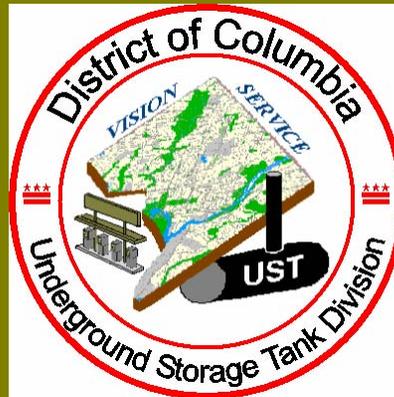


2006 EPA Region III LUST Technical Conference

District of Columbia Case Study At former Exxon Gas Station Located at 1100 Park Road, NW

Presented By Million Demissie
Washington, DC



Department of Environment
Environmental Health Administration
Bureau of Hazardous Materials & Toxic Substances
Underground Storage Tank Division

April 3, 2006

District of Columbia



Site Assessment

- Site Description and Background
- Site Investigation
- Receptors
- Method of Investigation
- Data collection discussion
- Permeability and Hydraulic Conductiveness
- Discussion of Results
- Contaminant Migration
- Risk Screening Criteria

Site Description & Background

- Location and Surrounding Area
- History of the site
- Geology/Topography
- Existing Condition and Physical settings

Location and Surrounding area

- Land use in the area is mixed, i.e. Commercial and Residential
- The site is bordered by town homes with basement to the west and north

Aerial photo of the site



Site existing condition



Aerial photo of surrounding area



Topography, Drainage

- The site is relatively flat.
- Sanitary and Sewers Pipe lines are reported to be above the groundwater elevation therefore the use of the this utility lines as preferential pathway is not considered.

History of the Site

- The site was a residential property prior to 1928 then functioned as a gas station through 1977.
- The property was owned by Exxon then known as Standard Oil Company , from 1942 through 1972 then by Exxon through 1978.
- Used as a cab service and auto sales through 1993 until WMATA obtained the property in 1993 for construction of Metro systems..
- Twelve USTs have been removed from the site.

History of tanks removed from the site.

No.	Year Installed	Company	UST size	Status
1	1924	Standard Oil	1000	Removed / Filled with sand 1953~1957
2	1924	Standard Oil	1000	Removed / Filled with sand 1953~1957
3	1924	Standard Oil	1000	Removed / Filled with sand 1953~1957
4	1924	Standard Oil	1000	Removed / Filled with sand 1953~1957
5	1929	Standard Oil	2000	Removed / Filled with sand 1953~1957
6	1953~1957	Standard Oil	3000	Removed;Late 1970's early 1980's
7	1953~1957	Standard Oil	3000	Removed;Late 1970's early 1980's
8	1953~1957	Standard Oil	3000	Removed;Late 1970's early 1980's
9	1953~1957	Standard Oil	3000	Removed;Late 1970's early 1980's
10	Unknown*	Unknown	3000	Permanently out of Use;Late 1970's, early 1980's
11	Unknown*	Unknown	1000	Permanently out of Use;Late 1970's, early 1980's
12	Unknown*	Unknown	500	Permanently out of Use;Late 1970's, early 1980's

Geology

- The site is in the Atlantic Coastal plain physiographic province.

- The Geology of the site from soil boring and excavations is predominantly clay and silt with sand to silty sand lenses and traces of gravel.

- Most of the sand layer occurs in the 7 feet to 20 feet BGS.

Hydrology

- Groundwater elevation changes from time to time but generally encountered between 12 feet and 27 feet.
- Perched water was also observed during well installation.
- Groundwater flow directions has been consistent over the recent monitoring periods, i.e predominantly to NW.

Current Physical settings

- In 1996 Washington Metropolitan Area Transit Authority (WMATA) installed a deep ventilation shaft in the NE Portion of the site.
- The Green Metro line is running beneath Park road.
- The current surrounding area is dominated by residential properties with basements.

Summary of Investigation

Soil:

Elevated level of petroleum contamination were exhibited along the soil column ranging between 20 to 27 feet BGS prior to the remediation activity. Contaminated soil was removed during excavation for Metro Fan shaft construction.

