Dow AgroSciences (NZ) Ltd Monitoring Programme Annual Report 2014-2015

Technical Report 2015–84

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Executive summary

Dow AgroSciences (NZ) Ltd (Dow AgroSciences) operates an industrial agrichemical formulating and packaging facility located at Paritutu Road, New Plymouth, in the Herekawe catchment. The Company holds resource consents to allow it to discharge stormwater into the Herekawe Stream, and to discharge emissions into the air. 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 effects of the Company's activities.

The Company held 2 resource consents which included a total of 24 conditions setting out the requirements that the Company must satisfy. The Company held one consent to allow it to discharge stormwater into the Herekawe Stream, and one consent to discharge emissions into the air at the plant site. The consent to emit to air was replaced during the review period.

During the monitoring period, Dow AgroSciences demonstrated an overall high level of environmental performance.

The Council's monitoring programme included 4 inspections, 4 sets of water samples collected for pesticide analysis, 2 biological surveys of receiving waters, and a marine ecology inspection. The Company carried out air emission sampling and groundwater monitoring through independent consultants and further storm water sampling, and forwarded the results to the Council for audit and review.

The monitoring showed that the Company has had no significant impact on air quality in the vicinity of the plant or on water quality in the Herekawe Stream. No complaint in relation to the Company's activities was registered by the Council.

During the year, the Company demonstrated a high level of environmental and administrative performance.

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 recommendations 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 the Annual Report for the period July 2014-June 2015 by the Taranaki Regional Council on the monitoring programme associated with resource consents held by Dow AgroSciences (NZ) Ltd (Dow AgroSciences). The Company operates an industrial agrochemical formulation plant situated at Paritutu Road, New Plymouth, in the Herekawe catchment.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by Dow AgroSciences that relate to discharges of water within the Herekawe catchment, and the air discharge permit held by Dow AgroSciences 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 Taranaki Regional Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of Dow AgroSciences' use of water and air, and is the twenty-third combined annual report by the Taranaki Regional Council for the Company.

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 through annual programmes, the resource consents held by Dow AgroSciences in the Herekawe catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted at Dow AgroSciences' site.

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

Section 3 discusses the results, their interpretation, 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 a discharger, and may include cultural and socio-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 (eg, 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 Taranaki Regional 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. 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 during the period under review, this report also assigns a rating as to the 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 these were 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

Figure 1 Aerial photograph of Dow AgroSciences site

Dow AgroSciences prepares a range of agricultural chemicals at its facility in New Plymouth. It both manufactures (reacting substances to form new ones) and formulates (blending active ingredients and other agents). The production is based

on 'batch' processes (i.e. not continuous) involving chemical reactions, blending or packaging. Various formulation types are produced/packed or repacked, including liquid concentrates, flowable suspensions, wettable powders, water dispersible granules and coated granules. There are approximately 36 different active ingredients handled on the site. Of these, 13 are contained in products that are only repacked or stored for further distribution. The remainder are used in the formulation of products in varying quantities. There are five production plants on the site, and in addition there are support activities such as laboratories and a high temperature waste incinerator.

1.2.1 History

Dow AgroSciences has been located at the present site since 1960. The manufacturing processes for phenoxy herbicide active ingredients (2,4-D, MCPA and MCPB) and triclopyr were discontinued in early 1998 and the Phenoxy Plant shut down. These active ingredients were then imported for formulation into herbicide products. As a result of the closure of the Phenoxy Plant a number of raw materials are no longer used on the site, including chlorophenols (2, 4- dichlorophenol and p-chloro-o-cresol) and monochloroacetic acid (MCAA). The cessation of these chemical syntheses reduced the number of chemicals stored on site and consequently has reduced the potential for odour to be emitted from the site.

