

# Audit of the Remediation of former FCC site Mapua, June 2009

## Executive Summary

Fruitgrowers Chemical Company (FCC) formerly operated an agrichemicals factory on a site in the small settlement of Mapua, 15 km west of Nelson. The site has the Mapua Channel and the Waimea Inlet on two boundaries. The former use of the land left a legacy of contaminated soil, marine sediment and groundwater on and adjacent to the site. Pattle Delamore Partners Limited (PDP) has been engaged by the Ministry for the Environment (MfE) to audit the recently completed remediation of the site.

### The remediation

Environmental investigations and assessments carried out at the site in the past found elevated concentrations of contaminants in soil on the site and adjacent land, in groundwater, and in nearby marine sediments (thought to have been caused by run-off from the site). The major contaminants of concern were organochlorine pesticides (OCPs), which include DDT, DDD and DDE (collectively known as DDX), and aldrin, dieldrin and lindane (collectively known as ADL).

A decision was made to remediate the site to prevent further effects on the marine environment and to restore the site to a usable condition. Following initial trials, works commenced in October 2004 and were completed in early 2008. The remediation Validation Report was submitted to MfE in December 2008. The site has remained vacant since the remediation was completed.

The overall remediation site is made up of nine separate components each with different remediation targets: the western part of the former FCC site (FCC West), intended for residential use; the eastern part of the former FCC site (FCC East), intended for commercial use and open space; a former landfill area (FCC Landfill), intended to be recreational open space; two marine foreshore areas; and four privately owned residential properties to the south of the FCC sites. Site-specific soil acceptance criteria (SAC) were developed for each of the residential, commercial/open space and foreshore areas. The SACs were primarily aimed at protecting the marine environment, but by doing so, were also protective of human health.

Almost the complete site was excavated, with the soil tested as it was removed to determine its acceptability against the SACs. Soil was then assigned to stockpiles for later reuse as residential or commercial soil, or sent for treatment. Soil that exceeded commercial criteria for OCPs was treated to reduce concentrations to below the commercial criteria using a mechano-chemical dehalogenation (MCD) process.

The excavations were then backfilled with material that was considered suitable for the proposed land use for that area. The entire site was finally covered with half a metre of residential quality soil, the top third of which was imported topsoil.

Two areas of foreshore adjacent to the FCC site were included in the remediation. This consisted of excavating contaminated material broadly defined by previous investigation results and backfilling with imported clean gravel.

A number of groundwater monitoring wells and private groundwater bores were monitored prior to and during the remediation as a condition of resource consent.

### **The audit**

An audit of the remediation has been carried out to assess whether the site complies with the SACs, is now fit for its intended purposes or whether any further steps are necessary to achieve this. During the audit a large number of documents relating to the site and remediation were reviewed, and key individuals involved in the remediation were consulted. This process has resulted in a good understanding of the remediation process, which provides confidence in the conclusions drawn.

The detailed and methodical approach by site staff gives confidence in the quality of the remediation works. The soil and marine sediment sampling carried out to assess the effectiveness of the remediation was undertaken in a professional manner, using methods consistent with accepted industry practice. The quality of the data used to validate the remediation was generally of an acceptable quality.

Overall, the site-specific SACs developed as targets for the remediation are appropriate for the future uses, and so where the relevant SACs are met for a particular part of the site, then that part of the site is fit for its intended purpose. An exception to this is exposure through drinking of groundwater, which is assumed to be controlled by other means. Also, no criteria were derived for nitrogenous compounds or phosphorus, which were used in significant quantities as additives in the soil treatment process.

#### Soil:

FCC West is fit for its intended purpose (residential) with respect to soil quality, subject to a minor uncertainty on whether concentrations of DDX always meet the residential SAC due to high detection limits used in the laboratory analysis. A programme of sampling or retesting of existing samples has been recommended to address this uncertainty. It is probable that the additional testing will confirm the current results.

