



Accelerated Bioremediation &
Natural Attenuation by
iSOC™
Groundwater Remediation System
Case Study – Brush, Colorado

Case Site Characteristics

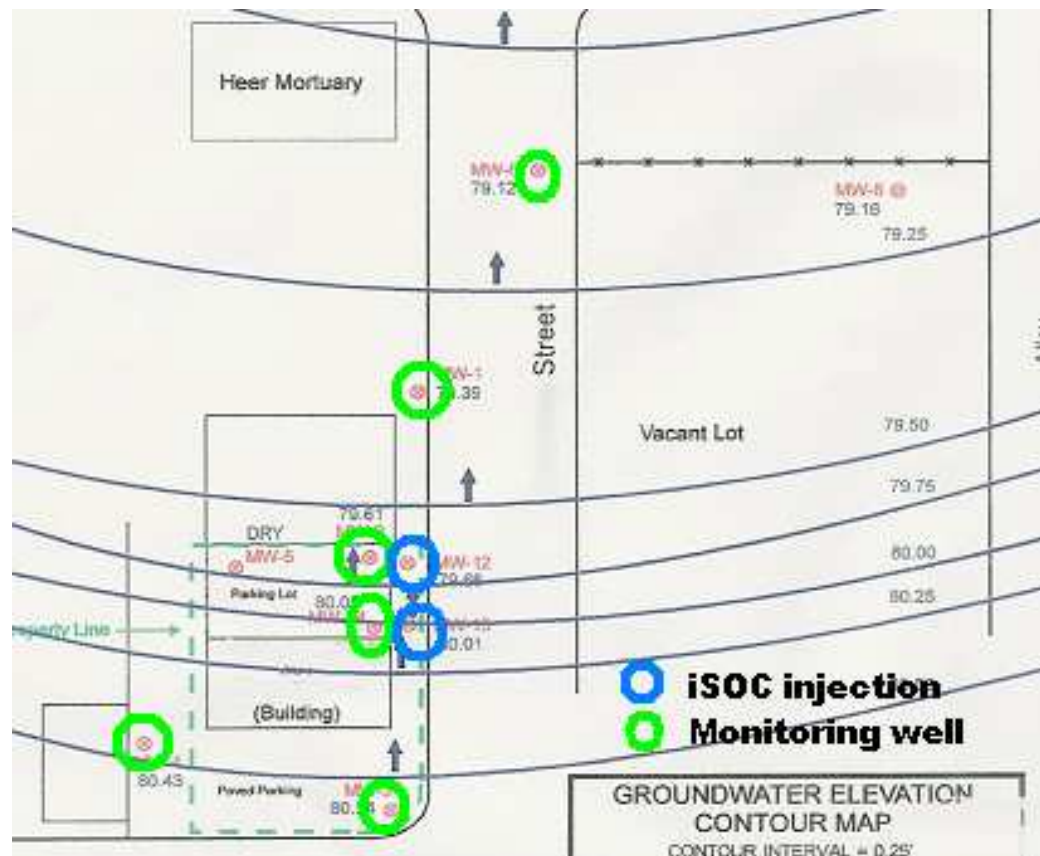
- Site was a gas station until July, 1997.
- Tanks removed and gasoline was discovered.
- Due to low permeability of the site, initial corrective action consisted of natural attenuation with quarterly monitoring of groundwater release.
- Later determined that natural attenuation required too much time.

Case Site Characteristics

- Petroleum-impacted soils in former tank pit area excavated Summer, 2001.
- Site underlain by clay with silt, depth of water table is 3.0 to 4.5 metres
- *iSOC™* system installed October 2001.
- Ground water near *iSOC™* system had *BTEX* concentration of 27000 ppb

