CASE STUDY – PORT OF ANTWERP OIL SPILL SOIL REMEDIATION PROJECT

THE PROBLEM

In 1990, 4500 m^3 of silty sand/soil contaminated with mineral oil (diesel) to a level of 1500 ppm was treated on-site (Port of Antwerp) at the request of the client.

OUR APPROACH

On reviewing both the site and the scope of the project it was clear to Nordevco staff that the most cost effective and efficient approach would be to treat the soil in a modified soil pile/wet cell using the BactiDomus® Technology and a bioreactor. The construction of a bioremediation system began with the leveling of the area and placement of an environmental liner to ensure that the treatment was contained within the site with no risk of collateral contamination (see diagram at end of report).

The contaminated soil was processed through a sieve to remove all large rocks. A rubber tired loader was used to place relatively thin layer of on the liner in order to avoid any puncturing of the liner. A layer of BactiDomus® Technology (product 402), was spread over the soil. This pattern of alternating layers was continued until the design height of 4m was achieved. A retaining wall was placed around the pile once the construction was completed.

At the base of the soil pile, between the pile and the retaining wall, a trench was constructed and was lined with the excess environmental liner. This trench was used as a catchment for the water that drained from the soil pile. The trench water was designed to flow into a two chamber bioreactor composed of two concrete chambers. The first chamber was used both as a sedimentation chamber and as a reservoir while the second chamber was designed to be used as an aerated bioreactor. A mixture BactiDomus® Technology product 208 and product 401GG were added to the bioreactor.

The treated water exiting the treatment chamber was then re-injected on to the top of the pile. This treated water carried with it some of the BactiDomus® Technology microorganisms back to the pile. This allowed for some passive treatment of the contaminants in the pile itself, while the bioreactor actively biodegraded the contamination washed from the soil into the water.

THE TECHNOLOGY

Nordevco's BactiDomus® Technology was developed by a diversified group of research scientists working together at Universities in Belgium and France. Their goal was to create a mechanism with the flexibility to delivery biological solutions to a range of environmental issues more effectively and efficiently

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The foundation for the success of the BactiDomus® Technology was the development team's clear understands that for any carrier material to be successful it had to meet specific underlying needs of the organisms:

- Regardless of the organisms used, they would be cultured in a sterile laboratory and would require time to acclimate to the environment they were activated in.
- Microorganisms, like humans, do not exist or thrive in isolation of each other but rather rely on others for stimulation and competition;
- Organisms prefer to grow and live in colonies or flocs and prefer to attach to something to anchor these colonies;
- Individual species of microorganisms do not work in isolation to break down organic compounds. To successfully break down any organic completely to CO2 and H20, a variety of different organisms are required;

The result of that work is the BactiDomus® Technology which is based on the use of an inorganic limestone-like porous carrier material. The porosity of the material allows it to be bathed in a nutrient broth, absorbing key micro-nutrients that act as an initial food source when the product is activated. It is then impregnated with a range of different naturally occurring and non-pathogenic organisms, selected for their ability to breakdown specific organic contaminants.

The organisms selected for inclusion are selected based on the understanding that each contaminated environment can be aerobic, anaerobic or facultative anaerobic. Therefore, aerobic, anoxic and anaerobic organisms are selected and used in each product to ensure that they can function successfully in a broad range of environments.

The carrier material's large surface area to size ratio provides the organisms with both internal and external floc points where they grow and create large effective colonies of biodegraders working together to break down the organic contaminant into carbon dioxide and water.
The carrier material's hydrophilic nature allows it to absorb both the water and contamination. This provides a steady strong contact between the imbedded organisms and organic contaminant. This ensures that the organisms have a continuous food source as they grow and create flocs within the protective confines of the capillary network of the carrier material.

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THE RESULTS

Length of treatment	Initial Concentration	Final Concentration	% Reduction in Concentration
35 Days	1,500 ppm	1.2 ppm	99.9%

Analysis after five weeks confirmed that the soil met or exceeded all environmental regulations and the project was deemed to be a success.

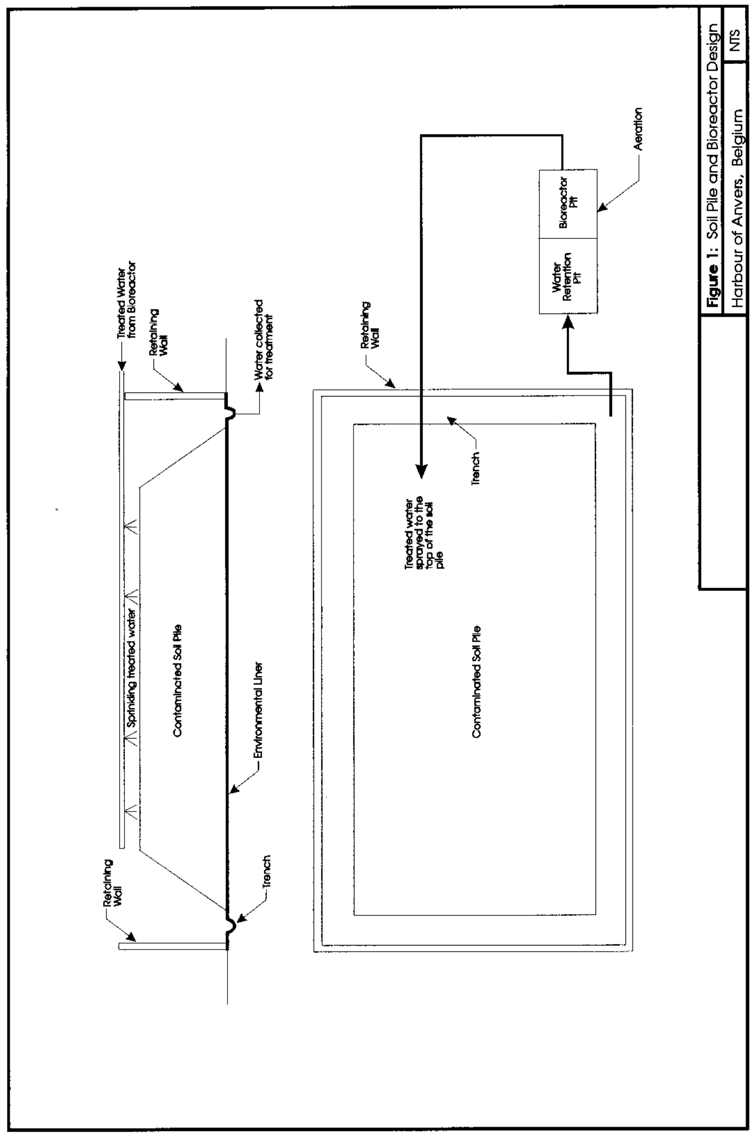

Figure 1: Soil Pile and Bioreactor Design
Harbour of Anvers, Belgium

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