THERMAL REMEDIATION services inc.

T-*Timely and Efficient*
R-*Results Without Cost Overruns*
S-*Superior Customer Service*

"TRS guarantees excellence and remediation certainty without cost overruns. Our word is who we are."

Full Scale Remediation of PCE, TCE and TetCA using ERH at Fort Richardson, Anchorage, AK

- *Contaminants Treated:* Tetrachloroethene (PCE), Trichloroethene (TCE), 1,1,2,2-Tetrachloroethane (TetCA)
- *Geology:* Clay and silt
- *Hydrology:* Groundwater at 8 ft bgs
- *Beginning Contaminant Levels:* Average 1,900 mg/L and 348 mg/kg Total VOCs
- *Cleanup Levels Achieved:* 57 µg/L and 1.75 mg/kg or 97% and 99% average reductions, respectively
- *Remediation Time Period:* 4.5 months
- *Project Reference:* Mr. Scott Kendall, US Army Corp of Engineers, Anchorage, AK (907) 753-5661

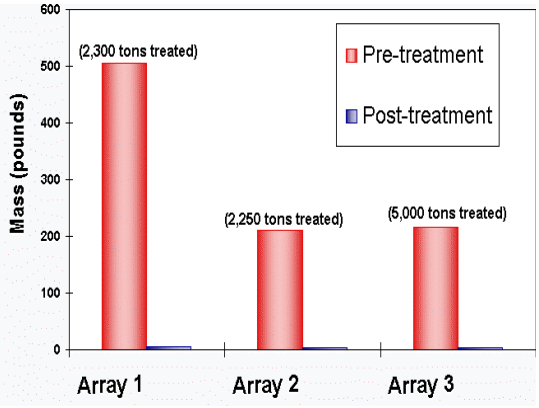


Figure 1. Mass Removal in All Three Arrays.

TRS senior personnel, while working for a previous company, provided design, installation and operations of the ERH remediation system at Fort Richardson, AK as a subcontractor to URS Corp. In three separate applications, ERH successfully remediated Dense Non-Aqueous Phase Liquids (DNAPL) from tight saturated soil. Three ERH arrays were used to treat DNAPL to a depth of 40-feet bgs. Arrays 1 and 2 measured 27-feet in diameter, while array 3 measured 40-feet. Combined, the arrays treated approximately 6,800 cubic yards. Site lithology consisted of dense, impermeable soil with GW at 8-ft bg. Site impact was primarily from PCE, TCE and 1,1,2,2-tetrachloroethane (TetCA) with soil and GW concentrations as high as 16,000 mg/kg and 1,900 mg/l, respectively. ERH arrays consisted of six electrodes in a hexagonal pattern with a neutral electrode in the center.

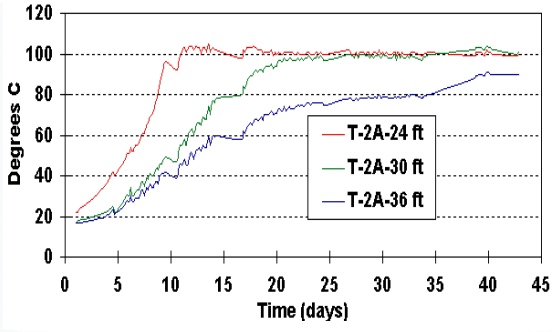


Figure 2. Subsurface Temperature at Depth

Electrodes were installed to 38.5-ft bg and active heating extended from 10-40 ft bg. Heating was conducted sequentially, and each array was operated for six weeks. At each array, subsurface temperatures were increased to 100°C during the first 2 weeks of heating, allowing 4 weeks of aquifer boiling and steam stripping to remove contaminants from the soil matrix within the treatment area (Fig. 1).

TRS provides financial certainty and assurance that your subsurface environmental liability will be remediated.

Our reputation is built through hard work and trust because in the end our word is who we are. We provide our customers with certainty that their projects will be completed to the performance and budgetary assurances presented in our proposals.

