BROWNFIELD BRIEFING REMEDIATION INNOVATION AWARDS 2008 :

FORMER DELTA METALS SITE, BIRMINGHAM

Nominated Category : Best Use of a Combination of Remediation Techniques
Submission by WSP Remediation Limited

INTRODUCTION

WSP Remediation is pleased to submit an application for the 2008 Brownfield Briefing Remediation Innovation Awards in the category of 'Best Use of a Combination of Remediation Techniques'.

2008 sees the completion of the Meteor Park Development located to the north of Birmingham. The site was purchased by SEGRO Plc, formerly Slough Estates, and was designated for demolition and redevelopment into four large warehouse facilities ranging in size between 2,066 - 10,690m^2. The site was identified by SEGRO as prime for development being in close proximity to Birmingham city centre and major transport routes. However, prior to WSP Remediation's involvement, development was becoming marginal through spiralling remediation costs associated with significant site contamination.

In delivering this project, WSP Remediation has adopted a combination of sustainable on-site treatment technologies integrated within a challenging construction programme to address a complex mixture of site contamination across a variety of media unlocking this heavily polluted site.

BACKGROUND

Located on the former Delta Metals engineering facility, this 4.4 hectare site was heavily contaminated through over 60 years of heavy industry associated with the machining and manufacture of vehicle components for the car industry.

The site is located within the shadow of Spaghetti Junction, an area of former heavy industry, located above a major aquifer (Sherwood Sandstone) and adjacent to the River Tame. Whilst historically impaired, these water resources formed the most sensitive environmental receptors in the area together with future site occupants of the proposed industrial facilities (commercial use).

The site was underlain by mainly granular made ground, overlying organic alluvial clays, river terrace sands and gravels followed by the sandstone aquifer. Independent water bodies were found in the made ground, the terrace gravels and the sandstone aquifer.

Various site investigations; undertaken prior to WSP Remediation's involvement, identified the following contamination:

- Diesel and lubrication oil hydrocarbons and chlorinated solvent contamination with made ground and alluvial soils;
- Localised hydrocarbon free product present as Light Non-Aqueous Phase Liquid (LNAPL) within perched water and sands and gravel aquifer associated with former below ground structures;
- Widespread dissolved phase chlorinated solvent contamination within the underlying sands and gravel aquifer.

BEST PRACTICE

The mix and spread of contamination throughout the soil and groundwater profile meant that a combination of remediation techniques would be required. The methodologies adopted comprised best practice, using sustainable on-site treatment technologies within a compressed remediation programme and supported by remediation design trials, risk assessment and validation protocols.

The remediation works were initiated by completion of an extensive supplementary Site Investigation followed by a site specific Quantitative Risk Assessment (QRA). The supplementary investigation works enabled further delineation of the contaminant source zones and the QRA was based upon a CONSIM model using a high percentage of site data to minimise the requirement for generic assumptions and give confidence to all parties that the risks had been adequately characterised.

Remediation trials were carried out to fine-tune the remediation design, optimise the remediation techniques applied and recover site specific data for the risk assessment model:

Soil treatment trial - Ex-situ bioremediation was chosen as a well established and successful method for treating organic contamination. Programming constraints meant that the soils remediation works would largely be undertaken during the winter and so aerated biopiles were selected to reduce sensitivity of the treatment works to adverse weather conditions.

The feasibility trials included soil sampling and laboratory analysis to examine soil condition in relation to contaminant speciation, nutrient content to identify the key bioremediation drivers, bacterial plate counts to assess natural bacterial activity and physical screening to assess treatability.

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Groundwater treatment trial - Prior to WSP Remediation's involvement, the preferred remediation method for dealing with the groundwater contamination had been containment incorporating, treatment via some form of Permeable Reactive Barrier (PRB) and a funnel and gate system. Discussions with the EA identified potential concerns associated with this strategy given the extent of the contamination (too significant), the absence of a demonstrable aquitard for any wall to "key" into and the long term efficacy of a containment strategy given the potential for vertical migration of the solvent contamination into the underlying aquifer.

Step and continuous rate pump tests were undertaken to gain a greater understanding of the aquifer flow characteristics. Trial injections of a saline solution were carried out to determine zones of influence, followed by the injection of a reducing substrate, to check that enhanced reductive conditions could be established, to accelerate reductive dechlorination.

The product chosen was Adventus EHC™, a formulation of Carbon and Zero Valent Iron with added nutrients; designed to provide support for and to accelerate the action of the indigenous bacteria within the groundwater and saturated zone. This technology represents the pinnacle of current reductive groundwater bioremediation.

SUSTAINABILITY IN REMEDIATION

WSP Remediation strives to offer sustainable remediation solutions to our clients. We are strong advocates of the emerging Green Remediation approach. Green remediation focuses on the remediation technologies employed, the objectives of the remediation scheme, and the impact of the remediation works against the environmental improvement achieved by the works. What defines "Green Remediation" versus "sustainability" is a reduced emphasis on seeking to quantify wider intangible social benefits, though some will logically accrue, for example, by better carbon management.

