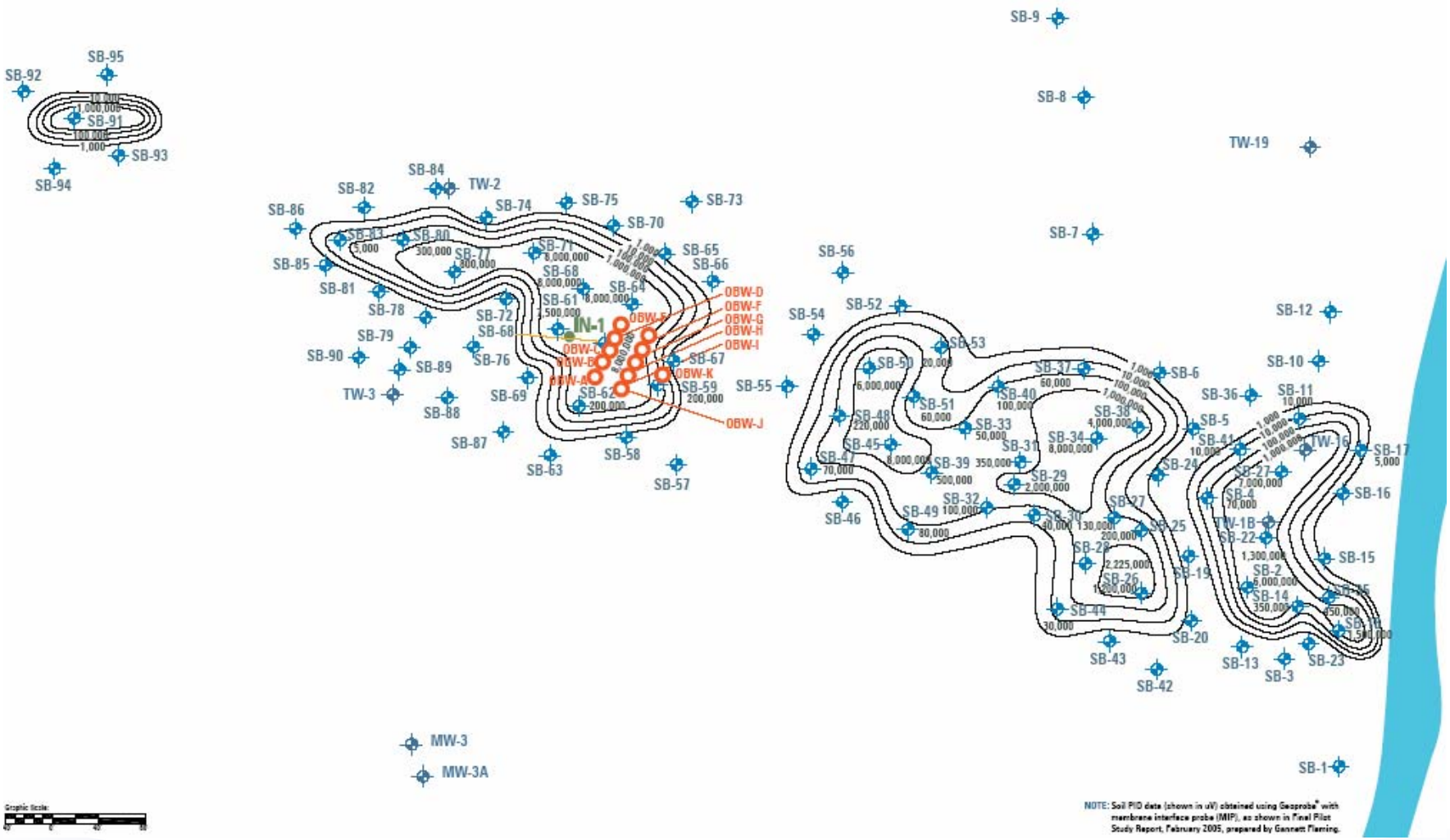
Site


SB-9
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SB-76
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SB-62
SB-59
TW-3
SB-88
SB-87
SB-58
SB-63
SB-57
OBW-D
OBW-F
OBW-G
OBW-H
OBW-I
OBW-K
OBW-J
MW-3
MW-3A
SB-1
NOTE: Soil PID data (shown in uV) obtained using Geoprobe® with membrane interface probe (MIP), as shown in Final Pilot Study Report, February 2005, prepared by Gannett Fleming.