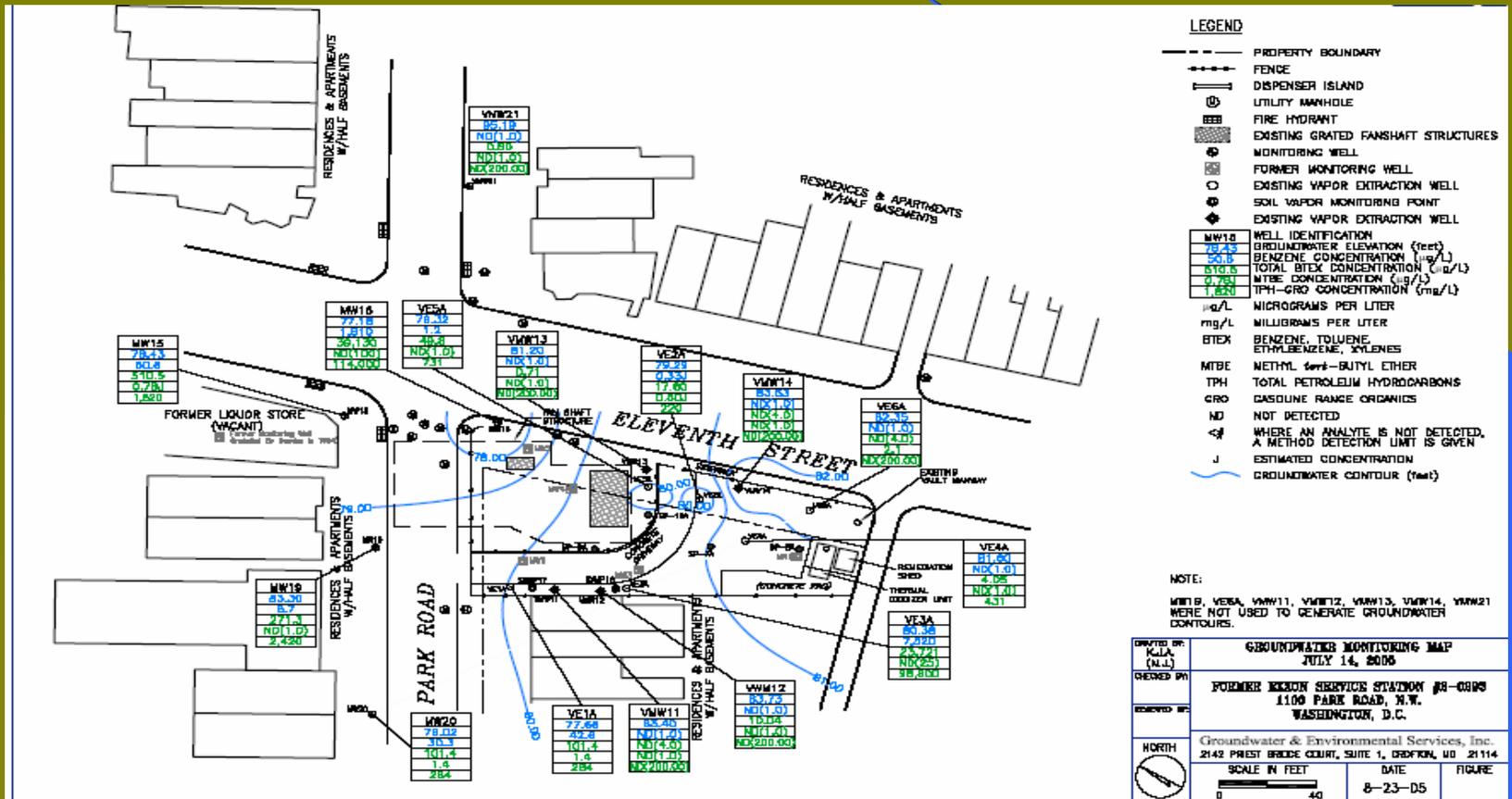
Groundwater:

15 monitoring wells were on monitoring plan, of which 11 MWs showed elevated level of petroleum concentration initially.