We believe the Meteor Park site is an exemplar green remediation project for the following reasons:

Action : Soil Remediation
Technique : Static Aerated Biopiles
Green Remediation Credentials :

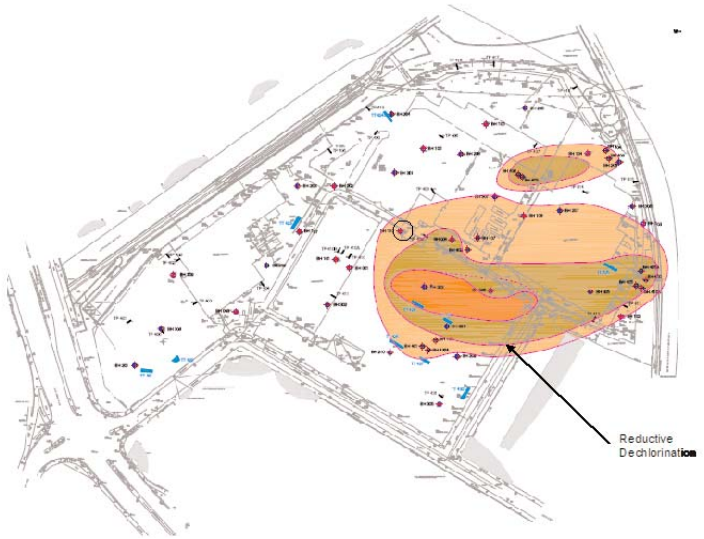
- Avoids removal of contaminants and soils to landfill relieving the waste burden.
- Limited plant requirements for static biopiles, with some diesel consumption for air generation and blowers.
- Contaminant reduction by up to 80%.
- Note: some carbon dioxide generation as part of degradation process (unavoidable and embedded within the pollution mass)

Action : LNAPL Recovery
Technique : Dewatering and In-Situ Recovery
Green Remediation Credentials :

- Dewatering from open excavations provided rapid recovery limiting the length of ongoing recovery requirements.
- Groundwater system operated through mains electricity; more efficient than use of diesel generators.
- Balanced remediation standard of asymptotic recovery using best endeavours.
- Recovered oils recycled (future use unknown).

Action : Solvent Treatment
Technique : Direct Injection of EHC (Reductive Dechlorination)
Green Remediation Credentials :

- In-situ destruction of pollutant mass.
- Limited energy consumption other than drilling equipment, delivery of product and site attendances.
- Note: embedded carbon footprint of EHC is unknown at this stage, although we have requested this data from Adventus.



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REMEDIATION WORKS

The WSP remediation works comprised the remediation of both soils and groundwater at the site. The methodologies developed enabled the soil and groundwater operations to be undertaken simultaneously and in a phased approach to tie in with the build contractor appointed by SEGRO.

Active works, including enabling and soil excavations commenced in November 2006 and were completed in May 2007 followed by ongoing groundwater treatment and post remediation monitored natural attenuation monitoring.

Soil Remediation

Soils identified for treatment comprised made ground and alluvial deposits. Hydrocarbon contamination was significant, with a site maximum of 33,448mg/kg with a target concentration of 7,500 mg/kg.

Soil excavation works commenced at known areas of impact supported by an agreed programme of field testing, supported by laboratory testing to characterise soils for reuse or treatment. Contaminated soils were treated using biopiles in a lined treatment compound incorporating an engineered drainage system and air blower system to enable aeration of the piles.

Nutrient enrichment was carried out to accelerate microbial growth and regular monitoring for bacterial activity, temperature, oxygen and carbon dioxide was undertaken. The completed piles were covered to maintain heat and manage moisture content. The works successfully treated approximately 6,800m^3 of contaminated soils which were handed back as suitable for re-use within the development.

Targeted LNAPL Recovery

Initially, comprised targeted LNAPL collection using skimming and pumping allowing recovery concurrent with the excavation phase of the soil remediation works. A permanent system was then installed comprising a series of LNAPL recovery trenches and sumps within the specific target areas of the site. The trenches were engineered to generate a preferential flow path for the LNAPL towards the collection sumps. The recovery sumps were fitted with pneumatically driven skimmer pumps. To allow the redevelopment works to continue unhindered, the system was integrated into the main build design/structure and linked to a WSP designed and purpose made product recovery and water treatment system via service ducts completed below ground level.

Remediation of Solvent Contamination

These works focussed on the treatment of a plume covering approximately 3,150m^2. The contaminants of concern were Trichloroethene (TCE) with a site maximum concentration of 103.25mg/l, and degradation products cis 1,2-Dichloroethene (DCE) and Vinyl Chloride (VC). Works to address this contamination comprised the injection of approximately 105,300 litres of slurry, formed by mixing the remediation substrate EHC™ with water, to enhance degradation. In order to ensure complete plume coverage, the substrate was injected via more than 100 injection points installed at depths between 3-6m below ground level using a direct push drilling rig.