Changes to the site over the past three decades have included:

- production of the herbicide 2,4,5-T ceased in 1987;
- terminating the manufacture of dairy sanitisers and detergent bases;
- the high temperature solids incinerator has been upgraded to include a new control system, an extended secondary combustion chamber, and the installation of a liquids nozzle to allow liquids to be burnt;
- cessation of use of the 'liquids' incinerator in 1994, and demolition of the liquids incinerator in June 2000;
- diversion of stormwater from the roads in the vicinity of the incinerator to a new HDPE-lined stormwater pond (SV9200) in the 1995-1996 year;
- termination of the production of phenoxy herbicides (2,4-D, MCPA and MCPB) and triclopyr in 1998;
- introduction of the insecticide active ingredient spinosad, and start up of the Spinosad Plant in 1998;
- closure of the powders side of the Powders/Protectants Plant at the end of 1999;
- in accordance with the revised site Groundwater Management Plan, 18 groundwater bores were closed in 2001-2002; dedicated pumps were installed into remaining sampling wells in May 2002;
- formulation of solid herbicides ceased in June 2002 and the Solids Plant closed;

- the formulation of water-based glyphosate product was introduced during 2002-2003;
- from 2003-2004, there was reduced use of the High Temperature Incinerator, with the operation changed from continuous use to operation 5 days per week (24 hours) intermittently for a total of 6 months of the year;
- the esterification process of 2,4-D esters recommenced in October 2005, in the Commodity Herbicides Plant;
- the neutralisation process with amines of MCPA (2006) and 2,4-D (2007) recommenced, and of glyphosate (2007) and clopyralid (2012) commenced, in the Commodity Herbicides Plant; and
- a new building air extraction and vent treatment system for improved odour control was completed in 2011 for the warehouse where 2,4-D acid is stored.
- the pilot plant and TCP plant were demolished in 2014.

1.2.2 Herbicides Plant

Formulations involving a wide range of active ingredients are prepared for sale. Both liquid (water and solvent based) and granular herbicides are produced. 2,4-D is the most common ingredient.

Air from liquid formulation preparation areas is passed through a coarse filter to capture dust, before treatment through a series of carbon beds before being discharged to atmosphere.

1.2.3 Commodity Herbicides Plant

The esterification process of 2,4-D esters recommenced in October 2005. Imported 2,4-D flake is reacted with either butyl or ethylhexyl alcohol to convert the acid to the ester form.

The amine neutralisation of MCPA recommenced in September 2006, using the same equipment that is used in 2,4-D esterification. Imported MCPA is mixed with dimethylamine (DMA) to convert the acid to the amine.

The amine neutralisation of glyphosate commenced in August 2007. Imported glyphosate acid is mixed with isopropylamine (IPA) to convert the acid to the amine.

The amine neutralisation of 2,4-D recommenced in August 2007. Imported 2,4-D flake is mixed with either IPA or a dimethylamine/dimethylethanolamine (DMEA) mixture to convert the acid to amine form.

The amine neutralisation of clopyralid commenced in September 2012. Imported clopyralid is mixed with DMA to convert the acid to amine form.

The process ventilation system is connected to a caustic scrubber followed by a carbon filter, to remove organic vapours before discharge to atmosphere.

1.2.4 Insecticides Plant

Liquid organophosphate insecticides, mostly based on chlorpyrifos, are blended and packaged for sale. The process ventilation system is connected to a sodium hypochlorite scrubber, in which chemical reactions between hypochlorite and compounds released from the process lead to the solubilisation of those compounds and their capture in the scrubber.

1.2.5 Granular Herbicides Plant

Granules, based on picloram, are formulated and packaged. Discharges are passed through a bag filter and absolute (high performance) filter before discharge.

1.2.6 Suspension Concentrates (Spinosad) Plant

Liquid spinosad-based insecticides are formulated and packaged. The process ventilation system passes through a bag filter and absolute filter before discharge.

1.2.7 High Temperature Incinerator

A high temperature incinerator provides for the thermal destruction of Company wastes. Materials to be combusted include all chemically contaminated clothing and production plant wastes. The liquids nozzle allows the burning of liquids such as wash water.

Emissions are controlled primarily by optimising the conditions of combustion, together with the proper design of the combustion chamber and stack.

1.2.8 Laboratories

Fumes from the laboratories are extracted either as general building ventilation air or through fume cupboard hoods. The quantities of chemicals involved are minute by comparison either with the formulating processes or with the amounts that would be handled by an end user of the Company's products.

1.2.9 Maintenance workshops

Activities carried out in the workshops, and periodically on site, include welding, painting, abrasive blasting, and other typical operations. Ventilation systems extract air from around particular process areas.

1.2.10 Product Development Laboratory

The building is used only infrequently, to trial process control or to produce small scale batches.

1.3 Resource consents

1.3.1 Water discharge permit

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 rule in a regional plan, or by national regulations.