Site History

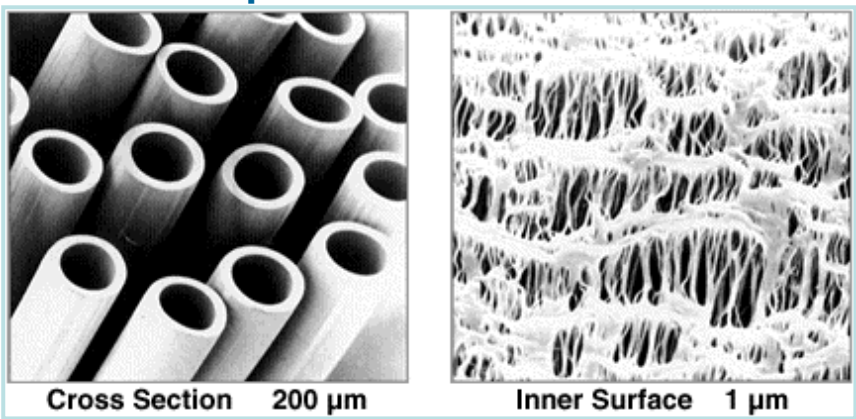
- 1988 spill of 50, 000 gallons of xylene and 20,000 gallons of brake fluid during a train derailment in Georgia.
- Product recovery and groundwater pump and treat system operated until 1998.
- Air sparging/Soil vapor extraction system operated 1997 to present.
- South plume is approximately 500 feet long, 80 feet wide, traveling south at 78 ft/year
- Depth to bedrock approximately 7-15 feet; most ground water contamination in a narrow zone 1 to 2 feet above bedrock.
- Most of the site has low permeability, heterogeneous layers of interbedded sands, silts and silty clay.

Technology Selection

- Expanded groundwater investigation in 2002 identified larger plume area downgradient that required treatment.
- Analysis showed it would not be cost effective to expand AS/SVE system to the impacted area.
- Electrical costs for AS/SVE were high at $1500 per month for the existing system.
- iSOC® installation and operational costs were lower.
- Pilot test was conducted to evaluate performance of the iSOC® technology.

How does it Work?