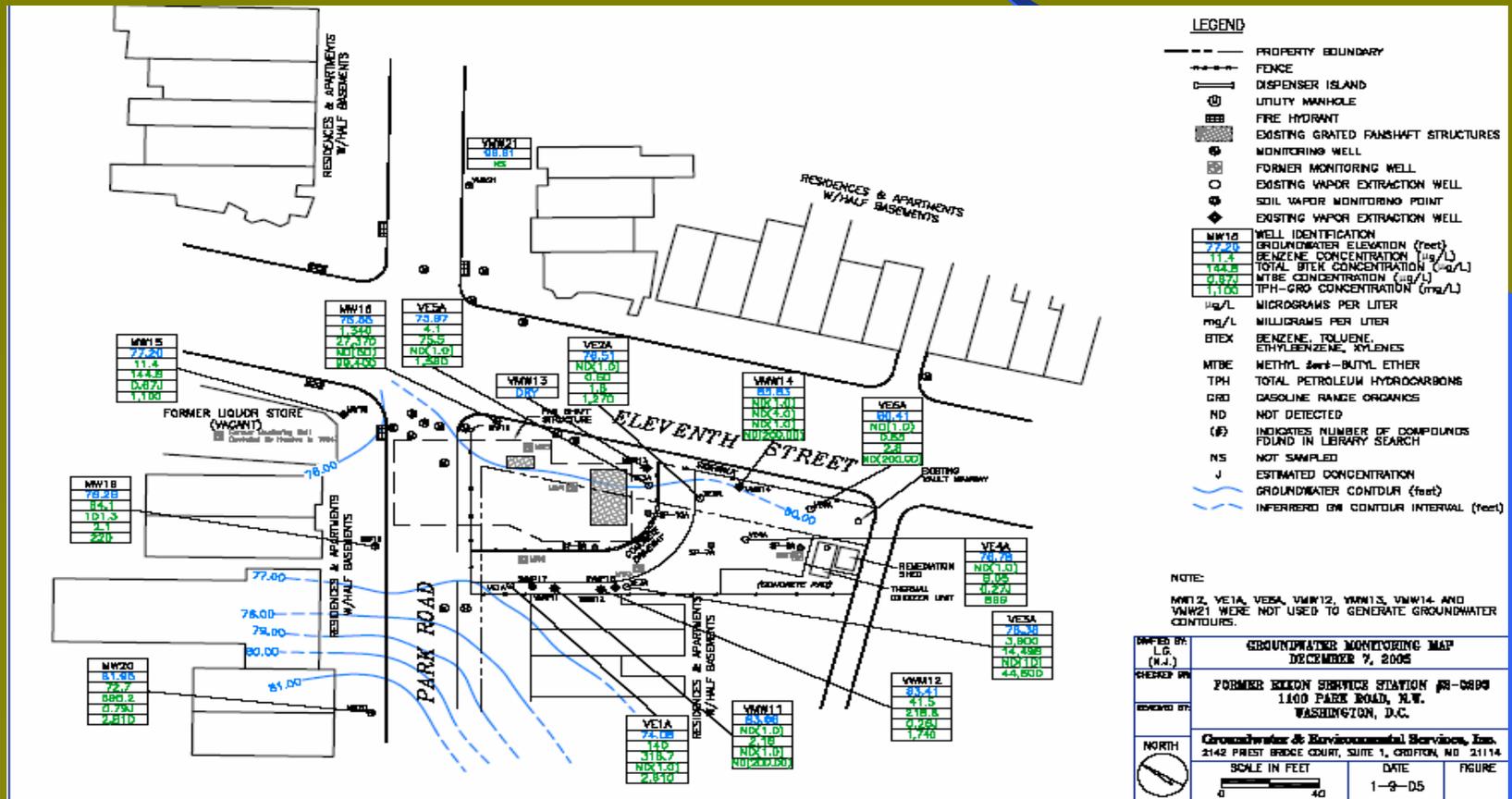
Soil vapor:

Permanent dual nested soil vapor points installed.

