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CASE STUDY

Waste Treatment / Recovery

Vale Refinery, Clydach

Client

VALE

Main Contractor

Jones Brothers Henllan Ltd

Site Background & History

The Clydach Refinery, affectionately known as the Mond, was built in Clydach, near Swansea at the turn of the 20th century and started production in 1902. The plant was built by Ludwig Mond, the inventor of the nickel carbonyl process. During the 100 years since it began production the Clydach refinery has become the largest and most versatile nickel refinery in Europe. The refinery currently employs over 220 people.

The original 30-acre site has now grown to 55-acres. The site produces about 40,000 tonnes of nickel products per annum. The products are made in pellet form for use in stainless steel appliances, nickel plating and special alloys for anti-corrosive applications. Another major processing line produces nickel in powdered form. These products are utilised in a diverse range of processes including the production of rechargeable batteries and catalytic converters.

Environmental legislation has become more stringent over recent years necessitating significant improvements in the quality of all water and air borne environmental discharges and emissions.

Vale has obtained both OHSAS 18001 and ISO 14001 accreditation and is currently consulting the public on the 'Advanced Energy Project' – the aim is to provide energy security for the long term whilst also providing a means of reducing the carbon footprint of the company. The Advanced Energy Project will enable Vale to reduce carbon emissions by 50%.

Vale is aiming to recycle waste materials as far as practically possible (as part of the company's commitment to greater environmental awareness).

Remediation Works

Envirotreat carried out remediation works in 2011 which enabled the reuse on-site of treated nickel and copper waste streams. The treated materials were reused on-site as a fill material in a supporting batter (see separate Case Study summarising the 2011 remediation works).

Envirotreat were commissioned by Jones Brothers (Henllan) Limited [JBHL] in late 2012 to investigate several waste streams located on site to evaluate the most cost effective treatment option.

The waste streams had been segregated by Vale in accordance with their perceived waste classification and / or environmental risk. The majority of the waste streams were in dedicated stockpiles of varying sizes

The stockpiles comprised of the following waste soils / materials:

- Recovered contaminated sediments from the historic canal bed (generated from canal improvement works) – see Figure 1 below
- Waste soils generated from the installation of a new water main

- Bobby Filter Waste – this waste stream comprised of filter media similar in nature to the material treated previously by Envirotreat in 2011
- General waste soils / materials generated from site works – see Figure 2 below

All of these materials were contaminated with nickel and other metallic pollutants to varying degrees. The canal sediments were additionally contaminated with hydrocarbon pollutants.

Figure 1 – Canal Sediments Contaminated with Heavy Metal and Hydrocarbon Pollutants

Figure 2 – General Soils / Materials Contaminated with Heavy Metal Pollutants (Including Significant Quantities of Nickel - Green Colouration)

It was considered necessary to rationalise the numerous stockpiles for practical reasons and to enable the treatment process to be applied more efficiently – this was achieved by visual assessment of the stockpiled materials and subsequent grouping / consolidation based on the nature of the material. The canal sediments were kept separate as they additionally contained hydrocarbon pollutants necessitating a different treatment approach.

Envirotreat then carried out a more detailed assessment of the consolidated stockpiled materials to determine waste classification.

Several of the stockpiles were considered to be uncontaminated, particularly those primarily consisting of oversize concrete. In addition it was subsequently determined that one of the canal sediment stockpiles was uncontaminated.

The remaining stockpiled materials were predominantly contaminated with heavy metal pollutants or heavy metal / hydrocarbon pollutants (canal sediments). These contaminated materials were classified as a combination of hazardous and non-hazardous based on WAC testing.

Envirotreat then developed a remediation strategy to enable all the materials to be reused on-site (taking into account the initial and more detailed assessment of the waste streams).

The contaminated materials were treated by E-Clay Stabilisation following crushing (if required). The E-Clay formulation was determined based on the nature of the contamination.

The stockpiles containing predominantly metallic contamination were treated utilising a stabilisation medium comprising of a site-specific inorganoclay (E-Clay) formulation and cementitious materials.

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The stockpiles containing predominantly metallic and hydrocarbon contamination (canal sediments) were treated utilising a stabilisation medium comprising of a site-specific inorgano-organoclay (E-Clay) formulation and cementitious materials.

The treated materials were required to be compliant with an engineered fill specification and with risk based remediation leachate target criteria derived by Remedial Targets Methodology [RTM] / P20 modelling (to protect groundwater and controlled water receptors).

The contaminated materials were treated *ex-situ* utilising the designated E-Clay Stabilisation formulation. The soils were treated in 5m^3 batches utilising a mixing bin. The treatment process involved mixing the soils with the designated E-Clay in slurry form and cementitious materials added in dry form. The soils were mixed with the treatment materials to produce a homogeneous mass. In total 667m^3 of contaminated materials were treated and re-used on site.

The treated soils were stockpiled pending validation as shown in Figure 3 below.

Figure 3 – Stockpiled Treated Materials Pending Validation

The validated treated materials were used to provide a batter for a section of a retaining wall (as shown in Figure 4 below) and for general profiling improvements.

The inert canal sediments were utilised to provide a suitable capping layer for the deposited treated soils.

Figure 4 – Reuse of Treated Materials in a Supporting Batter

The inert oversize concrete materials were crushed and reused to raise levels in an area prone to flooding (due to a slight depression). This area is shown in Figure 5 below.

Figure 5 – Area Utilised for the Reuse of Inert Concrete Materials

The remediation works were undertaken in December 2012 by JHBL with supervision by Envirotreat.

The remediation works were undertaken within a one week timescale.

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Validation

Following a suitable period of "curing" representative composite samples of treated soils were leach tested and compared with the derived leachate target criteria. All leachate values were compliant with the designated remediation criteria. The treated material was therefore considered suitable for reuse on site and re-emplaced as a substitute for imported fill.

Conclusions

Envirotreat were able to demonstrate through a comprehensive Validation Report that the overall remediation strategy had been successfully implemented.

The prime drivers for the remediation works were the protection of human health and controlled waters.

The treated materials achieved both the environmental and engineering requirements to enable reuse on site (as a waste recovery process).