CLIENT: NASA

LOCATION: Huntsville, AL

TECHNOLOGY: Ferox™

LITHOLOGY: Clay, sand

CONTAMINANTS:

Chlorinated Solvents (TCE)

PNEUMATIC FRACTURING, FEROX™

Site Information

Cascade applied The Ferox™ process for a project at an active federal government facility located in northern Alabama. The remedial action was implemented under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) program targeting a former waste holding pond. The project scope of work included installation of two Ferox™ treatment zones: a 3000-sq. ft. Source Area Treatment Zone and a 450-ft. long by 60-ft. wide Downgradient Treatment Zone. The primary contaminant, TCE, was detected at concentrations as high as 72 mg/liter in the groundwater within the Source Area Treatment Zone.

Approach

The objective of the technology implementation was to actively remove TCE within the source area and rely on the passive downgradient barrier zone to intercept the more dilute portions of the plume. Contamination at the site was found primarily in a “rubble zone” consisting of a heterogeneous aggregate of clay, sand and small to large gravel-sized cherts. The 5-7 ft. rubble zone was overlain by approximately 30 ft. of a clayey residuum and underlain by limestone bedrock. Through a total of roughly 29 open boreholes, more than 11,000 lbs. of Ferox™ powder in the form of slurry was injected into the formation during the 4-week project utilizing a pressurized nitrogen gas based delivery system in conjunction with Pneumatic Fracturing. During the injections, pressure influence was observed as far as 80 ft. away from the injection point. Under pressures of 90-115 psi, the Ferox™ slurry was intermixed within the rubble zone by fluidizing the formation sandwiched between the two confining layers.

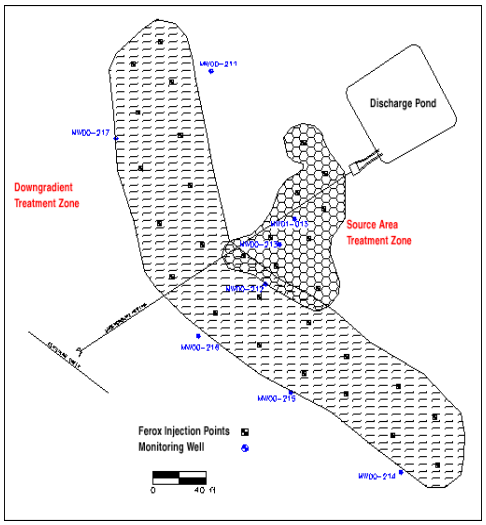

Figure 1 The construction plan

Results

Based on field observation and pressure monitoring, the injection process was a success in effectively dispersing the Ferox™ powder into the targeted zones. The data summary table below shows the baseline and post-injection analytical results.

This table shows the results of the baseline and post-injection groundwater sampling events. Baseline data was represented by the results of the July 11, 2000 sampling event. Note the decrease in the TCE concentrations and the corresponding increase in cis-1,2-DCE, and chloride levels in source area wells.

This is indicative of effective dechlorination of the TCE. Two years after the injection took place, the TCE concentrations have been significantly reduced by as high as 90% in the “hottest” well. A second injection or “polishing phase” will further remove the remaining TCE.