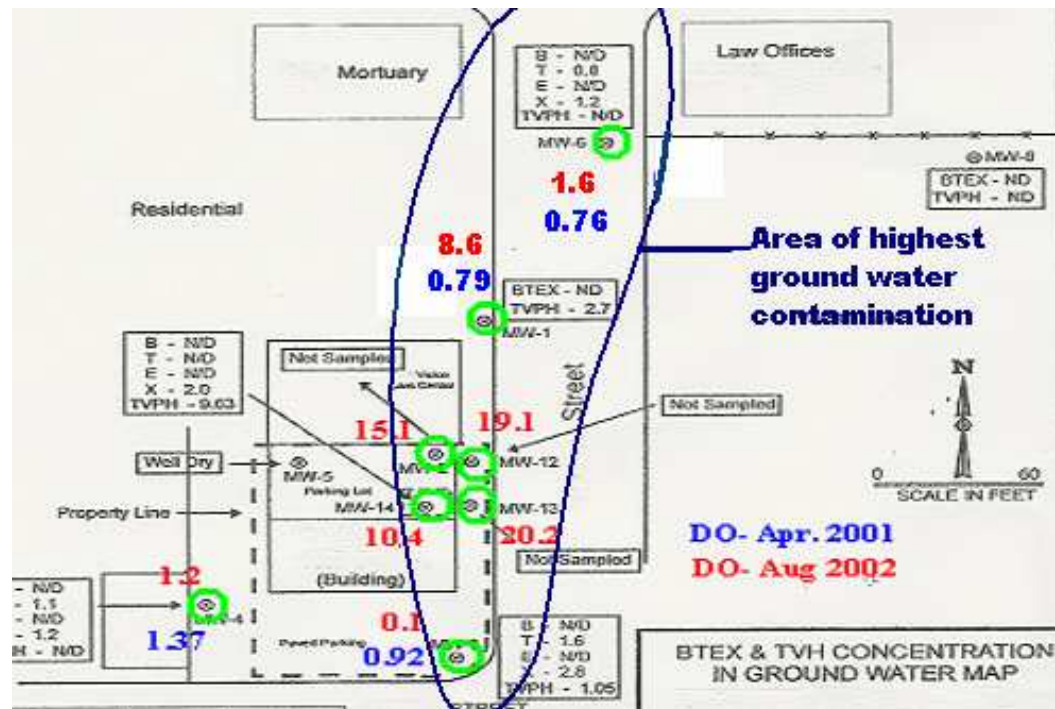
Case Site Characteristics

- Effective Aug, 2002, two iSOC[™]s in 2 in wells operating 7 to 7.5 m apart in 1.2 to 2.1 m water column delivering 20 ppm DO.



Case Study Discussion & Results

- Effective Aug, 2002, two iSOC[™]s still operating in 1.2 to 2.1 metres water column delivering 20 ppm DO.
- 8.6 ppm DO measured 18 metres away.
- 1.6 ppm DO measured 46 metres away.



