IN-SITU OZONE REMEDIATION OF ADSORBED PAHs IN SOIL

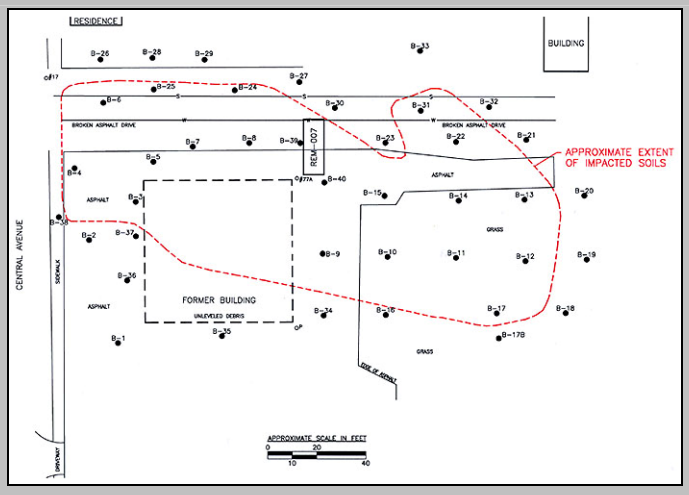
Former Fuel Oil Distribution Terminal, Ilion, New York

BLUE **L**IGHTNING **U**NDERGROUND **E**NTERPRISES (BLUE)
Moorestown, New Jersey 08057, U.S.A.

INTRODUCTION

We were retained to conduct an expedited remediation of vadose zone PAH impacts, to facilitate property divestiture and redevelopment. This remediation was contracted on a lump sub to closure basis.

A successful field implementation of in-situ ozone-injection was used to mitigate vadose zone, adsorbed phase PAH impacts at a former fuel oil distribution terminal in Upstate New York. A full-scale ozone system was designed and start-up of the 50 lb/day ozone/oxygen injection system was initiated in June 2001, for a total duration of eight weeks, to address adsorbed phase PAH compounds in vadose zone soil in the former loading rack area.



Initial PAH concentrations exceeding 30 mg/kg (primarily B(a)A, B(a)P, and chrysene) needed to be reduced up to 90%, to meet the NYSDEC - TAGM 4046 Standards.

Table 1 – Targeted PAH Contaminant Profile – Full Scale

PAH Compound	CONCENTRATION (ppb) Average	Maximum	TAGM 4046 Standard (ppb)
Benzo(a)anthracene	1,410	2,900	224
Benzo(a)pyrene	536	1,200	61
Benzo(b)fluoranthene	1,050	2,300	224
Benzo(b)fluoranthene	980	2,500	224
Chrysene	1,077	2,200	400
Total STARS PAHs	13,540	32,520	NA

PAH compounds were the regulatory drivers for remediation at this site, and due to their recalcitrant nature, they are not typically amenable to common in-situ remedial methods. Historically, excavation and disposal, or thermal treatment of PAH impacted soils have been the only viable alternatives for site remediation. However, the use of ozone for in situ oxidation of PAHs is starting to receive attention as a cost effective alternative to excavation.

SITE CHARACTERIZATION

The site is a former fuel oil terminal, with soil PAH impacts in an approximate 20,000 square foot area surrounding the former dispenser loading rack. The subsurface contains both contaminated fill and native soil. Groundwater is encountered between seven and eight feet below grade.

Adsorbed petroleum impacts were delineated from approximately 2 to 8 feet below grade, including primarily benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and chrysene. The remedial objective was to be in compliance with the NYSDEC TAGM 4046 standards. **Table 1,** (see previous page) presents a summary of the contaminant profile for the PAH impacted area. The total mass of hydrocarbons in the target zone needed to be reduced by approximately 75% in order to meet the remedial goals.

REMEDIATION: DESIGN, CONSTRUCTION & OPERATION

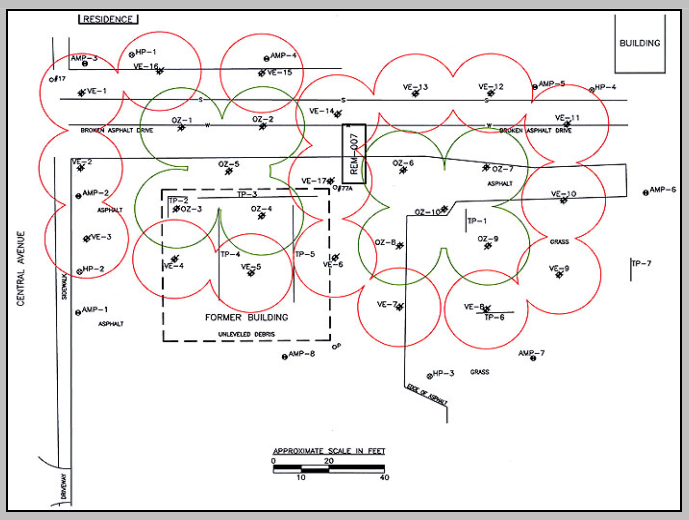
In order to keep the remedial duration less than 60 days, a nominal 50 lb/day ozone generation system was used. A total of 10 initial sparge points were installed at the site by direct-push methodology.

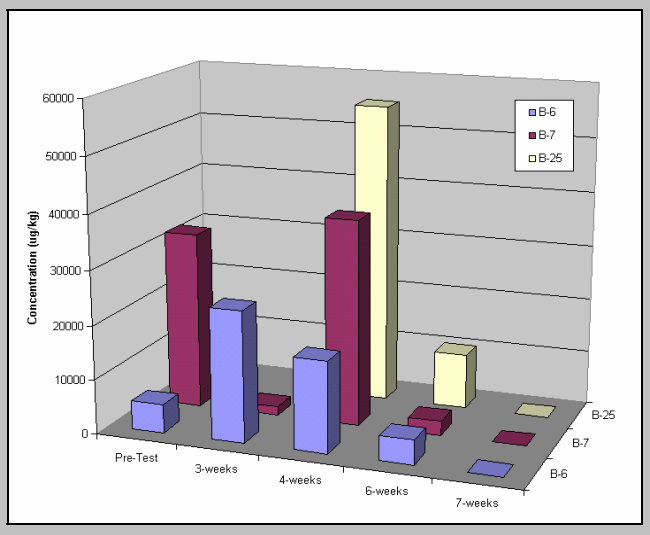
A shallow vapor extraction system was installed to control emissions. The vapor extraction system used 17 direct-push installed points. A multi-point, continuous ozone monitoring system was used to measure ambient ozone concentrations, and to control system operation safely.

RESULTS

Remediation was completed within 60 days. Post-treatment soil sampling results indicate no remaining PAH mass above the method detection limits, for an effectively 100% reduction.

Reduction to meet the TAGM 4046 Soil Standard was achieved within two months of active remediation. This project was completed for a fixed fee price that equates to approximately $24/cu.yd.





SUMMARY & CONCLUSIONS

This case history demonstrates that ozone can be effective at remediating adsorbed phase PAH compounds in vadose zone soils efficiently, such that attainment of remediation standards can be accomplished in a timely manner.

The NYSDEC issued an NFA for this site and redevelopment proceeded without delay.