

Project Background

- **Andrews Air Force Base (AAFB)**
Description:
 - 4,300 acre facility located 10 miles southeast of Washington, DC in Prince Georges County, Maryland
- **AAFB is part of the Air Force District of Washington**
 - Primary mission: Transport the President and other high-ranking personnel (home of Air Force One)
- **Subject Site Location**
 - Located in the northeast portion of the base at an active motor vehicle fueling facility



Figure 1. Air Force One

- **UST Removal: 1992 and 1993**
 - Five USTs removed – gasoline, heating oil, and used oil; a concrete anchor slab was left in place
 - Evidence of subsurface release observed (staining, free product, etc.)
 - Residual and free phase hydrocarbons present within tank excavation area
 - Dissolved-phase hydrocarbons documented migrating southwest of excavation

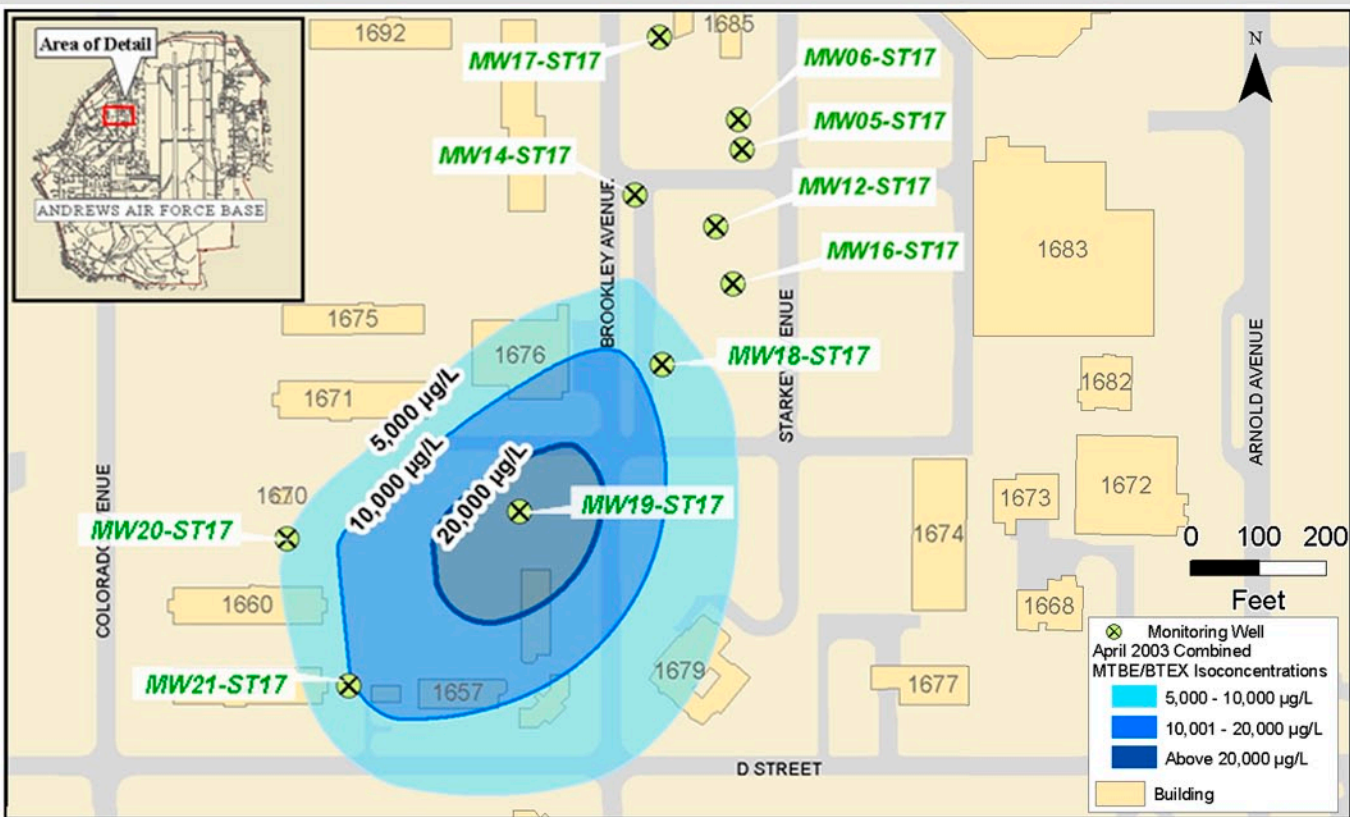


Figure 2. Pre-Remediation Combined MTBE/BTEX Isoconcentrations, April 2003

- **Average Groundwater Velocity**
 - 42.8 feet per year
- **Average Depth to Groundwater**
 - 10 feet
- **Contaminants of Concern**
 - Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)
 - Methyl Tert-Butyl Ether (MTBE)
- **Treatment Area**
 - Size: 210,000 ft²
 - Subsurface Soil
 - Clays and Gravels – 7 feet bgs
 - Sands and Gravels – 7 to 27 feet bgs

