/13/16	<1	<5	1.77	19	<1	433	
	11/01/16	2	<5	<1	<1	<1	440	
Target		165	33,100	23,200	175,000	662	496	
MW-3	04/24/14	829	300	1,390	2,850	10	NS	
	10/24/14	461	816	444	5,110	10	NS	
	01/19/15	149	209	176	1,300	10	NS	
	04/29/15	118	183	177	823	10	NS	
	08/04/15	218	145	381	1,520	10	NS	
	10/29/15	78.1	93.1	103	1,340	10	NS	
	01/25/16	10.0	<50	59	494	10	NS	
	05/02/16	8.54	21.8	26.2	275	<1	NS	
	07/13/16	14.7	32.5	21.5	473	<1	NS	
	10/31/16	59.0	134.0	71.0	887	<1	NS	
Target		165	33,100	23,200	175,000	662	496	
MW-4	04/24/14	61,200	2,300	2,650	15,700	17,700	NS	
	10/24/14	84.6	5.43	15.9	68.2	1,530	NS	
	01/19/15	36.2	<5	8.95	49.4	1,150	NS	
	04/28/15	3,150	2,480	1,650	11,070	979	NS	
	08/04/15	78.8	43.5	179	1,150	348	NS	
	10/29/15	24.8	13.4	49.3	333	170	NS	
	01/25/16	23.2	24.2	62.8	383	238	NS	
	05/02/16	12.4	15.3	40.9	279	159	NS	
	07/14/16	2.93	<5	3.42	25.5	124	NS	
	11/01/16	29	38	328	1,990	97	NS	
Target		165	33,100	23,200	175,000	662	496	

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Site Name							12/8/2016	
Site ID #								
Location	Date	Chemical of Concern, ppb						Total Mass> Target
		Benzene	Toluene	Ethylb.	Xylenes	MTBE	Lead	
MW-5	04/24/14	<1	<5	<1	<1	<1	NS	
	08/03/15	<1	<5	<1	<1	11.20	NS	
	07/14/16	<1	<5	<1	<1	<1	NS	
Target		100	20,100	14,100	175,000	402	301	
MW-6	04/24/14	<1	<5	<1	<1	<1	NS	-
	08/03/15	<1	<5	<1	<1	<1	NS	
	07/14/16	<1	<5	<1	<1	<1	NS	
Target		152	30,300	21,200	175,000	606	455	
MW-7	04/24/14	<1	<5	<1	<1	2.9	NS	
	10/24/14	32.2	<5	1.05	<1	9.84	NS	
	01/19/15	5.49	<5	<1	<1	5.49	NS	
	04/29/15	<1	<5	<1	<3	45.8	NS	
	08/04/15	<1	<5	<1	<3	82.6	NS	
	10/29/15	<1	<5	<1	<3	44.6	NS	
	01/25/16	<1	<5	<1	<3	8.8	NS	
	05/02/16	<1	<5	<1	<3	8.18	<100	
	07/14/16	<1	<5	<1	<3	14.50	NS	
	11/01/16	<1	<5	<1	<1	17	NS	
Target		165	33,100	23,200	175,000	662	496	
MW-8	04/24/14	<1	<5	<1	<1	1.07	NS	
	08/04/15	<1	<5	<1	<1	31.3	NS	
	07/14/16	<1	<5	2.0	20.9	13	NS	
Target		165	33,100	23,200	175,000	662	496	
VDW-9	04/24/14	1.5	<5	<1	<1	845	NS	
	10/24/14	1.4	<5	<1	<1	475	NS	
	01/19/15	1.21	<5	<1	<1	289	NS	
	04/29/15	1	<5	<1	<3	324	NS	
	08/04/15	1	<5	<1	<3	313	NS	
	10/28/15	1	<5	<1	<3	257	NS	
	01/25/16	1	<5	<1	<3	120	NS	
	05/03/16	1	<5	<1	<3	115	<100	
	07/14/16	1	<5	<1	<3	52.8	NS	
	11/01/16	1	<5	<1	<1	67.0	NS	
Target		165	33,100	23,200	175,000	662	496	
MW-10	04/24/14	<1	<5	<1	<1	<1	NS	
	08/04/15	<1	<5	<1	<1	<1	NS	
	07/14/16	<1	<5	<1	<1	<1	NS	
Target		90.9	18,200	12,700	175,000	364	273	