Site owners and consultants select TRS as the preferred ERH provider based on several factors. Please click this link to learn more.

http://thermalrs.com/TRSPages/CompanyMain.html

Contaminant laden steam was collected at the electrodes using Soil Vapor Extraction (SVE) and condensed to water and soil vapor for treatment by air stripping and catalytic oxidization. Analytical results indicated an average reduction in VOCs in Array 1 of approximately 96%,

with the average reduction of TetCA reaching 99%. In one location, the concentration was reduced from 1,000 mg/kg to non-detectable levels with only six weeks of heating. Estimates of the mass removed from the soil in Array 1 showed a reduction from 506 pounds to 6 pounds of TCE, PCE, and TetCA, representing a 98.8% removal. Review of the analytical data from Array 2 yielded similar results, with the average VOC concentration decreasing from 44.99 mg/kg to 0.95 mg/kg. This represented a 97.9% overall average reduction of VOC soil concentrations. In one sample location, TCE concentrations were reduced from 270 mg/kg to 0.09 mg/kg. Estimates of the mass of VOC removed from the Array 2 area showed reduction from 211 pounds to 4.4 pounds of TCE, PCE, and TetCA. Results of operations in Array 3 indicated an overall reduction in VOCs from 130.62 mg/kg to 4.31 mg/kg, representing a reduction of 96.7%.

Groundwater Performance Data for ERH at Fort Richardson

Analyte	Remedial Action Objective (mg/kg)	Month Sampled	Concentration and Detection Limit (mg/L)		
			MW-19	MW-22	MW-23
Benzene	0.005	March November	ND (0.001) ND (0.001)	ND (0.01) ND (0.001)	ND (0.01) ND (0.001)
Carbon Tetrachloride	0.005	March November	ND (0.001) ND (0.001)	ND (0.01) ND (0.001)	ND (0.01) ND (0.001)
Cis-1,2 DCE	0.07	March November	0.014 0.01	0.180 0.058	0.230 0.300
Trans-1,2-DCE	0.1	March November	0.006 0.0013	0.060 0.015	0.230 0.036
TECA	0.052	March November	0.690 0.850	2.800 0.810	17.000 0.100
PCE	0.005	March November	0.007 ND (0.001)	0.062 0.029	0.072 0.0010
TCE	0.005	March November	0.280 0.021	1.700 1.600	3.100 0.970

ND – non detect

Disclaimer: The Table below was not part of the original Woodward-Clyde (URS) Draft Design Verification Study.