Previous Assessment and Remedial Activities

- Groundwater Well and Soil Boring Installation and Monitoring
- Passive Recovery of Free-Phase Hydrocarbons
- Installation and Operation of SVE System (2 years)
- Application of Fenton’s Reagent within Former Tank Excavation

Site Closure Requirements

- MDE required “reducing trend” in contaminant levels
 - Particular interest paid to MW-19 (highest MTBE concentration)
- Appropriate evaluation of risk and documentation of such using Maryland Environmental Assessment Technology for Leaking Underground Storage Tanks
Risk Factors:
 - Presence of LPH
 - Current and Future Use of Impacted Groundwater
 - Contaminant Migration
 - Human and Environmental Ecological Exposure
 - Impact to Utilities or other Sensitive Receptors
- No numeric contaminant remedial goals established for site

Performance-Based Contract Remediation Team Utilizes Innovative Oxygen Release Technology to Achieve Rapid Closure of BTEX/MTBE Site

Andrews Air Force Base

Performance Based Contracting

Performance-Based Contracting (PBC) is a contracting style that establishes a project goal and milestones but does not prescribe how consultants will reach goals and milestones. It provides flexibility to explore various remedial techniques and make adjustments as necessary to optimize results. For this project, the PBC mechanism was crucial in allowing the BEM/MACTEC team to mitigate unexpected conditions and increase performance efficiency.

In-Situ Treatment Technology

In-situ treatment was selected to minimize infrastructure installation, alleviate operation and maintenance requirements, and reduce project wastes. Injection of ORC Advanced® provided additional oxygen within the subsurface, stimulating and supporting microbial degradation activities. ORC Advanced is an oxyhydroxide-based peroxygen product with Controlled-Release Technology (CRT™) that yields a slow oxygen release into the subsurface, lasting up to 12 months following a single application.

Project Goals and Results

- **Project Goal**
Achieve site regulatory closure under Maryland Department of Environment (MDE) criteria by the contracted date of October 2006. Closure requirements include:
 - Demonstrating a reducing trend of dissolved-phase contamination
 - Demonstrating low or minimal relative risk to human health or the environment
- **Project Result**
Site regulatory closure attained in June 2005 (16-months ahead of required schedule). Closure granted based on regulatory review of site data and risk evaluation that demonstrated:
 - Dissolved-phase contaminant concentration reduction of approximately 23%
 - No significant risk to human health or the environment identified during risk evaluations

| Table 1. Targeted Treatment Well MW-19 Petroleum Hydrocarbon Reduction (ug/L) | | | |
|---|------------------|-------------------|------------------------|
| | Pre-ORC Advanced | Post-ORC Advanced | ORC Advanced Reduction |
| BTEX | <2,700 | <54 | 98%* |
| MTBE | 28,000 | 20,800 | 23% |

BALANCED ENVIRONMENTAL MANAGEMENT

BEMSYSTEMS

MACTEC, Inc.

REGENESIS

Remedial Activities

- **Source Removal (December 2003- addressing residual-phase contaminants)**
 - Excavation removed 2,180 tons of petroleum-impacted soil
 - Backfill included 500 pounds of ORC Advanced to facilitate bioremediation of remaining residual-phase contamination
- **In-Situ Enhanced Aerobic Bioremediation (February 2004 – addressing dissolved-phase contaminants)**
 - Tight grid design around highly impacted well MW-19
 - Injection of 23,700 pounds of ORC Advanced through 415 injection points at 20-ft spacing
 - Groundwater monitoring performed as 5 events between March and December 2004

Remedial Evaluation

- **Analytical results for post-excavation soil samples below MDE non-residential standards**
- **DO (dissolved oxygen) and ORP (oxidation reduction potential) increased significantly and remained elevated**
- **Evaluation of MDE risk criteria indicated:**
 - LPH not observed following remedial activities (excavation and injection)
 - No identified current or future use of groundwater
 - Fate and Transport modeling indicated plume would attenuate before reaching AAFB boundary
 - Combined carcinogenic human health risks for on-site exposure to groundwater and volatilization of groundwater in an enclosed space were below acceptable range
 - Calculated health index for non-carcinogenic effects for groundwater volatilization <1
 - Calculated health index for non-carcinogenic effects for groundwater direct contact >1 (indicating potential risk)
 - No identified utilities at groundwater depths; no identified sensitive receptors