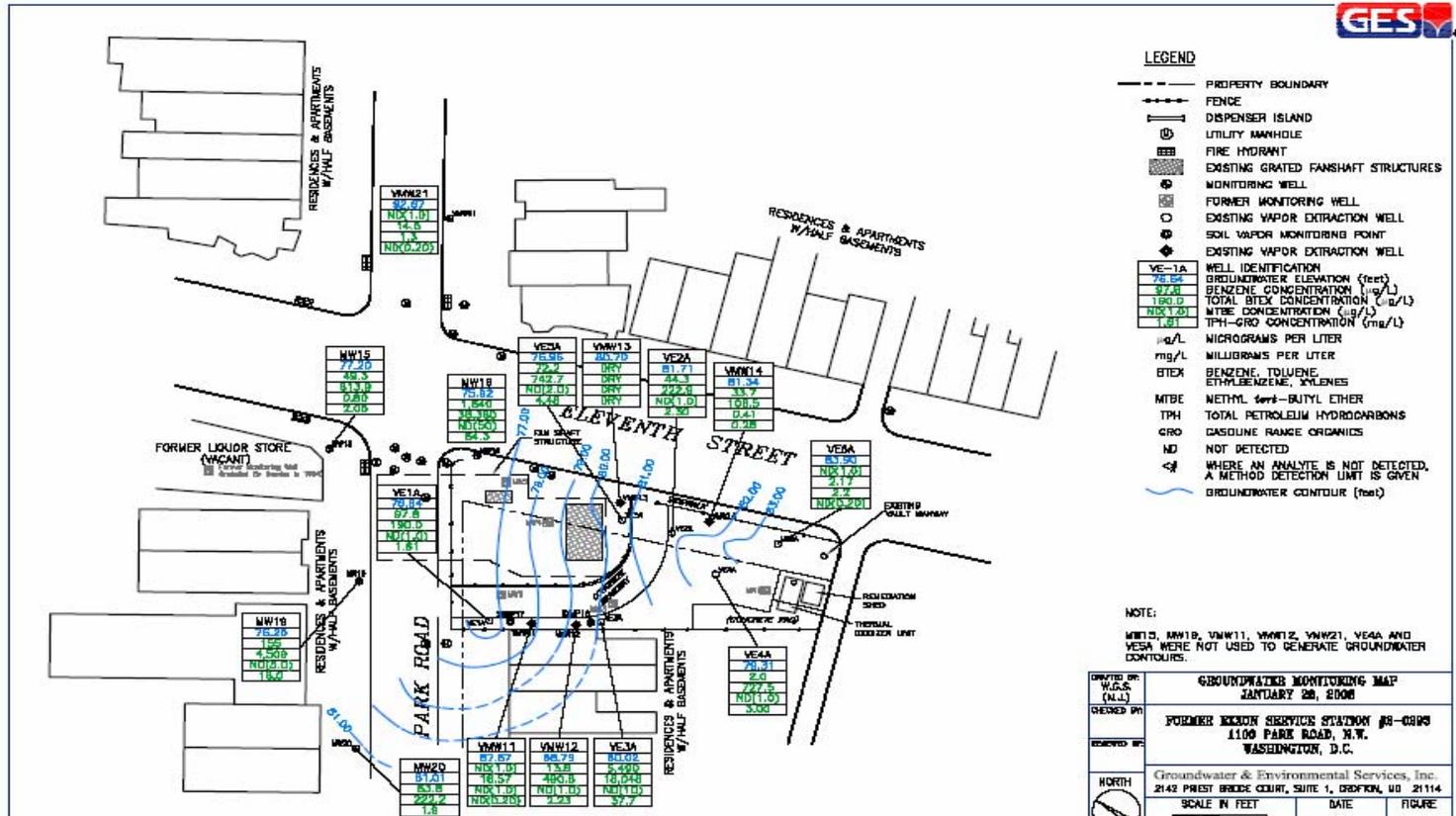
Groundwater Data, July 2005



Groundwater Data, Dec 2005



Groundwater Data January, 2006



Evaluation of Data

- Verification of assumptions.
- Depth to groundwater tables
- Groundwater flow directions
- Verification of data and characteristic of potential contaminants.

Verification of Data

- Soil and Groundwater exhibit elevated level of petroleum contamination
- Soil Borings SB1~ SB6 conducted to evaluate the performance of Remediation System and effect of chemical grouting around the Metro Exhaust Shaft exhibit elevated level of petroleum contamination at the deeper depth (50'~52')

Depth to Groundwater

- The water table occurs under unconfined conditions at a depth ranging from 12 ~27 feet
- Storm sewer pipe and sanitary line were located above the groundwater table

Permeability and Hydraulic Conductivity

- Slug tests were conducted on MW-3A & MW-4A
- Soils encountered during well installation were dominated by silty clay with fine to medium sands and traces of gravel.
- During excavation and construction of the Green Metro Line In 1996 soils in and around fan shaft and adjacent stacked tunnels were stabilized by chemical grouting and this chemical grouting has changed the physical properties of the soil.

