# Greymouth Petroleum Limited
# Turangi Production Station
# Annual Report
# 2014-2015

## Technical Report 2015-91

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Taranaki Regional Council
Private Bag 713
STRATFORD

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# Executive summary

Greymouth Petroleum Limited (the Company) operates a petrochemical production station located on Turangi Road at Motunui, in the Parahaki catchment. The Turangi Production Station processes oil and gas from from the Company's northern Taranaki operations, including the Turangi and Kowhai groups of wellsites. This report for the period July 2014-June 2015 describes the monitoring programme implemented by the Taranaki Regional Council to assess the Company's environmental performance during the period under review, and the results and environmental effects of the Company's activities.

The Company holds three resource consents in relation to the Turangi Production Station, which include a total of 68 conditions setting out the requirements that the Company must satisfy. The Company holds two consents to discharge stormwater and treated produced water onto land, in circumstances where it may subsequently enter an unnamed tributary of the Parahaki Stream, and one consent to discharge emissions related to production activities into the air at this site.

**During the monitoring period, Greymouth Petroleum Ltd demonstrated an overall good level of environmental performance.**

The Council's monitoring programme for the period under review included six inspections, four water samples collected for physicochemical analysis, and two ambient air quality surveys.

Site inspections found that the stormwater systems were constructed and maintained in accordance with consent conditions. However, routine sampling on 12 May 2015 found that the discharges from the Turangi Production Station contained a slight excess of suspended solids which was likely due to instability of the edges of the site surface. Receiving water inspection and sampling showed that the effect of these discharges on the tributary of the Parahaki Stream were no more than minor.

There were no adverse effects on the environment resulting from the exercise of the air discharge consent. The ambient air quality monitoring at the site showed that levels of carbon monoxide, combustible gases, PM10 particulates and nitrogen oxides were all below levels of concern at the time of sampling. No offensive or objectionable odours were detected beyond the boundary during inspections and there were no complaints in relation to air emissions from the site.

During the year, the Company demonstrated a good level of environmental performance and a high level of administrative compliance with the resource consents. The Turangi Production Station and associated wellsites were well managed and maintained.

For reference, in the 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

This report includes a recommendation for the 2015-2016 year.

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# 1. Introduction

## 1.1 Compliance monitoring programme reports and the Resource Management Act 1991

### 1.1.1 Introduction

This report is for the period July 2014-June 2015 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Greymouth Petroleum Limited (GPL). The Company operates a petrochemical production station situated on Turangi Road at Motunui, in the Parahaki catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company that relate to discharges of water within the Parahaki catchment, and the air discharge permit held by GPL to cover emissions to air from the site.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water, land and air, and is the seventh combined annual report by the Council for the Turangi Production Station.

### 1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the RMA and the Council's obligations and general approach to monitoring sites though annual programmes, the resource consents held by the Company in the Parahaki catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted at the Turangi Production Station

Section 2 presents the results of monitoring during the period under review, including scientific and technical data.

Section 3 discusses the results, their interpretations, and their significance for the environment.

Section 4 presents recommendations to be implemented in the 2015-2016 monitoring year.

A glossary of common abbreviations and scientific terms, and a bibliography, are presented at the end of the report.

### 1.1.3 The Resource Management Act 1991 and monitoring

The RMA primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

(a) the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
(b) physical effects on the locality, including landscape, amenity and visual effects;
(c) ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
(d) natural and physical resources having special significance (for example recreational, cultural, or aesthetic);
(e) risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

### 1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the consent holder/s during the period under review, this report also assigns a rating as to each Company's environmental and administrative performance.

**Environmental performance** is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. **Administrative performance** is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

**Environmental Performance**

- **High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment .The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

- **Good:** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

  For example:

  - High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
  - Strong odour beyond boundary but no residential properties or other recipient nearby.

- **Improvement required:** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

- **Poor:** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

**Administrative performance**

- **High:** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

- **Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

- **Improvement required:** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

- **Poor**: Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

## 1.2 Process description

The Turangi-A wellsite production facilities were commissioned in late 2006 following the successful drilling and testing of the Turangi-1 well. Two further production wells were drilled on the wellsite in 2008. The site was expanded to the south during the 2013-2014 year. The production facilities currently treat condensate and gas from GPL's northern Taranaki operations, including the Turangi and Kowhai groups of wellsites.

The primary facilities at the Turangi Production Station consist of:

- Wellhead shutdown systems.
- Sand catcher and heating systems.
- Inlet separator and LTS.
- Methanol storage and dosing system.
- A low pressure gas compressor.
- Flare system and flare pit.
- Storage tanks (condensate, methanol, and produced water) and a condensate load-out facility.

Gas is compressed, metered and exported to the national gas network. Condensate storage is located on the wellsite and currently consists of three 60 $m^3$ above ground tanks and a truck load-out facility. Condensate is trucked to the Omata tank farm on a daily basis. Produced formation water is stored on the site in bunded tanks prior to being pumped down the Turangi-3 well into the Mt Messenger formation for disposal.

All chemical storage is contained within bunds and isolated from the stormwater system. The stormwater drain system consists of open culverts which capture and drain general surface water run-off from the site and some surrounding farmland. Stormwater from the site passes through two sets of lined skimmer pits before discharging to land and into a tributary of the Parahaki Stream at points north and south of the access road. The separate oily water drainage system consists of a buried pipe which gathers oily water from spill containment areas (i.e. curbed foundations and tank bunds) and directs these flows into a triple interceptor pit located near the truck loading bay. Oily water drains from the compressor house are collected in a buried fibreglass tank and are routinely pumped out into the storage tanks.

**Photo 1** Turangi Production Station

## 1.3 Resource consents

### 1.3.1 Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

GPL holds water discharge permit **6498-1** for the northern section of the site, to discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream. This permit was issued by the Taranaki Regional Council on 7 December 2004 under Section 87(e) of the RMA. On 17 March 2008 the consent was varied in relation to the method of discharging produced water and it was also transferred from Greymouth Petroleum Acquisition Company Limited to Greymouth Petroleum Limited. On 10 September 2013 further variations were made to allow for an increase in the size of the catchment area and alterations to the stormwater system. It is due to expire on 1 June 2021.

There are 25 special conditions attached to this consent.

Conditions 1 and 6 relate to the discharge of treated water and the perimeter drain.

Conditions 2 to 5 set out contaminant concentrations that must not be exceeded in the soil layer.

Conditions 7, 8 and 12 require records to be kept, and the provision of management and contingency plans.

Conditions 9 to 11 relate to the best practicable option, catchment area and works notifications.

Conditions 13 to 18 relate to the stormwater system design and bunding of hazardous substance storage areas.

Conditions 19 to 22 specify limits in the discharge, effects on receiving waters and no direct discharge to surface water.

Conditions 23 to 25 relate to site reinstatement, lapse and review.

GPL also holds water discharge permit **9674-1** for the southern section of the site, to discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi Production Station, onto land where it may enter an unnamed tributary of the Parahaki Stream. This permit was issued by the Taranaki Regional Council on 6 September 2013 under Section 87(e) of the RMA. On 13 February 2014 variations were made to allow for an increase in the size of the catchment area and alterations to the stormwater system. It is due to expire on 1 June 2027.

There are 16 special conditions attached to this consent.

Condition 1 requires the consent holder to exercise the best practicable option to prevent or minimise effects.

Conditions 3 and 14 require notification to the Council prior to the commencement of site works, drilling and reinstatement.

Condition 4 requires maintenance of a contingency plan for spillages or accidental discharges.

Conditions 2 and 5 to 10 relate to stormwater system design, management and maintenance.

Conditions 11 to 13 place limits on constituents in the discharge and effects in the receiving waters.

Conditions 15 and 16 are lapse and review provisions.

These permits are attached to this report in Appendix I.

### 1.3.2 Air discharge pemit

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

GPL holds air discharge permit **6497-1**, to discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite. This permit was issued by the Taranaki Regional Council on 7 December 2004 under Section 87(e) of the

RMA. On 10 September 2013 the consent was varied to allow for relocation of the flare pit. It is due to expire on 1 June 2021.

There are 27 special conditions attached to this consent.

Conditions 1 to 3 specify design and reinstatement requirements.

Conditions 4 to 7 relate to notifications.

Conditions 8 and 9 require consideration of the wind and effective separation, prior to flaring.

Conditions 10 to 12 state that no liquid or solid hydrocarbons shall be flared, and only substances from the well stream will be combusted.

Conditions 13 to 15 relate to the best practicable option and prohibit effects beyond the boundary.

Condition 16 requires vapour recovery on storage vessels.

Condition 17 specifies the maximum opacity of smoke emissions.

Conditions 18 to 20 place limits on contaminant concentrations due to air emissions.

Conditions 21 to 25 specify records to be kept and reporting requirements.

Conditions 26 and 27 are lapse and review provisions.

The permit is attached to this report in Appendix I.

### 1.3.3 Wellsite consents

GPL also holds consents for production activities at wellsites associated with the Turangi Production Station. A summary of these consents is provided in Table 1.

**Table 1** Consents for production activities at wellsites associated with Turangi Production Station

| Wellsite | Consent number | Purpose | Issue date | Expiry |
|---|---|---|---|---|
| Epiha | 7722-1 | To discharge treated stormwater, produced water and surplus drilling water from hydrocarbon exploration and production operations at the Epiha wellsite onto and into land | 30/11/2010 | 2027 |
| | 7725-1 | To discharge emissions to air associated with production activities at the Epiha wellsite, including flaring from well workovers, and in emergency situations, and other miscellaneous activities | 30/11/2010 | 2027 |
| Kowhai-A | 6719-1 | To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Kowhai-A wellsite | 1/11/2005 | 2021 |
| | 6720-1 | To discharge treated stormwater and treated production water from hydrocarbon exploration and production operations at the Kowhai-A wellsite onto and into land in the vicinity of an unnamed tributary of the Waiau Stream | 26/10/2005 | 2021 |

| Wellsite | Consent number | Purpose | Issue date | Expiry |
|---|---|---|---|---|
| Kowhai-B | 9203-1 | To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Kowhai-B wellsite onto and into land | 23/2/2012 | 2027 |
| | 9204-1 | To discharge emissions to air associated with production activities at the Kowhai-B wellsite, including: flaring associated with emergencies and maintenance; and minor emissions from other miscellaneous activities | 28/2/2012 | 2027 |
| Kowhai-C | 9474-1 | To discharge emissions to air associated with hydrocarbon producing wells at the Kowhai-C wellsite | 13/2/2013 | 2027 |
| | 9478-1 | To discharge treated stormwater, treated produced water and surplus drilling water from hydrocarbon exploration and production operations at the Kowhai-C wellsite onto and into land where it may enter an unnamed tributary of the Waiau Stream | 29/10/2013 | 2027 |
| Ohanga-A | 7024-1 | To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Ohanga-A wellsite onto and into land and into an unnamed tributary of the Onaero River | 22/11/2006 | 2021 |
| | 7025-1 | To discharge emissions to air from: flaring of hydrocarbons; and miscellaneous activities associated with well clean-up, well testing, and production testing, associated with up to eight wells at the Ohanga-A wellsite | 22/11/2006 | 2021 |
| Onaero | 7555-1 | To discharge treated stormwater, treated produced water and treated surplus drilling water from hydrocarbon exploration and production operations onto and into land in circumstances where the discharge may enter an unnamed tributary of the Onaero River at the Onaero wellsite | 10/12/2009 | 2027 |
| | 7558-1 | To discharge emissions to air during flaring from well workovers and in emergency situations associated with production activities at the Onaero wellsite | 10/12/2009 | 2027 |
| Turangi-B | 7853-1 | To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi-B wellsite onto and into land | 16/6/2011 | 2027 |
| | 7854-1 | To discharge emissions to air associated with production activities at the Turangi-B wellsite, including: flaring from well workovers; flaring in emergency situations; and emissions from other miscellaneous activities...also 1713611E-5682583N | 5/12/2011 | 2027 |
| Turangi-C | 9415-1 | To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi-C wellsite onto land | 5/2/2013 | 2027 |
| | 9420-1 | To discharge emissions to air associated with hydrocarbon producing wells at the Turangi-C wellsite | 5/2/2013 | 2027 |
| Turangi Metering Station | 6807-1 | To discharge emissions into the air from flaring of petroleum products in emergency situations, commissioning, and plant shutdowns, together with miscellaneous emissions at the Turangi Metering Station | 20/9/2006 | 2021 |
| | 6808-1 | To discharge treated stormwater from the Turangi Metering Station onto and into land in the vicinity of the Waiau Stream | 30/3/2006 | 2021 |
| Urenui-1 | 7532-1 | To discharge treated stormwater, treated surplus drilling water and treated produced water from hydrocarbon exploration and production operations at the Urenui-1 wellsite, onto land where it may enter an unnamed tributary of the Onaero River | 7/8/2013 | 2027 |
| | 9631-1 | To discharge emissions to air associated with hydrocarbon producing wells at the Urenui-1 wellsite | 20/8/2013 | 2027 |

## 1.4 Monitoring programme

### 1.4.1 Introduction

Section 35 of the RMA sets out obligations upon the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region and report upon these.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations, and seek information from consent holders.

The monitoring programme for the Turangi Production Station consisted of three primary components.

### 1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in:

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- in discussion over monitoring requirements;
- preparation for any reviews;
- renewals;
- new consents;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

### 1.4.3 Site inspections

The Turangi Production Station was visited six times during the monitoring period. With regard to consents for the discharges to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

### 1.4.4 Chemical sampling

The Council undertook sampling of both the discharges from the site and the water quality upstream and downstream of the discharge points and mixing zone.

