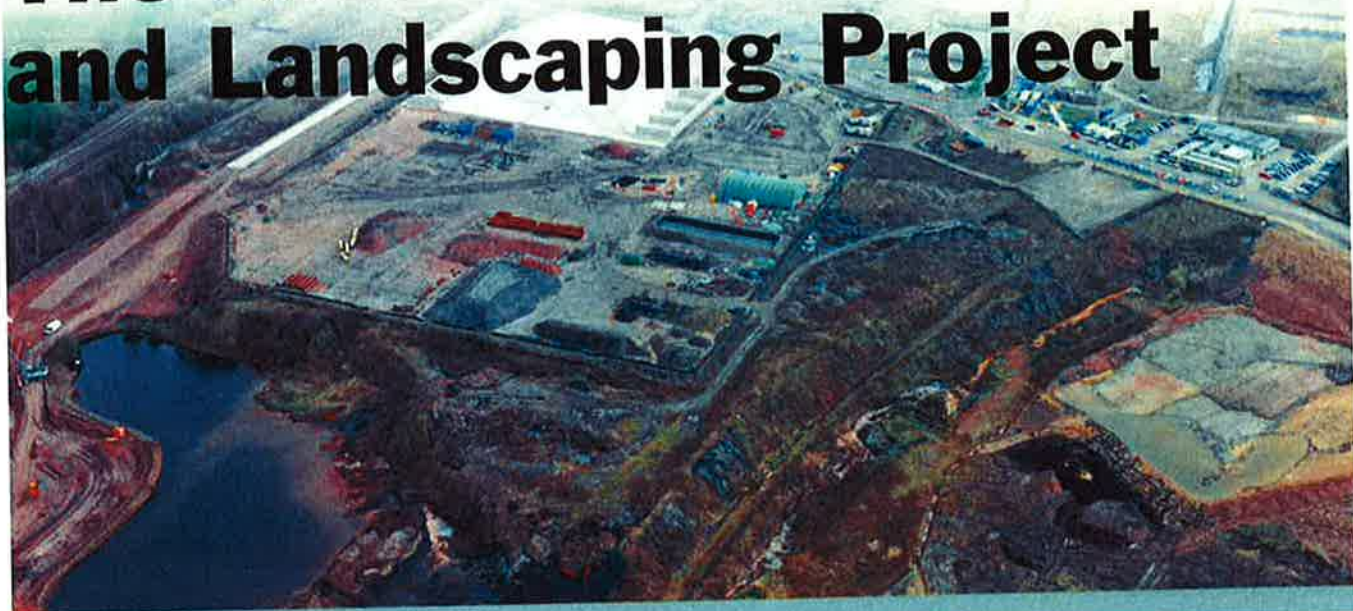


The Avenue Remediation and Landscaping Project



THE AVENUE former coking works located 3 km south of Chesterfield, Derbyshire is a prominent site within the region and also nationally within the remediation sector as it has been dubbed 'the most contaminated site in Europe' by more than one commentator. The 98ha site operated for 36 years as a coking works and had a long and varied industrial history prior to this use. In addition to the production of smokeless fuels the site also processed the by-products from this process and as well as receiving wastes from other National Coal Boards sites in the region. As such the site possibly lives up to its tag by being complexly contaminated with a range of sulphates, creosote, blended fuel wastes, benzoles, tars, asbestos and spent oxides.

The coking works were closed in 1992 and ownership passed through English Partnerships (now the Homes and Communities Agency – HCA) to East Midlands Development Agency (emda) who is managing the remediation and landscape works which are being funded by the HCA as part of their National Coalfields Regeneration Programme.

VSD - a joint venture consortium comprising DEC (DEME Environmental Contractors – the Belgian based Environmental Contractor), Sita Remediation (a Dutch based thermal desorption specialist) & Volker Stevin (the civil engineering contractor) were awarded the £82million remediation and landscaping contract in July 2009. This appointment followed previous phases of work including additional site investigation, contamination mapping and contamination treatability trials some of which VSD Avenue carried out in the UK on the site and others which required Transfrontier Shipment Agreements

allowing the exporting of contaminated waste which was then treated elsewhere in Europe.

