



## A COMMERCIAL APPLICATION OF VIROSOIL™ TECHNOLOGY

### CASE STUDY: CIVIL, MINING AND CONSTRUCTIONS BIOREMEDIATION OF TPH, BTEX AND PAH

*Hydrocarbon destruction using ViroSoil™ Technology proved to be a safe, cost-effective and environmentally responsible method of dealing with and eliminating hydrocarbon contamination in soils.*



*Underground sludge tank*

## >>> CASE STUDY: CMC - TPH, BTEX AND PAH BIOREMEDIATION

### PROBLEM

A large civil contractor, Civil Mining and Construction (CMC), was developing a disused industrial site and had an urgent need to remove a large volume of oily sludge located in an underground tank. The oily sludge was characterised by high levels of odour and had high level concentrations of total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, and xylenes (BTEX), and polynuclear aromatic hydrocarbons (PAH) that prohibited acceptance to landfill. CMC was pursuing a rapid solution for the on-site bioremediation of this contaminated waste material.

### VIROTEC TOTAL SOLUTIONS

Virotec was contracted by CMC to implement its ViroSoil™ Technology utilising the “Rapid Sequestro-Degradation” (RSD) method of hydrocarbon and odour destruction. RSD is an advanced form of bioremediation, which significantly reduces the length of time it would take standard methods of landfarming and bioremediation to destroy contaminants. This method was required to meet the urgent needs of CMC to safely dispose of the contaminated material. Using the RSD method, the rate of destruction of hydrocarbons was increased using an inoculum of naturally occurring petrophillic microbes and nutrients to enhance natural degradation processes and to establish healthy microbial populations in the soil.

The key objective was to bioremediate over 50 cubic meters of highly contaminated sludge to reduce TPH, BTEX and PAH levels to below Queensland EPA acceptance criteria for landfill acceptance. The sludge in its existing form cannot be accepted to landfill.

### BACKGROUND

CMC, a large civil contractor, discovered a disused underground tank that required removal prior to the re-development of a former industrial site. The underlying problem of this project was the contents of the tank were unknown, although it had been characterised as an extremely odorous and oily material. Initial analysis conducted by Virotec showed elevated levels of TPH, BTEX and PAH.

Hydrocarbons, such as fuels, oils, grease, solvents and lubricants, are recognised as the most common types of contaminants in industrial applications. Sustainable development and a rapid solution were critical to CMC’s project objectives. The use of ViroSoil™ Technology to permanently destroy the hydrocarbons in the soil was seen as the best remediation option to meet the project objectives.

ViroSoil™ Technology, using RSD, has been successfully applied at operational and disused industrial sites where hydrocarbon contamination is a problem. Unlike the standard methods of excavating and dumping, incineration, sterilisation (e.g. thermal desorption), and soil washing technologies,

## >>> CASE STUDY: CMC - TPH, BTEX AND PAH BIOREMEDIATION

which are expensive methods for treating hydrocarbon-contaminated soil, ViroSoil™ Technology offers a cost-effective way to treat hydrocarbon contaminated soils. ViroSoil™ Technology has been developed to meet the needs of the client and the site.

### TREATMENT METHOD

An initial full analysis was conducted on the sludge to determine the contaminant types and levels, so that an appropriate treatment strategy could be chosen. The NATA certified initial analysis showed the following contaminants exceed the landfill acceptance guidelines.

#### **Total Petroleum Hydrocarbons**

- > C6-C9 Fraction
- > C10 – C14 Fraction
- > C15 – C28 Fraction
- > C29 – C36 Fraction

#### **BTEX**

- > Ethyl Benzene
- > Total Xylenes

#### **PAH**

- > Naphthalene

The underground sludge tank is shown in Figure 1



**Figure 1 - The underground sludge tank at the CMC site**

**>>> CASE STUDY: CMC - TPH, BTEX AND PAH  
BIOREMEDIATION**

Figure 2 shows the extraction of the contaminated sludge from the underground tank. A strong organic hydrocarbon odour was detected during removal of the sludge, again confirming the presence of hydrocarbons. As the sludge also had very high moisture content, it was decided to “bulk up” the treated waste with other TPH contaminated soil located on site to ensure acceptance to landfill as a solid (rather than a liquid) waste after the application of RSD processes.