The production station discharges were sampled on one occasion, and the samples analysed for chlorides, conductivity, hydrocarbons, pH, temperature, turbidity and suspended solids. The receiving waters of the unnamed tributary of the Parahaki Stream were sampled concurrently, and the samples analysed for the same constituents.

The Council also undertook sampling of the ambient air quality outside the boundary of the site. A multi-gas meter was deployed on one occasion in the vicinity of the plant, with monitoring consisting of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases). A PM10 particulate monitor was deployed concurrently with the multi-gas meter. Two nitrogen oxide measuring devices were also deployed in the vicinity of the plant on one occasion during the year under review. The Company supplied data on flaring causes and flare and fuel gas volumes throughout the period.

# 2. Results

## 2.1 Water

### 2.1.1 Inspections

Six inspections were carried out at the Turangi Production Station and associated wellsites in the 2014-2015 year. The following was found during the inspections:

**9 July 2014**
The site was inspected during calm cool weather. There was a slight NNE breeze blowing across the plant which did not carry any odours from processing equipment or the flare. Minimal flaring was occurring at the time. The ring drains and bunds were all clear of obstructions or contaminants. The site was neat and tidy. Some works were underway to complete the production site extension. The large skimmer pits for the southern catchment had been lined and completed. The deepwell injection site showed no visual effects of its use. Everything was satisfactory.

**30 July 2014**
The Kowhai-A site was neat and tidy. A new produced water tank and bund were being installed and nearly ready to be commissioned. There was no flaring or odours. The ring drains and stormwater system were working well, though there was an accumulation of silt in the skimmer pit, possibly from the farm access track. Ambient monitoring of Kowhai-B was undertaken as the gates were locked and no staff were on site. There was no flaring and no issues noted. Production testing equipment was present at Kowhai-C. All sites were neat and tidy.

**13 October 2014**
Site inspection was undertaken during a fine spell of weather. There were low flows in the adjacent streams. A new flare regime was being implemented. The new flare pit construction was complete. Both the northern and southern skimmer pits were clear of contaminants. There was no off site discharge at the time. Minimal flaring was being undertaken. The Company was advised to check the water levels in the low lying area of the ring drain near the new flare pit. Some reshaping of the drain may have been required to ensure all stormwater was being directed through the skimmer pits.

**13 March 2015**
Inspection of Turangi Production Station, including the expanded storage area and truck load out area, showed that this site is well managed and the new facilities, including the additional skimmer pits and bunds, were operating as per the design specifications. Tadpoles were present in the new skimmer pits. No discharges were occurring from either the old or new skimmer pit systems and no evidence of any previous discharges were noted. The minimal flaring was not giving rise to any odours, smoke or off site effects. The Kowhai-A skimmer pit was not discharging. The contents of the skimmer pit were clean. No smoke or odours were evident beyond the boundary. Both sites were neat, tidy and well managed. Everything was satisfactory.

**29 April 2015**
Inspection of the Turangi Production Station and associated wellsites was undertaken with a Company representative. Particular attention was given to stormwater and wastewater management, flaring, deep well injection and mix, bury, cover activities.

All of the sites inspected showed that the stormwater systems, ring drains and skimmer pits had handled the excessive stormwater run off during recent high rainfall events. There were no signs of any damage or design failures within these systems. Some of the skimmer pits remained unlined, though this would be addressed whenever further exploration or re-entry work takes place. No flaring had taken place at the majority of the wellsites for some time. The flare pits were well situated to minimise off site effects. No drilling muds or fluids were present in the flare pits.

The sites where deepwell injection operations had been undertaken showed no effects from this activity. Mix, bury, cover sites were clear of any seepages or visual effects and these areas were generally revegetated, with no detrimental effects to growth noted. Silt retention and control measures, where required, were in place. These received frequent monitoring to ensure the integrity of these controls. All sites were being regularly checked by Company field staff as part of standard procedures.

The sites were generally neat and tidy. Security fencing and safety mechanisms were constantly being improved to prevent willful damage and minimise any threat to the environment. Everything was satisfactory.

**25 June 2015**

All sites and stormwater systems were checked following an extreme high rainfall event that resulted in a 'State of Emergency' declaration being made in Taranaki. The design, management and maintenance of the stormwater systems had ensured that no off site effects had occurred. No contaminants were evident in the skimmer pits and only evidence of elevated suspended solids had occurred, as would be expected under the circumstances. No off site odours or smoke from flaring were noted. All sites had come through the extreme weather event very well. Everything was satisfactory.

### 2.1.2 Results of discharge monitoring

Chemical water quality sampling of the discharges from the Turangi Production Station was undertaken on one occasion during the 2014-2015 period. The samples were collected on 12 May 2015. Table 2 presents the results. The locations of the sampling sites (IND002035 and IND002052) are shown in Figure 1.

**Table 2** Results for discharge monitoring from the Turangi Production Station

| Parameter | Units | 12 May 2015 | | Consents limits |
|---|---|---|---|---|
| | | Northern discharge **IND002035** | Southern discharge **IND002052** | |
| Chloride | $g/m^3$ | 7.6 | 9.1 | 50 |
| Conductivity | mS/m @ 20°C | 4.5 | 4.8 | - |
| Hydrocarbons | $g/m^3$ | < 0.5 | < 0.5 | 15 |
| Suspended solids | $g/m^3$ | **130** | **180** | 100 |
| Temperature | Deg. C | 14.0 | 14.9 | - |
| pH | | 7.0 | 6.8 | 6.0 – 9.0 |
| Turbidity | NTU | 120 | 180 | - |

The results are indicative of uncontaminated discharges, with hydrocarbon and chloride concentrations well within the consent limits, and neutral pH levels. However, both discharges had elevated levels of suspended solids which exceeded the limits stipulated in consents 6498-1 and 9674-1. An unauthorised discharge incident was lodged in response, as discussed in Section 2.3 of this report.

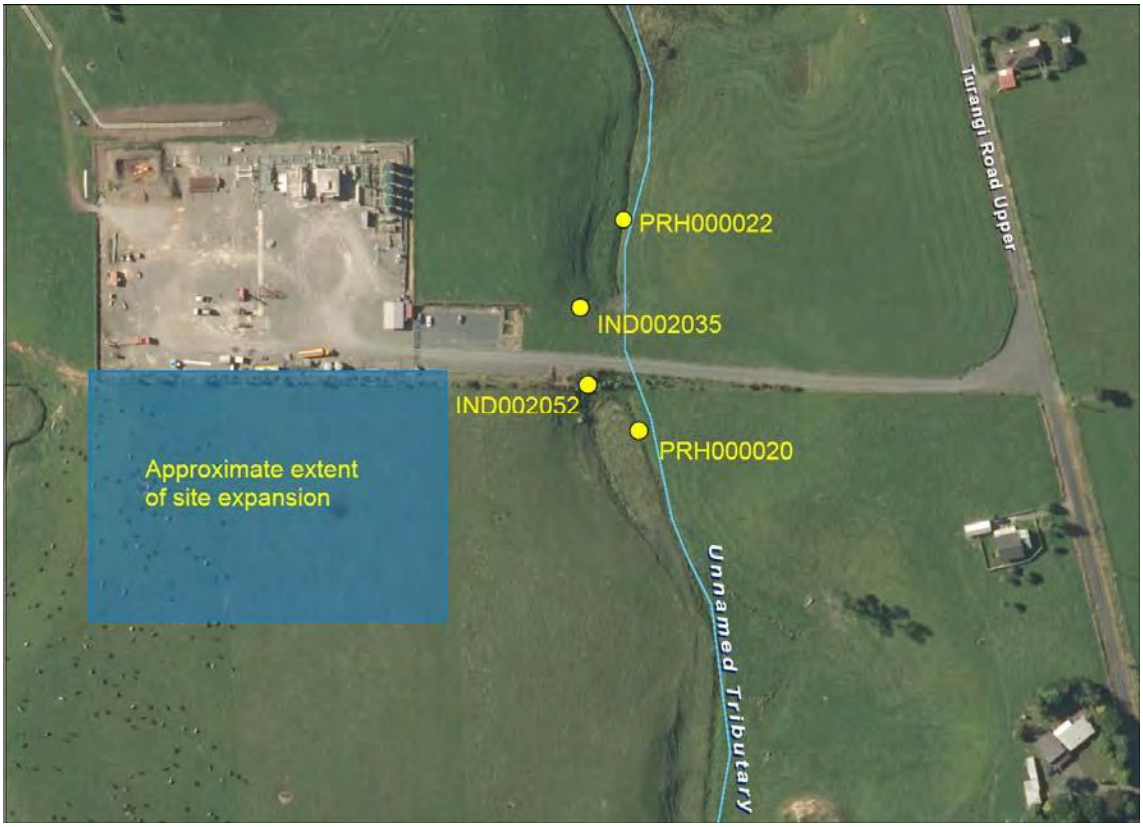


**Figure 1** Turangi Production Station and associated sampling sites

### 2.1.3 Results of receiving environment monitoring

Chemical water quality sampling of the receiving environment was undertaken in conjunction with discharge monitoring on 12 May 2015. The results are presented in Table 3 and the sampling sites are shown in Figure 1.

**Table 3** Results of receiving environment monitoring in relation to the Turangi Production Station

| Parameter | Units | 12 May 2015 | | Consents limits |
|---|---|---|---|---|
| | | Upstream site **PRH000020** | Downstream site **PRH000022** | |
| Chloride | $g/m^3$ | 20.3 | 19.0 | - |
| Conductivity | mS/m @ 20°C | 15.9 | 15.0 | - |
| Hydrocarbons | $g/m^3$ | < 0.5 | < 0.5 | No conspicuous oil films |
| Suspended solids | $g/m^3$ | 23 | 38 | No conspicuous change |
| Temperature | Deg. C | 15.5 | 15.4 | < 2 Deg C increase |
| pH | | 6.5 | 6.5 | - |
| Turbidity | NTU | 13 | 27 | No conspicuous change |

The results indicate that the discharges were causing a small elevation in the suspended solids and turbidity of the receiving waters. It was noted at the time that the upstream sample was cleaner than the downstream sample. However, the change was not conspicuous when viewing the waters in the tributary and any effect would have been no more than minor. The other parameters were unaltered by the discharges.

## 2.2 Air

### 2.2.1 Inspections

Air inspections were carried out in conjunction with site inspections as discussed in Section 2.1.1 above. No issues regarding air quality were noted during the monitoring year.

### 2.2.2 Results of receiving environment monitoring

#### 2.2.2.1 Carbon monoxide and combustible gases

During the monitoring year, a multi-gas meter was deployed on one occasion in the vicinity of the plant. The deployment lasted approximately 68 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases). The monitoring sites used in the year under review are shown in Figure 2.

Because of the nature of the activities on the site, it was considered that the primary information of interest in respect of gases potentially emitted from the site was the average downwind concentration, rather than any instantaneous peak value. That is, the long-term exposure levels, rather than short-term maxima, are of most interest. The gas meter was therefore set up to create a data set based on recording the average concentration measured during each minute as raw data.


**Figure 2** Air monitoring sites at Turangi Production Station for 2014-2015

The details of the sample run are summarised in Table 4 and the data from the sample run are presented graphically in Figure 3.

The consent covering air discharges from the Turangi Production Station has specific limits related to particular gases. Special condition 18 of consent 6497-1 sets a limit on the carbon monoxide concentration at or beyond the production station's boundary. The limit is expressed as 10 mg/m³ for an eight hour average or 30 mg/m³ for a one hour average exposure. The maximum concentration of carbon monoxide found during the monitoring run was 7.67 mg/m³ while the average concentration for the entire dataset was only 0.23 mg/m³ which comply with consent conditions. This is in line with the pattern found in previous years.

**Table 4** Results of carbon monoxide and LEL monitoring at Turangi Production Station

| | Period | 05/05/2015 13:03 to 08/05/2015 08:58 |
|---|---|---|
| Max | CO(ppm) | 6.70 |
| | LEL(%) | 0.20 |
| Mean | CO(ppm) | 0.20 |
| | LEL(%) | 0.00 |
| Min | CO(ppm) | 0.00 |
| | LEL(%) | 0.00 |

Notes: (1) the instrument records in units of ppm. At 25°C and 1 atm, 1ppm CO = 1.145 mg/m3
(2) because the LEL of methane is equivalent to a mixture of approximately 5% methane in air, then the actual concentration of methane in air can be obtained by dividing the percentage LEL by 20.