The key objectives of the remediation of the Avenue site are to remove the existing site contamination through on site treatment and to deliver a restored landform which will provide significant benefits for the local community along with the provision of environmental enhancement and a flood alleviation scheme protecting areas of Chesterfield from future flooding. The restored landform will include a development platform and significant areas of public open space including sports pitches, public footpaths and other public amenity facilities. This new landform has been designed to be sympathetic to the surrounding environment and to create habitats that will further encourage a diverse wildlife population including many protected species which will be encouraged to make the restored site their new home. The remediation and landscaping package will take over 4 years to deliver.

Due to the size of the site and the varied nature of the made ground, soils and contaminants, the Avenue is a very complex project even before considering the many complex civil engineering issues which the site team has to manage and plan for during and throughout the life of the project. Before the remediation works can start in earnest this summer, a large amount of enabling works has had to be carried out. As well as works to divert existing services within the site one of the most visible elements of works has been the construction of a large coffer dam and a temporary river crossing in the floodplain area of the River Rother at the northern end of the site. Currently the Rother runs between a number of artificial lagoons which contain contaminated liquid and solid wastes. The contaminated lagoons are leaking contaminants into the surrounding soils and groundwater and following the installation of the coffer dam and cut off walls later works

will allow the lagoons to be emptied and the contents processed. During the remediation works to the lagoons the river will be temporarily realigned a number of times before the permanent realignment based on a more natural looking course through the newly remediated area is completed. The final alignment includes improved flood defences for the river which has a history of flooding in heavy rains particularly during the winter.

The total volume of material to be excavated processed and replaced on the Avenue project is in the order of 2,000,000m³ which makes the Avenue one of the largest remediation projects currently working in the UK. Approximately 1,500,000m³ of this material will require little or no treatment and will be replaced on the site in areas where it is immediately suitable for reuse. Of the remaining 422,000m³ of contaminated material approximately 50% of the material is to be processed by thermal desorption and 50% by bioremediation.

To prevent any further or cross contamination of the site all of the remediation processes including haulage and storage will take place on impermeable structurally sound platforms. Due to the former nature of the site there are a considerable number of very large slabs still present following the demolition works. VSD have been refurbishing a large number of these making them watertight and constructing impermeable bunds around their perimeters and across the slabs to segregate different types of contaminated material during storage. In addition considerable numbers of concrete holding bays for contaminated and processed materials have been constructed. This will enable the efficient management of materials prior to and post processing and allow testing to be undertaken before the treated material is released for reuse on site in accordance with the remediation strategy.



The highly complex range of contaminated materials and variable underlying made ground conditions present on site means no single treatment technology is capable of remediating the soils and creating material suitable for reuse on the site. VSD's remediation strategy is based on using the 'best, most economically viable and practicable technique' allowing appropriate re-use of processed material within the site dependant upon the sensitivity of the receiving areas. Due to the wide breadth of expertise and experience within VSD a number of different remediation treatments are being utilised. These techniques include; Thermal Desorption, Ex-Situ Bioremediation and Screening & Soil Washing. These techniques are being supported by screening crushing and grading of materials which are already suitable for re-use on the site.

For the purposes of the remediation and landscaping works the site has been divided into 5 main zones. This zoning is mainly based on the contaminants and geotechnical nature of the material in that location and it is the contamination present that then determines the principal remediation technique.

Excavation is the first stage of processing starting by the identification and segregation of all material containing Visible Free Product (VFP) – this will be done by trained operatives. Any material containing VFP is deemed unsuitable for reuse on site even if it can be shown to satisfy the reuse criteria following chemical analysis and must go for processing by the appropriate remediation technique.