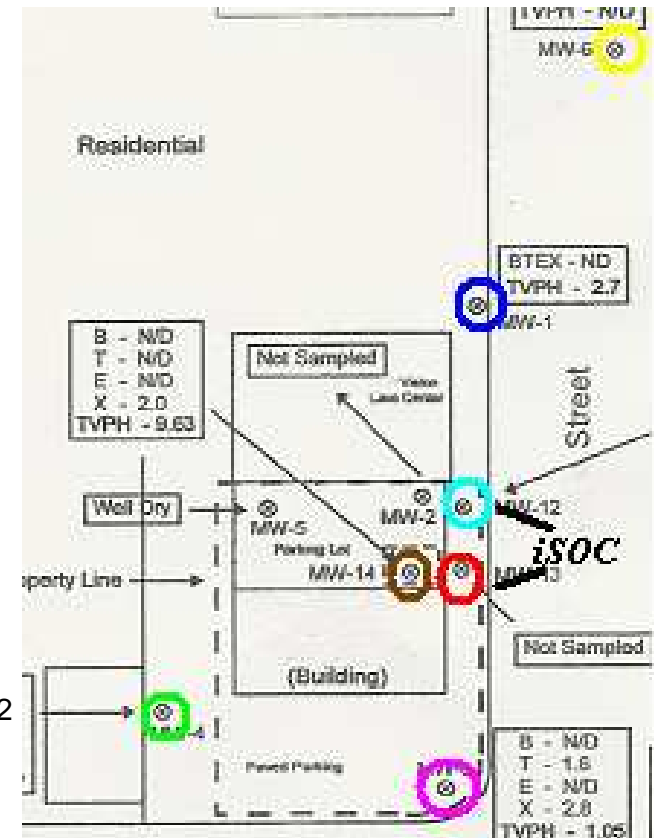
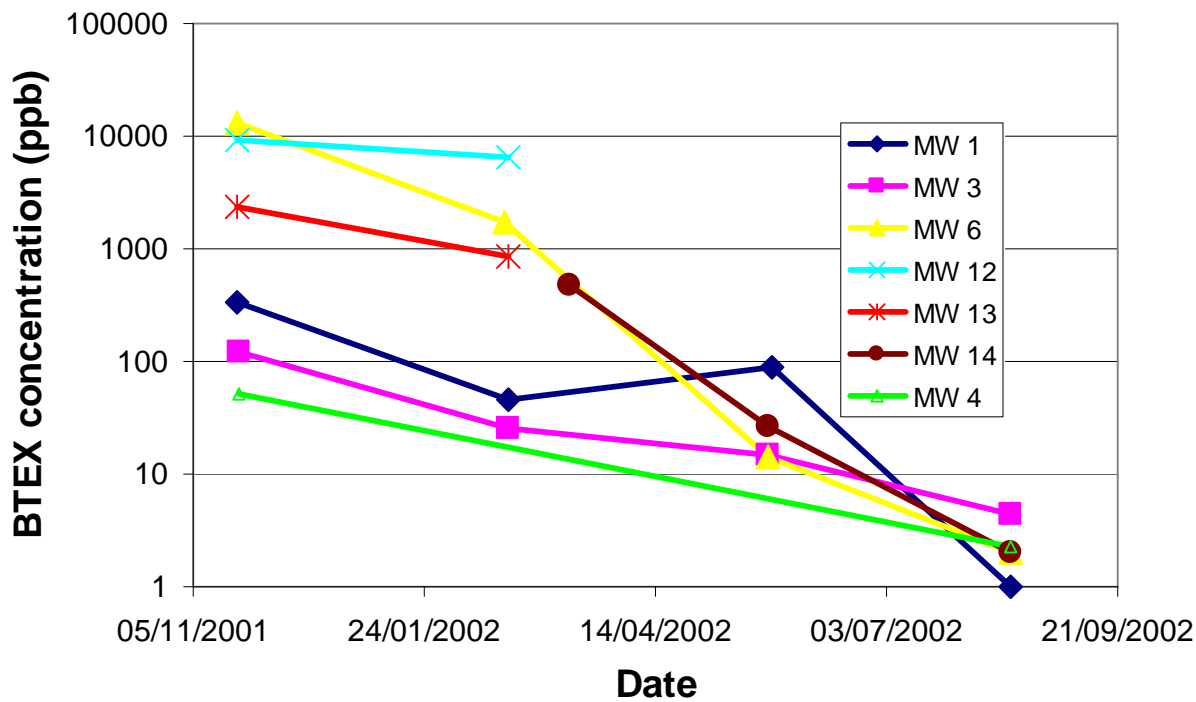
Case Study Results

SAMPLE NUMBER	SAMPLE DATE	BENZENE (ppb)	TOLUENE (ppb)	ETHYL-BENZENE (ppb)	XYLENES (ppb)	TOTAL BTEX (ppb)	TOTAL VOLATILE PETROLEUM HYDROCARBONS (ppb)	% BTEX REDUCTION 11/01- 8/02
	6/18/01	ND*	ND*	84	ND*	84	4.7	
→	11/20/01	37	110	140	54	341	5.7	
	2/22/02	ND*	ND*	38	8.6	46.6	2.7	
MW 1	5/24/02	5.9	ND*	75	9.4	90.3	4	
	8/15/02	ND*	ND*	ND*	ND*	ND*	2.7	100%
	9/26/01	2.7	10	5.8	50	68.5	3.1	
→	11/20/01	ND*	ND*	ND*	ND*	ND*	ND*	
	2/22/02	7.5	ND*	32	11.7	51.2	3.5	
MW 2	5/23/02	8.3	ND*	17	6.8	32.1	4.3	
	8/15/02-ns**	-	-	-	-	-	-	-
	6/18/01	11	3.8	24	8	46.8	1.4	
→	11/21/01	7.5	36	21	58	122.4	3.4	
	2/22/02	6.7	8.5	6.7	3.8	25.7	1.1	
MW 3	5/23/02	9.1	ND*	4.1	2.5	14.8	1.5	
	8/15/02	ND*	1.6	ND*	2.8	4.4	1.05	97%
	6/19/01	ND*	ND*	ND*	ND*	ND*	ND*	
→	11/21/01	9	22	11	10	52	1.3	
	2/22/02	ND*	ND*	ND*	ND*	ND*	ND*	
MW 4	5/23/02	ND*	ND*	ND*	ND*	ND*	ND*	
	8/15/02	ND*	1.1	ND*	1.2	2.3	ND*	96%
	6/18/01	ND*	ND*	ND*	ND*	ND*	ND*	
→	11/20/01	ND*	ND*	ND*	ND*	ND*	ND*	
	2/22/02	ND*	ND*	ND*	ND*	ND*	ND*	
MW 5	5/23/02	ND*	ND*	ND*	ND*	ND*	ND*	
	8/15/02 dry	-	-	-	-	-	-	-
	6/18/01	840	510	930	1,320	3,600	24	
→	11/20/01	890	480	820	11,120	13,310	12	
	2/21/02	470	270	440	559	1,739	7.1	
MW 6	5/23/02	ND*	ND*	3.9	11.3	14.2	1	
	8/15/02	ND*	0.8	ND*	1.2	2	ND*	99.9%

