Case Study

Morfa Landfill Design and Construction

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Steel has been produced on the site of the country's largest steelmaking plant for generations. Waste produced in the steelmaking process has been deposited within the plant, and since the early 1970's into a landfill without the benefit of a lining system. With the implementation of the Landfill Regulations the landfill site was decommissioned and a replacement site constructed to modern standards.

Geotechnology Ltd was commissioned by Corus to see it through the transition from the old method of disposal to the new. This included the design of both hazardous and non-hazardous landfills as well as the design of the restoration scheme for the closed landfill. The designs were developed by carrying out a series of risk assessments, including hydrogeological, landfill gas, stability and nuisance, and then producing design drawings and a Specification. The risk assessments were used to support an application for PPC Permits for both the hazardous and non-hazardous landfills. The closed landfill risk assessments allowed the designs to be incorporated into the post-closure plan and the site Environmental Permit.

At the same time as the transition between regulatory regimes for the Environmental Permit a major review of the Planning Consent was initiated by the local planning authority. Geotechnology was commissioned to prepare an Environmental Statement to support the application for revised conditions.

The Morfa landfills have been constructed in a way that protects the shallow groundwater by providing an artificially established geological barrier beneath the HDPE artificial sealing liner. The very shallow groundwater in the wind blown sand stratum beneath the site required the landfill base to be positioned precisely to maintain an unsaturated zone of the necessary thickness. The absence of a naturally occurring geological barrier required the

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construction of a wholly artificial barrier. The lack of suitable geological materials locally resulted in the choice of bentonite enhanced sand (BES). A review of the waste and leachate chemistry however revealed an incompatibility between the conventional sodium activated bentonite and the leachate. This has resulted in calcium bentonite being used to produce the BES used beneath both the hazardous and non-hazardous landfills.

Characterising the BES was a key aspect to the development of a successful design, and this was carried out by evaluating the performance of various bentonite and host material combinations until the optimum design was determined. Using initially laboratory and finally full scale field trials, the performance of the BES was evaluated and its characteristics (permeability and attenuation) used to refine the hydrogeological simulation of the landfills.

Since the PPC Permits for the sites have been issued, Geotechnology has been retained by Corus to act as construction project managers, performing several key roles in delivering the landfill cells. To date, more than 60,000m^2 of BES/HDPE lined cells have been constructed using in-house contractors to supply plant to the project, with materials sourced from local and national suppliers tendering for the supply contracts.

Construction plant is directed on a day to day basis by Geotechnology site staff, who also set-out the works and supervise the construction. Using specialist mixing contractors the BES is produced on site, under the supervision of our staff. BES

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material is placed to line and level and is then subjected to Construction Quality Assurance procedures to ensure it has the characteristics of the Specification and has been placed in accordance with the design. Geotechnology staff also carry out the CQA testing and sampling on-site and dispatch samples to the contracted laboratories for independent testing.

Five large cells have been delivered to Corus to date, all of which have been designed, specified and built under the day to day supervision of Geotechnology. During this time the practice has developed an in depth knowledge of the construction of BES liners, both in terms of mixing control and placement procedures. Combine this with our experience of reviewing the design, specifications and construction records of all other BES landfills in the Welsh Region and it is difficult to identify any other organisation with as much experience of this increasingly common construction method.

As well as delivering the completed landfill cells, Geotechnology has also delivered more than 10 Hectares of restored closed landfill. The restoration system also uses BES beneath a series of collection reservoirs used to harvest rainwater. This unusual design has developed from the need to prevent infiltration into the wastes whilst providing a groundwater recharge system fed by a clean water source. The recharge system has been devised as a mechanism to improve groundwater quality around the site as well as protecting against the effects of groundwater depletion caused by recharge shading.

In summary, Geotechnology has designed and specified unconventional landfill engineering. After guiding the designs through the regulatory regime the practice has managed the construction of the cells and the restoration scheme.