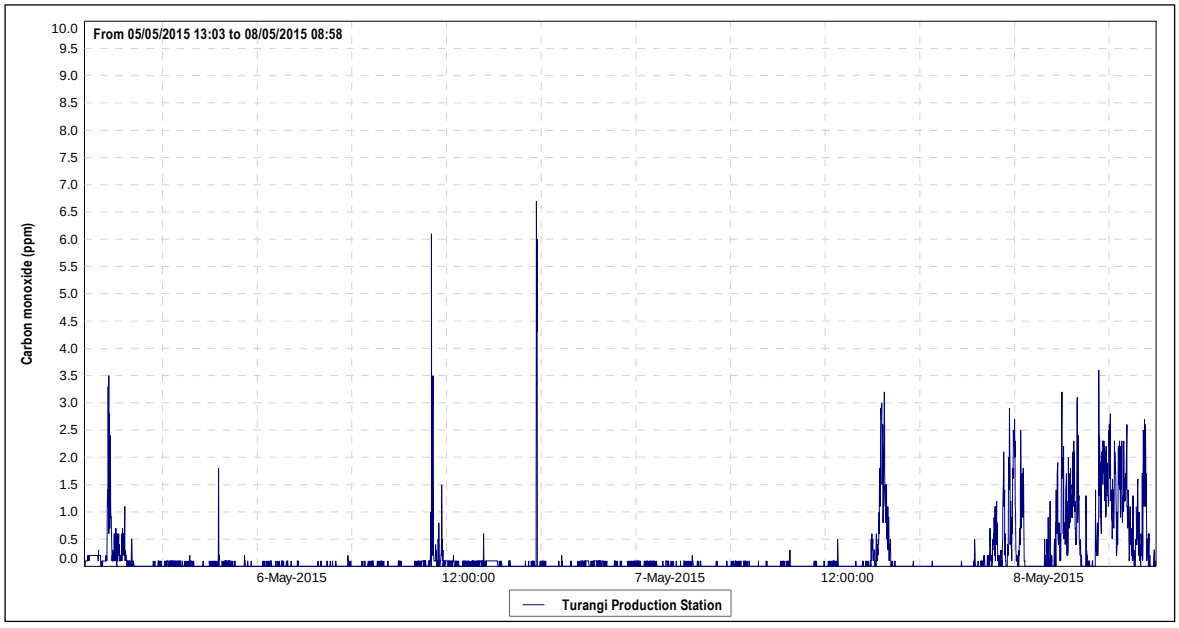


**Figure 3** Ambient CO levels in the vicinity of Turangi Production Station

Lower Explosive Limit (LEL) gives the percentage of the lower explosive limit, expressed as methane that is detected in the air sampled. The sensor on the instrument reacts to gases and vapours such as acetone, benzene, butane, methane, propane, carbon monoxide, ethanol, and higher alkanes and alkenes, with varying degrees of sensitivity. The Council's Regional Air Quality Plan has a typical requirement that no discharge shall result in dangerous levels of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of the Turangi Production Station reach any more than a trivial level.

#### 2.2.2.2 PM10 particulates

In September 2004 the Ministry for the Environment enacted National Environmental Standards (NESs) relating to certain air pollutants. The NES for PM10 particulates is 50 µg/m³ (24-hour average).

Particulates can be derived from many sources, including motor vehicles (particularly diesel), solid and oil-burning processes for industry and power generation, incineration and waste burning, photochemical processes, and natural sources such as pollen, abrasion, and sea spray.

PM10 particles are linked to adverse health effects that arise primarily from the ability of particles of this size to penetrate the defences of the human body and enter deep into the lungs, significantly reducing the exchange of gases across the lung walls. Health effects from inhaling PM10 include increased mortality and the aggravation of existing respiratory and cardiovascular conditions such as asthma and chronic pulmonary diseases.

During the reporting period, a DustTrak PM10 monitor was deployed on one occasion in the vicinity of Turangi Production Station. The deployment lasted approximately 54 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continual measurements of PM10 concentrations. The location of the DustTrak monitor during the sampling run is shown in Figure 2. The results of the sample run are presented in Figure 4 and Table 5.

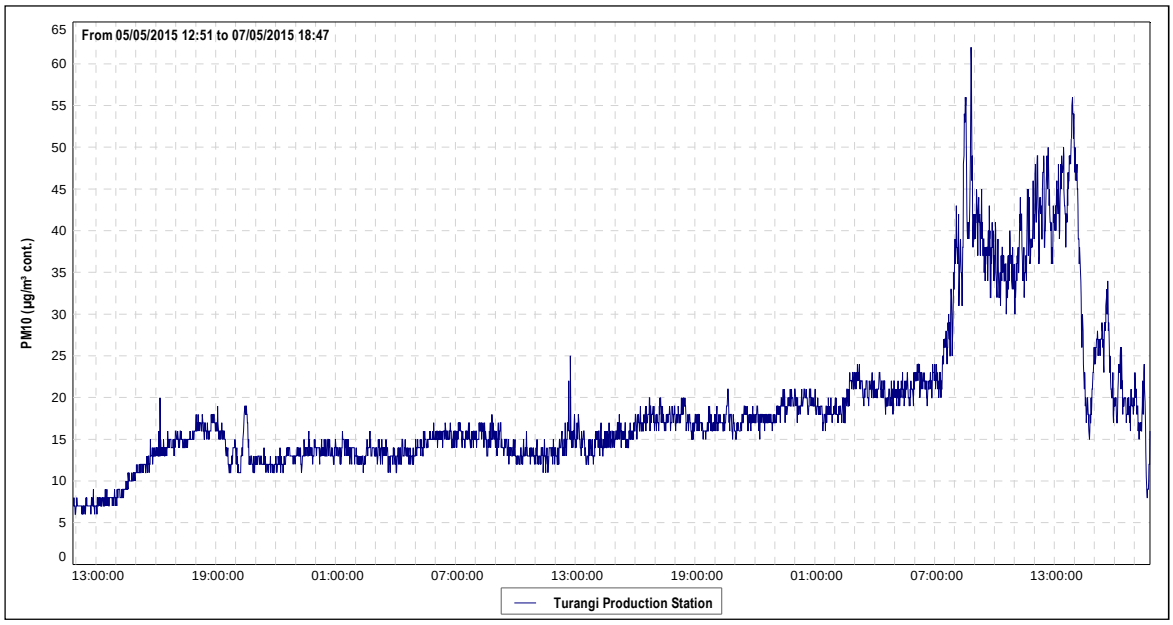


**Figure 4** PM10 concentrations (µg/m³) at Turangi Production Station

**Table 5** Daily averages of PM10 results from monitoring at Turangi Production Station

| | (54 hours) (05-07/05/2015) | |
|---|---|---|
| 24 hr. set | Day 1 | Day 2 |
| Daily average | 13.2 µg/m³ | 25.3 µg/m³ |
| NES limit (24 hour average) | 50 µg/m³ | |

During the 54 hour run, from 5 May to 7 May 2015, the average recorded PM10 concentration was 13.2 µg/m³ for the first 24 hour period and 25.3 µg/m³ for the second 24 hour period. These daily averages equate to 26.4% and 50.6%, respectively, of the 50 µg/m³ value that is set by the NES. Background levels of PM10 in the region have been found to be typically around 11 µg/m³.

#### 2.2.2.3 Nitrogen oxides

From 2014 onwards, the Council implemented a coordinated region-wide compliance monitoring programme to measure nitrogen oxides (NOx). The programme involves deploying measuring devices at 28 NOx monitoring sites (including two sites in the vicinity of Turangi Production Station) on the same day, with retrieval three weeks later. This approach assists the Council in further evaluating the effects of local and regional emission sources and ambient air quality in the region.

The consent covering air discharges from the Turangi Production Station has specific limits related to particular gases. Special condition 19 of consent 6497-1 sets a limit on the nitrogen dioxide concentration at or beyond the production station's boundary. The limit is expressed as 200 µg/m³ for a 1-hour average or 100 µg/m³ for a 24-hour average exposure.

NOx passive adsorption discs were place at two locations in the vicinity of the Turangi Production Station on one occasion during the year under review. The discs were left in place for a period of 21 days. The calculated 1-hour and 24-hour theoretical maximum NOx concentrations found at Turangi Production Station during the year under review equate to 11.1 µg/m³ and 5.6 µg/m³, respectively. The results show that the ambient ground level concentration of NOx is well below the limits set out by consent 6497-1.

The full air monitoring reports are attached to this report in Appendix II.

### 2.2.3 Summary of flaring volumes reported by GPL

A summary of flaring volumes at Turangi Production Station is provided in Figure 5.

The quantities of gas flared at the production station relate to the frequency of equipment trips and plant servicing. The facilities were upgraded during the year under review and new facilities were commissioned. This resulted in slightly higher flaring volumes than previous years. Flaring was also undertaken at the Kowhai sites, Urenui-1 and Ohanga-A, mainly relating to planned maintenance, well testing and production testing.

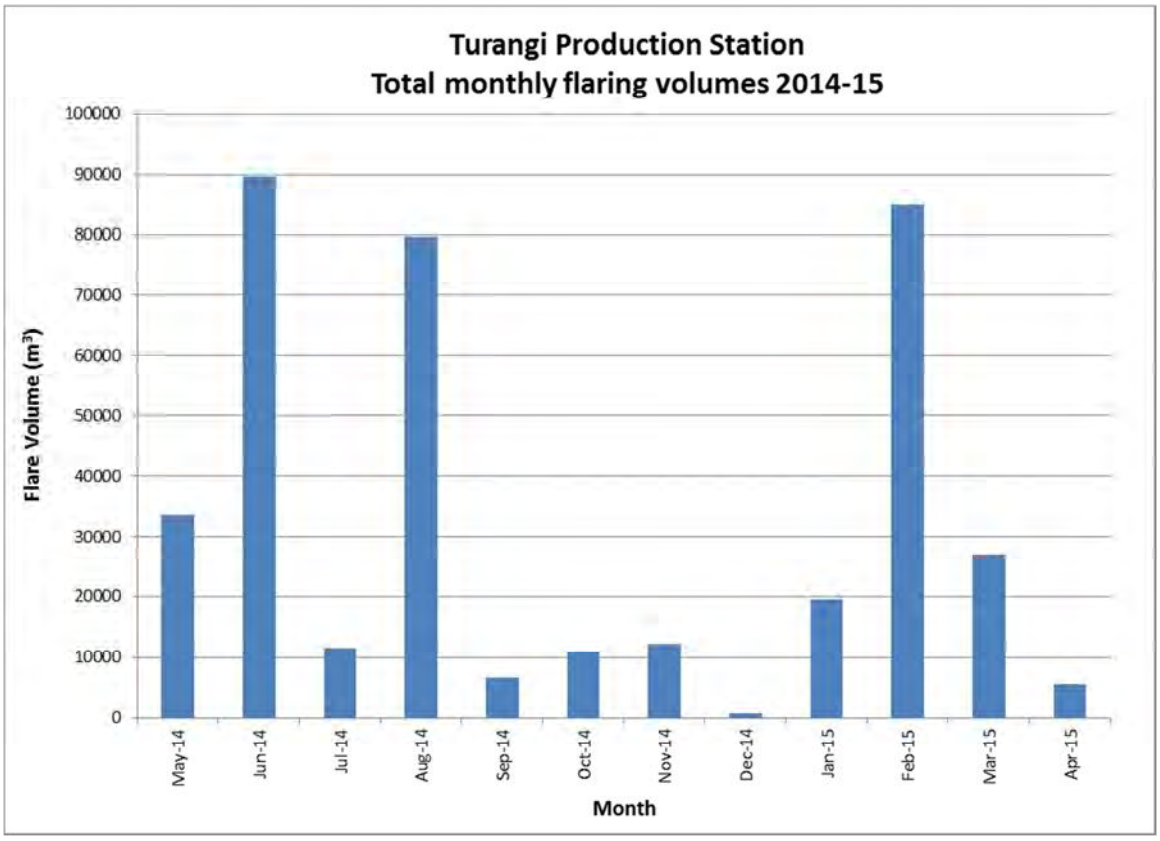


**Figure 5** Summary of monthly gas flaring volumes at Turangi Production Station

## 2.3 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual courses of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The Incident Register (IR) includes events where the Company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Complaints may be alleged to be associated with a particular site. If there is potentially an issue of legal liability, the Council must be able to prove by investigation that the identified company is indeed the source of the incident (or that the allegation cannot be proven).

In the 2014-2015 period, the Council was required to investigate one incident in association with the activities at the Turangi Production Station.

Analysis of water samples taken during routine monitoring on 12 May 2015 found minor exceedances of the suspended solids limits of the two consents for Turangi Production Station's northern and southern stormwater discharges. Concurrent

sampling of the receiving waters showed that the effects of these unauthorised discharges on the unnamed tributary of the Parahaki Stream were no more than minor.

A site meeting was held with representatives of the Company to discuss measures for preventing the entrainment of solids in the stormwater. It was believed that instability of the surface at the pad edges was resulting in excessive flushing of fines and heavier gravels into the ring drains during rainfall. The Company committed to undertaking works to reduce sediment loading in the stormwater discharges. Compliance with consents 6498-1 and 9674-1 was to be ascertained during further routine monitoring.

# 3. Discussion

## 3.1 Discussion of site performance

Monitoring of the Turangi Production Station during the 2014-2015 year found that the site was well managed. All consent conditions relating to site operations and management were complied with. Any issues identified during inspections were quickly resolved.

## 3.2 Environmental effects of exercise of consents

Site inspections found that the stormwater systems were constructed and maintained in accordance with consent conditions. However, routine sampling on 12 May 2015 found that the discharges from the Turangi Production Station contained a slight excess of suspended solids which was likely due to instability of the edges of the site surface. Receiving water inspection and sampling showed that the effect of these discharges on the tributary of the Parahaki Stream were no more than minor.

There were no adverse effects on the environment resulting from the exercise of the air discharge consent. The ambient air quality monitoring at the site showed that levels of carbon monoxide, combustible gases, PM10 particulates and nitrogen oxides were all below levels of concern at the time of sampling. No offensive or objectionable odours were detected beyond the boundary during inspections and there were no complaints in relation to air emissions from the site.

