

WAIKATO CARBONISATION PLANT – INVESTIGATING A HISTORICAL LEGACY

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Abstract

The Waikato Carbonisation Plant (WCP) is recognised by the New Zealand Historic Places Trust as an industrial site of national and international significance. The WCP produced coal brickettes (carbonettes), coal tar and creosote from the 1930s until its closure in the mid 1980s.

The manufacturing process created a range of waste products, with phenolic liquid waste the most predominant. Waste disposal at the site was to land and to the neighbouring Awaroa Stream. As a result of these practices the land and underlying groundwater at the site was thought to be contaminated with a range of semi-volatile hydrocarbons.

In the early 1990s Environment Waikato instigated the remediation of the residual phenolic liquid and sludge that was left in large storage ponds at the site. The wall of the pond had the potential to fail and release a large volume of phenolic liquid waste directly to the Awaroa Stream. While the focus of the work was on the management of the phenolic wastes, remediation of the remaining site was restricted to containment of the coal tar and the construction of a bund around the perimeter of the site.

Tonkin & Taylor Ltd was engaged to undertake a site audit and intrusive ground investigation of the former WCP. The goal of the investigation was to benchmark the site and to identify possible future management options. The investigation was funded through the Contaminated Sites Remediation Fund, and from financial contributions from the New Zealand Historic Places Trust and Solid Energy New Zealand Ltd.

Surface soils exceed the Tier 1 acceptance criteria for human health, and a semi quantitative risk assessment identified that the current stormwater discharge is likely exceed ANZECC water quality guidelines for the protection of 95% of aquatic organisms immediately downstream of the discharge point.

Up to 335 cubic metres of coal tar is still contained in above ground storage tanks. Some of these tanks have been partially submerged by water for many years and are in a poor state of repair.

This paper describes the history of the site, and outlines the findings of our investigation and site audit. Management options that aim to manage the potential and environmental risks, while preserving and maintaining their historical significance are also discussed.

Introduction

A site audit and intrusive ground investigation has been undertaken at the former Waikato Carbonisation Plant (WCP), located 8 kilometres west of Huntly (Photo 1). The investigation and audit was undertaken to determine the residual level of contamination across the site and to determine the risks to human health and the aquatic environment from the contamination of

soil and water. . Future management options were identified and prioritised as a result of the Tier 1 and Tier 2 risk assessments undertaken.



Photo 1: Waikato Carbonisation Plant (April 2007) prior to dewatering

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- The Ministry for the Environment's Contaminated Sites Remediation Fund (administered by Environment Waikato)
- Historic Places Trust
- Solid Energy New Zealand Ltd

Background

The WCP operated from the mid 1930s to the mid 1980s. It used waste coal to produce coal char by a process of heating, distillation and compacting. By-products included creosote and coal tar. The WCP and a separate plant that used the char and coal tar as a binder to manufacture carbonettes, for domestic heating.

Historically waste products from the WCP were discharged directly to the Awaroa Stream, the main tributary of Lake Waahi whose outflow is to the Waikato River. Serious pollution of the Awaroa Stream occurred in the early days of the operation. In the 1960s a rudimentary effluent treatment system was installed and the discharge legalised by a permit issued by the then Pollution Advisory Board. In the 1970s the control of the discharge was delegated to the then Waikato Valley Authority (WVA). A water right was issued for the discharge to the stream in 1976, however the company was unable to meet the conditions with frequent complaints being received by downstream users. In 1981 the water right expired and the WVA decided to decline an application by the company for a new right to discharge the

effluent to the stream. An incineration trial programme was initiated, but production of waste exceeded the capacity of the burners and increasing volumes of waste accumulated in an expanded system of ponds. In 1985, following a major fire at the site, the plant was closed.

Waikato Carbonisation Ltd was a wholly crown-owned company, up until 1983 under the State Coal Mines Department and after that time via a shareholding evenly split between the Ministry of Energy and New Zealand Steel. The latter private sale of NZ Steel included an indemnity from any liability for environmental problems. When Coal Corporation of New Zealand Ltd purchased some of the assets of State Coal Mines from the Ministry of Energy, the WCP was not included in the list of assets. As a result, the remaining assets became the responsibility of the Transitional Management Unit, which was wound up in 1990. The land on which the WCP is situated is administered by the Public Trust.