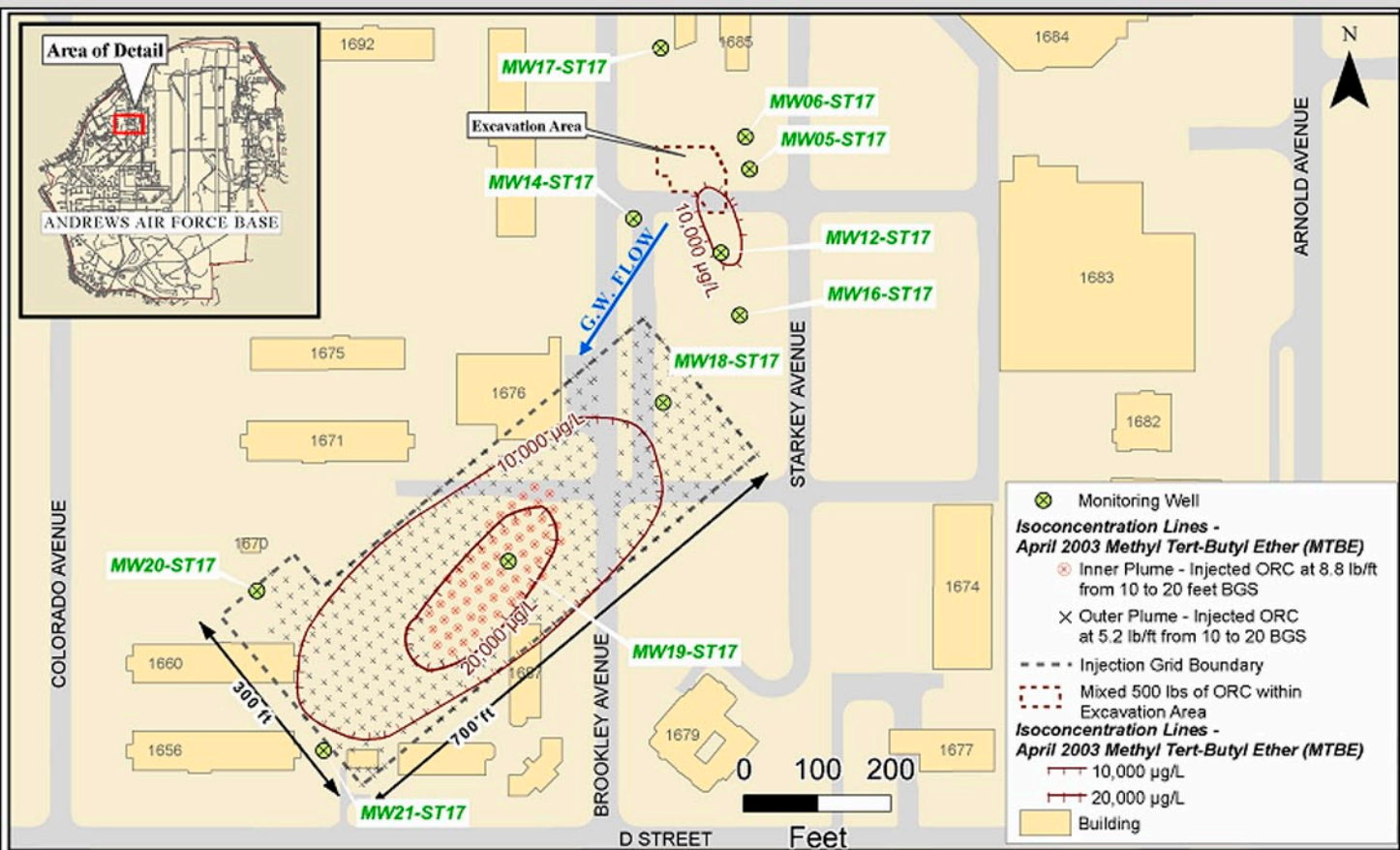


Figure 3. Outlined Excavated Area and ORC Advanced Injection Grid Design



Figure 4. ORC Advanced Injection



Figure 5. Former Tank Basin Excavation