Microporous Hollow Fibre



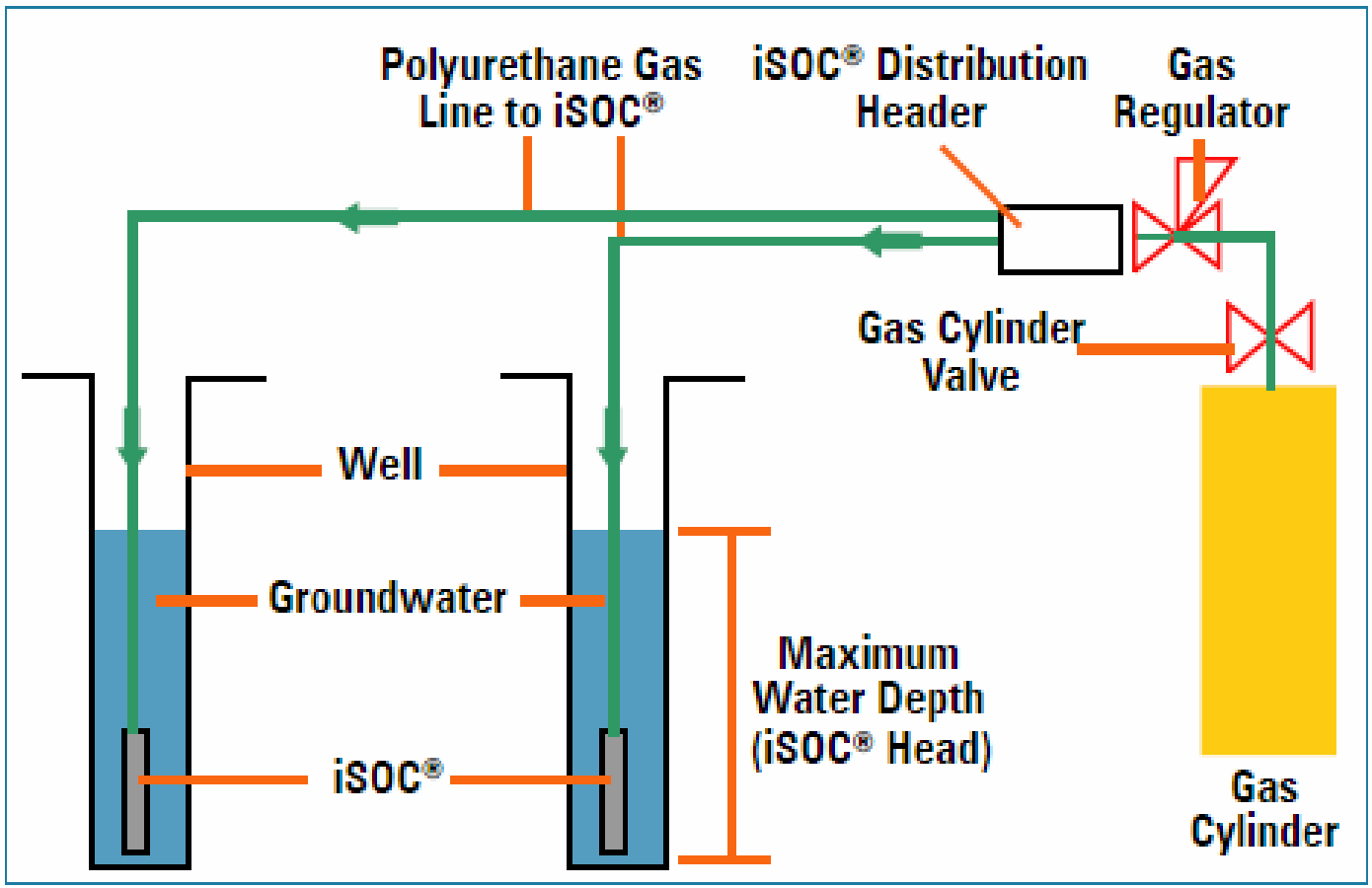
iSOC®