Historical Significance

The historical significance of the site is recognised by the Historic Places Trust (HPT) as it has identified the Lurgi retort building and screening plant as Category 1 buildings, and has classified the whole site as a Historical Area. The WCP was the first Lurgi (heating in the absence of air) plant to be constructed in the Southern Hemisphere. (Photo 2)

The historical significance of the site is considered by HPT to be due to several factors:

- It provides representative example of industrial practices in New Zealand before the advent of current safety and environmental requirements. The plant, during operation, was dangerous and explosions and fire were a constant risk. One person was killed in 1974 by an explosion at the tar still, and in 1987 the retort exploded, which resulted in the closure of the site.



Photo 2: WCP showing the Lurgi Retort building, screening plant. Note the stored carbonettes in the foreground.

- The Rotowaro Works was an innovative technique for using a waste coal (slack coal). At the time the carbonisation works were thought to be a forerunner of similar plants on the coal fields through out New Zealand, however no other plants were constructed and Rotowaro remained the only plant of its type for treatment of low grade coal by gasification to produce domestic fuel.
- The Rotowaro Carbonisation Plant is regarded as symbolic of New Zealand's growing national attitude towards technology, and a movement away from dependency on England. The technology was sourced from Germany and not England, which at the time was the common source for New Zealand's industrial engineering technology. In fact, German engineers were brought in to establish the plant and several engineers who were still in New Zealand at the start of World War II had to be deported.

The historical value of the site and its legacy can not be overlooked, and both the investigations and remedial options needed to recognise and take account of its historical significance.

Previous Phenolic Liquid Remediation

Following closure of the site in the mid 1980s, the WVA took the initiative and raised concerns with the Ministry for State Owned Enterprises about the possible abandonment of the site and contamination issues. The most pressing concerns were:

- The escape of wastes from the storage ponds, with potentially devastating effects on the Awaroa Stream and Lake Waahi; and
- The continuation of uncontrolled surface and subsurface runoff from the site carrying contaminants to the Awaroa Stream

In 1991 the Ministry for the Environment provided the necessary funding of the cleanup, with the now Environment Waikato (EW) taking responsibility for the management and implementation of the remedial measures. The objectives of the cleanup at the site included:

- Removal of phenolic liquids from several large storage ponds;
- Neutralisation/removal of sludge materials;
- Removal of liquids/wastes around the buildings and site which could pollute the environment; and
- Securing, recontouring and revegetating the site

A total of 11,000 cubic metres of phenolic liquid, from the main phenol pond, the small southern phenol pond and all sumps, tanks and flooded basements were transported to Kinleith in Tokoroa for incineration. All sumps and basement areas were then backfilled with compacted clean fill. This resulted in around 2,000 cubic metres of phenolic sludge remaining, which was found to increase to around 4,000 cubic metres over the winter period due to infiltration and rainwater.

In 1992 a biological treatment cell was constructed on the site of one of the two existing sludge storage ponds. Air supply pipes were located on the cell floor and the entire cell was covered by a transparent plastic roof to keep rainwater from adding to the treatment volume. Sludge was transferred to the treatment cell and nutrients added to obtain optimum

conditions and the resultant mix aerated. As the liquid level dropped additional sludge was imported to maintain the maximum storage in the treatment unit.

The treatment process quickly reduced the phenol levels to below 1mg/L in the liquid fraction. A clarifier was later installed to enable the treated liquid to be separated and discharged to a stormwater treatment system for a nearby mine at a rate of around 20 cubic metres per day. Sludge from the system was returned to the treatment unit. By early 1995 a final volume of around 500 cubic metres was estimated to remain in the treatment cell. The remaining sludge was then mixed with overburden clay from the neighbouring mine and placed back in the treatment cell. The area of the ponds was then levelled and revegetated.