**Figure 2 - Excavation of sludge from underground tank**

The designed ViroSoil™ bioremediation treatment comprised of a two-stage addition of the ViroBind™ reagent. The Virotec total solution ensured that the contaminated sludge had a custom-designed treatment solution in order to meet treatment targets efficiently and effectively.

The sludge was treated over a four-week period in two stages. The first stage of treatment of the ViroBind™ reagent consisted of both bacterial and nutrient addition as well as an extended period of aeration. The second stage of treatment involved dosing with bacteria, enzymes and surfactants. The sludge was aerated for a minimum of two hours per week.

Following the ViroSoil™ treatment, the treated sludge was “bulked up” with other contaminated oils and left in-situ. The total volume of resultant treated oily sludge was approximately 100 cubic metres. The treated sludge was sampled and sent to an independent, National Association of Testing Authorities (NATA) accredited laboratory for analysis. Sampling was conducted at a rate of one test per 50 cubic metres.

Figure 3 overleaf shows the sludge and contaminated soil being mixed and treated in a “Designated Treatment Area” (DTA) on site.

## >>> CASE STUDY: CMC - TPH, BTEX AND PAH BIOREMEDIATION



*Figure 3 - Treatment of sludge and contaminated soil in the “Designated Treatment Area”*

### RESULTS

After treatment with ViroSoil™ Technology, the TPH, BTEX and PAH levels were dramatically reduced within a four-week period. Treatment results and initial contaminant levels are summarised in Table 1 below.

TABLE 1: SOIL TREATMENT RESULTS

Component	Before Treatment (mg/kg)	Sample A After Treatment (mg/kg)	Sample B After Treatment (mg/kg)	Qld EPA landfill acceptance (mg/kg)
C6 – C9	2,700	16	22	500
C10 – C14	110,000	1,590	1,480	5,000
C15 – C28	56,000	2,840	2,960	10,000
C29 – C36	24,000	2,080	1,980	10,000
Ethyl Benzene	590	<0.5	2.2	500
Meta-para Xylene	1,100	<0.5	4.4	250
Ortho Xylene	13	<0.5	2.7	250
Naphthalene	210	0.6	2.3	500

## >>> CASE STUDY: CMC - TPH, BTEX AND PAH BIOREMEDIATION

The final moisture content was 14.8% and 16.8%, and as such it was suitable for acceptance as a solid waste landfill. It was noticed by site operators that there was a substantial improvement in odour after treatment as compared to sludge odour immediately after excavation. Based on these results, the soil was considered to be remediated and could be transferred to landfill.

### CONCLUSION

Hydrocarbon destruction using ViroSoil™ Technology proved to be a safe, cost-effective and environmentally responsible method of dealing with and eliminating hydrocarbon contamination in soils. Intractable hydrocarbon destruction, particularly the destruction of BTEX and PAH, the presence of which are known to pose significant health risks, represented a significant outcome for the long-term sustainable re-use of the site. For example, the short term breathing of high levels of benzene can result in death, while low levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, and even death. With the application of ViroSoil™ Technology, these long-term risks have been avoided.

The Virotec total solution thereby gave the following outcomes to the customer:

- > Rapid treatment;
- > Low cost compared with other remediation methods;
- > A significant reduction in health risks; and
- > A proven technology, using an EPA approved methodology, to remediate TPH, BTEX and PAH.

### TESTIMONIAL

**Virotec Global Solutions were contracted to treat approximately 25,000 liters of highly contaminated hydrocarbon sludge found in an underground tank. The solution they offered was very simple with treatment being completed within 4-5 weeks and meeting the EPA guidelines for disposal to landfill.**

**The work performed by their staff was very professional and all relevant safety requirements were met by their and Civil, Mining & Constructions systems.**

**We were satisfied with their performance and would have no hesitation in commissioning Virotec Global Solutions for any hydrocarbon contaminated soil services in the future.**

**Rod Woodrow**

**Project Manager**

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