

Results:

- 192 days of operation
- 450 lbs (205 kg) of mass removed as PCE
- 8,100 lbs (3,675 kg) of mass removed as petroleum hydrocarbons
- All soil samples collected within all four stratigraphic layers at the Site met the remedial objectives
- The average concentration within the treatment area met the remedial objective

Approach:

- In Situ Thermal Desorption
- ~14,000 cubic yards (1,070 m³)
- Target temperature: between 100°C and 250°C
- Thermal wells: 257
- Multi-phase extraction wells: 19
- Vapor extraction wells: 72
- Temperature monitoring points: 28
- Pressure monitoring points: 14
- Primary treatment: granular activated carbon

For further information:

TERRATHERM, inc.
151 Suffolk Lane
Gardner, MA 01440
(978) 730-1200
info@terratherm.com
www.terratherm.com

Site Information: At a former dry cleaner site purchased by International Business Machines Corporation (IBM) in Upstate, NY, tetrachloroethene (PCE) and fuel oil No. 2 (unrelated upgradient release) were found in soils and groundwater at the site (the Site). Located in a residential/commercial neighborhood, the Site was

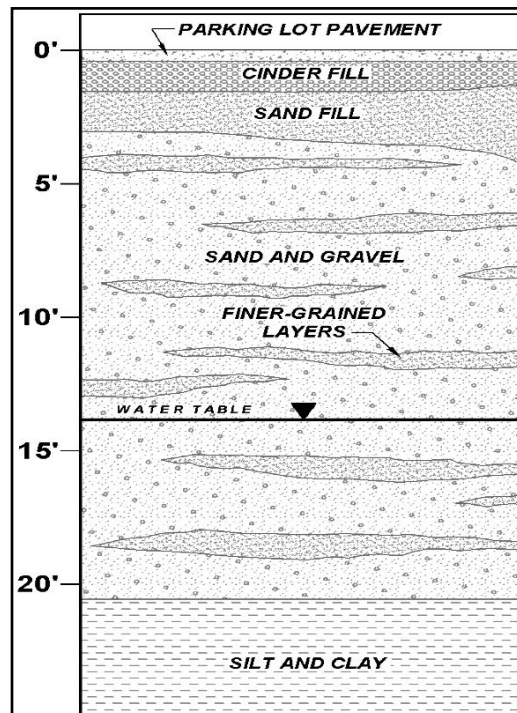


ISTD Full Scale Wellfield

initially developed between 1918 and 1927. From the time of its development until 1965, site operations included auto sales and service, electrical contracting, and retail sales. From 1965 to 1985, the Site housed a dry cleaning facility, the former Ideal Cleaners. Operating practices of this establishment are believed to be responsible for the subsurface PCE contamination. In 1985, IBM purchased the property to use as a parking lot for its employees.

Objectives: The overall remedial objectives for the full scale implementation was to remove PCE from subsurface soils to the point where no single post treatment sample exceeded 5.5 mg/kg, and the average PCE concentration in all post thermal samples was less than or equal to 0.56 mg/kg.

Conceptual Site Stratigraphy

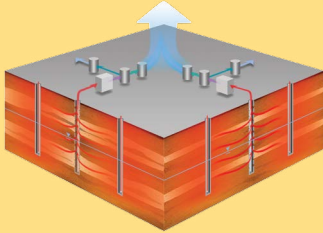


Geology: Cinder fill, soil fill, outwash sand (with both an unsaturated and saturated zone) and Lacustrine silt.

Design Challenges:

- Cinder fill (high levels of carbon/sorption of PCE)
- Smear zone (outwash sand) within the water table containing PCE mixed with petroleum hydrocarbons
- Nearby residences
- Dissolved plume downgradient of source area

Heating Method:
In Situ Thermal Desorption



Location: Upstate, NY



Time Frame: 2009-2010

Project Team:

TerraTherm, IBM, and
O'Brien & Gere

Regulatory Oversight:

NYSDEC, NYSDOH

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Summary: The full scale implementation of ISTD followed a treatability study and a pilot study. Based on the data collected from both of those efforts, the full scale system was modified to include a more robust insulating thermal vapor cover, more groundwater extraction wells, and was designed to heat for a longer duration at 100°C.

To address lagging temperatures in the cinder fill layer observed during heating, 32 additional shallow heater wells (8 ft [2.4 m] bgs), and 13 additional shallow vapor extraction wells (8ft [2.4m] bgs) were installed, and an additional layer of concrete was added over a portion of the existing vapor cover to better seal it from any potential water and air infiltration.

All post thermal soil samples collected from the four discrete geologic layers met all of the remedial objectives.

ISTD achieved and exceeded (by an order of magnitude) the remedial objectives developed by IBM and New York State Department of Environmental Conservation (NYSDEC). A letter was issued by NYSDEC and New York State Department of Health (NYSDOH) indicating that "thermal was a success". Since thermal completion, groundwater concentrations in samples collected downgradient from the Site have returned to near non-detect. In December 2011, IBM discontinued groundwater extraction from a downgradient pumping well, 14 years earlier than expected.

Project Final Statistics:

- Total mass removed (pilot and full scale)
 - ◊ 3,100 lbs (1,400 kg) of chlorinated compounds
 - ◊ 9,000 lbs (4,080 kg) of petroleum hydrocarbons
- <\$1M pilot + \$2.8M full scale (heating <1 year)
- All remedial goals met
- NYSDEC and NYSDOH stated "ISTD successful"
- Monitored Natural Attenuation (MNA) Record of Decision (ROD) issued to IBM
- Post thermal treatment, downgradient groundwater concentrations decreased to near non-detect
- Discontinued groundwater extraction
- Recent groundwater data results collected as part of MNA effort, indicate concentrations have further decreased and no rebound has been observed



Treatment Area Today