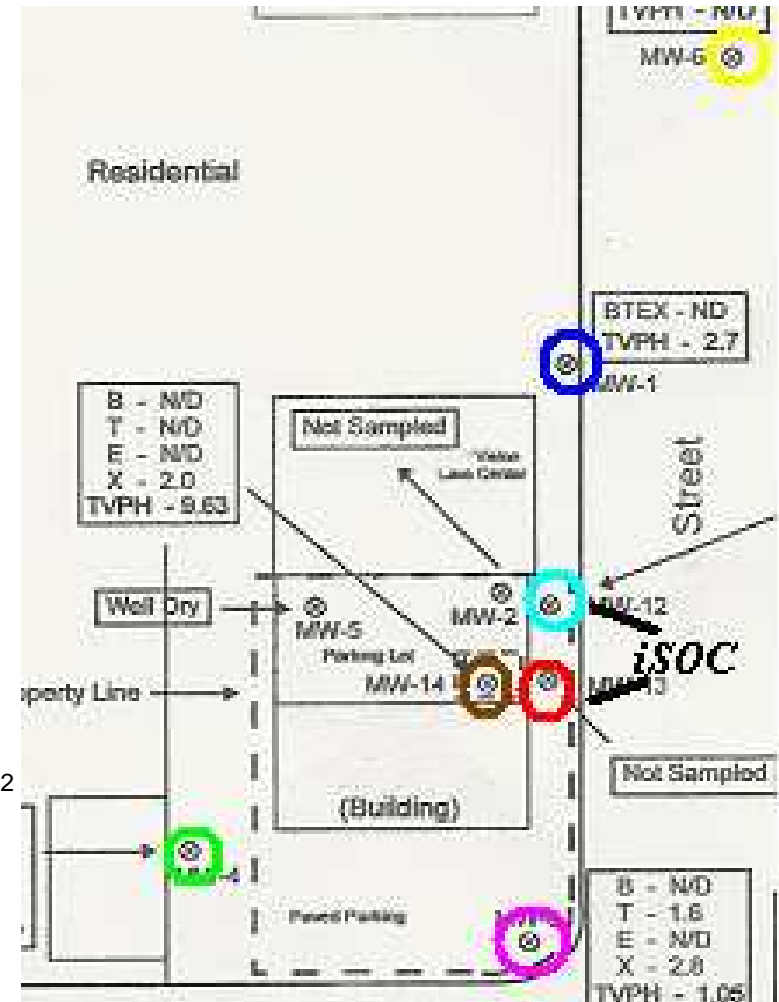
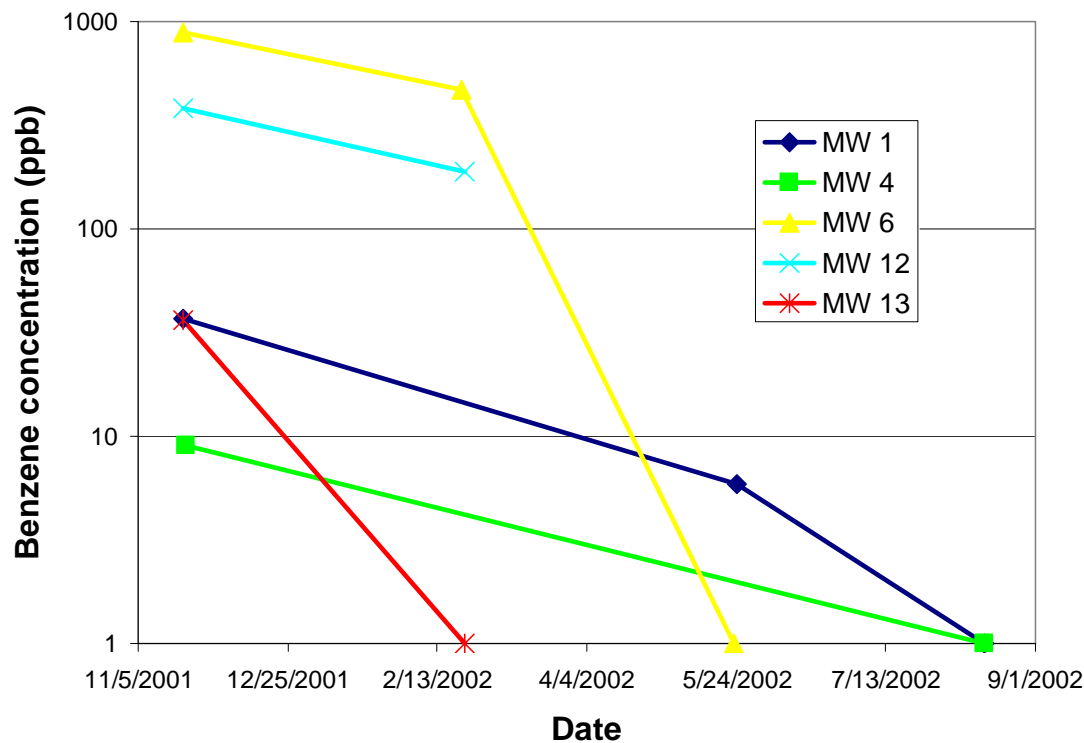
Case Study Results