FIGURES

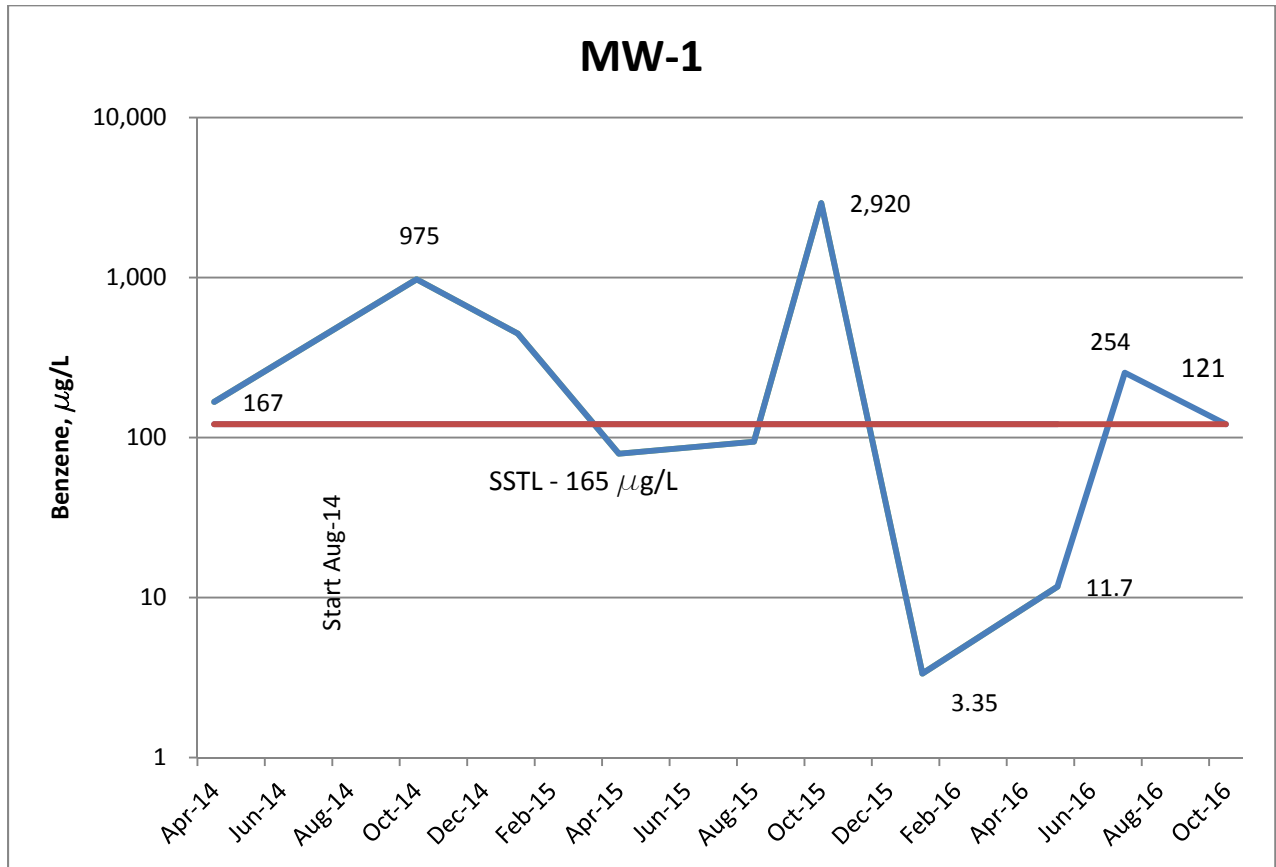


