



## ADVANCED OXIDATION- USING OZONE INJECTION

Active Retail Gasoline Service Station, Pine Barrens, Southern New Jersey

**BLUE LIGHTNING UNDERGROUND ENTERPRISES (BLUE)**

Moorestown, New Jersey 08057, U.S.A.

### INTRODUCTION

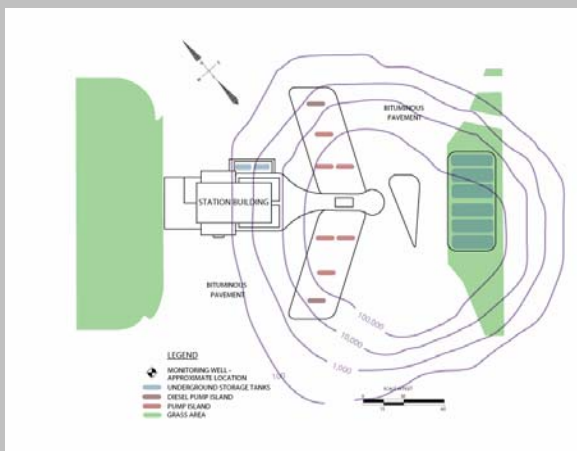
The subject site is an active retail petroleum service station located adjacent to a major highway in southern New Jersey. The original steel USTs, four 10,000 gallon gasoline and one 10,000 gallon diesel were removed during the period of December 1993 through February 1994. Six new 10,000 gallon fiberglass USTs were installed and are currently active. The facility is located in a sensitive area of New Jersey where the Groundwater Quality Criteria for Class I-PL aquifer applies. Because of the groundwater criteria for the facility, high priority was given to implementing a remediation system that would contain the contaminant plume. The client wanted to insure that the plume was contained onsite and did not migrate into a sensitive receptor. The objective was to reduce the dissolved petroleum hydrocarbons throughout the source area, in a timely manner. These tasks were performed so that they did not interfere with day-to-day operations of the facility.



### BACKGROUND

Management of the site began in May 1996 and we conducted an RI on the site, which consisted of nine soil borings in the vicinity of the USTs and the pump islands. The location of the soil borings was designed to delineate the total extent of xylenes in the soil above NJDEP soil remediation standards. A total of 15 soil samples were taken at depths ranging from 2.5 to 17 feet below ground surface (bgs). Soil adsorbed phase petroleum hydrocarbon compounds (PHCs) were not detected above the proposed NJDEP Soil Remediation Standards in the eleven soil samples analyzed for volatile organic compounds (VOCs). As such, the RI delineated the vertical and horizontal extent of soil-adsorbed phase PHCs above proposed NJDEP IGWSCC in the area of the pump island and the USTs.

In early 1997 our client initiated a program of delineating the dissolved phase of the PHC plume through the installation of four groundwater test points. Based on the outcome of the round of analytical data from the additional sampling, Another consulting firm implemented the design and subsequent installation of a 6 point SVE system that was located in the area between the former tank field and the pump island. Due to the unexpectedly high vapor influent concentrations, two 375 pound VGAC units were spent within two days. Subsequent rapid re-bedding changes of carbon led to the installation of a bio-filter off-gas treatment unit, which was used as the primary means for off-gas treatment for 8 months, at which point a reduction in VOCs was obtained.



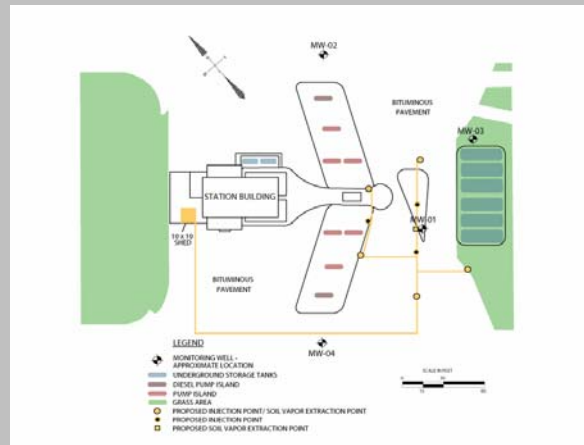
In an effort to enhance the remedial effort, BLUE designed and installed an advanced oxidation remediation system, which injected a combination of air and ozone into the groundwater.

## REMEDIATION: DESIGN, CONSTRUCTION & OPERATION

The remedial design for this site area was based on air and ozone injection into groundwater to reduce BTEX, TBA and MTBE within soil and groundwater. The ozone system was augmented with soil vapor extraction.

The system was comprised of a total of 8 ozone injection points, 6 vent wells and 4 points for monitoring pressure and vacuum across the treatment area. The area remediated was approximately 60' X 100'.

Recovered VOCs were treated above grade with conventional vapor phase granular activated carbon. The system injected 2 lbs of ozone per day and ran for a total of 12 months.

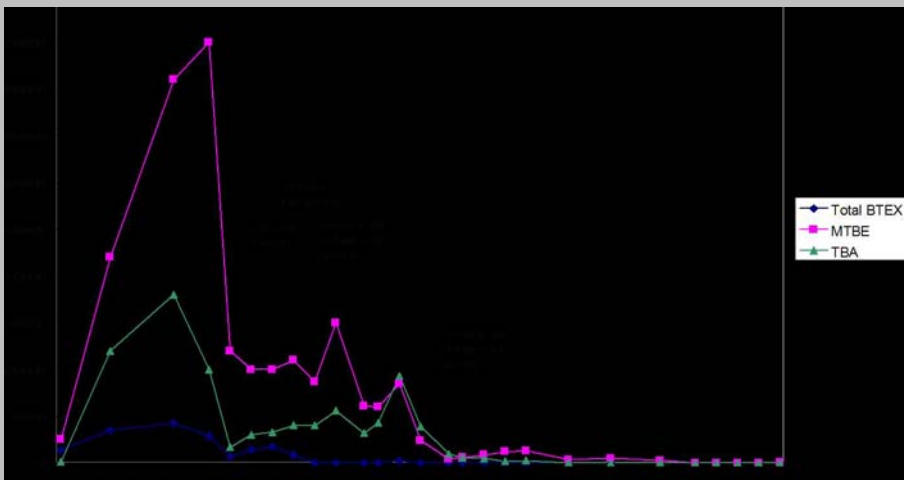


## RESULTS

Ozone injection clearly affected the oxidation of the contaminants in the groundwater. Also, as expected the injection of ozone into the groundwater caused an increase in dissolved oxygen levels in the groundwater.

BTEX and MTBE concentrations were significantly reduced to extremely low levels over the course of the remediation. During the 365 day long project more than 3500 pounds of contaminants were treated either above grade through soil venting or in the subsurface as a result of in-situ chemical oxidation or in-situ bioremediation as a result of increased oxygen levels.

Additional UST construction and upgrade work at this site indicated additional sources of gasoline are most likely present up gradient of the plume remediated here in.



## SUMMARY & CONCLUSIONS

The site area was treated using ISCO via ozone injection. MTBE, TBA and BTEX concentrations and mass was reduced over 99% within the plume area. The site remains an open case with the NJDEP due to other releases affecting other areas on the site. These other areas are being addressed via monitored natural attenuation.