Dow AgroSciences holds water discharge permit **4108-2** to cover the discharge of stormwater from its production site via retention dams, together with uncontaminated stormwater from landscape and non-manufacturing areas, into the Herekawe Stream. This permit was issued by the Taranaki Regional Council on 4 September 2008 under Section 87(e) of the RMA. It is due to expire on 1 June 2026.

Condition 1 requires the adoption of the best practicable option for controlling effects of discharges on the environment.

Condition 2 sets a maximum stormwater catchment area.

Condition 3 requires a management plan to prevent and to deal with spillage and accidental discharges.

Condition 4 addresses record keeping.

Condition 5 prohibits significant adverse effect on the environment.

Condition 6 imposes limits upon the discharge's significant potential contaminants.

Condition 7 is a general review provision.

The permit is attached to this report in Appendix I.

1.3.2 Air discharge permit

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.

Dow AgroSciences held two permits to discharge emissions to air during the 2014-2015 review period. Discharge permit **4020-3** expired and was replaced with discharge permit **4020-4**.

Dow AgroSciences held air discharge permit **4020** to cover the discharge of emissions from the manufacture of agrichemical products and associated processes.
This permit was issued by the Council on 12 June 1996 under Section 87(e) of the RMA. It expired on 1 June 2014, but remained in force while application for a new consent was being processed.

Conditions 1 and 2 require the adoption of the best practicable option for controlling effects of discharges on the environment, and that processes be operated to minimise discharges.

Condition 3 requires Dow AgroSciences to provide a report every 2 years on technological advances in reduction or mitigation of discharges to air, particularly dioxin, together with an inventory of discharges.

Condition 4 requires consultation with Council before any significant changes on the site.

Conditions 5 and 6 address the keeping of records and information relevant to process control, and to formulations on the site.

Conditions 7 and 8 impose limits on significant potential contaminants in discharges.

Condition 9 relates to monitoring.

Conditions 10 to 18 relate to an incinerator, imposing limits on visual effects and significant potential contaminants, placing controls on operating conditions, and requiring provision of records.

Condition 19 prohibits direct significant adverse ecological effects.

Condition 20 is a review provision.

Conditions 21 and 22 involve submitters and the local community in liaison meetings and the monitoring of odour.

Dow AgroSciences holds discharge permit **4020-4** to discharge contaminants to air from all activities associated with the current and future operation of an agrichemical formulation and packaging plant. This permit was issued by Council on 5 November 2014 under Section 87(e) of the RMA.

Condition 1 relates to the maintenance and operation of emission control equipment.

Condition 2 prohibits offensive or objectionable odour or dust beyond the site boundary.

Condition 3 sets limits on concentrations of contaminants, other than from the High Temperature Incinerator Stack, at ground level off-site.

Conditions 4 to 10 deal with the High Temperature Incinerator, imposing limits on significant potential contaminants, prohibiting incineration of certain materials, placing controls on operating conditions, and requiring records to be kept.

Condition 11 requires an air discharge management and monitoring plan.

Conditions 12 and 13 relate to the maintenance of a chemical materials register.

Condition 14 deals with air monitoring and response triggers (thresholds for Company actions in response to any elevated emission levels).

Condition 15 requires the annual provision of information on air quality monitoring, any changes in process or in emission controls, and any consultation undertaken.

Condition 16 requires a six-yearly report on investigations into and, where applicable, the adoption of new technology to reduce or mitigate emissions to air.

Condition 17 is a review provision.

The permits are attached to this report in Appendix I.

1.4 Monitoring programme: water

1.4.1 Introduction

Section 35 of the Resource Management Act sets out an obligation 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 Dow AgroSciences site consisted of six primary components.

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in on-going liaison with resource consent holders over consent conditions and their interpretation and application:

- in discussion over monitoring requirements
- preparation for any reviews
- renewals
- or 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 Dow AgroSciences site was visited four times during the monitoring period for scheduled visits. The main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. 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 Stormwater sampling

Stormwater is sampled and analysed for chemical and physical parameters before it is released. If the collected stormwater does not meet the release criteria, an application for approval is sought from New Plymouth District Council before it is pumped to the trade waste system.