SAMPLE NUMBER	SAMPLE DATE	BENZENE (ppb)	TOLUENE (ppb)	ETHYL-BENZENE (ppb)	XYLENES (ppb)	TOTAL BTEX (ppb)	TOTAL VOLATILE PETROLEUM HYDROCARBONS (ppb)	% BTEX REDUCTION 11/01- 8/02
	6/18/01	2.2	ND*	3	ND*	5.2	ND*	
→	11/20/01	ND*	ND*	ND*	ND*	ND*	ND*	
	2/22/02	ND*	ND*	ND*	ND*	ND*	ND*	
MW 10	5/24/02	ND*	ND*	ND*	ND*	ND*	ND*	
	8/14/02	ND*	ND*	ND*	ND*	ND*	ND*	-
	6/18/01	ND*	ND*	ND*	ND*	ND*	ND*	
→	11/21/01	1.3	5.3	ND*	3	9.5	ND*	
	2/22/02	ND*	ND*	ND*	ND*	ND*	ND*	
MW 11	5/24/02	ND*	ND*	ND*	ND*	ND*	ND*	
	8/14/02	ND*	ND*	ND*	ND*	ND*	ND*	100%
	9/26/01	790	11,000	3,200	11,500	26,940	140	
→	11/20/01	380	2,900	2,100	6,000	9,380	43	
	2/22/02	190	800	2,300	3,200	6,490	35	
MW 12	5/24/02-ns**	-	-	-	-	-	-	
	8/15/02-ns**	-	-	-	-	-	-	*** 31%
	9/26/01	ND*	59	1,600	770	2,429	16	
→	11/20/01	36	69	1,600	630	2,355	20	
	2/22/02	ND*	28	770	62	860	10	
MW 13	5/24/02-ns**	-	-	-	-	-	-	
	8/15/02-ns**	-	-	-	-	-	-	***63%
	3/15/02	ND*	ND*	460	14	475	8-Jul	
MS 14	5/23/02	ND*	ND*	9.8	17	26,8	4.6	
	8/15/02	ND*	ND*	ND*	2	2	9.63	****96%

Results-BTEX Degradation



Results-Benzene Degradation



Conclusions

- *iSOC™* produced DO concentrations of 8.6 ppm more than 18 metres down gradient of *iSOC™* after 10 months of system installation.
- Concentrations of gasoline constituents reduced by 95–100% in 6 of 8 nearby monitor wells within 10 months of *iSOC™* system installation.
- After 10 months of operation, no area monitor well had higher than 4 ppm of BTEX.
- Site has been recommended for closure.