## 3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 6-8.

**Table 6** Summary of performance for Consent 6497-1

| **Purpose:** ***To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 1. Flare pit to be lined | Inspection | Yes |
| 2. Flaring shall occur at the designated location | Inspection | Yes |
| 3. Temporary flare pit to be removed upon completion of the new flare pit | Inspection | Yes |
| 4. Notification to Council one month prior to production operations | Production operations commenced early 2006 | N/A |
| 5. Notification to neighbours 24 hrs prior to flaring & record of complaints | Inspection and liaison with consent holder | Yes |

| **Purpose:** ***To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 6. Notification to Council 24 hrs prior to flaring | Notifications received | Yes |
| 7. No alterations without approval | Inspection and liaison with consent holder | Yes |
| 8. Take into account wind speed & direction when flaring | Inspection and Company records | Yes |
| 9. Effective separation to minimise smoke | Inspection and Company records | Yes |
| 10. Notification to Council of ineffective separation | No incidents during year under review | N/A |
| 11. No liquid or solid hydrocarbons flared | Inspection and liaison with consent holder | Yes |
| 12. Only substances from well stream to be flared | Inspection and Company records | Yes |
| 13. Adoption of the best practicable option | Inspection and liaison with consent holder | Yes |
| 14. No hazardous/toxic/noxious contaminants beyond boundary | Inspection and air monitoring | Yes |
| 15. No offensive odour or smoke beyond boundary | Inspection | Yes |
| 16. Hydrocarbon storage vessels to have vapour recovery systems | Inspection | Yes |
| 17. Specified opacity for smoke emissions | Not assessed | N/A |
| 18. Control of carbon monoxide emissions | Air monitoring | Yes |
| 19. Control of nitrogen oxide emissions | Not measured, sampling undertaken in previous years | N/A |
| 20. Control of emissions to achieve specified contaminant concentrations | Not assessed | N/A |
| 21. Keep & maintain record of smoke emitting incidents | Inspection and annual flaring report | Yes |
| 22. Keep & maintain flaring log | Inspection and annual flaring report | Yes |
| 23. Monthly flaring information supplied | Information received | Yes |
| 24. Provision of annual flaring & air emissions report during May | Latest report received 3 June 2015 | Yes |
| 25. Analysis of typical gas and crude oil stream | Analysis not requested | N/A |
| 26. Lapse provision | Consent exercised | N/A |

| **Purpose:** ***To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 27. Optional review provision | Next option for review in June 2021 | N/A |
| Overall assessment of consent compliance and environmental performance in respect of this consent | | **High** |
| Overall assessment of administrative performance in respect of this consent | | **High** |

N/A = not applicable

**Table 7** Summary of performance for Consent 6498-1

| **Purpose:** ***To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 1. No observable hydrocarbon run-off to perimeter drain | Inspection | Yes |
| 2. Soil conductivity limits | Not assessed | N/A |
| 3. Soil sodium absorption ratio limits | Not assessed | N/A |
| 4. Concentrations in soil not to be exceed prior to expiry/cancellation/ surrender | Consent still current | N/A |
| 5. Hydrocarbons in soil to comply with MfE guidelines | Not assessed | N/A |
| 6. Treated produced water discharged to land shall be within perimeter drain | All produced water re-injected | Yes |
| 7. Records to be kept and forwarded to Council quarterly | Inspection and company records | Yes |
| 8. Approved management plan | Received and approved | Yes |
| 9. Adoption of the best practicable option | Inspection and liaison with consent holder | Yes |
| 10. Maximum stormwater catchment area | Inspection and company records | Yes |
| 11. Notification to Council 7 days prior to site works and well drilling | Notifications received | Yes |
| 12. Approved contingency plan | Latest update received 14 Aug 2013 | Yes |
| 13. All stormwater & produced water discharged through treatment system | Inspection | Yes |
| 14. Consent exercised in accordance with application documentation | Inspection and liaison with consent holder | Yes |
| 15. Design of skimmer pits to meet minimum size and hydrocarbon capture requirements | Inspection and sampling | Yes |

| **Purpose:** ***To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 16. Stormwater retention areas to be lined | Inspection | Yes |
| 17. Stormwater system to be installed prior to any site works | Inspection | Yes |
| 18. Bunding and drainage of hazardous substances | Inspection | Yes |
| 19. Concentrations not to be exceeded in the discharge | Sampling | **No.** One exceedance of suspended solids limit during period. |
| 20. Temperature increase of not more than 2 degrees Celsius in receiving waters | Sampling | Yes |
| 21. No effects upon surface water bodies | Inspection and sampling | Yes |
| 22. No direct discharge to surface water | Inspection | Yes |
| 23. 48 hrs notice prior to reinstatement | Site still active | N/A |
| 24. Lapse provision | Consent exercised | N/A |
| 25. Optional review provision | Next option for review in June 2021 | N/A |
| Overall assessment of consent compliance and environmental performance in respect of this consent | | **Good** |
| Overall assessment of administrative performance in respect of this consent | | **High** |

**Table 8** Summary of performance for Consent 9674-1

| **Purpose:** ***To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi Production Station, onto land where it may enter an unnamed tributary of the Parahaki Stream*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 1. Adoption of the best practicable option | Inspection and liaison with consent holder | Yes |
| 2. Maximum stormwater catchment area | Inspection and company records | Yes |
| 3. Notification to Council 7 days prior to site works and well drilling | Notifications received | Yes |
| 4. Approved contingency plan | Latest update received 14 Aug 2013 | Yes |
| 5. Consent exercised in accordance with application documentation | Inspection and liaison with consent holder | Yes |
| 6. All stormwater and produced water discharged through treatment system | Inspection | Yes |

| **Purpose:** ***To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi Production Station, onto land where it may enter an unnamed tributary of the Parahaki Stream*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 7. Design of skimmer pits to meet minimum size and hydrocarbon capture requirements | Inspection and sampling | Yes |
| 8. Minimum skimmer pit storage volume | Inspection | Yes |
| 9. Stormwater retention areas to be lined | Inspection | Yes |
| 10. Stormwater system to be installed prior to any site works | Inspection | Yes |
| 11. Concentrations not to be exceeded in the discharge | Sampling | **No.** One exceedance of suspended solids limit during period. |
| 12. Temperature increase of not more than 2 degrees Celsius in receiving waters | Sampling | Yes |
| 13. No effects upon surface water bodies | Inspection and sampling | Yes |
| 14. 48 hrs notice prior to reinstatement | Site still active | N/A |
| 15. Lapse provision | Consent exercised | N/A |
| 16. Optional review provision | Next option for review in June 2021 | N/A |
| Overall assessment of consent compliance and environmental performance in respect of this consent | | **Good** |
| Overall assessment of administrative performance in respect of this consent | | **High** |

During the year, the Company demonstrated a good level of environmental and a high level of administrative performance with the resource consents as defined in Section 1.1.4. The Turangi Production Station and associated wellsites were well managed and maintained.

## 3.4 Recommendations from the 2012-2014 Biennial Report

In the 2012-2014 Biennial Report, it was recommended:

1. THAT monitoring of consented activities at the Turangi Production Station in the 2014-2015 year be amended from that undertaken in 2012-2014 to account for changes at the expanded site by altering the location of the stormwater discharge sampling points.

2. THAT the option for review of resource consents in June 2015, as set out in conditions 27 and 25 of consents 6497-1 and 6498-1, respectively, not be exercised on the grounds that the current conditions are considered adequate to deal with any adverse effects on the environment arising from the exercise of these resource consents.

These recommendations were implemented.

## 3.5 Alterations to monitoring programmes for 2015-2016

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, its obligations to monitor emissions/discharges and effects under the RMA, and report to the regional community. The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

It is proposed that for 2015-2016 the monitoring of consented activities at the Turangi Production Station and associated facilities is amended from that undertaken in 2014-2015 to align with programmes for other petrochemical production stations by including biomonitoring of the tributary of the Parahaki Stream. A recommendation to this effect is attached to this report.

# 4. Recommendation

1. THAT monitoring of consented activities at the Turangi Production Station and associated facilities in the 2015-2016 year is amended from that undertaken in 2014-2015 to align with programmes for other petrochemical production stations by including biomonitoring of the tributary of the Parahaki Stream.

# Glossary of common terms and abbreviations

The following abbreviations and terms may be used within this report:

| | |
|---|---|
| Al* | Aluminium. |
| As* | Arsenic. |
| Biomonitoring | Assessing the health of the environment using aquatic organisms. |
| BOD | Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate. |
| BODF | Biochemical oxygen demand of a filtered sample. |
| Bund | A wall around a tank to contain its contents in the case of a leak. |
| CBOD | Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate. |
| cfu | Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample. |
| COD | Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction. |
| Conductivity | Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m. |
| Cu* | Copper. |
| Cumec | A volumetric measure of flow- 1 cubic metre per second (1 $m^3s^{-1}$). |
| DO | Dissolved oxygen. |
| DRP | Dissolved reactive phosphorus. |
| E.coli | Escherichia coli, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample. |
| Ent | Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample. |
| F | Fluoride. |
| FC | Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample. |
| Fresh | Elevated flow in a stream, such as after heavy rainfall. |
| $g/m^2/day$ | grams/$metre^2$/day. |
| $g/m^3$ | Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures. |
| Incident | An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred. |

| | |
|---|---|
| Intervention | Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring. |
| Investigation | Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident. |
| IR | The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan. |
| L/s | Litres per second. |
| $m^2$ | Square Metres. |
| MCI | Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats. |
| mS/m | Millisiemens per metre. |
| Mixing zone | The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point. |
| $NH_4$ | Ammonium, normally expressed in terms of the mass of nitrogen (N). |
| $NH_3$ | Unionised ammonia, normally expressed in terms of the mass of nitrogen (N). |
| $NO_3$ | Nitrate, normally expressed in terms of the mass of nitrogen (N). |
| NTU | Nephelometric Turbidity Unit, a measure of the turbidity of water. |
| O&G | Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons). |
| Pb* | Lead. |
| pH | A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5. |
| Physicochemical | Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment. |
| $PM_{10}$ | Relatively fine airborne particles (less than 10 micrometre diameter). |
| Resource consent | Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15). |
| RMA | *Resource Management Act* 1991 and including all subsequent amendments. |
| SS | Suspended solids. |
| SQMCI | Semi quantitative macroinvertebrate community index. |
| Temp | Temperature, measured in °C (degrees Celsius). |
| Turb | Turbidity, expressed in NTU. |
| UI | Unauthorised Incident. |

Zn* Zinc.

*an abbreviation for a metal or other analyte may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

For further information on analytical methods, contact the Council's laboratory.

# Bibliography and references

Taranaki Regional Council (2014): Greymouth Petroleum Turangi Production Station Monitoring Programme Biennial Report 2012-2014. Technical Report 2014-33

Taranaki Regional Council (2013): Greymouth Petroleum Turangi-A Wellsite Monitoring Programme Annual Report 2011-2012. Technical Report 2012-73

Taranaki Regional Council (2011): Greymouth Petroleum Turangi-A Wellsite Monitoring Programme Annual Report 2010-2011. Technical Report 2011-20

Taranaki Regional Council (2010): Greymouth Petroleum Turangi-A Wellsite Monitoring Programme Annual Report 2009-2010. Technical Report 2010-47

Taranaki Regional Council (2009): Greymouth Petroleum Turangi-A Wellsite Monitoring Programme Annual Report 2008-2009. Technical Report 2009-37

Taranaki Regional Council (2008): Greymouth Petroleum Turangi-A Wellsite Monitoring Programme Annual Report 2007-2008. Technical Report 2008-91

# Appendix I

## Resource consents held by Greymouth Petroleum Limited

**(For a copy of the resource consent please contact the TRC consent department)**

# Discharge Permit

**Pursuant to the Resource Management Act 1991**
**a resource consent is hereby granted by the**
**Taranaki Regional Council**

| | |
|---|---|
| Name of Consent Holder: | Greymouth Petroleum Limited<br>P O Box 3394<br>NEW PLYMOUTH 4341 |
| Decision Date (Change): | 10 September 2013 |
| Commencement Date (Change): | 10 September 2013 (Granted: 7 December 2004) |

## Conditions of Consent

| | |
|---|---|
| Consent Granted: | To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite |
| Expiry Date: | 1 June 2021 |
| Review Date(s): | June 2015 |
| Site Location: | Turangi Production Station, Turangi Road, Motunui (Property owner: BA & JM McKenzie) |
| Legal Description: | Sec 21 Blk VI Waitara SD (Discharge source & site) |
| Grid Reference (NZTM) | 1713792E-5681411N (temporary flare pit)<br>1713756E-5681440N |

*For General, Standard and Special conditions*
*pertaining to this consent please see reverse side of this document*

## General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

## Special conditions

### Information and notification

1. Flaring shall only occur over a pit, or similar containment area, lined with impermeable material that prevents any liquid from leaking through its base or sidewalls and discharging to land.

2. Flaring shall only occur within 20 metres of the location defined by NZTM:

- 1713792E-5681411N (temporary flare pit); and
- 1713756E-5681440N.

3. The temporary flare pit shall be removed and site reinstated following the completion of the permanent flare pit.

4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least one month prior to the establishment of production operations at the Turangi Road wellsite.

5. At least 24 hours prior to any flaring, other than in emergencies, the consent holder shall undertake all practicable measures to notify residents within 1000 metres of the site of the commencement of flaring. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and/or complaints received.

6. The consent holder shall, whenever practicable, notify the Chief Executive, Taranaki Regional Council, whenever the continuous flaring of hydrocarbons (other than purge gas) is expected to occur for more than five minutes in duration. Notification shall, as far as practicable, be no less than 24 hours prior to such flaring being commenced.