Groundwater Flow Direction

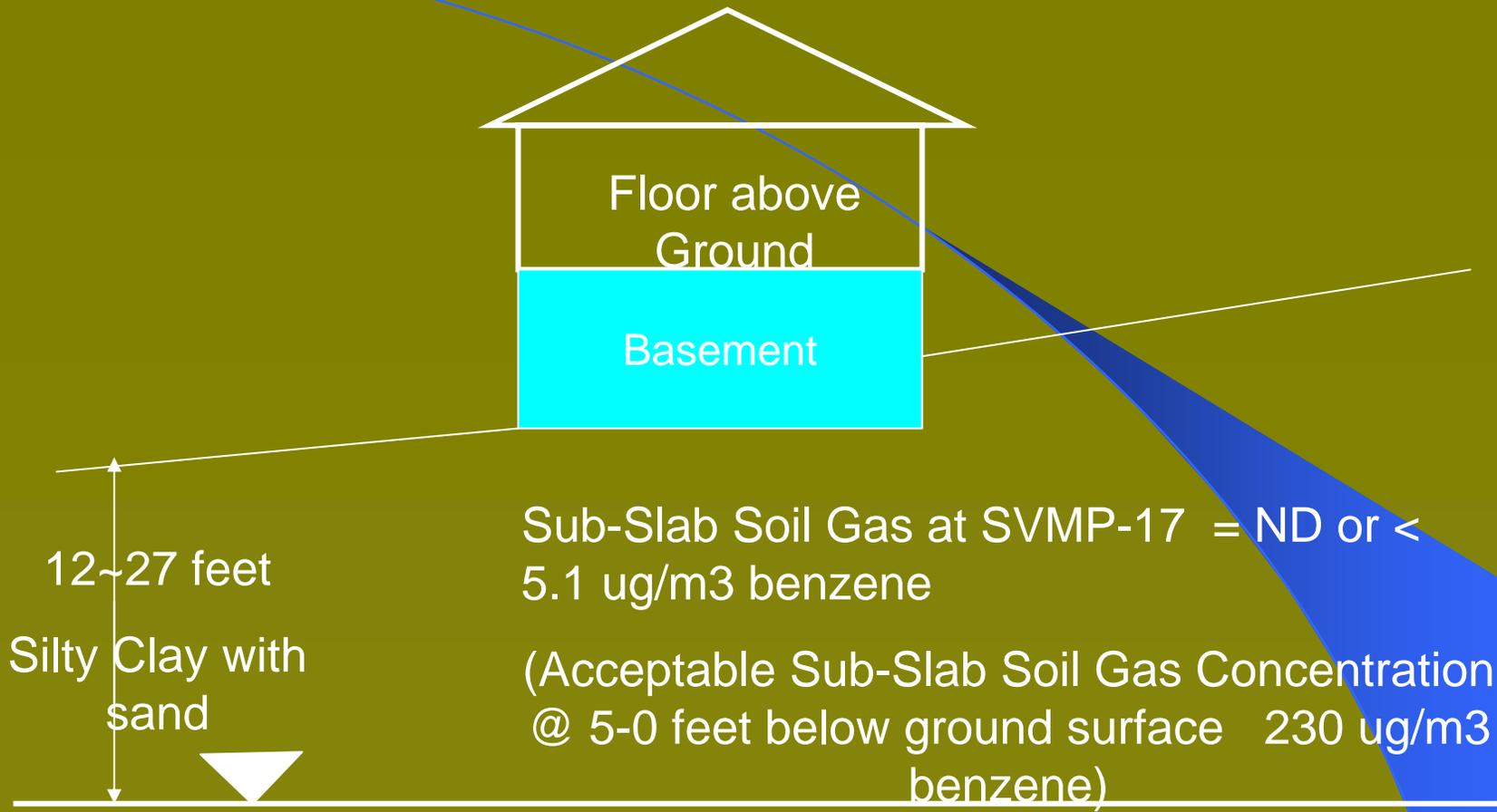
- The recent Groundwater contour suggests directions is predominantly to NW directions.
- Dewatering activities and grouting construction and Operation of the adjacent Metro line has contributed to the migration of contaminates.

