Ex-situ Thermally Enhanced Coal Tar Recovery – A Low Carbon Option

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GreenRemediation – Copenhagen, 2009

Presentation Outline

- Background
- Guiding Principles and Project Design
- Scope of Works
- Remedial Technique Selection
- Remediation Methodology
- Results
- Carbon Quantification and Cost Effectiveness
- Applications for Industry
- Questions

Guiding Sustainability Principles

- National Grid and Atkins have clearly defined sustainability principles that are actively encouraged to be integrated in to projects by design
- Awareness of the six principles of sustainable remediation and the wider objective of sustainable development
- All these have been considered within the following case study.

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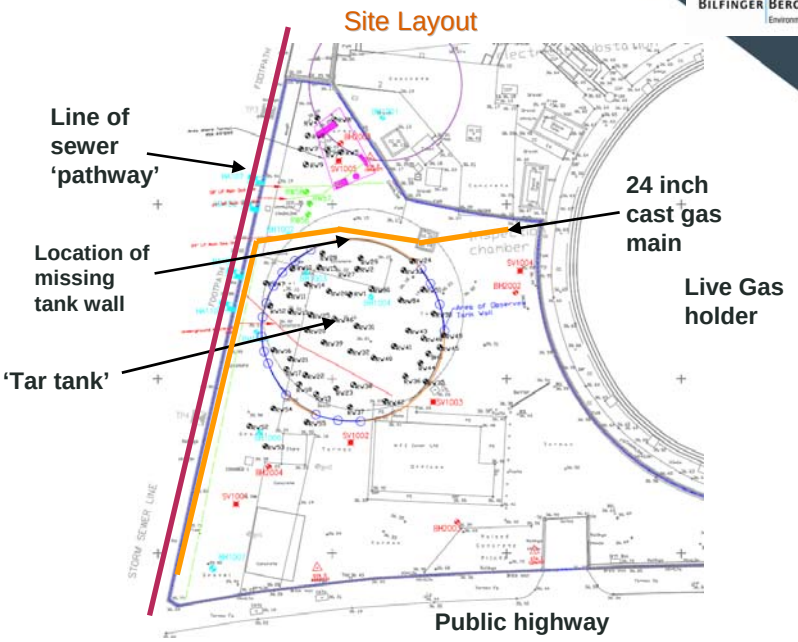
Project Background

- National Grid property portfolio extensive across UK with industrial legacy
- Study site a former gas works
- Site is now vacant with much of the wider areas developed as high density housing
- Coal tar present from about 2.5 m bgl within a below ground tar tank
- Tar tank breached on one side due to low pressure gas main
- Conceptual model shows potential for slow migration of coal tars via breach into off site sewer and to small surface water stream
- Treatment area primarily focused on former below ground tar tank

Site Layout



Scope of Works

In general the scope of works was to:

- Reduce risks to identified surface waters as far as reasonably practicable (Due to constraints and nature of impacts, remediation was based on betterment rather than comparison to risk based criteria)
- Project was to be achieved by utilisation of a robust yet innovative technique considering sustainable approaches and cost effectiveness

Technique Selection

- Atkins undertook a remediation options appraisal to identify the most appropriate technique for the site
- Options for viable techniques was severely limited by various constraints on the site – live gas mains, access ways, proximity to residents etc
- Atkins drafted performance specification in line with National Grid guidance. Specification was based on total fluids pumping enhanced by flow path management and thermal heating – allowed for innovation on the part of the tenderers to ensure that best value was attained

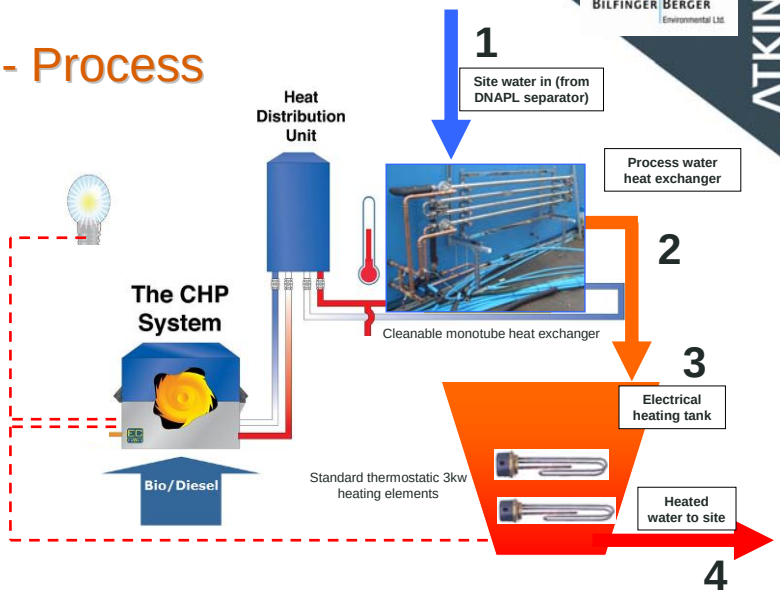
Project Design

Total fluids recovery, with application of moderate heat
- **A change from ambient to just 30degC reduces tar viscosity, 100cS to 10cS**
- Moderate heats avoids risks to gas infrastructure, and production of vapours
- Low impact to local environment
- Avoids risk of creating LNAPL's at higher temperatures