Following trials undertaken by VSD it has been shown that the waste tip consists of a variable mixture of soils, waste and colliery spoil and the material in the plant area consist of made ground containing a large proportion of colliery spoil. These materials due to their granular nature are ideal for soil washing techniques. Soil washing as its name implies is a fast physicochemical process involving agitating the soils in water with detergents and flocculants to remove the contaminated materials leaving a reusable sand and gravel. Prior to soil washing the material will be screened and separated to remove different non washable materials such as timber, metals, plastics and

other deleterious matter. These segregated wastes are then directed to immediate reuse (post chemical testing), further treatment or off site disposal.

Following the soil washing the silt fraction (<2mm) containing the residual contamination is likely to go for further on site treatment. The sand and gravel fractions are then tested allowing immediate reuse or further treatment by bioremediation. The oversized fraction (>75mm) is suitable for reuse across the site and may be used directly or following crushing to a specific grading.

A number of treatment trials have been undertaken by emda and verified by CL:AIRE confirming that thermal treatment is the only technique that can remediate the worst of the contaminated material on site cost effectively. This material contains gross contamination by tars and oils as well as phenols and thiocyanates.

This material is mainly contained in the lagoon areas but also includes a proportion of materials from the other zones on site. These trials have proven that Thermal Desorption is the only viable method that ensures the treatment of the very heavily hydrocarbon contaminated soils to achieve the strict reuse criteria on the site.

The Thermal Desorption plant being used at the Avenue is designed to process 25 tonnes per hour using both indirect and direct thermal technology. The main process is variable and heats the contaminated soils to 500-650°C dependent on the nature and concentration of the contaminants in the soil. This intensive heating evaporates the contaminants from the soil before they are destroyed in the second phase of the plant; the oxidiser – where temperatures will exceed 1000°C. These 'off gases' are then processed through multi-stage cleansing and treatment process including dust removal, gas scrubbers, lime scrubbers and activated carbon filters.

The thermal desorption plant has been designed and fabricated by VSD to be exceptionally efficient whilst still delivering the requirements of the project and the state of the art plant meets all the agreed UK regulations on emissions. Once

processing starts the Thermal Desorption plant will run 24 hours a day for over 2 years except for essential maintenance. The main energy source for the desorption process is by natural gas which comes from a nearby medium pressure gas main.

Post treatment the soil is held in storage bins allowing for further chemical testing and results to be obtained before the material is released for reincorporation into the main earthworks. The removal of water from the soils during the thermal process can reduce the volume of the material by up to 30%.

Due to the exceptional contamination removal properties of the thermal process the treated soil can then be reused in the most sensitive parts of the site.

The Avenue is the largest Thermal Desorption project to be undertaken on site to date in the UK and is using the largest plant ever operated over here.

Trials by DEC and others between 2000-2004 have proved that some of the contaminated material has the potential for treatment by Bioremediation. Bioremediation uses micro organisms and oxygen to biodegrade contaminants that are water soluble. In addition some volatile compounds will partly volatilise during the aeration of the material and some contaminants will leach out to the drainage layer during the process. To ensure efficient bioremediation the optimum oxygen and moisture contents of the spoil must be maintained along with sufficient oxygen availability.

The Avenue will have two bio-beds created in separate locations on site. Both bio-beds will consist of a number of winrows or biopiles situated upon a low permeability liner and appropriate drainage and may use forced aeration to provide oxygen. The bio-beds will be capable of treating soils with a range of different levels of hydrocarbon contamination. The treatment times range from 4-16 weeks dependant upon the degree to which the soil is contaminated.

As bioremediation changes contaminants to less harmful compounds the material post treatment and testing is suitable for reuse at depth in the development area and in open space areas away from sensitive receptors such as the River Rother.

The Avenue has been a high profile site for all of its working life and the recent past whilst it has remained derelict. Even now it retains a high profile with the local residents keeping a close eye on the remediation works as well as the wider remediation industry following progress keenly. VSD and the other stakeholders in the project are proud to be involved with the remediation of one of 'Europe's most polluted site' and deliver a platform that the community can enjoy and benefit from in the future.

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