Mass Transfer Device

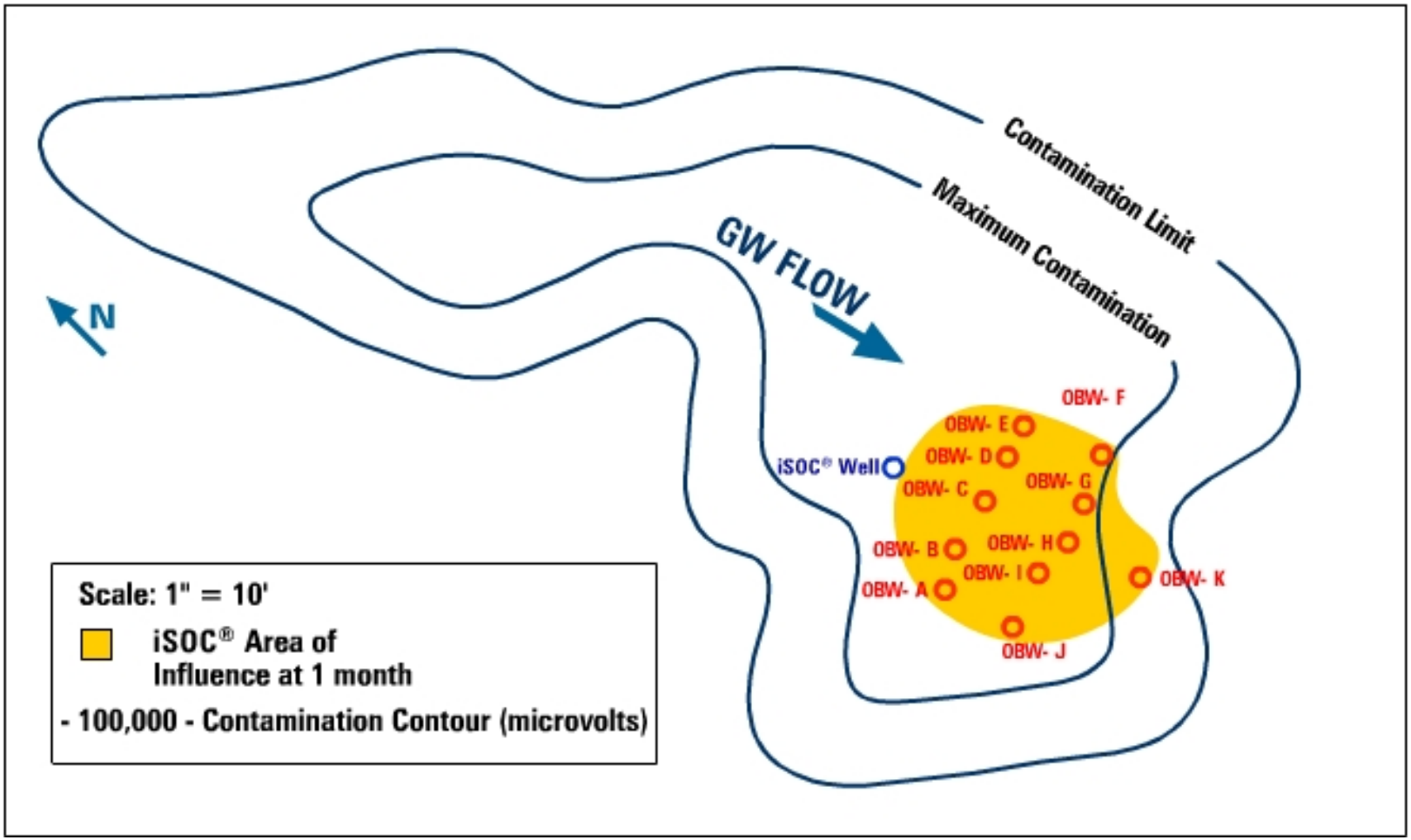
How Does It Work?