Results of monitoring are reported by Dow AgroSciences to the Regional Council, and samples of stormwater are taken by the Council for comparative laboratory analysis. The stormwater discharge was sampled by Council on four occasions, and the samples sent to an independent laboratory (AsureQuality) for acid herbicides analysis and a multi-residue pesticide scan on each occasion and for glyphosate analysis once.

1.4.5 Groundwater monitoring

Dow AgroSciences conducts an on-going groundwater monitoring and modelling program, prepared in consultation with the Council, to assess the quality of groundwater beneath the site. Results are forwarded to the Council annually, while relevant matters are discussed as they arise. Shallow groundwater under the site flows under natural gradients north and west towards the coastal marine area, including the Sugar Loaf Islands (Nga Motu) Marine Protected Area.

To address the low-level contamination found through a past investigation, Dow AgroSciences developed a Site Groundwater Management Plan, which was received and agreed to by the Council during the 1996-1997 period and (updated) in 2001. Contaminants (phenoxies and chlorophenols) were initially detected at low levels and groundwater flow suggested that the contamination evident would pose no environmental risk and would reduce to levels below detection.

Dow AgroSciences fully evaluated the site and recommended a monitoring approach to ensure that, as predicted by modelling, no adverse environmental effects occur. The current monitoring approach adopted through the Site Groundwater Management Plan requires the Council to remain fully informed of the results. The approach enables the risk of effects on the environment to be assessed fully on an on-going basis, and appropriate action to be taken. The information available at this time suggests that no adverse environmental effects are likely and that the contaminants will fully degrade before migration from the site occurs.

In July 2008, the Council agreed to a change in the date of annual sample collection, from October to June-August, to coincide with maximum groundwater levels. This was in response to most of the monitoring wells being found dry in October 2007.

1.4.6 Freshwater biological surveys

The Council has a bio-monitoring programme to assess biological diversity and richness of the Herekawe Stream. Two surveys were conducted during the monitoring year to assess whether discharges from the Dow AgroSciences Paritutu Road site were having any environmental impact on the stream.

1.4.7 Foreshore marine ecology inspection

The Council carries out an annual marine ecology inspection on the Back Beach foreshore by the Dow AgroSciences Paritutu Road site to look for any evidence of a discharge from the Dow AgroSciences site (including any groundwater seeps) and to assess any environmental impact.

1.5 Monitoring programme: air emissions

1.5.1 Introduction

Section 35 of the Resource Management Act sets out an obligation for the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region.

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 air quality monitoring programme for the Dow AgroSciences site consisted of three primary components. One component, that of chemical emission sampling, was extended during the review period to meet requirements under the new air consent 4020-4 that was issued in November 2014.

1.5.2 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, or new consents, advice on the Council's environmental management strategies and the content of the air quality regional plan, and consultation on associated matters.

1.5.3 Site inspections

The Dow AgroSciences site was visited four times during the monitoring period. The main points of interest were 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.

As far as was practicable, inspection in relation to air emissions were integrated with inspections undertaken for other purposes e.g. stormwater discharges.

1.5.4 Chemical emission sampling

Air emissions from process vents and the High Temperature Incinerator stack were monitored to check for compliance with consent conditions. Since 2006-2007, Dow AgroSciences has implemented a policy that all air emission monitoring be undertaken by independent specialist environmental consultants. In 2014-2015, Source Testing New Zealand Ltd carried out and reported on the sampling and analysis of vent and stack emissions.

Process vents in the Insecticides Plant, Granules Herbicides Plant, Herbicides Plant and Commodity Herbicides Plant, and also the Suspension Concentrates Plant, were monitored under typical operating conditions.

The High Temperature Incinerator stack was monitored under typical operating conditions. The stack emissions were tested for dioxins and furans, hydrogen chloride and (voluntarily) particulate matter.

Under the Stack Emission Monitoring Plan that is attached to the Air Management and Monitoring Plan (ADMMP) required under consent 4020-4, the range of parameters tested for in the High Temperature Incinerator emissions was in May 2015 increased to include total halides, sulphur dioxide and metals.

2. Results

2.1 Water

2.1.1 Inspections

Stormwater from the production plants, dangerous goods storage compound, despatch store, incinerator and roads in these areas is collected in two retention pond systems. It is sampled and analysed for checking against release criteria. If the stormwater meets the release criteria, it is discharged to the Herekawe Stream. Stormwater which fails to meet the release criteria may be pumped to the trade waste system with approval from the New Plymouth District Council.

