

Results:

- Achieved all remedial goals
- Approximately 101,000 gallons (382 m³) of water were treated
- Approximately 16,700 gallons (63 m³) of coal tar were recovered and disposed of
- At least 300,000 lbs (136,000 kg) of contaminants (expressed as naphthalene) removed in total

Approach:

- In Situ Thermal Desorption (ISTD)
- Target temperature: 325°C (617°F)
- Thermal wells: 25
- Spacing between thermal wells: 12 ft (3.7 m)
- Thermal well depth: 18 ft (5.5 m)
- Water treatment by oil-water separator, clay-carbon media, liquid-phase Granular Activated Carbon (GAC)
- Vapor treatment by regenerative thermal oxidizer with backup vapor-phase GAC

For further information:

TERRATHERM, Inc.

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

Site Information:

Manufactured Gas Plant (MGP) operations began in the 1860s and continued until 1952. On Site, an abandoned gasholder contained approximately 2,010 cubic yards (cy) (1,537m³) of soil and debris contaminated with coal tar. The 62 ft (19 m) diameter by 18 ft (5.5 m) deep gasholder had brick walls and a bottom believed to be constructed of concrete.

Contract Type and

Project Goals: Guaranteed performance contract to achieve a permanent

solution in accordance with the Massachusetts Contingency Plan (MCP), by eliminating Dense Non-Aqueous Phase Liquid (DNAPL) within the holder and reducing concentrations of Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs) and Total Petroleum Hydrocarbons (TPH) below MCP Upper Concentration Limits (UCLs) so that residual risk is minimized.

Contaminants of Concern (COCs) were as follows: Coal tar containing concentrations as high as benzo(a)pyrene [B(a)P] 650 mg/kg; naphthalene 14,000 mg/kg; benzene 6,200 mg/kg; and TPH 230,000 mg/kg.

Soil Characteristics: Mixture of sand, gravel, cobbles, bricks, concrete fragments, ash, and clinker.

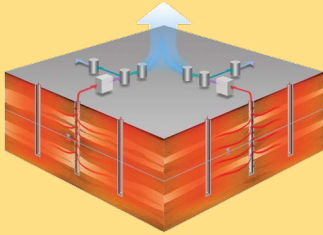
Groundwater: Perched water table was encountered within the gasholder at 5.5 ft (1.7 m) below ground surface (bgs). The regional groundwater table is beneath the holder.



Close-Up of Stabilized Coal Tar from just above the Bottom of the Gasholder

Heating Method:

In Situ Thermal Desorption



Location: North Adams, MA, USA



Time Frame:

August 2003 - June 2005

Project Staffing:

As General Contractor, TerraTherm provided all project design, construction, operation, and equipment

Subcontracting:

TerraTherm subcontracted for some labor, drilling, and electrical services

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Project Summary: TerraTherm used its In Situ Thermal Desorption (ISTD) technology at full scale as follows: Prior to the site being heated, coal tar DNAPL had resisted recovery. After dewatering, TerraTherm applied ISTD in a step-wise fashion, without excavation. To our knowledge, this is the first site where a multi-level in-situ heating approach has been applied. We utilized three levels of heating (Levels 1, 2 and 3) sequentially, achieving low (80°C), moderate (100°C) and higher (325°C) soil temperatures, respectively. During Level 1, >16,000 gal (60,000 l) of coal tar/emulsion was recovered, while during Levels 2 and 3, >166,000 lb (75,000 kg) expressed as naphthalene were extracted and treated in the vapor phase. ISTD resulted in the following reductions in soil concentrations (mg/kg): Level 2, benzene from 3400 to 0.95, naphthalene from 14000 to 70, and benzo(a)pyrene from 650 to 100; Level 3, benzene from 2068 to 0.35, naphthalene from 679 to 5.7, and benzo(a) pyrene from 20 to 0.33. No DNAPL remained within the gasholder, and all constituents were below the remedial goals. National Grid judged the turn-key cost (\$850,000 for ISTD) to be less than the excavation alternative.

TerraTherm mobilized to the site in November 2003, with site construction beginning the same month. Dewatering/tar recovery began in February 2004. Full power heating began in July 2004 and was completed in March 2005, with demobilization completed June 2005.

Results:

**Pre- and Post-Treatment Soil Concentrations Within the
Construction Worker Exposure Depth**

Sampling Depth: 6 - 14 ft (1.8 - 4.3 m)

Average Concentrations

Constituent	Pre-Treatment mg/kg	Post-Treatment mg/kg	Reduction %
Benzene	2068	0.35	99.98%
Anthracene	19	0.48	97.47%
Benzo(a)anthracene	20	0.51	97.45%
Benzo(a)pyrene	20	0.33	98.35%
Chrysene	20	0.71	96.45%
Fluoranthene	43	1.02	97.63%
Naphthalene	679	5.7	99.16%
Phenanthrene	107	3.82	96.43%
Pyrene	65	1.12	98.28%
C11-C22 Aromatics, unadj.	4000	43.15	98.92%

All below UCLs