Table 1: Source Area Well

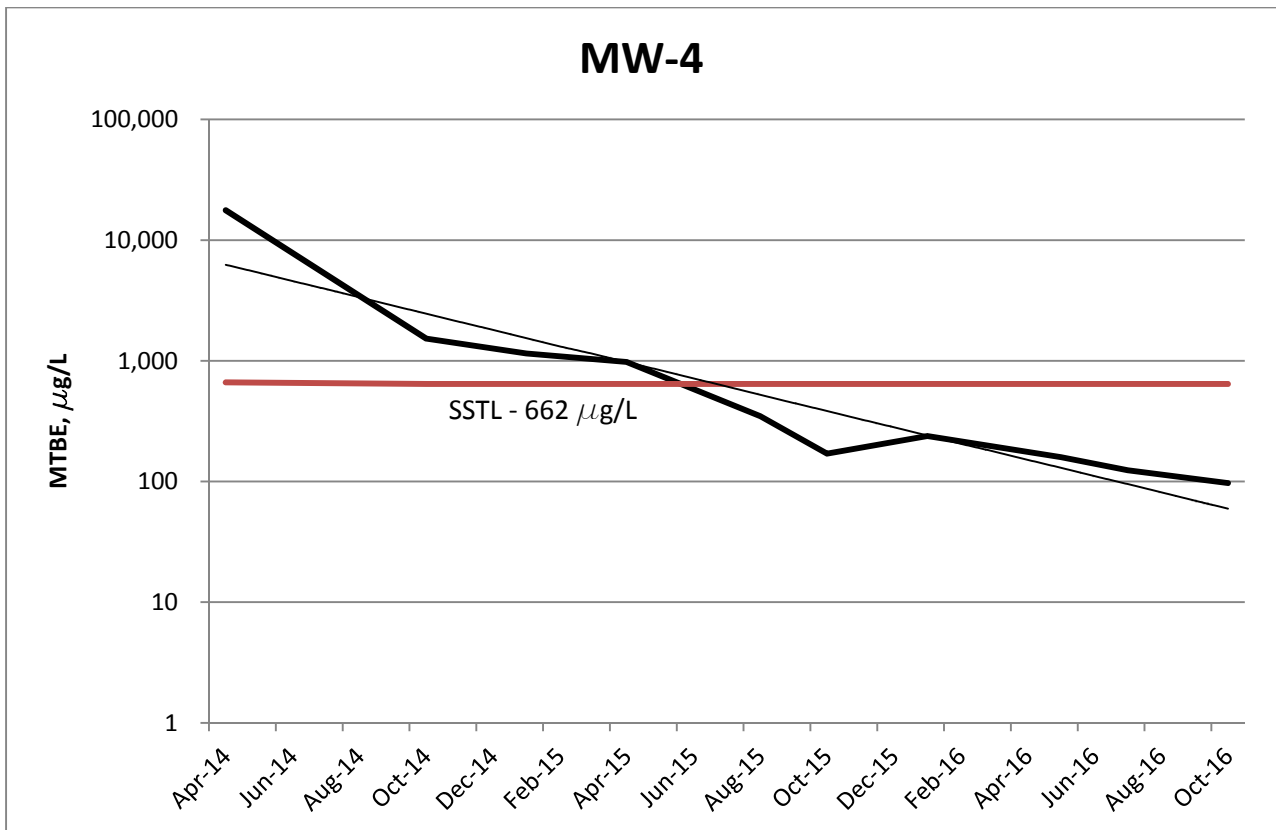