Stormwater from the southern part of the site drains directly to a New Plymouth District Council stormwater drain and then to the Herekawe Stream. This part of the site is predominantly an open grassed area surrounding a parking area, two storage buildings, the closed pilot plant and the access road to the site.

There are four stormwater retention ponds at the Paritutu Road site: SV9000, SV9100, SV9200 and SV8000. Stormwater from building roofs and roading is collected in SV9100 after treatment in separators to remove silt. SV9000 is used as an overflow retention pond. Stormwater from around the incinerator building and roadway is collected in SV9200, while stormwater from around the despatch and dangerous goods storage areas is collected in SV8000.

If stormwater does not meet the release criteria, Dow AgroSciences seeks to identify the source of the contaminant so corrective actions can be implemented to prevent a recurrence.

Officers of the Council carried out regular inspections of the site during the 2014-2015 monitoring period. The inspections included the storage of raw materials and product, the maintenance and housekeeping of process areas and roadways, the stormwater collection and retention systems, stormwater sampling and release records and inspections of the discharge point and receiving waters in the Herekawe Stream. Scheduled inspections were carried out on 5 August and 9 December 2014 and 11 March and 17 June 2015.

Notes from these visits are listed below. Records of production and incinerator operation were inspected and found to be satisfactory.

5 August 2014
The weather was fine and cloudy, with a blustery SW wind, following heavy rain two to three days before. The storm ponds and discharge to Herekawe Stream were sampled. The High Temperature Incinerator was down for annual maintenance, over about a week. The Commodity Herbicides Plant had been manufacturing 2,4-D ester for several weeks; the air scrubber record was satisfactory; the caustic solution had recently been changed. The Herbicides Plant large and small pack lines were operating. The Insecticides Plant was repacking Mycloss Xtra fungicide – there was noticeable chemical odour at the entrance to the building. A new product, Tordon 2G Gold, containing actives picloram and aminopyralid, was planned, and not expected to change emissions composition. Obsolete buildings 13 and 20 were due to be demolished by end of year, as previously advised, with specialists containing any asbestos. The ongoing air consent replacement process was discussed; also, changes

to the Company staff structure. Odour survey: a faint, fluctuating sweet chemical odour was noticed at the top of Paritutu Road. The Company was informed and took action by closing the Insecticides Plant roller door. Noticeable, not visible, domestic smoke odour was present at the bottom of Paritutu Road.

9 December 2014
The weather was fine with a light NW wind, after rain the previous day. The storm ponds and discharge to Herekawe Stream were sampled. The High Temperature Incinerator was operating, on a liquid burn, after solids earlier in the day. Temperature (high) and carbon monoxide (low) levels were satisfactory. The burn manifests for the last two days were inspected. The incinerator PLC was recently repaired and would be replaced in the next two years. The current incinerator monitoring programme would continue until the Air Discharge Monitoring and Management Plan (ADMMP) required under the new air consent was produced. Stack testing of the suspension concentrates and granulated herbicides plants had been carried out a month ago; insecticides plant testing was delayed until January to ensure sampling during production. Two obsolete buildings had been removed; capping their sites with concrete/asphalt, with drainage of stormwater to the holding dams, was planned. The Commodity Herbicides Plant was aminating MCPA, and had been esterifying 2,4-D recently; the caustic air scrubber was satisfactory. Odour survey: domestic fire smoke was visible at the bottom of Paritutu Road; otherwise, no odour was detected on the road circuit around the Dow AgroSciences plant.

11 March 2015
The weather was fine and bright, with thin high cloud and a light N wind, after rain four to five days before. The storm ponds were sampled, for inter-laboratory comparison, but not the discharge as testing by the Company had not been completed, and hence no discharge was occurring. The High Temperature Incinerator was burning general waste; temperature and oxygen limits were complied with; a new oxygen analyser was reported to be working well; the liquid waste store was greatly reduced. The Commodity Herbicides Plant was aminating clopyralid; both air scrubber records for February and March were satisfactory; stack testing was planned for the next week, during 2,4-D esterification. Odour survey: no odour from the Dow AgroSciences plant was detected; a small fire was occurring in a domestic yard at the corner of Ngamotu and Paritutu Roads with limited effect; fibre-optic cable was being laid along several roads, without dust generation.