After substrate injection, the plume was monitored via a network of 20 wells. The monitoring demonstrated that the aquifer conditions were within those appropriate for reductive dechlorination and that the degradation processes were occurring. This was observed through field Redox readings and laboratory monitoring of chlorides, dissolved ethane and ethene, used to confirm that complete degradation of the DCE and VC.

Validation monitoring confirmed that the TCE concentrations had reduced to less than 0.05mg/l in all monitoring wells; substantially below the agreed remediation standard of 10mg/l for both TCE and DCE.

> “The WSP Remediation approach to this complex remediation problem was proactive and innovative. Their design philosophy acknowledged our requirement to remove long term environmental liabilities to enhance investment values, and they delivered a cost effective solution integrated into the build programme that ultimately gave SEGRO the confidence to move forward with this challenging scheme.”
>
> Brendan Fogarty
> Group Environmental Manager
>
> SEGRO
> SLOUGH ESTATES GROUP

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COST EFFECTIVENESS

The works were delivered under a fixed price contract. The chosen techniques, delivery methods and timescales ensured substantial cost and programme savings for a development scheme of marginal viability. Our approach was cost effective for a number of reasons:

- Optimisation of the remediation and construction programme allowed a phased release of the site to the client's build contractor.
- The use of aerated biopiles, in preference to windrows, reduced the area of the site "locked up" by the treatment bed.
- Ex-situ bioremediation of soils produced approximately 6,800 m^3 of soils which were used within the development, rather than landfilled, offering a significant saving in tipping and transport costs.
- The initial skimming and pumping of the LNAPL allowed soil and product removal to take place concurrently saving time on the programme.
- The construction of product recovery trenches, with the sumps and treatment plant positioned outside of the construction areas allowed the build contractor to commence construction before the product recovery was complete, giving more savings to the build programme.
- Stimulation and enhancement of an already occurring natural process to facilitate degradation of the TCE plume represented a substantial cost saving to the proposed Permeable Reactive Barrier and resulted in the removal of the pollution burden within an impressive timescale.

REDUCTION OF POLLUTION BURDEN

The Meteor Park project has achieved a substantial reduction in the pollution burden through the use of on-site treatment technology of limited plant and materials intensity and resulting in a high level of pollutant destruction rather than transfer of pollutants:

- The on-site soil remediation technique ensured on-site destruction of the contamination present in soils achieving an 80% reduction in contaminant concentrations.
- Waste oils recovered during the LNAPL remediation works were separated on site to concentrate the mass of free product recovered allowing the recovered LNAPL to be disposed to a third party plant for blending and reuse.
- Treatment to remove dissolved phase contaminants from groundwater generated during the LNAPL recovery was undertaken using Granular Activated Carbon (GAC) with spent media removed from site and returned to the supplier for re-generation and subsequently re- use.
- Solvent degradation through bioremediation processes and zero valent iron treatment effectively enhanced naturally occurring processes and is therefore a zero waste process.
- Waste minimisation and management is routine within WSP as we are accredited to ISO14001.

COMMUNITY AND STAKEHOLDER ACCEPTANCE

Throughout the planning, development and remediation stages of the works, the Environment Agency (Groundwater and Contaminated Land Department and Licensing Department) and Birmingham City Council (Environmental Health Officer) were closely involved and consulted.

Environment Agency involvement in the project at an early stage helped develop an in depth statutory appreciation of the site. Through this proactive approach, the regulatory authorities were instrumental in the development of the remedial strategy and were able to support a phased release and sign-off of the remediation works, which are now substantially complete with sign off achieved for soil remediation works and rebound monitoring ongoing for groundwater remediation.

COMPLIANCE WITH HEALTH AND SAFETY

Health and safety is of supreme importance. WSPR is ISO 18:001 accredited and maintains the highest standards in site management. This is demonstrated through the award of a RoSPA Gold Medal in 2008. WSP promotes the behaviours, culture and leadership that deliver these high standards; all our operational staff hold CSCS cards and have the necessary training to ensure that they are competent to operate safely on complex construction schemes.

WSPR ensured that all works synchronised with construction activities to allow close working without direct overlapping. WSPR worked closely with the construction contractor to develop their understanding of the remediation works and to identify likely risks that would be encountered by the entire project team working on site ensuring that contamination related works were segregated from the construction activities.

No time was lost throughout the works to health and safety and no complaints were received relating to dust, noise or odours associated with the remediation works.

CONCLUSIONS

WSP Remediation consider the Meteor Park project represents a best practice and sustainable application of a combination of remediation technologies integrated within a challenging construction programme to address a complex mix of contamination on a former brownfield site and we would be delighted to be acknowledged for our efforts on this project.

FURTHER INFORMATION

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