

BIOREMEDIATION OF GROUND WATER BY TREATMENT OF SOIL AT SOURCE WITH VAPORREMED

Background

In February of 2005, a release of between 150 and 200 gallons of #2 fuel oil occurred at a residence in Blandon, Pennsylvania. The released fuel oil entered the basement of the residence, covering a 200 square-foot area. The spill was responded to immediately by local environment agency and the response actions included removal of the concrete floor and underlying soils.



Figure 1. Basement immediately after removal of dirt

Since additional excavation would compromise the integrity of the building structure, an in-situ remedial method using VaporRemed was selected to address the remaining soils that were impacted above Statewide Health Standards, as well as the residual contaminants in groundwater. Groundwater was encountered at a depth of approximately two to three feet below the floor level. Also, noticeable petroleum vapors were persistent in the basement as well as the first floor of the residence.

In this case spilled residual oil was expected to be bioremediated by VaporRemed resulting in reduced concentrations of compounds of concern like benzene and other Volatile Organic Compounds in soil and also that of ground water. The post-excavation sampling on 16th February, 2005 indicated that constituents of concern exceeded Pennsylvania's Statewide Health Standards in both soil and groundwater. These included benzene concentrations of 2,200 $\mu\text{g}/\text{kg}$ in soil (Statewide Health Standard is 500 $\mu\text{g}/\text{kg}$), and benzene and naphthalene concentrations of 120 $\mu\text{g}/\text{L}$ and 2,800 $\mu\text{g}/\text{L}$ in groundwater



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(Statewide Health Standards are 5 µg/L and 100 µg/L, respectively). On February 22, 2005, 10 gallons of the VaporRemed was applied at the site. Two weeks following the application, soil and groundwater sampling was performed.

Results

Laboratory analysis results from two soil samples indicated benzene concentrations of 330 µg/kg and 54 µg/kg, an order of magnitude lower than the pre-remediation concentration, and below the Statewide Health Standard. Later soil sampling that was conducted in a biased fashion to demonstrate attainment of Statewide Health Standards indicated non-detectable concentrations of benzene in five soil samples. The two groundwater samples that were collected contained benzene at concentrations of 12 and 20 ug/L, and naphthalene concentrations of 280 and 880 ug/L, both reflecting significant decreases from the concentrations observed prior to remediation. Petroleum odors in the residence were also observed to have greatly diminished.

Location/Date	Benzene	Ethylbenzene	Cumene	Fluorene	Naphthalene	Toluene	Phenanthrene
MSC	5	700	1,100	1,500	100	1,000	1,100
West Sump							
2/16/2005	120	130	28	970	2,800	340	2,700
3/11/2005	12	54	25	160	280	64	430
3/29/2005	NS	NS	NS	NS	NS	NS	NS
5/2/2005	NS	NS	NS	NS	NS	NS	NS
1/19/2006	<1	<2	<2	<2	<2	<2	<2
4/25/2006	<1	<2	<2	5	<2	<2	16

Table 1. Showing analysis of ground water before and after application of VaporRemed

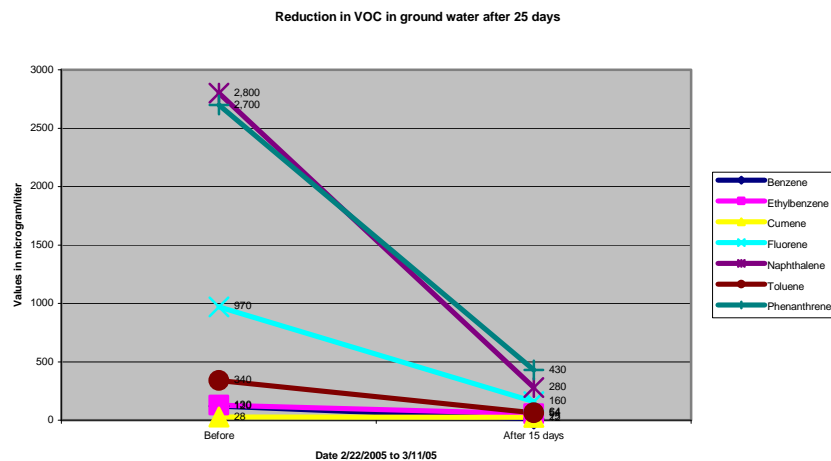


Figure 2. Shows reduction of BTEX in Ground water after 15 days



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Results of samples collected in January of 2006 showed that both benzene and naphthalene were no longer detectable in groundwater above the laboratory detection limit of 2 ug/L.

Conclusions:

Treatment of impacted soil with VaporRemed reduced concentration of BTEX and other VOC in the ground water suggesting that addition of bioremediation compounds to the ground water directly may not be necessary if the contamination is treated at source.