12 June 2015
The weather was fine and bright with high thin cloud, after moderate rain over each of the last three days. The storm ponds and discharge to Herekawe Stream were sampled. The High Temperature Incinerator was undergoing routine maintenance; stack testing had recently been carried out, taking two weeks, longer than before as more testing is required under the new ADMMP, once per year. A slight odour of chlorine was noticed near the cooling tower, which was being cleaned. The Commodity Herbicides Plant had a new visual system at the control panel for monitoring processes; the air scrubber record was satisfactory. The new ADMMP was discussed. The Odour Register and Chemical Materials Register were inspected. Odour survey: no odour from the Dow AgroSciences plant was detected; there was slight noticeable, but not visible, domestic fire smoke at the corner of Herekawe Road/Rangitaike Drive.

2.1.2 Results of discharge monitoring

All stormwater collected in the four stormwater retention ponds is sampled and analysed by the Company prior to release. The samples are checked for the parameters controlled by consent 4108 - floatable and suspended materials, odour, colour and visual clarity, pH and the potential chemical contaminants phenoxy herbicides, organophosphates, triclopyr, picloram, glyphosate, and oxyfluorfen. During the 2014-2015 year, a total of 124 stormwater samples were collected and analysed by the Company. On all occasions, the release criteria were met.
The stormwater ponds are also sampled by the Regional Council for consent compliance checking and inter-laboratory comparison on four occasions each year. The Council's laboratory determines general water quality parameters, and an independent specialist laboratory (AsureQuality) is used to analyse for the organic constituents limited on the consent. In 2014-2015, sampling was undertaken by an officer from the Council with staff from Dow AgroSciences on 5 August and 9 December 2014, and 11 March and 17 June 2015.

The focus of monitoring continued to be on acid herbicides, in connection with the recommencement of esterification of 2,4-D and neutralisation of MCPA and 2,4-D with amines, rather than on organophosphorus pesticides, which had not been detected from monitoring over the previous decade.

The results of Council monitoring for 2014-2015 are presented in Table 1 and Table 2.

Table 1 Stormwater results for acid herbicides, glyphosate and pH in 2014-2015

Parameter	Maximum concentration detected (g/m^3 or mg/L)			
	SV8000 (n = 4)	SV9000* (n = 1)	SV9100 (n = 3)*	Maximum
2,4,5-T	0.00048	0.00055	0.0010	0.0010
2,4-D	0.0013	0.0031	0.00089	0.0031
2,4-DB	<0.0001	<0.0001	<0.0001	<0.0001
MCPA	0.00022	0.0026	0.00010	0.0026
MCPB	0.00014	0.00018	<0.0001	0.00018
Picloram	0.0015	0.0022	0.0070	0.0070
Triclopyr	0.0015	0.00034	0.0018	0.0018
Glyphosate	<0.001	-	<0.001	<0.001
pH (range)	6.8 – 8.8	7.1 – 8.9	7.1 – 7.2	6.8 – 8.9

* SV9000 was sampled on 5 August 2014 and 11 March 2015, as SV9100 was empty

Table 2 Stormwater results for pesticides in 2014-2015

Parameter	Maximum concentration detected (g/m^3 or mg/L)			
	SV8000 (n = 4)	SV9000 (n = 1)	SV9100 (n = 3)	Maximum
chlorpyrifos	<0.001	<0.001	<0.001	<0.001
chlorpyrifos-methyl	<0.001	<0.001	<0.001	<0.001
oxyfluorfen	<0.001	<0.001	<0.001	<0.001

A total of 255 pesticide residues were tested for (excluding acid herbicide compounds that were tested separately), at detection limits of 0.001 to 0.005 g/m^3. The list of residues determined is given in Appendix II.

A summary of the Company's results from inter-laboratory comparison exercises is presented in Table 3. The results indicate good agreement, and compliance with the conditions of the Company's stormwater discharge consent 4108, after mixing.