- **Microporous hollow fiber.**
- **700 fibers (filled with holes).**
- **Provides large surface area for mass transfer (7000 sq ft per cu ft).**
- **Mass transfer occurs when gas pressure is less than GW.**
- **High DO levels migrate to surrounding biomass.**

iSOC® Installation Diagram



Site Map


Contamination Limit
Maximum Contamination
GW FLOW
N
OBW- F
OBW- E
OBW- D
iSOC® Well
OBW- C
OBW- G
OBW- B
OBW- H
OBW- I
OBW- K
OBW- A
OBW- J
Scale: 1" = 10'
iSOC® Area of Influence at 1 month
- 100,000 - Contamination Contour (microvolts)

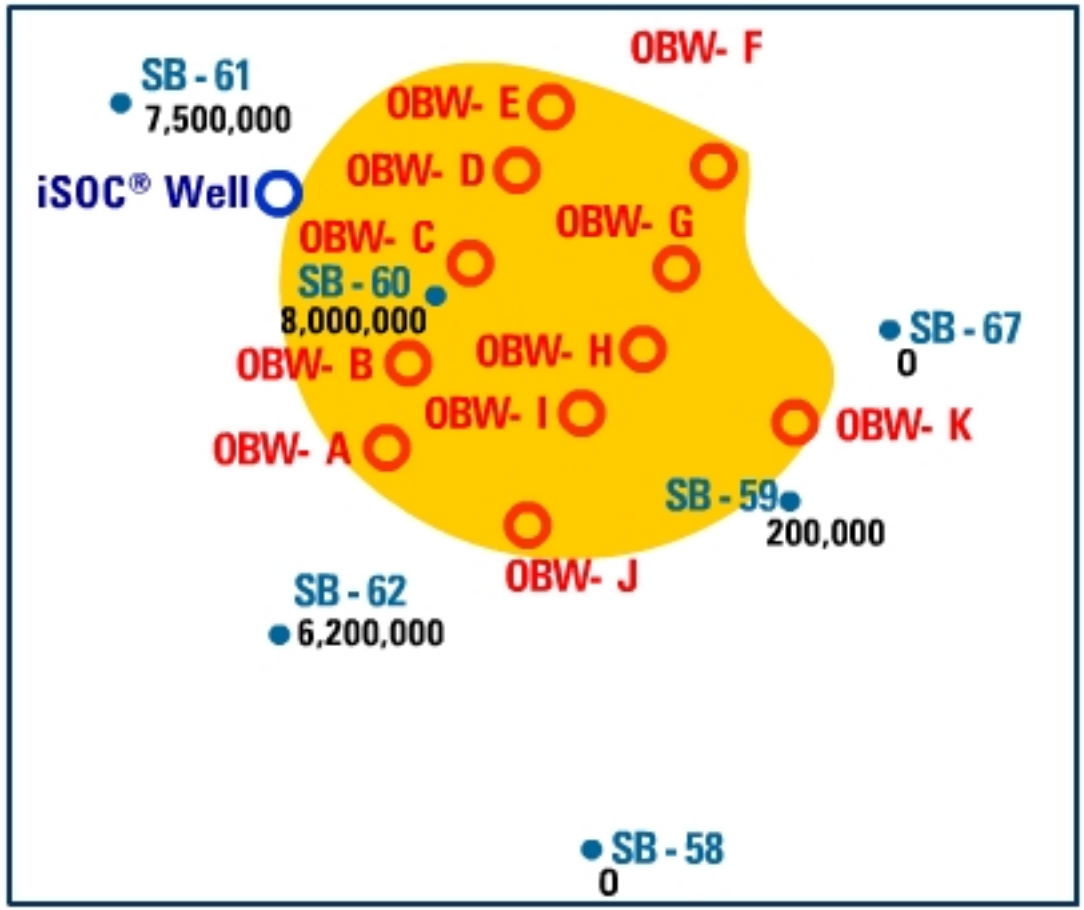
Pilot Test Description

- Pilot test consisted of 1 iSOC® injection well and 11 down-gradient monitoring wells (started the end of April 2004).
- Two rows of monitor wells (5 wells per line, spaced 5 feet apart) at 10 feet, 20 feet down gradient of injection well; a single monitoring well was placed 30 feet down gradient of the injection well.
- BTEX and heterotrophic bacteria plate counts sampled in monitor wells.
- Water quality sampled in April, May, September, October, December 2004 and April 2005.

Pilot Test Bioremediation Results

- iSOC® area of influence created in all 11 monitor wells down gradient of injection well within one month of pilot startup.
- Within this area of influence, all 11 wells showed large increases in heterotrophic bacteria; most wells had decreases in background xylene concentrations.
- Four months after pilot startup, xylene reduced in total of 9 of 11 wells.
- Within 20 feet of injection well, largest reduction was 93%, smallest reduction 7.7%.
- In monitor well OBW-H (well with highest xylene concentration 82,000ppb), reduction was 61% in four months.
- In April 2005, groundwater sampled at OBW-H had a xylene concentration of 3,600 ug/L, which would indicate reduction of 98.66%.