7. No alteration shall be made to plant equipment or processes which may substantially alter the nature or quantity of flare emissions or other site emissions, including but not limited to the recovery of produced gas, other than as notified in this consent application, without prior consultation with the Chief Executive, Taranaki Regional Council, and the consent holder shall obtain any necessary approvals under the Resource Management Act 1991.

**Emissions from the site**

8. Other than for the maintenance of a pilot flare flame, the consent holder shall have regard to the prevailing and predicted wind speed and direction at the time of initiation of any episode of flaring or other combustion of hydrocarbons.

9. All gas being flared, at any time must first be treated by effective liquid and solid separation and recovery, as far as is practicable, to ensure that smoke emission during flaring is minimised.

10. If separation cannot be implemented and/or maintained at any time while there is a flow from the well, whether natural or induced, then the consent holder shall notify the Chief Executive, Taranaki Regional Council, and shall in any case re-establish liquid and solid separation and recovery within three hours.

11. Subject to special conditions 9 and 10, no liquid or solid hydrocarbons shall be combusted through the gas flare system other than in an emergency.

12. Only substances originating from the well stream and treated as outlined by conditions 9, 10, 11 & 13 are to be combusted within the flare pit.

13. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air from the flare or any other emissions to air from the Turangi Road wellsite. Any adoption of the best practicable option as outlined in this special condition shall be to the satisfaction of the Chief Executive, Taranaki Regional Council.

14. The consent holder shall not discharge any contaminant to air authorised by this consent at a rate or a quantity such that the contaminant, whether alone or in combination with other contaminants, is or is liable to be hazardous or toxic or noxious at or beyond the boundary of the wellsite, or beyond 100 metres of the flare, whichever distance is greater.

15. There shall not be any offensive odour or smoke, as determined by an enforcement officer of the Taranaki Regional Council, beyond the boundary of the wellsite or beyond 100 metres of the flare, whichever distance is greater, arising from the exercise of this consent.

16. All hydrocarbon storage vessels shall be fitted with vapour recovery systems.

17. The opacity of any smoke emissions shall not exceed a level of 1 as measured on the Ringelmann Scale for more than four minutes cumulative duration in any 60-minute period.

18. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare, whether alone or in conjunction with any other emissions from the wellsite, in order that the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 mg/$m^3$ (eight-hour average exposure), or 30 mg/$m^3$ one-hour average exposure) at or beyond the boundary of the wellsite or beyond 100 metres from the flare, whichever distance is greater.

19. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare, whether alone or in conjunction with any other emissions from the wellsite, in order that the maximum ground level concentration of nitrogen dioxide arising from the exercise of this consent measured under ambient conditions does not exceed 100 micrograms per cubic metre (24-hour average exposure), or 200 micrograms per cubic metre (1-hour average exposure) at or beyond the boundary of the wellsite, or beyond 100 metres from the flare, whichever distance is greater.

20. The consent holder shall control emissions to the atmosphere from the wellsite and flare of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides, whether alone or in conjunction with any emissions from the flare, in order that the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the wellsite or beyond 100 metres from the flare, whichever distance is greater, is not increased above background levels:

    a) by more than 1/30$^{th}$ of the relevant Occupational Threshold Value-Time Weighted Average, or by more than the Short Term Exposure Limit at any time (all terms as defined in Workplace Exposure Standards, 2002, Department of Labour); or

    b) if no Short Term Exposure Limit is set, by more than three times the Time Weighted Average at any time (all terms as defined in Workplace Exposure Standards, 2002, Department of Labour).

**Recording and reporting information**

21. The consent holder shall keep and make available to the Chief Executive, Taranaki Regional Council, upon request, a record of all smoke-emitting incidents noting time, duration and cause.

22. The consent holder shall keep and maintain a log of all continuous flaring incidents longer than five minutes, and any intermittent flaring lasting for an aggregate of ten minutes or longer in any 120-minute period. Such a log shall contain the date, the start and finish times, the quantity and type of material flared, and the reason for flaring. This log shall be made available to the Chief Executive, Taranaki Regional Council, upon request, and summarised annually in the report required under condition 20.

23. The consent holder shall supply to the Taranaki Regional Council each month a copy of flaring information comprising: the type and amount of material flared (including any gas used to maintain a pilot flame), the date this was flared, the reason why flaring was undertaken, and an indication of whether smoke was produced from such flaring events.

24. The consent holder shall provide to the Taranaki Regional Council during May of each year, for the duration of this consent, a report:

    i) detailing any energy efficiency measures implemented on the site;
    ii) detailing smoke emissions as required under condition 21;
    iii) detailing any measures to reduce smoke emissions;
    iv) detailing any measures to reduce flaring;
    v) addressing any other issue relevant to the minimisation or mitigation of emissions from the flare;
    vi) detailing any complaints received and any measures undertaken to address complaints; and
    vii) reviewing all options and technological advances relevant to the reduction or mitigation of any discharge to air from the site, how these might be applicable and/or implemented at the site, and the benefits and costs of these advances.

25. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and crude oil stream from the field, covering sulphur compound content and the content of carbon compounds of structure $C_6$ or higher number of compounds.

**Lapse and Review**

26. This consent shall lapse on the expiry of 16 years after the date of first issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

27. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 10 September 2013

For and on behalf of
Taranaki Regional Council

_____

**Director-Resource Management**

# Discharge Permit

**Pursuant to the Resource Management Act 1991**
**a resource consent is hereby granted by the**
**Taranaki Regional Council**

| | |
|---|---|
| Name of Consent Holder: | Greymouth Petroleum Limited<br>P O Box 3394<br>NEW PLYMOUTH 4341 |
| Decision Date (Change): | 10 September 2013 |
| Commencement Date (Change): | 10 September 2013 (Granted: 7 December 2004) |

## Conditions of Consent

| | |
|---|---|
| Consent Granted: | To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream |
| Expiry Date: | 1 June 2021 |
| Review Date(s): | June 2015 |
| Site Location: | Turangi Production Station, Turangi Road, Motunui (Property owner: BA & JM McKenzie) |
| Legal Description: | Sec 21 Blk VI Waitara SD (Discharge source & site) |
| Grid Reference (NZTM) | 1713982E-5681378N |
| Catchment: | Parahaki |

*For General, Standard and Special conditions*
*pertaining to this consent please see reverse side of this document*

## General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

## Special Conditions

1. The consent holder shall ensure that the discharge of treated produced water to land does not result in an observable Hydrocarbon run-off into the perimeter drain.

2. The conductivity of the soil layer containing the discharge shall be maintained at less than 400 $mSm^{-1}$, or alternatively, if the background soil conductivity exceeds 400 $mSm^{-1}$, the application of waste shall not increase the soil conductivity by more than 100 $mSm^{-1}$ over the background concentrations established prior to the exercise of this consent.

3. The sodium absorption ratio (SAR) of the soil layer containing the discharge shall be maintained at less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the application of waste shall not increase the SAR by more than 1.0 over the background concentrations established prior to the exercise of this consent.

4. Prior to the expiry, cancellation, or surrender of this consent soil parameters shall not exceed the following limits: conductivity, 290 $mSm^{-1}$; total dissolved salts, 2500 $gm^{-3}$; sodium, 460 $gm^{-3}$; and chloride, 700 $gm^{-3}$.

5. At all times the levels of hydrocarbons in the soil within the discharge area shall comply with the guideline values for sandy soil type in the surface layer set out in Tables 4.12 and 4.15 of the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Ministry for the Environment, 1999), appended to this consent.

6. Any discharge of treated produced water directly to land shall occur within the area enclosed by the perimeter drain

7. The consent holder shall keep records of the following:

   a) The results of analysis of a monthly representative sample of the composition of the treated produced water, which is being or will be discharged on the site (including pH level, electro-conductivity, Salinity, and concentration of total hydrocarbons)
   b) volumes of treated produced water discharged directly to land
   c) dates and times of commencement and completion of discharge events
   d) sampling, analysis and results of monitoring undertaken by the consent holder

   and shall forward these records to the Chief Executive, Taranaki Regional Council, on a quarterly basis, or as requested by the Council.

8. Prior to the exercise of this consent, the consent holder shall provide, to the written satisfaction of the Chief Executive, Taranaki Regional Council, a management plan to confirm that the activity will be conducted to comply with all of the conditions of this consent. The management plan shall be reviewed annually and shall include as a minimum:

   a. sampling regime
   b. a representative analysis of the quality of soil within the proposed discharge area;
   c. procedures for notification to Council of disposal activities;
   d. contingency procedures;
   e. site reinstatement and monitoring; and
   f. control of site access.

9. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects of the discharge on the environment.

10. The maximum stormwater catchment area shall be no more than 1.8 hectares.

11. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 7 days prior to any site works commencing, and again in writing at least 7 days prior to any well drilling operation commencing.

12. Prior to the exercise of this consent, the consent holder shall provide for the written approval of the Chief Executive, Taranaki Regional Council, site specific details relating to contingency planning for the wellsite.

13. All discharges from the site, including from any containment pit or hydrocarbon combustion facility (e.g. flare pit, thermal oxidiser), shall flow to a perimeter drain and skimmer pit. Perimeter drains shall be designed, including by having a positive grade and low permeability, to ensure that runoff flows directly to a skimmer pit without ponding.

14. Subject the other conditions of this consent the design, management and maintenance of the stormwater system shall be undertaken in accordance with the information submitted in support of the consent application 7570, and in particular:

    - Drawing 12364-02, Sheet 1, prepared by BTW Company Limited and dated June 2013;
    - Drawing 12364-02, Sheet 5, prepared by BTW Company Limited and dated June 2013; and
    - Stormwater design report for Turangi Production Station, prepared by BTW Company Limited, referenced 12364-8/2013 and dated 14 August 2013.

15. Skimmer pits shall have a combined capacity of no less than 340 $m^3$, and be designed to retain any hydrocarbons that enter them.

16. All skimmer pits and any other stormwater retention areas shall be lined with an impervious material to prevent seepage through the bed and sidewalls, and all skimmer pits shall have a valve that can be shut off to prevent any discharge from the site.

17. Perimeter drains and skimmer pits necessary to comply with the conditions of this consent shall be installed before any site works commences. Site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site.

18. Any above ground hazardous substances storage areas shall be bunded with drainage to sumps, or other appropriate recovery systems, and not to the stormwater catchment.

19. The following concentrations shall not be exceeded in the discharge from the perimeter drain through the interceptor pit:

| **Component** | **Concentration** |
|---|---|
| pH (range) | 6.5 - 8.5 |
| suspended solids | 100 $gm^{-3}$ |
| total recoverable hydrocarbons (infrared spectroscopic technique) | 15 $gm^{-3}$ |
| chloride | 50 $gm^{-3}$ |

    This condition shall apply prior to the entry of the treated stormwater and produced water either onto and into land, or into surface water, at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

20. After allowing for reasonable mixing, within a mixing zone extending seven times the width of the water body downstream of a designated discharge point, the discharge shall not give rise to an increase in temperature of more than 2 degrees Celsius.

21. After allowing for reasonable mixing, within a mixing zone extending seven times the width of the water body downstream of a designated discharge point, the discharge shall not give rise to any of the following effects in the receiving waters:

    a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
    b) any conspicuous change in the colour or visual clarity;
    c) any emission of objectionable odour;
    d) the rendering of fresh water unsuitable for consumption by farm animals;
    e) any significant adverse effects on aquatic life.

22. The discharge onto and into land shall occur a minimum of 20 metres from any surface water body. Discharge shall be onto and into land and there shall be no direct discharge to surface water.

23. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise effects on stormwater quality.

24. This consent shall lapse on the expiry of five years after the date of first issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

25. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 10 September 2013

For and on behalf of
Taranaki Regional Council

_____

**Director-Resource Management**

## Appendix 1

Tables 4.12 and 4.15 of the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand [Ministry for the Environment, 1999].