Table 3 Company stormwater results from 2014-2015 inter-laboratory comparisons

Consent Item	Consent limit	SV8000	SV9000	SV9100
Oil, floatables, suspended solids	None present	Pass	Pass	Pass
Objectionable odour	None present	Pass	Pass	Pass
Colour and visual clarity	No change	Pass	Pass	Pass
pH	6.0 – 9.0	7.4 – 8.4	7.4 – 7.8	7.3 – 7.5
Total phenoxy herbicides	0.10 mg/L	0.075*	0.075*	0.075*
Total organophosphates	0.0005 mg/L	0.0004**	0.0004**	0.0004**
Triclopyr	0.10mg/L	<0.05	<0.05	<0.05
Picloram	0.10mg/L	<0.05	<0.05	<0.05
Glyphosate	0.10mg/L	<0.00022	<0.00022	<0.00022
Oxyfluorfen	0.005mg/L	<0.0007	<0.0007 – 0.0007	<0.0007 – 0.0007

* none detected, assumes 2,4-D, MCPA and MCPB all present at half detection limit of 0.05 mg/L

** none detected, assumes chlorpyrifos and chlorpyrifos-methyl both present at half detection limit of 0.0004 mg/L

In September 2015, the Council received a stormwater report from Dow AgroSciences covering the period between July 2014 and June 2015. The report is attached as Appendix III.

The stormwater report summarises the monitoring and discharge data for the Dow AgroSciences site during the 2014-2015 monitoring period. It also details process management of stormwater and its release from site. As noted in the report, there were no changes to the stormwater system during 2014-2015.

2.1.3 Freshwater biological monitoring

Freshwater biological surveys were undertaken in the Herekawe Stream on 16 October 2014 and 20 February 2015. The surveys were both undertaken under low flow conditions. Copies of the full reports are attached as Appendix IV.

The surveys were undertaken using standard Council procedures and indicated that the streambed communities had not been significantly affected by stormwater discharges from the Dow AgroSciences site or other industrial sites in the vicinity.

2.1.4 Foreshore marine ecology inspections

A marine ecological inspection was undertaken of the intertidal area at Back Beach on 18 May 2015. A copy of the report is attached as Appendix V.

An intertidal reef area is present at the north eastern end of Back Beach at the base of Paritutu Rock. The outer landward edges of the reef are subject to fluctuating levels of sand, and during this inspection there was substantial build up at the top end of the reef. Further down the shore, rocks and boulders were exposed, but no cobbles present higher on the shore.

Two groundwater seeps were observed flowing down the cliffs to the south of Paritutu Rock. The groundwater had no noticeable odour. The seeps flowed across the beach and over the reef before reaching the sea. These flows did not appear to be deleteriously affecting the reefs, as abundant limpets and little back mussels were present close to the flows.

A diverse range of algae and animal species were present on the reef. From observations made during this inspection, the diversity of reef biota is typical to that seen at other local intertidal reefs in the Taranaki region.

2.2 Air

2.2.1 Inspections

Officers of the Council carried out regular inspections of the Dow AgroSciences Paritutu Road site during the 2014-2015 monitoring period. Scheduled inspections were undertaken on 5 August and 9 December 2014, and 11 March and 17 June 2015.

During each inspection a record was made of weather conditions prevailing at the time. An odour survey was carried out on the site boundary and around the surrounding neighbourhood. Some slight odours were detected during the routine inspections. The incinerator and its operating records were found to be in compliance with consent conditions during inspections. The vents on site were all visually checked for emissions during each inspection. At no time were any emissions noticed. A high standard of housekeeping in all areas of the site was noted at each inspection.

2.2.2 Company air emissions report

In September 2015, Council received an air emissions report from Dow AgroSciences covering the period from July 2014 to June 2015. The main body of this report is attached as Appendix VI – the appendices to the report are available from Council. The report addresses changes in plant processes, emission control technology, resource consent requirements, and emission monitoring. Process management of air emissions is described, and the results from monitoring of point source emissions (process vents and incinerator stack) produced. General aspects of air quality management are covered, including the ADMMP. The results of monitoring are summarised in sections 2.2.3 and 2.2.4 below.

2.2.3 Process vents

Monitoring of process vent emissions from the Insecticides Plant, Suspension Concentrates Plant, Granule Herbicides Plant, Herbicides Plant and Commodity Herbicides Plant was carried out by independent specialist Source Testing New Zealand Ltd (STNZ). Emissions were sampled by STNZ using international standard methods where applicable, and analysed by an IANZ accredited laboratory.

The monitoring was undertaken in accordance with the Stack Emission Monitoring Plan attached to the ADMMP.