Pilot Test Layout



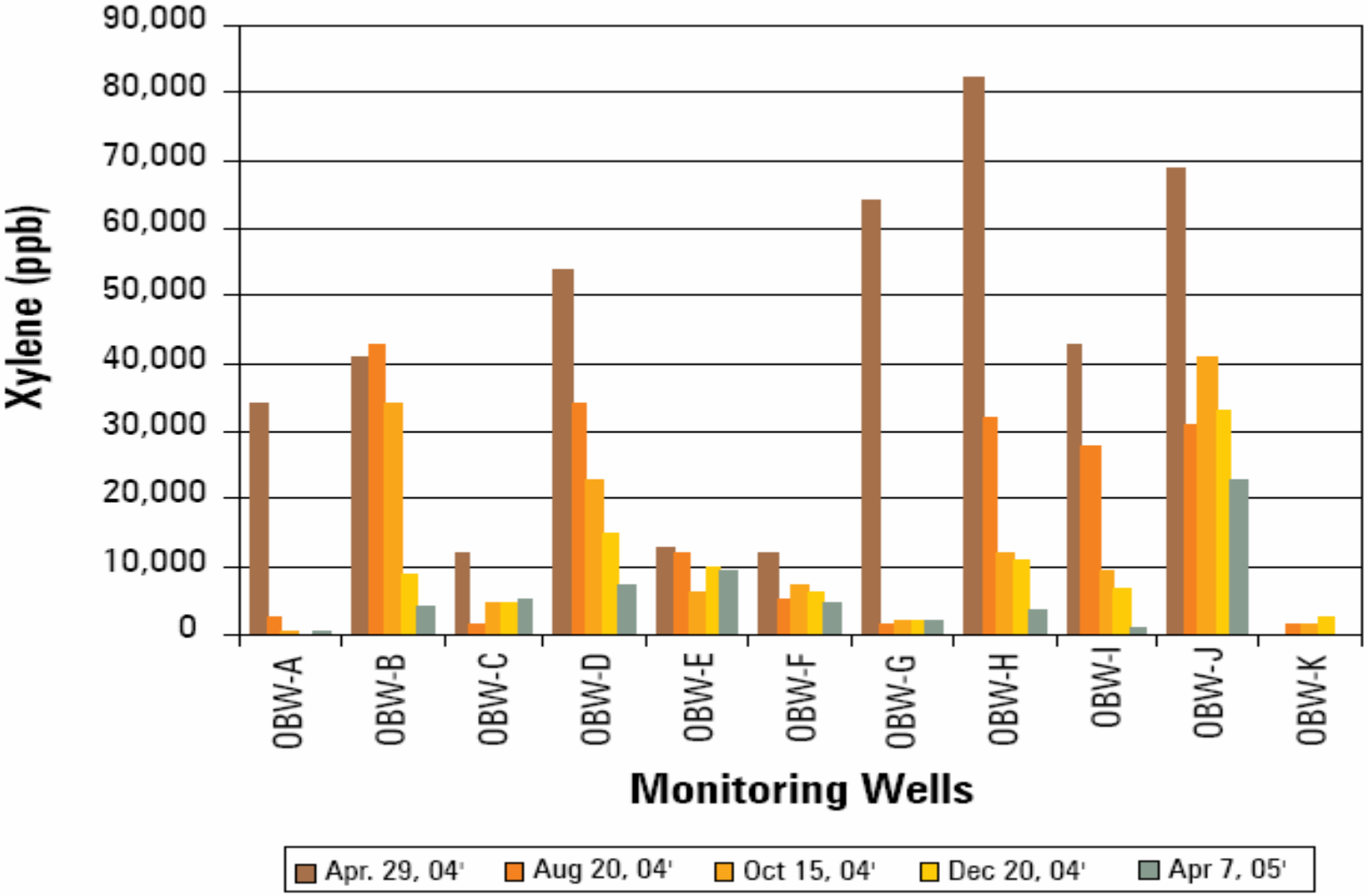
iSOC® Pilot Test (Xylene and Hetrotrophic Bacteria Plate Count)

Well Number	Sample Date	Xylene (µg/L)	Heterotrophic Bacteria Plate Count (CFU/mL)	Xylene % Reduction
OBW-A	4/29/04	34,000	>300	93.0
	5/27/04	-	20,000	
	8/20/04	2,500	12,400	
OBW-B	4/29/04	41,000	>300	-
	5/27/04	-	32,000	
	8/20/04	43,000	430,000	
OBW-C	4/29/04	12,000	>300	87.5
	5/27/04	-	36,000	
	8/20/04	1,500	116,000	
OBW-D	4/29/04	54,000	>300	37.0
	5/27/04	-	26,000	
	8/20/04	34,000	3,200,000	
OBW-E	4/29/04	13,000	>300	7.7
	5/27/04	-	75,000	
	8/20/04	12,000	44,000	