**Table 4.12 Tier 1 soil acceptance criteria *Agricultural use* [1,3,6] ALL PATHWAYS (all values mg/kg)**

| Soil Type/ Contaminant | Depth of contamination | | |
|---|---|---|---|
| | Surface (<1m) | 1m - 4m | > 4m |
| **SAND** | | | |
| MAHs | | | |
| Benzene | 1.1 [v] | 1.9 [7,v] | 2.4 [7,v] |
| Toluene | (68) [4,v] | (94) [4,m] | (230) [4,v] |
| Ethylbenzene | (53) [4,v] | (92) [4,7,v] | (120) [4,v] |
| Xylenes | (48) [4,v] | (130) [4,7,v] | (180) [4,v] |
| PAHs | | | |
| Naphthalene | 7.2 [p] | 70 [v] | 80 [v] |
| Non-carc. (Pyrene) | (160) [4,p] | NA [2] | NA [2] |
| Benzo(a)pyrene eq. [5] | 0.027 [p] | (25) [4,m] | NA [2] |
| **SANDY SILT** | | | |
| MAHs | | | |
| Benzene | 1.1 [v] | 1.9 [v] | 2.4 [v] |
| Toluene | (82) [4,v] | (170) [4,v] | (240) [4,v] |
| Ethylbenzene | (59) [4,v] | (92) [4,v] | (140) [4,v] |
| Xylenes | (59) [4,v] | (130) [4,v] | (180) [4,v] |
| PAHs | | | |
| Naphthalene | 7.2 [p] | 83 [v] | (130) [4,v] |
| Non-carc. (Pyrene) | (160) [4,p] | NA [2] | NA [2] |
| Benzo(a)pyrene eq. [5] | 0.027 [p] | (25) [4,m] | NA [2] |
| **SILTY CLAY** | | | |
| MAHs | | | |
| Benzene | 1.7 [v] | 4.6 [v] | 12 [v] |
| Toluene | (210) [4,v] | (950) [4,v] | (3,000) [4,v] |
| Ethylbenzene | (110) [4,v] | (800) [4,v] | (2,800) [4,v] |
| Xylenes | (160) [4,v] | (710) [4,v] | (2,200) [4,v] |
| PAHs | | | |
| Naphthalene | 7.2 [p] | (330) [4,v] | (1,100) [4,v] |
| Non-carc. (Pyrene) | (160) [4,p] | NA [2] | NA [2] |
| Benzo(a)pyrene eq. [5] | 0.027 [p] | (25) [4,m] | NA [2] |

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.
2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
3. Surface soil acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (Table 4.19). Criteria for soils at 1 m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4 m are based on volatilisation only.
4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.
6. The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation
7. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

**Table 4.12 (CONTINUED)**
**Tier 1 soil acceptance criteria *Agricultural use* [1,3,6] ALL PATHWAYS**
**(all values mg/kg)**

| Soil Type/ Contaminant | Depth of contamination | | |
|---|---|---|---|
| | Surface (<1m) | 1m - 4m | > 4m |
| **CLAY** | | | |
| MAHs | | | |
| Benzene | 2.7 [v] | 8.8 [v] | (26) [4,v] |
| Toluene | (320) [4,v] | (2,400) [4,v] | (8,500) [4,v] |
| Ethylbenzene | (160) [4,v] | NA [2] | NA [2] |
| Xylenes | (250) [4,v] | (1,800) [4,v] | (6,500) [4,v] |
| PAHs | | | |
| Naphthalene | 7.2 [p] | (360) [4,v] | (1,200) [4,v] |
| Non-carc. (Pyrene) | (160) [4,p] | NA [2] | NA [2] |
| Benzo(a)pyrene eq. [5] | 0.027 [p] | (25) [4,m] | NA [2] |
| **PUMICE** | | | |
| MAHs | | | |
| Benzene | 1.2 [v] | 2.4 [v] | 3.1 [v] |
| Toluene | (73) [4,v] | (240) [4,v] | (350) [4,v] |
| Ethylbenzene | (48) [4,v] | (140) [4,v] | (220) [4,v] |
| Xylenes | (53) [4,v] | (180) [4,v] | (260) [4,v] |
| PAHs | | | |
| Naphthalene | 7.2 [p] | 140 [v] | (220) [4,v] |
| Non-carc. (Pyrene) | (160) [4,p] | NA [2] | NA [2] |
| Benzo(a)pyrene eq. [5] | 0.027 [p] | (25) [4,m] | NA [2] |
| **PEATS AND HIGHLY ORGANIC SOILS** | | | |
| MAHs | | | |
| Benzene | 5.7 [v] | 10 [v] | 13 [v] |
| Toluene | (2,500) [4,v] | (2,900) [4,v] | (3,800) [4,v] |
| Ethylbenzene | (2,200) [4,v] | (2,500) [4,v] | (3,200) [4,v] |
| Xylenes | (1,700) [4,v] | (2,000) [4,v] | (2,600) [4,v] |
| PAHs | | | |
| Naphthalene | 7.2 [p] | (2,700) [4,v] | (3,500) [4,v] |
| Non-carc. (Pyrene) | (160) [4,p] | NA [2] | NA [2] |
| Benzo(a)pyrene eq. [5] | 0.027 [p] | (25) [4,m] | NA [2] |

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.
2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
3. Surface soil acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (Table 4.19). Criteria for soils at 1 m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4 m are based on volatilisation only.
4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.
6. The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation

**Table 4.15 Tier 1 soil acceptance criteria for TPH[1,3,5,6] *Agricultural use* ALL PATHWAYS**
**(all values in mg/kg)**

| Soil Type/ Contaminant | Depth of contamination | | |
|---|---|---|---|
| | Surface (<1m) | 1m - 4m | > 4m |
| **SAND** | | | |
| $C_7$-$C_9$ [4] | 120 [m] | 120 [m] | (3,800) [7,8,v] |
| $C_{10}$-$C_{14}$ | 58 [x] | (560) [7,x] | (650) [7,x] |
| $C_{15}$-$C_{36}$ | (4,000) [7,x] | NA [2] | NA [2] |
| **SANDY SILT** | | | |
| $C_7$-$C_9$ [4] | (500) [7,m] | (500) [7,m] | (3,800) [7,v] |
| $C_{10}$-$C_{14}$ | 58 [x] | (670) [7,x] | (4,900) [7,v] |
| $C_{15}$-$C_{36}$ | (4,000) [7,x] | NA [2] | NA [2] |
| **SILTY CLAY** | | | |
| $C_7$-$C_9$ [4] | (2,700) [7,v] | (7,300) [7,v] | (19,000) [7,v] |
| $C_{10}$-$C_{14}$ | 58 [x] | (2,700) [7,x] | (8,900) [7,x] |
| $C_{15}$-$C_{36}$ | (4,000) [7,x] | NA [2] | NA [2] |
| **CLAY** | | | |
| $C_7$-$C_9$ [4] | (15,000) [7,v] | NA [2] | NA [2] |
| $C_{10}$-$C_{14}$ | 58 [x] | (2,900) [7,x] | (9,700) [7,x] |
| $C_{15}$-$C_{36}$ | (4,000) [7,x] | NA [2] | NA [2] |
| **PUMICE** | | | |
| $C_7$-$C_9$ [4] | (810) [7,m] | (810) [7,m] | (4,800) [7,v] |
| $C_{10}$-$C_{14}$ | 58 [x] | (1,100) [7,x] | (1,800) [7,x] |
| $C_{15}$-$C_{36}$ | (4,000) [7,x] | NA [2] | NA [2] |
| **PEATS AND HIGHLY ORGANIC SOILS** | | | |
| $C_7$-$C_9$ [4] | (6,700) [7,m] | (6,700) [7,m] | NA [2] |
| $C_{10}$-$C_{14}$ | 58 [x] | NA [2] | NA [2] |
| $C_{15}$-$C_{36}$ | (4,000) [7,x] | NA [2] | NA [2] |

NOTES:

1. Criteria for C10 - C14 and C15 - C36 are based on consideration of aliphatic component of TPH measurement and consideration of TPH as a surrogate measure for PAH, consideration of PAHs completed by extrapolation of PAH content of diesel and PAH criteria (refer Table 4.10)
2. NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
3. Based on protection of human health only. Site specific consideration of aesthetic and ecological impact is required.
4. Based on health effects associated with aliphatic component only. Separate consideration of the health effects associated with the aromatic component (i.e. BTEX) is required.
5. Soil acceptance criteria are based on the lower value of criteria based on volatilisation (Table 4.16), other pathways (Table 4.18), criteria for the protection of maintenance workers (Table 4.19) and TPH criteria developed as surrogates for PAHs (Table 4.22). Surface soils criteria are based on all three pathways, criteria for soils at 1 m are based on volatilisation and maintenance workers, and criteria for soils at 4 m are based on volatilisation only. PAH surrogate considerations apply at all depths.
6. The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion d - Dermal, p - Produce, m - Maintenance/Excavation, x - PAH surrogate
7. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
8. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

# Discharge Permit

**Pursuant to the Resource Management Act 1991**
**a resource consent is hereby granted by the**
**Taranaki Regional Council**

| | |
|---|---|
| Name of Consent Holder: | Greymouth Petroleum Limited<br>P O Box 3394<br>NEW PLYMOUTH 4341 |
| Decision Date (Change): | 13 February 2014 |
| Commencement Date (Change): | 13 February 2014 (Granted: 6 September 2013) |

## Conditions of Consent

| | |
|---|---|
| Consent Granted: | To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi Production Station, onto land where it may enter an unnamed tributary of the Parahaki Stream |
| Expiry Date: | 1 June 2027 |
| Review Date(s): | June 2015, June 2021 |
| Site Location: | Turangi Production Station, Turangi Road, Motunui<br>(Property owner: Ducal Products Limited) |
| Legal Description: | Sec 21 & Lot 1 DP 19476 Blk VI Waitara SD<br>(Discharge source & site) |
| Grid Reference (NZTM) | 1713988E-5681344N |
| Catchment: | Parahaki |

*For General, Standard and Special conditions*
*pertaining to this consent please see reverse side of this document*

## General condition

a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act 1991.

## Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.

2. Stormwater discharged shall be collected from a catchment area of no more than 1.8 Ha.

3. At least 5 working days prior, the consent holder shall advise the Chief Executive, Taranaki Regional Council of the date of each of the following events:

   a) commencement of any site works (site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site);
   b) commencement of any well drilling operation; and
   c) recommencement of any site works or drilling operations following a period of inactivity exceeding 30 days.

   If any of these events is rescheduled or delayed, the consent holder shall immediately provide further notice advising of the new date.

   Any advice given in accordance with this condition shall include the consent number and the wellsite name and be emailed to worknotification@trc.govt.nz.

4. The consent holder shall maintain a contingency plan that details measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge. The contingency plan shall be certified by the Chief Executive, Taranaki Regional Council prior to discharging from the site, and after any change to the Plan.

5. Subject the other conditions of this consent the design, management and maintenance of the stormwater system shall be undertaken in accordance with the information submitted in support of the consent application 9674 and in particular, the following drawings prepared by BTW Company Limited:

   a) Drawing 12364-103-GIS, Sheet 1 and dated March 2013;
   b) Drawing 12364-02, Sheet 1, Revision 2 and dated December 2013;
   c) Drawing 12364-02, Sheet 2, Revision 3 and dated December 2013;
   d) Drawing 12364-02, Sheet 3, Revision 2 and dated December 2013;
   e) Drawing 12364-02, Sheet 4, Revision 3 and dated December 2013;
   f) Drawing 12364-02, Sheet 5, Revision 3 and dated December 2013;
   g) Drawing 12364-02, Sheet 6, Revision 3 and dated December 2013;
   h) Stormwater design report for Turangi-A Production Station, referenced 12364-8/2013, Revision 2 and dated December 2013.

6. All discharges from the site, including from any containment pit or hydrocarbon combustion facility (e.g. flare pit, thermal oxidiser), shall flow to a perimeter drain and skimmer pit. Perimeter drains shall be designed, including by having a positive grade and low permeability, to ensure that runoff flows directly to a skimmer pit without ponding.

7. Skimmer pits shall have a combined capacity of no less than 370 $m^3$, and be designed to retain any hydrocarbons that enter them.

8. Skimmer pits shall have a combined capacity of no less than 370 $m^3$ including a 'dead storage' of no less than 106 $m^3$, and be designed to retain any hydrocarbons that enter them.

9. All skimmer pits and any other stormwater retention areas shall be lined with an impervious material to prevent seepage through the bed and sidewalls, and all skimmer pits shall have a valve that can be shut off to prevent any discharge from the site.

10. Perimeter drains and skimmer pits necessary to comply with the conditions of this consent shall be installed before any site works commences. Site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site.

11. Constituents in the discharge shall meet the standards shown in the following table.

| Constituent | Standard |
|---|---|
| pH | Within the range 6.0 to 9.0 |
| suspended solids | Concentration not greater than 100 gm-3 |
| total recoverable hydrocarbons | Concentration not greater than 15 gm-3 [as determined by infrared spectroscopic technique] |
| chloride | Concentration not greater than 50 gm-3 |

12. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to an increase in the temperature of the receiving waters of more than 2 degrees Celsius.

13. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to any of the following effects in the receiving water:

    a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
    b) any conspicuous change in the colour or visual clarity;
    c) any emission of objectionable odour;
    d) the rendering of fresh water unsuitable for consumption by farm animals;
    e) any significant adverse effects on aquatic life.

14. The consent holder shall advise the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise adverse effects on stormwater quality. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

15. This consent shall lapse on 30 September 2018, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

16. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2021, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 13 February 2014

For and on behalf of
Taranaki Regional Council

_____

A D McLay
**Director-Resource Management**

# Appendix II

# Air monitoring reports

# Memorandum

**To** Job Manager, Callum MacKenzie
**From** Scientific Officer - Air Quality, Brian Cheyne
**File** 1660530
**Date** March 24, 2016

# Ambient Gas (PM10, NOx, CO and LEL) Monitoring at Turangi Production Stations during 2014-2015 monitoring year

## Introduction

In January and May 2015 as part of the compliance monitoring programme for the Turangi production station, a survey of ambient air quality sampling was carried out by the Taranaki Regional Council (the Council) in the vicinity of the plant. The main objectives were to measure:

- The concentrations of PM10 using a portable data logging TSI 'DustTrak';
- To measure the concentrations of the nitrogen oxides (NOx) using a passive sampling method, that gives a result for average exposure;
- And to measure carbon monoxide (CO) using a portable multi gas meter that provides instantaneous data throughout the monitoring period.

The findings of this study are presented in this memorandum, together with the locations of the monitoring sites which are provided in Figure 1.

## Carbon monoxide (CO) and Lower explosive limit (LEL)

During the monitoring year, a multi-gas meter was deployed on one occasion in the vicinity of the plant. The deployment lasted approximately 68 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases).

Because of the nature of the activities on the site, it was considered that the primary information of interest in respect of gases potentially emitted from the site was the average downwind concentration, rather than any instantaneous peak value. That is, the long-term exposure levels, rather than short-term maxima, are of most interest. The gas meter was therefore set up to create a data set based on recording the average concentration measured during each minute as raw data.


