



Bioremediation of Hydrocarbon Contaminated Soils

The Client: Nynas UK AB, Bitumen Refinery, Dundee

The Challenge: Nynas inherited an old soil treatment bed with their site purchase. The old soil treatment bed was identified as an environmental liability which required a solution. Nynas were looking for a sustainable and low environmental impact solution to the liability. Soilutions worked with the client's environmental consultant to produce an options appraisal detailing potential remedial solutions. We were then commissioned with remediating the materials on site.

The Solution: Soilutions provided a comprehensive options appraisal outlining costs, timeframes and risks for several on-site treatment options. Further to extensive discussions between Nynas, Soilutions, and the regulator, Soilutions were contracted to bioremediate the impacted soils under their Mobile Plant Licence. Approximately 1,500m³ of contaminated soils required treatment.

Soils were excavated out of the treatment bed. The treatment bed and associated infrastructure was subsequently decommissioned. Contaminated soils were screened to remove 'oversize' materials which didn't require treatment. Remaining soils were then formed into windrows on impermeable bases with breathable 'fleece' covers. Soil conditions were enhanced by adding hydrocarbon degrading bacteria, adding a balance of nutrients, and aerating the soils.

Throughout the treatment period gas and temperature levels were monitored, soils were routinely sampled and nutrient and moisture levels amended accordingly. The windrows were periodically 'turned' to aerate and evenly distribute nutrients and bacteria throughout the windrow.

At the completion of the project the treated materials were deemed suitable for re-use on site.

Duration: Initial site preparation and windrow formation: 5 weeks
Total Treatment: 2 years and 3 months

Project Recognition: The Scottish Environment Protection Agency (SEPA) used this bioremediation project as a demonstration project for the Swedish Environment Agency during their visit to Scotland.

Client Feedback: Soilutions have managed the bioremediation bed of contaminated soils at our Refinery in a thoroughly professional manner. They delivered the project on time and within the budget frame. They responded well and promptly to suggestions from the Regulator as well as the Customer – this is demonstrated by the fact that SEPA brought a delegation of foreign visitors to view this site as an example of good practice. Thank you for your support throughout this project.”

Nick Ashton HSSE MANAGER 06 FEBRUARY 2013



REMEDIATION AREA AT THE START OF WORKS



REMEDIATION WINDROWS



'TURNING' OF WINDROWS USING AN ALLU BUCKET



SOILS RE-USED ON REMEDIATION AREA



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Case Study – Bioremediation of Hydrocarbon Contaminated Soils

Options Appraisal: Initial assessment of the old treatment bed was carried out by the client's environmental consultant. The consultant identified that a specialist contractor (Soilutions Ltd) would be required to identify potential treatment options.

Following review of information made available, Soilutions identified several areas where further information would be beneficial. A high density sampling exercise was carried out by Soilutions with samples being sent for microbial population analysis as well as chemical analysis.

A remedial options appraisal was put together which detailed several appropriate techniques for removing the environmental liability. On-site bioremediation was identified as the most suitable approach, achieving the client's main objectives which were to have a low environmental impact on the environment within a reasonable budget.

Bioremediation: The project set-up included drafting and submission of a Site Specific Working Plan to the Scottish Environment Protection Agency (SEPA) under Soilutions Mobile Plant License. A Health, Safety & Environment Plan was drafted for the project and approved by the client's CDM co-ordinator.

The working area was fenced off and a site compound set-up. All staff were inducted in to Soilutions site management plan.

Soils were excavated out of the existing treatment bed and screened on to impermeable membranes. The treatment bed infrastructure was removed from the ground, including 2 sumps for effluent collections. Heavily contaminated groundwater was found around one of the old sumps. The client was informed and an agreement to install a temporary sump was made. The sump was pumped out regularly for the duration of the site works and monitored for 2 years.

Impermeable windrow bases were constructed on the treatment area. Approximately 1,500m³ of impacted material was formed in to windrows on top of the impermeable bases. A microbial mixture, cultured specifically for these contaminated soils, and a soil specific balance of nutrients was added and mixed into the soils. Soils were then mixed using an Allu bucket fitted to an excavator.

Soils were covered with breathable remediation 'fleeces' which allowed a level of moisture and temperature control within the soils.



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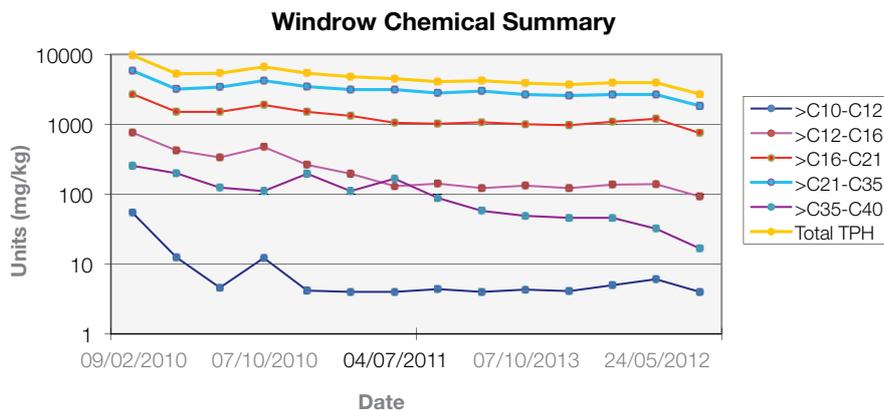
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22 lances were advanced into the windrows to enable the monitoring of gases and temperature throughout the windrows. These lances were monitored throughout the process with frequent visits during the warmer weather when bioremediation activity was high, and less frequent visits during the winter when the process was inhibited by lower temperatures. Gas concentrations and temperature levels within the windrow provide a good indicator of the rate at which microbial breakdown was occurring.

Additionally, representative samples were analysed for nutrient and contaminant concentrations. The windrows were 'turned' on a regular basis to aerate the soils and when necessary, nutrients and water were added to ensure that conditions were optimal for microbial growth.

Analytical Data : The table below shows analytical results recorded through the treatment works. Concentrations of Total Petroleum Hydrocarbons (TPH) were significantly reduced by the bioremediation works. A 72% decrease in TPH was measured over the course of the project. The lightest and heaviest fractions C10-C12 and C35-C40 showed the most significant reductions with a 93% decrease in concentrations in both fractions.



Project Conclusion: The client's consultant carried out a risk assessment using chemical analysis from the windrow soils. Soils at the conclusion of the project were assessed to be suitable for re-use in the treatment area.

The site was subsequently demobilised with the treated soils spread over the treatment area.

Quality: SEPA used this bioremediation project as a demonstration project for the Swedish Environment Agency during their visit to Scotland.



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