Soil Vapor Sample Collection

- Two Soil vapor points dual nested SVMPs (SVMP-17, SVMP-18) were installed at depth of (2.5~3.5) & (5.5~6.5) immediately adjacent to residential row homes.
- Soil vapor samples were collected with summa canisters and were submitted for lab analysis by EPA Method TO-15.

Soil Vapor Evaluation of Data

- The soil vapor analytical data was evaluated using Vex RAT a proprietary version of J&E Model 1991 and was concluded that the concentration of soil vapor is protective of human health.
- Soil vapor sample was collected from SVMPS In early winter months of 2005 to evaluate seasonal effect on soil vapor and result indicated all were below Removal action level.



Benzene conc. in Groundwater at V1-1A ranges 49.5 ~56.9ug/L during Soil vapor sampling

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Summary of Soil Vapor Analytical Results

Sample point	Screen Depth	Sample Depth	Benzene	Toluene	Ethyl benzene	Total xylenes	MtBE
SVMP 17s	3.0~3.5	05/27/04	1.62	<1.92	<2.21	4.86	1.83
SVMP 17s	3.0~3.5	10/31/05	ND<5.61	4.9	6.5	7.2	ND(5.8)
SVMP 17D	5.5~6.0	10/31/05	ND<5.61	ND(6.0)	ND(6.9)	ND(6.9)	ND(5.8)
SVMP 18s	2.5~3.0	05/27/04	1.62	2.3	<2.21	<4.42	5.87
SVMP 18s	2.5~3.0	10/31/05	ND<5.61	ND(6.0)	ND(6.9)	ND(6.9)	5.87
SVMP 18D	5.5~6.0	05/27/04	341	1190	38.3	45.5	6.31E
SVMP 18D	5.5~6.0	10/31/05	5.4	4.9	ND(6.9)	9.6	ND(5.8)

Soil vapor Removal Action Level for the District of Columbia as adopted from EPA as used for Washington D.C ,Chillum Site

Petroleum Chemical in soil	Soil vapor removal action Level ug / M ³
Benzene	230
Toluene	15000
Ethylbenzene	38000
Xylenes	39000
Methyl Tert Butyl Ether (MTBE)	16000

This soil vapor standard was implemented as removal action Level for Chillum site, Washington D.C.

REMEDIAL ACTIONS

- Remedial design incorporating sparging and soil vapor extraction was evaluated and feasibility test was conducted.
- The lithology on the boring logs in addition to slug test data indicates a formation of moderate permeability to groundwater movement and that was the base line to propose and implement sparge and soil vapor extraction.

Remedial System

- Sparge Soil Vapor Extraction used five monitoring wells (MW1A~MW5A) for soil vapor extraction and sparging used SP-7A ~ SP-10A)
- Soil vapor extraction would recover the hydrocarbons stripped from the groundwater by sparging and as well as soil vapor from vadoze zone in the soil column.
- Thermal Oxidizer or Catalytic Operation would be used for off gas treatment. Release of Hydrocarbons to atmosphere exceeding one lb/day requires treatment

Remedial Performance Data

- Groundwater has shown a decrease in Hydrocarbons Concentration
- Due to the grouting operation and dewatering activities for the construction of Fan Shaft and Green Line metro Hydrocarbons were pulled down from the vadose zone deep into the saturated zone profile in the range of 50~60 feet BGS

CAP Evaluation

- Groundwater has shown a decrease trend in Hydrocarbons Concentration.
- Short term goals to ensure unacceptable levels of exposure to human is evaluated
- The remediation system is still active but the soil could not be remediated as the grouting has changed significantly the physical properties mainly the hydraulic conductivity.

Conclusion

- Dewatering for the construction of the Fan shaft has contributed to the migration of contaminants to extend to 50 and 55 feet below BGS.
- The application of the highly impermeable grout coupled with dewatering has locked in the petroleum contamination within the soil column at depth of 50~55 feet.

The End

- Thank you