**Figure 1** Air monitoring sites at Turangi production station (2014-2015)

The details of the sample run are summarised in Table 1 and the data from the sample run are presented graphically in Figure 2**.**

The consents covering air discharges from the Turangi production station have specific limits related to particular gases. Special condition 18 of consent 6497-1 set a limit on the carbon monoxide concentration at or beyond the production station's boundary. The limit is expressed as 10 mg/m³ for an eight hour average or 30 mg/m³ for a one hour average exposure. The maximum concentration of carbon monoxide found during the monitoring run was 7.67 mg/m³ with average concentration for the entire dataset was only 0.23 mg/m³ which comply with consent conditions. This is in line with the pattern found in previous years.

**Table 1** Results of carbon monoxide and LEL monitoring at Turangi production station

| Period (from-to) | | 05/05/2015 13:03 to 08/05/2015 08:58 |
|---|---|---|
| Max | CO(ppm) | 6.70 |
| | LEL(%) | 0.20 |
| Mean | CO(ppm) | 0.20 |
| | LEL(%) | 0.00 |
| Min | CO(ppm) | 0.00 |
| | LEL(%) | 0.00 |

Note: (1) the instrument records in units of ppm. At 25°C, 1 atm.
1ppm CO = 1.145 mg/m$^3$

(2) See text for explanation of LEL. Because the LEL of methane is equivalent to a mixture of approximately 5% methane in air, then the actual concentration of methane in air can be obtained by dividing the percentage LEL by 20.

LEL gives the percentage of the lower explosive limit, expressed as methane that is detected in the air sampled. The sensor on the instrument reacts to gases and vapours such as acetone, benzene, butane, methane, propane, carbon monoxide, ethanol, and higher alkanes and alkenes, with varying degrees of sensitivity. The Council's Regional Air Quality Plan has a typical requirement that no discharge shall result in dangerous levels of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of the Turangi production station reach any more than a trivial level.

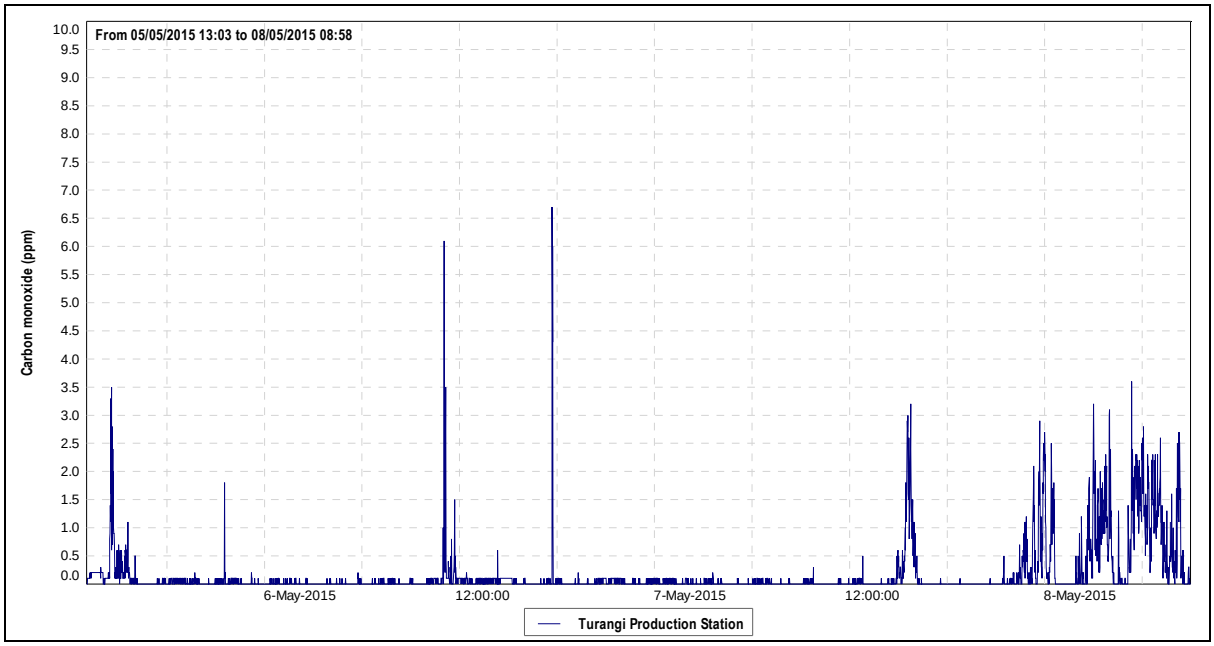


**Figure 2** Graph of ambient CO levels in the vicinity of the Turangi Production Station

## PM10

In September 2004 the Ministry for the Environment made public National Environmental Standards (NESs) relating to certain air pollutants. The NES for PM10 is 50 µg/m$^3$ (24-hour average).

Particulates can be derived from many sources, including motor vehicles (particularly diesel), solid and oil-burning processes for industry and power generation, incineration and waste burning, photochemical processes, and natural sources such as pollen, abrasion, and sea spray.

PM10 particles are linked to adverse health effects that arise primarily from the ability of particles of this size to penetrate the defences of the human body and enter deep into the lungs significantly reducing the exchange of gases across the lung walls. Health effects from inhaling PM10 include increased mortality and the aggravation of existing respiratory and cardiovascular conditions such as asthma and chronic pulmonary diseases.

During the reporting period, a "DustTrak" PM10 monitor was deployed on one occasion in the vicinity of the Turangi production station. The deployment lasted approximately 54 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continual measurements of PM10 concentrations. The location of the "DustTrak" monitor during the sampling run is shown in Figure 1.

The details of the sample run are presented in Figure 3 and Table 2.

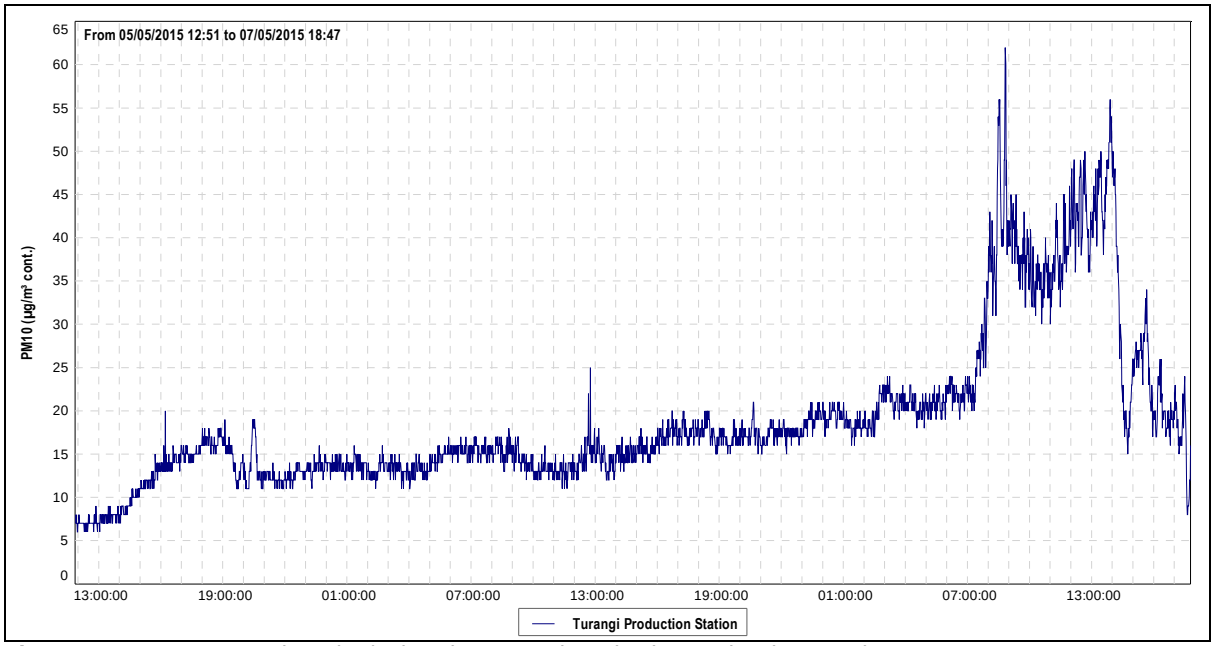


**Figure 2** PM10 concentrations (µg/m³) at the Turangi production station (2014-15)

| | (54 hours) (05-07/05/2015) | |
|---|---|---|
| 24 hr. set | Day 1 | Day 2 |
| Daily average | 13.2 µg/m³ | 25.3 µg/m³ |
| NES | 50µg/m³ | |

**Table 1** Daily mean of PM10 results during two days' monitoring at Turangi production station

During the 54-hour run, from 5th of May to 7th of May 2015, the average recorded $PM_{10}$ concentration for the first 24 hour period was 13.2µg/m³ and 25.3µg/m³ for the second 24 hour period. These daily means equate to 26.4% and 50.6%, respectively, of the 50 µg/m³ value that is set by the National Environmental Standard.

Background levels of $PM_{10}$ in the region have been found to be typically around 11 µg/m³.

## Nitrogen oxides (NOx)

From 2014 onwards, the Council has implemented a coordinated region-wide compliance monitoring programme to measure NOx. The programme involves deploying all measuring devices at 28 NOx monitoring sites (including two sites in the vicinity of the Turangi production station) on the same day, with retrieval three weeks later. This approach assists the Council in further evaluating the effects of local and regional emission sources and ambient air quality in the region.

The complete report covering region-wide NOx monitoring is attached in the Appendix to this memorandum and can also be found at the following link:
http://www.trc.govt.nz/assets/Publications/state-of-the-environment-monitoring/environmental-monitoring-technical-reports/1541533.pdf

The consents covering air discharges from the Turangi production station have specific limits related to particular gases. Special condition 19 of consent 6497-1 set a limit on the nitrogen dioxide concentration at or beyond the production station's boundary. The limit is

expressed as 100 µg/m³ for a 24 hour average or 200 µg/m³ for a one hour average exposure.

NOx passive adsorption discs were place at two locations in the vicinity of the Turangi production station on one occasion during the year under review. The discs were left in place for a period of 21 days.

The calculated 1-hour and 24-hour theoretical maximum NOx concentrations found at the Turangi production station during the year under review equates to 11.1µg/m³ and 5.6 µg/m³ respectively. The results show that the ambient ground level concentration of $NO_x$ is well below the limits set out by consent 6497-1.

## Memorandum

| | |
|---|---|
| **To** | Fiza Hafiz, Scientific Officer – State of the Environment<br>Job Managers - Callum MacKenzie, Emily Roberts, James Kitto |
| **From** | Brian Cheyne, Scientific Officer – Air Quality |
| **File** | Frodo # 1545133 |
| **Date** | 29 July 2015 |

# Monitoring of nitrogen oxides (NOx) levels in Taranaki near the NOx emitting sites, year 2014-2015

From 2014 onwards, the Taranaki Regional Council (TRC) has implemented a coordinated region-wide monitoring programme to measure NOx, not only at individual compliance monitoring sites near industries that emit NOx, but simultaneously at the urban sites (the Council regional state of the environment programme). The programme involves deploying all measuring devices on the same day, with retrieval three weeks later. This approach will assist the Council to further evaluate the effects of local and regional emission sources and ambient air quality in the region.

## Nitrogen oxides

Nitrogen oxides (NOx), a mixture of nitrous oxide (N2O), nitric oxide (NO) and nitrogen dioxide (NO2), are produced from natural sources, motor vehicles and other fuel combustion processes. Indoor domestic appliances (gas stoves, gas or wood heaters) can also be significant sources of nitrogen oxides, particularly in areas that are poorly ventilated. NO and NO2 are of interest because of potential effects on human health.

Nitric oxide is colourless and odourless and is oxidised in the atmosphere to form nitrogen dioxide. Nitrogen dioxide is an odorous, brown, acidic, highly corrosive gas that can affect our health and environment. Nitrogen oxides are critical components of photochemical smog – nitrogen dioxide produces the yellowish-brown colour of the smog.

### Environmental and health effects of nitrogen oxides

Nitrogen dioxide is harmful to vegetation, can fade and discolour fabrics, reduce visibility, and react with surfaces and furnishings. Vegetation exposure to high levels of nitrogen dioxide can be identified by damage to foliage, decreased growth or reduced crop yield.

Nitric oxide does not significantly affect human health. On the other hand, elevated levels of nitrogen dioxide cause damage to the mechanisms that protect the human respiratory tract and can increase a person's susceptibility to, and the severity of, respiratory infections and asthma. Long-term exposure to high levels of nitrogen dioxide can cause chronic lung disease. It may also affect sensory perception, for example, by reducing a person's ability to smell an odour.

### National environmental standards and guidelines

In 2004, national environmental standards (NES) for ambient (outdoor) air quality were introduced in New Zealand to provide a guaranteed level of protection for the health of New Zealanders. The national standard for nitrogen dioxide (NO2) is set out below.

In any 1-hour period, the average concentration of nitrogen dioxide in the air should not be more than 200 $\mu g/m^3$.

Before the introduction of the national environmental standards, air quality was measured against the national air quality guidelines. The national guidelines were developed in 1994 and revised in 2002 following a comprehensive review of international and national research and remain relevant. The national guideline for nitrogen dioxide (NO2) is set out below.

In any 24-hour period, the average concentration of nitrogen dioxide in the air should not be more than 100 $\mu g/m^3$.

Nitrogen dioxide limits are also set in the special conditions of the resource consents. The consents limits are the same as those imposed under the NES and MfE's guideline.