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PROJECT HIGHLIGHT

RESULTS CONTINUED

Well ID	Event	TCE (ug/L)	*cis*-1,2-DCE (ug/L)	1,1,2,2-PCA (ug/L)	1,1,2,-TCA (ug/L)	Cl (mg/L)	pH (s.u)
MW 01-013	Baseline	50200	30	240	64	2.76	7.04
	Post-Inj. I	10700	50 U	50 U	50 U	8.56	6.65
	Post-Inj. II	34000	180	250 U	250 U	9.6	6.97
	Post-Inj. III	10000	920	50 U	50 U	9.1	7
	Post-Inj. IV	13000	7700	100 U	100 U	11	7.01
	Post-Inj. V	6600	5000	40 U	40 U	15	7
	Post-Inj. VI	12000	11000	100 U	100 U	19	7.04
MW 00-211	Baseline	22	1 U	1 U	1 U	6.87	6.98
	Post-Inj. I	64	1 U	1 U	1 U	7.48	6.75
	Post-Inj. II	29	5 U	5 U	5 U	8	6.93
	Post-Inj. III	12	1 U	1 U	1 U	8.5	7.16
	Post-Inj. IV	12	1 U	1 U	1 U	7.7	6.3
	Post-Inj. V	11	1 U	1 U	1 U	9.2	6.93
	Post-Inj. VI	17	1 U	1 U	1 U	9.2	7.13
MW 00-212	Baseline	13300	122	500 U	500 U	4.34	6.35
	Post-Inj. I	3250	1140	50 U	50 U	10.5	6.8
	Post-Inj. II	8900	680	250 U	250 U	7	6.35
	Post-Inj. III	5100	900	5 U	5 U	7.9	6.72
	Post-Inj. IV	5800	630	50 U	50 U	6.6	5.57
	Post-Inj. V	4500	370	40 U	40 U	6.8	6.3
	Post-Inj. VI	5600	540	25 U	25 U	7.9	6.48
MW 00-213	Baseline	72800	100 U	100 U	100 U	3.29	6.91
	Post-Inj. I	9760	25	50 U	50 U	44.4	6.65
	Post-Inj. II	14000	430	250 U	250 U	42	6.54
	Post-Inj. III	5200	970	40 U	40 U	30	6.04
	Post-Inj. IV	4200	3900	50 U	50 U	23	6.32
	Post-Inj. V	3400	3500	40 U	40 U	30	7.29
	Post-Inj. VI	2500	9900	100 U	100 U	34	6.48
MW 00-214	Baseline	0.94	1 U	1 U	1 U	1.36	6.26
	Post-Inj. I	1 U	1 U	1 U	5 U	1.9	5.94
	Post-Inj. II	-	-	-	-	-	6.19
	Post-Inj. III	0.76	1 U	1 U	1 U	2.1	6.35
	Post-Inj. IV	0.71	1 U	1 U	1 U	1.6	6.07
	Post-Inj. V	0.67	1 U	1 U	1 U	2.1	5.88
	Post-Inj. VI	0.56	1 U	1 U	1 U	1.9	6.3
MW 00-215	Baseline	51	1.6	1 U	1 U	2.34	6.08
	Post-Inj. I	47	1.1	1 U	1 U	-	6.32
	Post-Inj. II	-	-	-	-	2.9	6.03
	Post-Inj. III	36	0.97	1 U	1 U	3.8	5.95
	Post-Inj. IV	48	0.84	1 U	1 U	3	5.34
	Post-Inj. V	63	1	1 U	1 U	3.4	5.7
	Post-Inj. VI	53	0.8	1 U	1 U	3.2	6.05
MW 00-216	Baseline	213	114	1 U	1 U	3.69	6.42
	Post-Inj. I	203	116	1 U	1 U	5.66	6.24
	Post-Inj. II	360	26	5 U	5 U	4.1	6.12
	Post-Inj. III	320	55	2 U	1 U	5.9	5.55
	Post-Inj. IV	300	72	1 U	1 U	4.7	5.06
	Post-Inj. V	210	51	2 U	2 U	6.2	5.66
	Post-Inj. VI	300	74	2 U	2 U	5.1	5.65
MW 00-217	Baseline	16	5.5	1 U	1 U	4.63	6.08
	Post-Inj. I	13	5.2	1 U	1 U	6.88	6.24
	Post-Inj. II	9.8	3.7	5 U	5 U	5.4	5.84
	Post-Inj. III	8.7	3.4	1 U	1 U	6.8	5.54
	Post-Inj. IV	9	3.2	1U	1U	5.3	5.45
	Post-Inj. V	13	5.6	1 U	1 U	6.2	6.2
	Post-Inj. VI	14	4.4	1 U	1 U	5.8	5.18

The previous table shows the results of the baseline and post-injection groundwater sampling events. The post-injection sampling events were conducted approximately 6 weeks, 10 weeks, 18 weeks, 30 weeks, 52 weeks and 64 weeks after the Ferox™ injection. Note the decrease in the TCE concentrations and the corresponding increase in cis-1,2-DCE, and chloride levels in source area wells. This is indicative of effective dechlorination of the TCE.