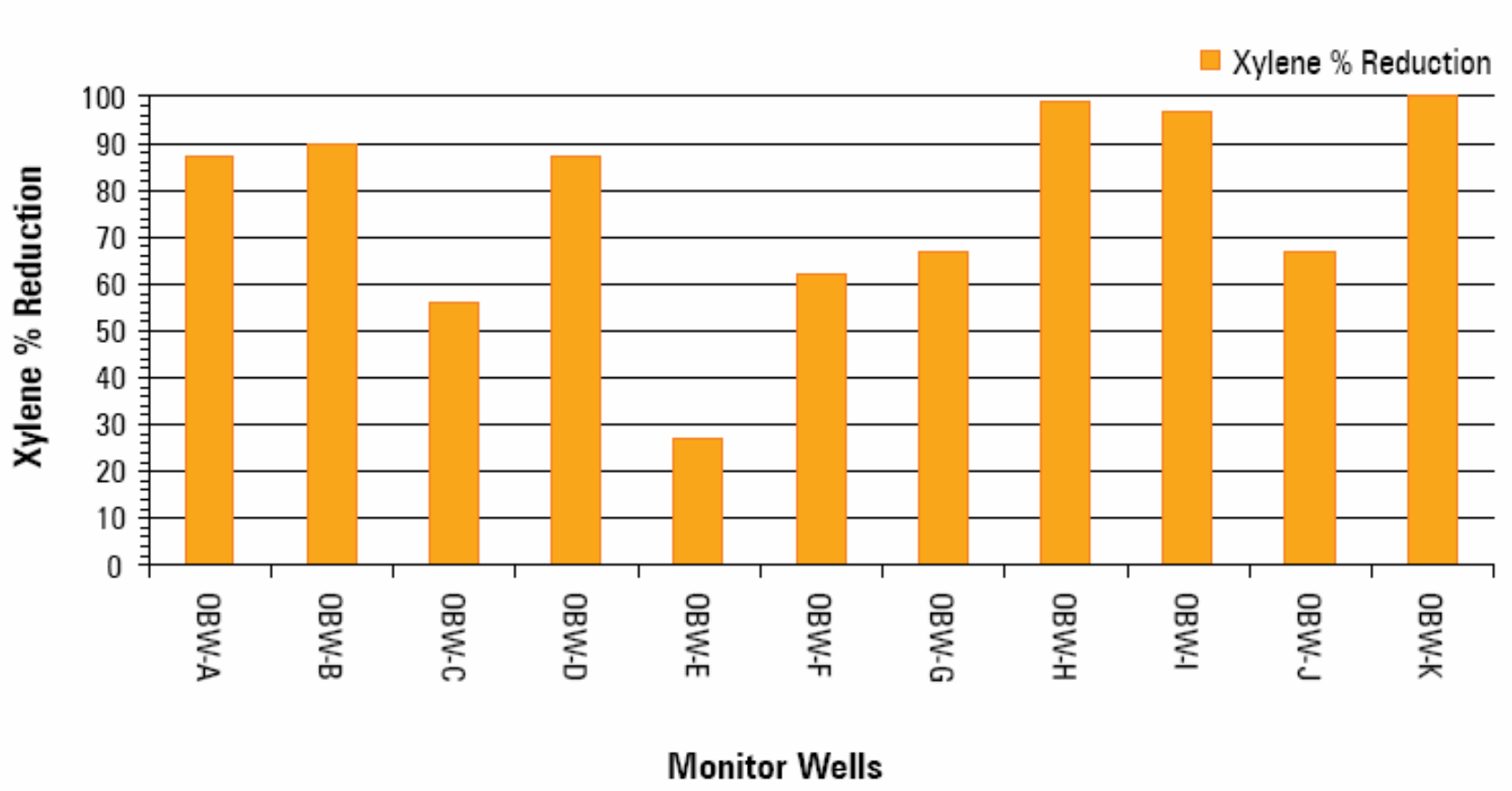
iSOC® Pilot Test (Xylene and Hetrotrophic Bacteria Plate Count)

Well Number	Sample Date	Xylene (µg/L)	Heterotrophic Bacteria Plate Count (CFU/mL)	Xylene % Reduction
OBW-F	4/29/04	12,000	>300	58.3
	5/27/04	-	42,000	
	9/2/04	5,000	-	
OBW-G	4/29/04	6,400	>300	78.1
	5/27/04	-	1,000	
	9/2/04	1,400	-	
OBW-H	4/29/04	82,000	>300	61.0
	5/27/04	-	17,000	
	9/2/04	32,000	-	
OBW-I	4/29/04	43,000	>300	34.9
	5/27/04	-	60,000	
	9/2/04	28,000	-	
OBW-J	4/29/04	69,000	>300	55.1
	5/27/04	-	1,000	
	9/2/04	31,000	-	
OBW-K	4/29/04	150	>300	-
	5/27/04	-	18,000	
	9/2/04	1,400	-	