Bund Construction

The existing bund around the perimeter of the WCP was constructed to secure the site from water ingress or movement of water off site. The bund was constructed in 1992 using clay overburden material from the neighbouring open cast mine. Prior to construction of the bund a key was excavated around the edge of the site to below the level of the Awaroa Stream and backfilled with compacted clay. Contaminated material from the key was placed behind the key and incorporated into the bund. The area was then revegetated.

The work resulted in the formation of two banded areas, one containing the majority of the WCP buildings and the other containing the two steel tar storage tanks (Figure 1). A 150 mm diameter pipe linking the two areas and a 300 mm diameter pipe discharging to the Awaroa Stream were inserted in the bunds. The construction of the bund and key together with the location of the discharge pipe to the Awaroa Stream has resulted in around 2 to 3 metres of ponded water around the existing buildings and steel tar tanks (Photo 3).



Photo 3: Flooded site looking towards the Briquette Plant and above ground storage tanks

Site Investigation

The site investigation and audit initially required the dewatering of the site. This involved the draining the site, and disposing of the water by irrigation to land. Up to 12,000 cubic metres of water was pumped from the site to provide access to the site and buildings (Photo 4).

Once dewatered the site investigation involved the excavation of trial pits and the drilling of soil sample and groundwater boreholes across the site. The intrusive site investigation involved the excavation of 51 soil sampling points and installation of 5 groundwater monitoring bores (Figure 1).

The site audit included the inspection of the existing buildings and above ground tanks for any residual product and likely contaminants.

Results of site investigation

The results of the site investigation indicated that surface soils across the site exceeded the Tier 1 guideline criteria for protection of human health, assessed against an unpaved industrial/commercial land use (Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in NZ (MFE 1999)). The key contaminants of concern were the carcinogenic polycyclic aromatic hydrocarbons (PAH).

A quantitative Tier 2 risk assessment was carried out to assess the risks to water quality from the discharge of stormwater from the site. This assessment indicated that the stormwater discharging from the site was likely to exceed guideline criteria for the protection of 95% of aquatic organisms immediately downstream of the discharge point, and that there is a potential for contaminated of groundwater leaching to surface water.



Photo 4: WCP following dewatering, showing existing above ground storage tanks containing residual coal tar

Results of site audit

The site audit found a total of 335 cubic metres of coal tar stored in the above ground storage tanks. The storage tanks were found to be in a poor condition, with rust and corrosion evident around the water line and valves (Photo 4). Other potential contaminants include Polychlorinated biphenyls PCBs and asbestos. Asbestos roofing material is present on most of the buildings and some is present as lagging, around heating pipes. PCBs are most likely to be associated with cooling and insulating fluid in sites transformers and in capacitors that are identified at the site.

Options of site audit and investigation

On review of the results from the site investigation and audit, options were made in regard to future works/remediation at the site. The options in order of priority were:

- The removal and offsite disposal of the stored coal tar. A discharge of contaminants to stormwater within the bunded area is occurring. Which is visually evident by a hydrocarbon sheen on the water surface. It is possible that this could be leaking from the stored coal tar. The tanks are in a poor condition and a mass release of product could occur, resulting in a significant discharge to the Awaroa Stream.
- The removal of water, disposal of accumulated sludge and capping of the site. The results of the soil analysis indicate elevated concentrations of contaminants in the near surface soils and residual coal dust across the WCP. This material may also be releasing contaminants to the water column, resulting in a discharge to the Awaroa Stream. The ponded water is also causing deterioration of the existing buildings and tanks. Capping and removing the water will also provide access to and allow restoration of the existing buildings.
- The control of asbestos cladding and lagging across the site. Asbestos cladding is located on the majority of the buildings and some lagging has been identified around the pipe work from the boiler house to machine house.
- The control of vegetation around the WCP. The site is surrounded in exotic weed species, which makes assessment of the ground and buildings difficult. Vegetation control would allow better access and assessment of buildings and surrounding area.

The options outlined above have been designed to address the environmental priorities for the site, not to provide a complete site remediation, while also ensuring that the site can continued to be managed as one of national and international significance.

References

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