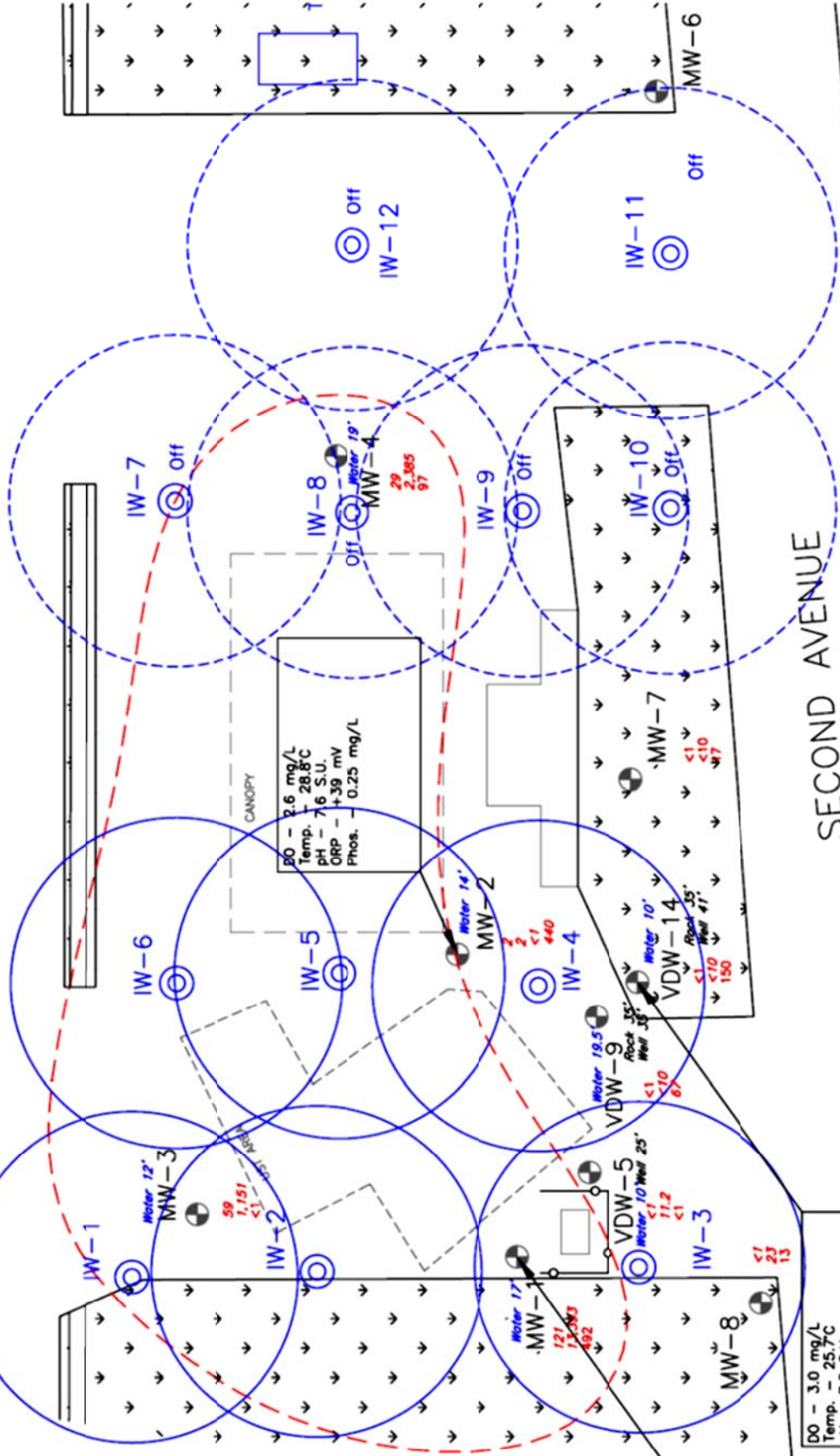