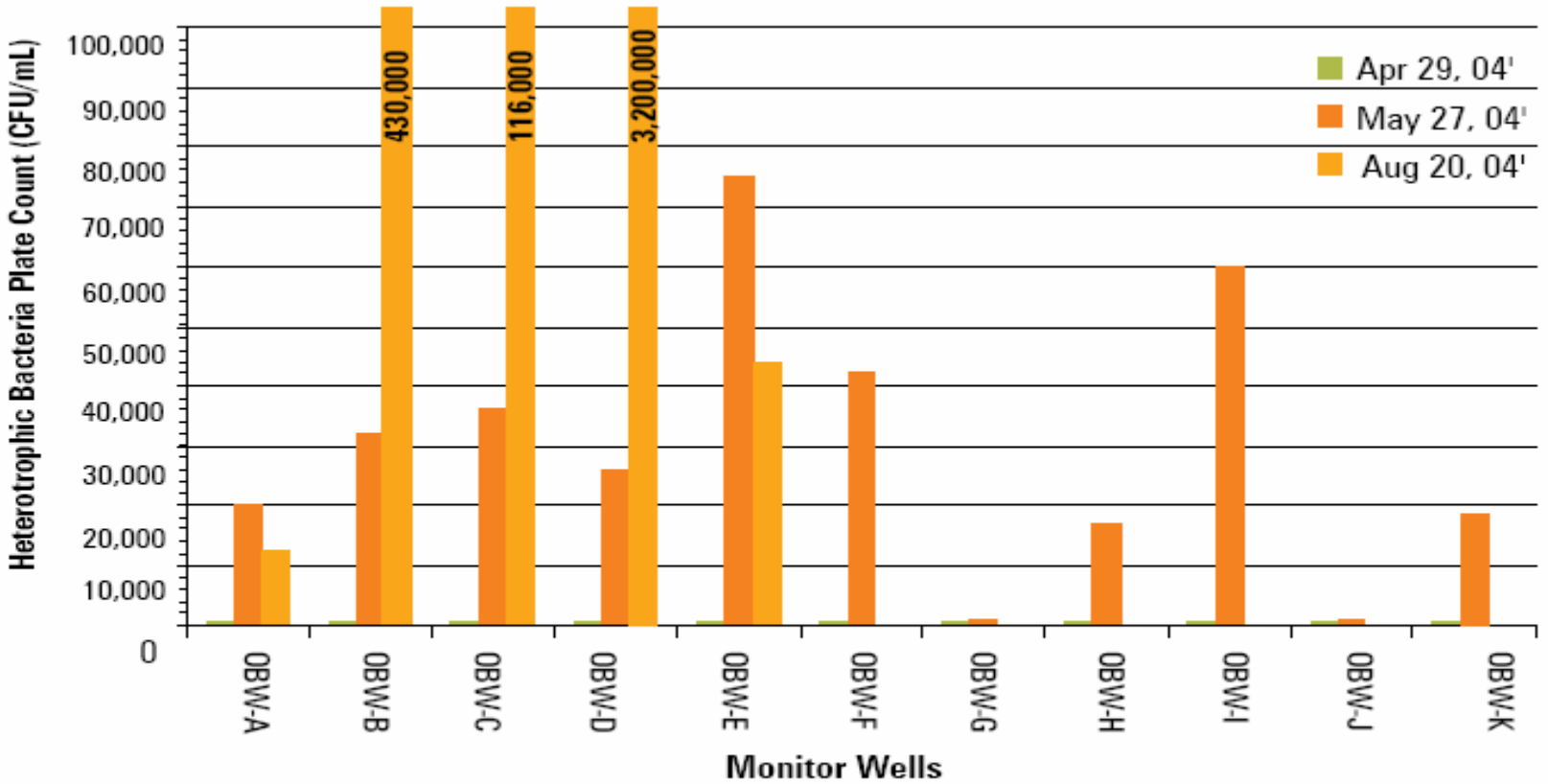
Xylene Plot


Xylene (ppb)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
OBW-A
OBW-B
OBW-C
OBW-D
OBW-E
OBW-F
OBW-G
OBW-H
OBW-I
OBW-J
OBW-K
Monitoring Wells
Apr. 29, 04'
Aug 20, 04'
Oct 15, 04'
Dec 20, 04'
Apr 7, 05'

Xylene Percentage Reduction



Heterotrophic Bacteria Plate Count (CFU/mL)



April 29, 04' – All monitor well concentrations are >300 CFU/mL

Corrective Action Plan

- August 25, 2005 : Consultant submitted a corrective action plan to Georgia Environmental Protection.
- The proposed plan calls for 30 iSOC®s to clean up of southern plume.
- Mineral nutrients may to be necessary for optimized treatment.