## Measurement of nitrogen oxides

The Taranaki Regional Council has been monitoring nitrogen oxides (NOx) in the Taranaki region since 1993 using passive absorption discs. Research to date indicates that this is an accurate method, with benefits of simplicity of use and relatively low cost. To date 527 samplers of nitrogen oxides have been collected in Taranaki region. Discs are sent to EUROFINS ELS Ltd. Lower Hutt for analysis. Passive absorption discs are placed at the nominated sites. The gases diffuse into the discs and any target gases (nitrogen dioxide or others) are captured.

In the 2014-15 year, passive absorption discs were placed on one occasion at twenty eight sites, staked about two metres off the ground for a period of 21 days, for the purpose of Compliance Monitoring and SEM studies.

## Conversion of exposure result to standardised exposure time period

From the average concentration measured, it is possible to calculate a theoretical maximum daily or one hour concentrations that may have occurred during the exposure period. Council data on NOx is gathered over a time period other than exactly 24 hours or one hour. There are mathematical equations used by air quality scientists to predict the maximum concentrations over varying time periods. These are somewhat empirical, in that they take little account of local topography, micro-climates, diurnal variation, etc. Nevertheless, they are applied conservatively and have some recognition of validity.
One formula in general use is of the form:

$$C(t_2) = C(t_1) \times \left(\frac{t_1}{t_2}\right)^P$$

where C(t) = the average concentration during the time interval t, and p = a factor lying between 0.17 and 0.20. When converting from longer time periods to shorter time periods, using p = 0.20 gives the most conservative estimate (i.e. the highest calculated result for time period $t_2$ given a measured concentration for time period $t_1$). Using the 'worst case' factor of p = 0.20, the monitoring data reported above has been converted to equivalent 'maximum' 1-hour and 'maximum'24-hour exposure levels.

## Results

The location of the NOx monitoring sites are shown in Figure 1 and the details of the NOx results are presented in Table 1 and Figure 2.

**Table 1** Actual (laboratory) and recalculated ambient NOx results, NES and MfE guideline.

| | Survey at | Site code | NOx(µg/m³) Lab. results | NOx 1/hr (µg/m³) Theoretical max. | NOx 24/hr (µg/m³) Theoretical max. |
|---|---|---|---|---|---|
| Petrochemical | McKee PS | AIR007901 | 4.5 | 15.6 | 8.3 |
| | | AIR007902 | 8.8 | 30.5 | 16.2 |
| | Turangi PS | AIR007922 | 2.9 | 10.1 | 5.3 |
| | | AIR007824 | 3.5 | 12.1 | 6.4 |
| | Kaimiro PS | AIR007817 | 1.8 | 6.2 | 3.3 |
| | | AIR007818 | 4.7 | 16.3 | 8.6 |
| | Sidewinder PS | AIR007831 | 1.1 | 3.8 | 2.0 |
| | | AIR007832 | 0.8 | 2.8 | 1.2 |
| | Maui PS | AIR008201 | 1.6 | 5.6 | 2.9 |
| | | AIR008214 | 2.1 | 7.3 | 3.9 |
| | Kupe PS | AIR007827 | Lost | N/A* | N/A* |
| | | AIR007830 | 2.3 | 8.0 | 4.2 |
| | Kapuni PS | AIR003410 | 5.5 | 19.1 | 10.1 |
| | | AIR003411 | 7.9 | 27.4 | 14.5 |
| | Cheal PS | AIR007841 | 5.7 | 19.8 | 10.5 |
| | | AIR007842 | 5.8 | 20.1 | 10.7 |
| | Waihapa PS | AIR007815 | 1.8 | 6.2 | 3.3 |
| | | AIR007816 | 0.5 | 1.7 | 0.9 |
| | Ballance AUP | AIR003401 | 7.2 | 25.0 | 13.2 |
| | | AIR003404 | 6.0 | 21.0 | 11.0 |
| Dairy factory | Fonterra | AIR002410 | 3.2 | 11.1 | 5.9 |
| | | AIR002711 | 6.8 | 23.6 | 12.5 |
| | | AIR002412 | 4.7 | 16.3 | 8.6 |
| | | AIR002413 | 3.2 | 11.1 | 5.9 |
| SEM | NPGHS | AIR000012(NW) | 7.5 | 26.0 | 13.8 |
| | | AIR000012(NE) | 5.4 | 18.7 | 9.9 |
| | | AIR000012(SW) | 6.2 | 21.5 | 11.4 |
| | | AIR000012(SE) | 8.2 | 28.5 | 15.1 |
| **National Environmental Standard (NES) and MfE guideline** | | | | **200 (NES)** | **100 (guideline)** |

*no results

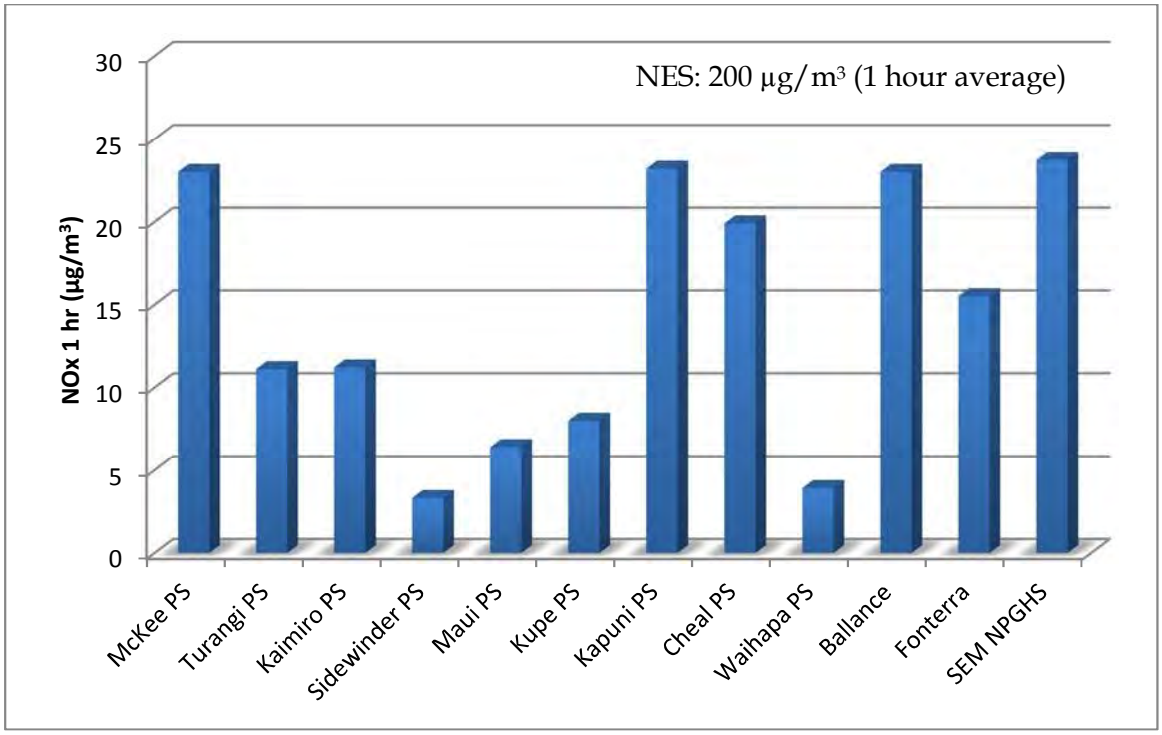


**Figure 2** Average NOx levels at 12 surveyed locations throughout the region (year 2014-2015).

## Discussion

The calculated 1-hour and 24-hour theoretical maximum concentrations (using a power law exponent of 0.2) ranged from 1.7 µg/m³ to 30.5 µg/m³ and 0.9 µg/m³ to 16.2 µg/m³ respectively. The highest results were obtained from the NOx emitting sites at four different locations:

1. In New Plymouth's urban area near a busy traffic intersection and next to the heavy road realignment works.
2. Around the Fonterra's Whareroa co-generation plant.
3. In Kapuni heavy industrial area around the STOS production station and Ballance ammonia/urea plant.
4. And from the sites at McKee production station and power generation plant.

All values were within the National Environmental Standards, Ministry for the Environment Ambient Air Quality Guidelines and the respective resource consents limits. This continues the pattern found in previous years.

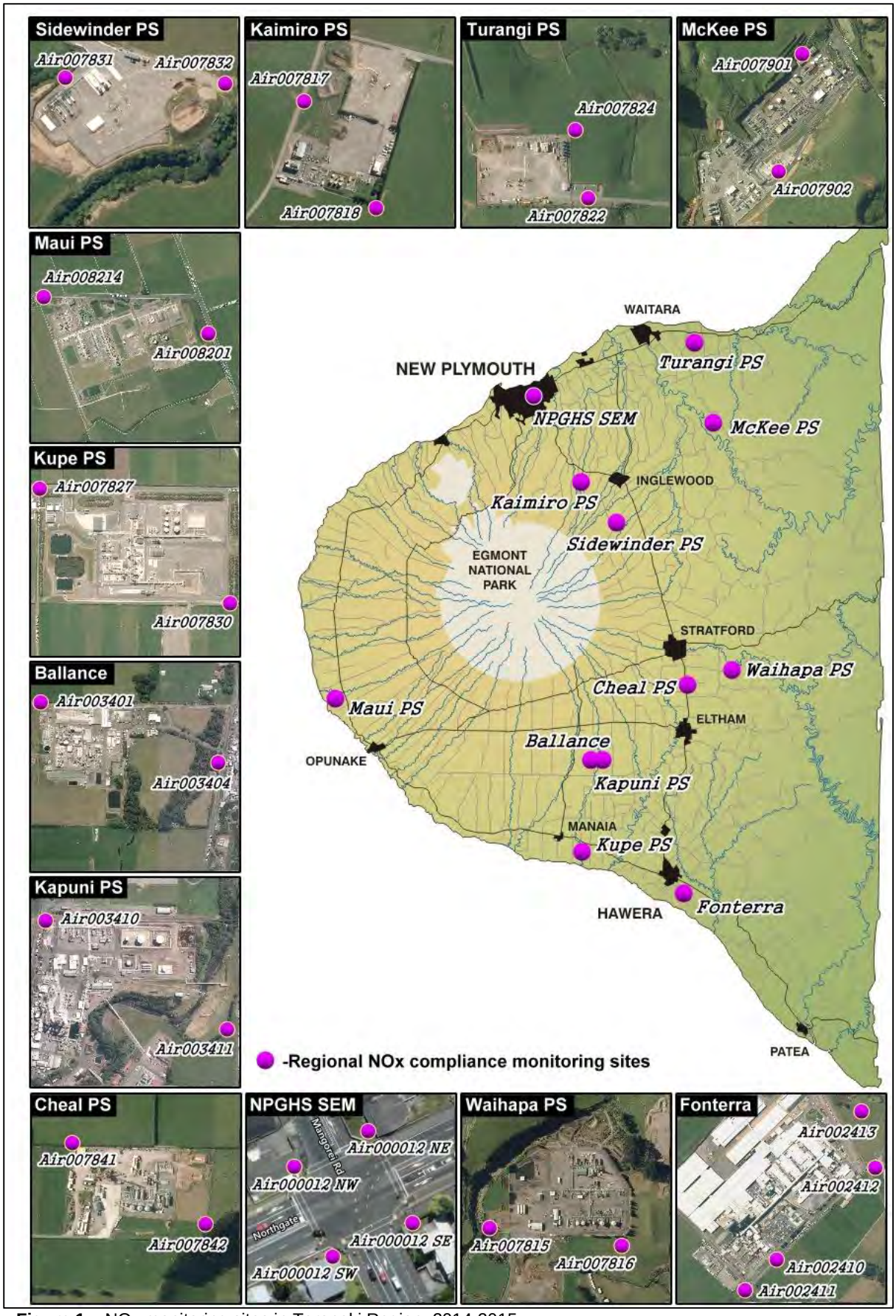


**Figure 1** NOx monitoring sites in Taranaki Region, 2014-2015

### Ministry for the Environment environmental performance indicator

Ministry for the Environment uses an environmental performance indicator to categorise air quality. These categories are set out in Table 2 and further details of the entire NOx results are set out in Table 3.

**Table 2** Environmental Performance Indicator air quality categories

| Measured value | Less than 10% of NES | 10-33% of NES | 33-66% of NES | 66-100% of NES | More than 100% of NES |
|---|---|---|---|---|---|
| Category | *excellent* | *good* | *acceptable* | *alert* | *action* |

**Table 3** Categorisation of results

| National Environmental Standard for NO2 = 200 µg/m³- 1 hour average. | | |
|---|---|---|
| **Category** | **Measured values** | |
| Excellent | <10% of the NES, (0-20µg/m³) | **18** (67%) |
| Good | 10-33% of the NES, (20-66µg/m³) | **9** (33 %) |
| Acceptable | 33-66% of the NES, (66-132 µg/m³) | **0** (0%) |
| Alert | 66-100% of the NES, (132-200 µg/m³) | **0** (0%) |
| **Total number of samples** | | **27** (100%) |

## Conclusion

The monitoring showed that 67% of the 1-hour average results fell into Ministry's 'excellent' categories and 33% of the results lay within Ministry's 'good' category. No results ever entered the 'acceptable' or 'alert' categories, i.e., no results ever exceeded the National Environmental Standard of 200µg/m³.

These results, and all regional monitoring to date, have shown that Taranaki has very clean air, and on a regional basis there are no significant pressures upon the quality of the air resource.