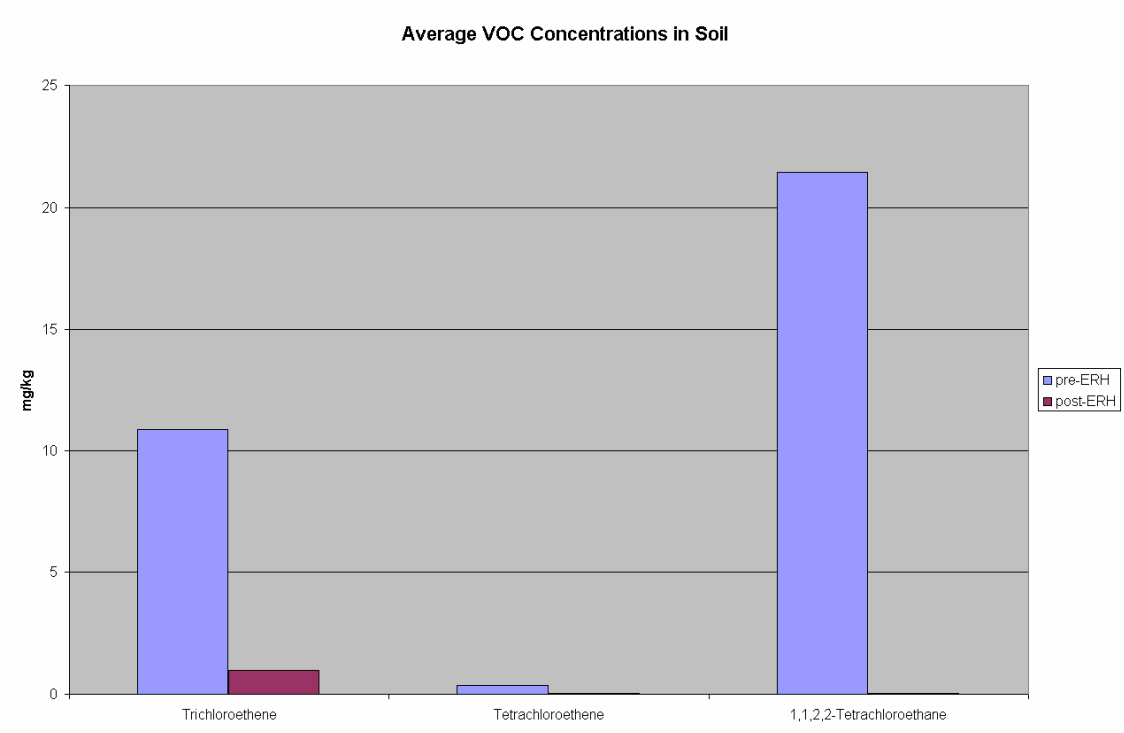
This table was prepared by TRS and inserted into the report after its production.
This table was prepared because boring T-A8 is located at a distance from Array 3 which is outside the region of effective remediation. This table only includes sample data for locations at which a remedial effect was expected before the remediation began.

Soil Performance Data for ERH at Fort Richardson

Sample Location	Sample Depth	Trichloroethene (mg/Kg)			Tetrachloroethene (mg/Kg)			1,1,2,2-Tetrachloroethane (mg/Kg)		
		Before	**After**	**%Removed**	**Before**	**After**	**%Removed**	**Before**	**After**	**%Removed**
T-A7	15-16.5	1.7	NS		0.06	NS		4.0	NS	
T-A7	20-21.5	25 D4	0.32	99%	0.60	ND (0.06)	90%	51	ND (0.06)	99.9%
T-A7	25-26.5	17 D4	1.7	90%	0.77	0.06	92%	34	ND (0.05)	99.9%
T-A7	30-31.5	1.3	0.92	29%	ND (0.05)	ND (0.05)	N/A	0.67	ND (0.05)	93%
T-A7	35-36.5	0.11	0.94	-755%	ND (0.06)	ND (0.05)	N/A	ND (0.06)	ND (0.05)	N/A
T4-1		640	12	99%	120	0.012	99.99%	12,000	ND (0.03)	99.999%
T4-2		6	0.087	98%	1	0.098	90%	67	ND (0.034)	N/A
T6-1		200	63	69%	3.1	0.71	77%	530	ND (0.033)	N/A
T6-2		1.7	0.84	51%	0.09	ND (0.032)	N/A	0.07	ND (0.032)	N/A
Average		**99.2**	**9.97**	**90%**	**13.07**	**0.13**	**99%**	**1,409**	**0.04**	**99.99%**

D4 - Diluted Sample
ND () - Not detected (detection limit)
NS - Not sampled .
Averages do not include the 15-16.5 ft bgs sample depth because no "after" data exists for comparison.
ND samples are averaged at one-half of the detection limit

The graph below includes the soil data from sample location T-A7 shown in the table above.



Combining Technologies for Increased Contaminant Reduction at Reduced Price

TRS has patents pending for heat-enhanced biodegradation.

ERH electrodes are used not only to increase the temperature in the treatment zone, but also to introduce biological or chemical amendments to enhance the degradation of contaminant source areas and dissolved contaminant plumes. The combination of electrical resistance heating and enhanced in-situ bioremediation technologies can achieve lower cleanup goals at reduced cost.