Rre-infiltred hot water as heat delivery method
- Abstracted water treated, then heated and re-infiltrated
- Targeted delivery allows flow path management and is efficient.
- Maintains water level, avoided risk of settlement

Micro Combined heat and power chosen as an 'energy source'
- Manufacturers claim 97% of fuel energy is captured as heat & electrical power.
- 26kW of heat energy provided to heat the process water.
- 17kW of electrical energy to power systems & additional heating elements.
- Fuel consumption is analogous to a standard 17kw generator

CHP - Process



CHP Installation

Efficiency Advantage of CHP

Thermal enhancement delivered at zero additional energy cost

- 5 litres fuel/hour required to power a standard pump and treat system
- 5 litres fuel/hour for pump & treat with thermal enhancement

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Further Reduction in CO2

Biodiesel used as fuel – no cost penalty

Sourced from 100% local waste vegetable oils

Recovered tars recycled into RFO (Recycled Fuel Oil)

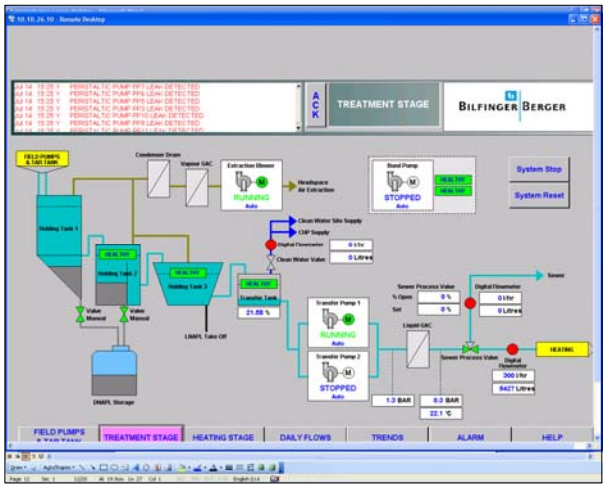
Surplus electrical power re-routed to Grid (22,000kW)

Site Wells and 'Tar Tank'

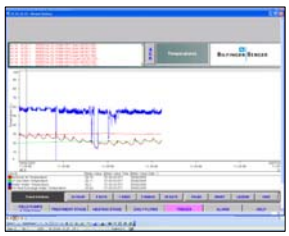
Drilling

Separation and Treatment Plant

Process Control



Sophisticated Telemetry control system reduces onsite staff time and journeys



Remediation - Application

- 6 months operation
- Telemetry enabled typical attendance of 2 days per week
- Heating process & water treatment / tar separation proved reliable with virtually no down time.
- Ground heated to 35DegC
- Minimal wastes to landfill

Remediation Results

22,000litres tar recovered

Remediation Results – Carbon Quantification

- Carbon quantification can be open ended. Need to define boundaries on a given calculation
- Calculation accounts for GHG emissions only (including plant movements from and to depot and those obviated by export of power to local grid)
- Provided a comparison to demonstrate systems performance
- Calculated using recently published carbon factor data from Defra (UK) and Atkins Remediation Options Carbon Calculator (ROCC)

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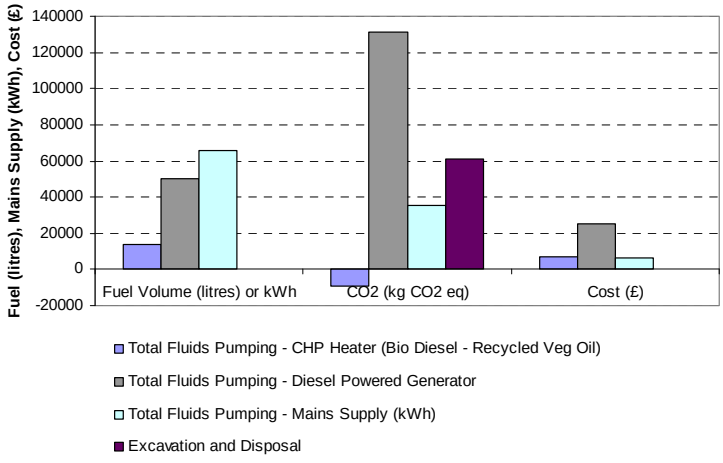
Remediation Results – Carbon Quantification



Cost Effectiveness

- Application of heat can reduce project programmes having a significant effect on total costs. This is further improved where operational costs due to ‘free’ heat supplied by CHP are substantially reduced.
- Initial capital outlay – economy of scale and moving forward opportunities exist to reduce outlay and increase competitiveness of option
- Energy efficiency and therefore operational costs will offer genuine cost reduction on future projects (20-30% compared to other traditional methods that do or could use heat enhancement)

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Application for Industry

The system developed at Sutton is considered to have potential applications to the wider remediation market:

- Soil Vapour Extraction
- Bio (in-situ and ex-situ)
- Sludge drying
- Volatile contaminants and LNAPL

And finally…….

We believe that this is the first thermally enhanced remediation project demonstrating a carbon positive operation ?