Table 2: MTBE K-rate 1/year.

PEPPERELL PARKWAY



SECOND AVENUE

Figure 1

Biological Sampling Results

Former Crown Station AL-038
 1625 Pepperell Parkway; Opelika, Lee County, Alabama
 for
 P E LaMoreaux & Associates, Inc.
 October 31, 2016



Graphic Scale

Smith Monitoring & Maintenance Engineering, Inc.
 145 Merrill Avenue
 Decatur, Georgia
 (404) 371-9332

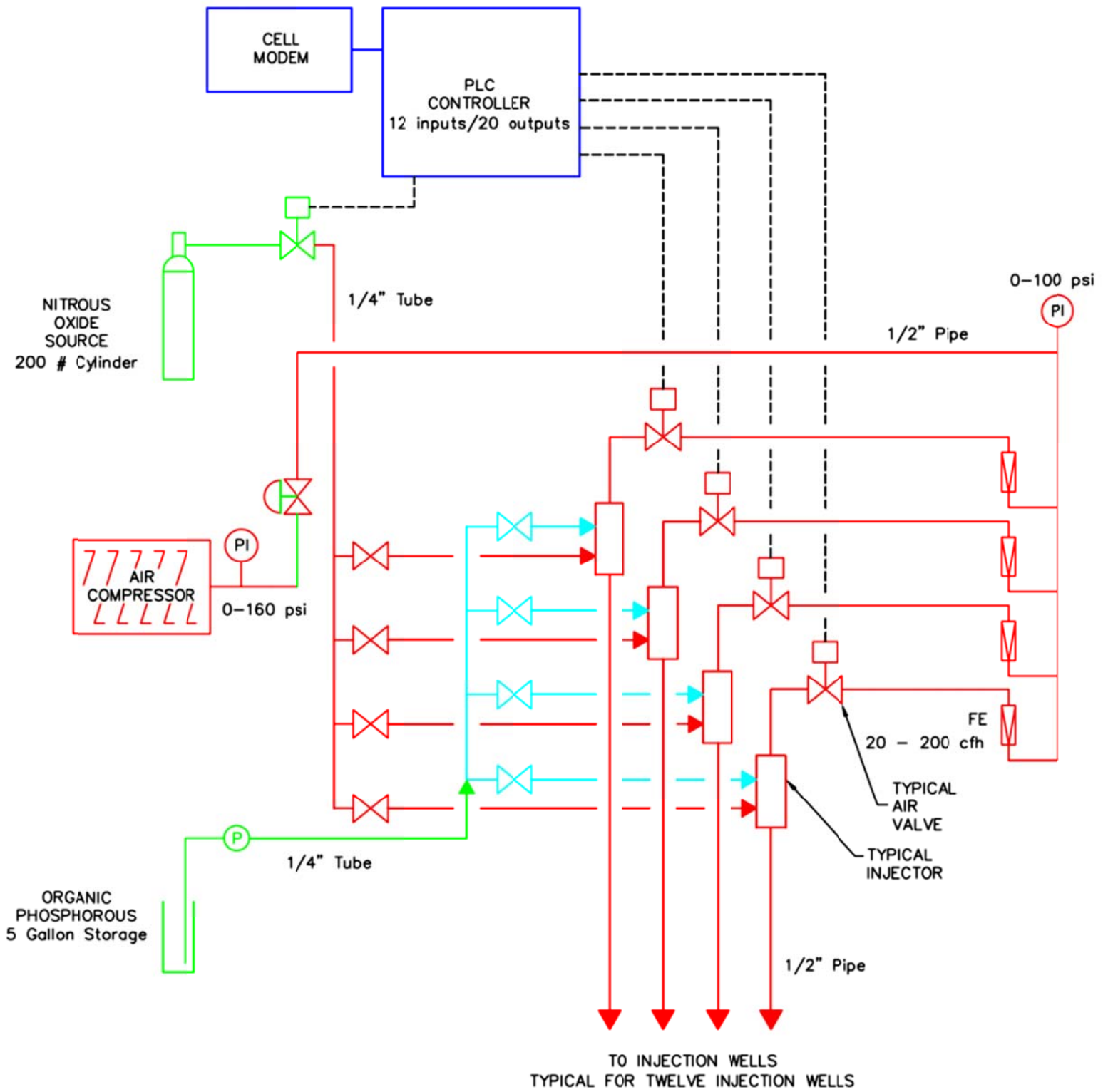


FIGURE 1
 PHOSter (BTEX)
 PROCESS DIAGRAM

TYPICAL P&ID FOR BTEX REDUCTION
 ATLANTA, GEORGIA

NOT TO SCALE JULY 2016



Six of the twelve injectors showing independent air flow control, nitrous oxide dosage on top and TEP dosage below.



System in Fence Enclosure