



SIoux CITY/IOWA

A Butane Biostimulation Technologies™ pilot study was conducted at a Superfund Site located in Sioux City, Iowa. The primary environmental contractor for the Site is HDR Engineering, Inc. located in Omaha, Nebraska. As part of the overall Site investigation program for the facility, a Feasibility Study (FS) was completed which detailed appropriate remedial technologies for Site soils and groundwater that have been adversely impacted by chemicals of concern (chlorinated volatile organic compounds). The objective of the FS was to develop, screen, and evaluate remedial alternatives potentially capable of meeting regulatory requirements imposed by state and federal agencies. The FS was conducted in accordance with United States Environmental Protection Agency (USEPA) guidelines under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The recommended alternative for remediation of soil and groundwater impacted with chlorinated VOCs was enhanced biodegradation using Butane Biostimulation Technologies™; however, the USEPA and IDNR requested that a field pilot study be conducted using the technology on Site groundwater before consideration of the technology for a full-scale remedial system. The scope and operational parameters for the pilot-scale system were provided in a Butane Biostimulation Technologies™ Pilot Study Work Plan/Quality Assurance Project Plan (QAPP). The report provided a description of the system design and operation, and of the procedures used to evaluate the data collected during the six month operation of the system.

Multiple vertical injection point screened intervals were chosen to allow for flexibility in the operation of the injection system, and to minimize potential laminar distribution of injected butane and air during the initial enrichment period of the pilot study. The site geology is composed of sand, silt and some clay, with an aquifer 100 feet deep (the local source of drinking water). Initially all three injection points (screened just below the water table surface, at mid-depth, and at the bottom of a shallow aquifer zone between the water table and the top of a clay layer at 42 feet) were used for injection. The three injection points were used during the butane enrichment period to maximize the distribution of dissolved oxygen and butane into the shallow aquifer zone. Although the pilot study ended in August 2001, the Butane Biostimulation™ system has been operating continuously for enhanced source area treatment. In May 2003, the Site PRP filed the requisite paperwork to obtain approval for full-scale technology implementation at the Site.

BUTANE BIOSTIMULATION TECHNOLOGIES™ Site Photos



Summary of Groundwater Quality Data
Sioux City, Iowa
Pilot Study Begin Date – February 2001
Pilot Study End Date – August 2001

Sample Location	Sample Date	Analytical Method	1,1,1-TCA	1,1-DCA	1,1-DCE	cis 1,2-DCE	TCE
MW-1	Feb-2001	8260 VOCs	8,320	17,400	1,800	22,500	5,320
	Aug-2001	8260 VOCs	49	460	49	2,230	70
MW-2	Feb-2001	8260 VOCs	7,160	5,170	1,400	5,720	1,400
	Aug-2001	8260 VOCs	6.0	16.6	0.8	32.6	6.5
MW-3	Feb-2001	8260 VOCs	300	2,800	780	27,600	660
	Aug-2001	8260 VOCs	BDL	44	2.4	115	11
MW-7*	Feb-2001	8260 VOCs	BDL	1,130	40	240	19
	Aug-2001	8260 VOCs	BDL	1,160	50	230	19
Maximum Contaminant Level (MCL)			200	70	7.0	70	5.0

NOTES: All concentrations expressed in µg/l (ppb)

BDL = Below Laboratory Detection Limit

* Monitoring well MW-7 was outside the butane treatment zone and thus served as a control well

REFERENCES

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