Overall, the FCC East site is also considered fit for its intended purposes (commercial and open space) with respect to the soil remediation. Some uncertainty remains with respect to the potential for ammonia gas to be generated from MCD-treated soil (arising from the additives used in the treatment) and possible effects on human health, and the possibility of plant health effects on deep-rooted plant species used in future amenity planting. These issues can be readily managed with a site management plan (SMP). The proposed SMP will also ensure that excavation into commercial quality soil will be controlled so that it is not left on the ground surface where it could migrate to the marine environment in site runoff, or be disposed of to a more sensitive environment. Copper compounds, also used as a treatment additive, are not of concern.

FCC Landfill site is also considered fit for its intended purpose (open space) with respect to the soil remediation. However, there is again some uncertainty with respect to the possibility of ammonia generation and phytotoxicity of copper in treated fines. However

these are not human health issues for day to day use as open space and can also be readily managed with an SMP.

The soil quality at the four residential property sites is considered to be fit for residential purposes.

Marine Foreshore:

It is considered that "remediation to the extent practicable" has been broadly achieved in the marine foreshore areas. The benefits of further remediation are likely to be outweighed by the additional disruption and impacts to the environment. It is clear that the remediation in these areas has not been successful in meeting the SACs for DDX and ADL. However, re-deposition of non-complying sediment from the surrounding marine environment probably meant that compliance with the SACs could not be achieved within the foreshore surface sediments. In addition, re-contamination of the deeper backfill material has occurred during the remediation works. The mechanism(s) for this are not clear, but site runoff is probably a major contributor.

While contamination remains within the backfilled material, there is evidence that the surface sediment quality has been improving since completion of the remediation. A key aspect of the foreshore remediation is the removal of the site as a source of ongoing sediment contamination. This will allow natural attenuation processes to slowly improve the foreshore sediment quality over the coming years.

Apart from localised effects on the marine ecosystem, the effects of the residual sediment contamination on other receptors are not likely to be significant. In the case of risks to human health via seafood consumption, additional data is required to confirm this as the current dataset is limited.

Groundwater:

The groundwater under the site contains elevated concentrations of some contaminants, in particular DDX, dieldrin and nutrients. This will remain for an extended period, resulting in discharges to the marine environment. However, it is by no means clear that the groundwater contamination is creating an unacceptable risk, or risks that cannot be managed. The direction and rate of groundwater flow under the site are currently uncertain, which makes the potential risks arising from the groundwater contamination difficult to assess.

This contamination may pose a risk to potential groundwater users on the site. However, future groundwater use can be controlled to mitigate this risk. In addition, the presence of a reticulated water supply provides a disincentive for future installation of water bores. While there is some uncertainty as to whether groundwater is flowing from the site towards existing private bores in nearby Tahī Street, the current groundwater quality from these bores is suitable for irrigation use.

It is likely that there will be localised effects on the foreshore ecosystem at the point of discharge of the groundwater. Algal growth shows excess nutrients in the discharge.

However, the potential effects on the wider marine ecosystem are not expected to be significant due to dilution. Remediation of groundwater could be considered to deal with local effects, but such consideration is premature. Further monitoring is required to better assess the significance of the local effects. Remediation should only be considered if unacceptable effects are confirmed and such effects cannot be managed in some other way. Remediation of groundwater would be expensive, potentially uncertain and have to continue for many years.

### **Recommendations**

Additional soil sampling should be undertaken on FCC West to increase confidence in the precision of the OCP soil analysis. This could also be achieved by re-analysing current samples held by the laboratory.

A programme of sampling and risk assessment should be carried out for ammonia gas in locations where treated soil exists. This could be carried out on a case-by-case basis when buildings are constructed on FCC East.

Additional groundwater monitoring wells should be installed and ongoing groundwater monitoring carried out. The groundwater monitoring data should be used to update the hydrogeological model for the site. This will contribute to assessing the importance of local effects from groundwater discharge on the foreshores and clarify whether there is a significant southerly groundwater flow towards private bores in Tahi Street.

Sediment and snail sampling should continue, following a review of the sampling design to ensure it is adequately quantifying the risk via seafood consumption and is properly representing the quality of the surface sediments.

The health and diversity of the foreshore ecosystems should be benchmarked relative to suitable control sites elsewhere in the Waimea Inlet. The information will contribute to assessing the significance of the residual contamination in the foreshore sediments and the local effects of contaminated groundwater discharge.