Samplings were timed and conducted to provide data representative of the various production and formulation processes. The emission components monitored were either active ingredients (chlorpyrifos, spinetoram, picloram, 2,4-D acid or ester) of products under formulation, or reactants (2-ethyl hexanol, 2,4-D acid/ester) in the 2,4-D esterification and neutralisation processes.

A summary of the emission test results and associated information is presented in Table 4.

Table 4 Summary of process vent emission monitoring results, 2014-2015

Plant	Vent	Emission component	No	Sampling period	Concentration* µg/m³	Emission limit**	
						µg/m³	%
Insecticides	03-5	Chlorpyrifos	3	13-14 Jan 2015	<0.8 - <2.3	132,240	<0.002
Suspension Concentrates	BB600	Spinetoram	3	11-13 Nov 2014	<2 - <4	3,078,000	<0.0002
Granulated Herbicides	03-14	Picloram	3	13-14 Nov 2014	<0.07 - 0.49	24,624,000	0.000002
Herbicides	03-8	Total 2,4-D (acid and ester)	3	8-9 Jun 2015	<0.3 – <0.4	214,000	<0.0002
Commodity Herbicides	48-1	Total 2,4-D (acid and ester)	3	18-20 Mar 2015	0.5 – 1.9	58,000	0.003
		2-ethyl hexanol	3	19-20 Mar 2015	200	4,640,000	0.004

* all data corrected to 0˚C, one atmosphere, dry gas basis

** limits for emission component concentrations derived from Schedules 1 and 3 attached to consent 4020-4

Condition 3 on new consent 4020-4 requires that the discharge of contaminants to air, other than from the High Temperature Incinerator Stack, shall be controlled to ensure that the maximum ground-level concentrations off site do not exceed air quality limits listed in Schedule 1 to the consent, using the following formula:

Maximum stack concentration (µg/m³) = air quality limit (µg/m³) x Dilution Factor

where the Dilution Factor is taken from the table in Schedule 3 to the consent, based on worst-case predictions from air dispersion modelling of the dilution of contaminants with ambient air between each process plant stack and ground level at the site boundary.

During 2014-2015, the air quality limits all related to existing compounds (as no new compounds were introduced), on the basis of annual average concentrations.

Table 4 presents the emission component concentrations as a percentage of the relevant maximum stack concentrations that are allowed. The highest emission concentration measured was 0.004% of the respective limit, for 2-ethylhexanol from the Commodity Herbicides Plant stack, that is, a factor of 23,000 below the limit.

It is noted that additional monitoring was carried out on the Commodity Herbicides Plant vent in April 2006, to verify that dioxins were not being generated from the 2,4-D esterification process. The maximum reported value for dioxins and furans was 0.00399 ng(TEQ)/m³, which is well within the range of field blank data from previous testing of the High Temperature Incinerator, that is, not measurably different from ambient air levels. As dioxins/furans are not created as part of the 2,4-D esterification or neutralisation processes, future monitoring is not required.
In comparison, the consent limit on average concentration for the High Temperature Incinerator stack is 0.1 ng(TEQ)/m³ (see section 2.2.4.1).

2.2.3.1 Multiple sources

Where multiple sources of an individual contaminant are involved, individual stack concentrations for that contaminant will be determined to ensure the air quality limit is complied with on a cumulative basis. (Schedule 3, consent 4020-4).

In 2014-2015, this requirement applied to Total 2,4-D (acid and esters), which was emitted from both the Herbicides Stack and the Commodity Herbicides Stack. The calculated boundary concentrations of Total 2,4-D from testing of emissions from the two stacks under normal operating conditions on separate occasions are given in Table 5. Maximum measured stack concentrations are used.

Table 5 Calculated concentration of Total 2,4-D outside site boundary

Vent	Maximum Stack Concentration µg/m³	Dilution factor from Schedule 3	Calculated boundary concentration µg/m³
Commodity Herbicides Plant	2	29,000	0.000069
Herbicides Plant	<0.4	107,000	<0.0000037
Total			**0.000073**

The calculated cumulative maximum Total 2,4-D (acid and ester) concentration beyond the boundary of the site was 0.000073 µg/m³. This is 0.004% of the air quality limit on consent 4020-4 of 2 µg/m³ for Total 2,4-D.

2.2.4 High Temperature Incinerator

Conditions on Dow AgroSciences's air discharge permit 4020-3 placed limits on the discharge of dioxins/furans and of hydrogen chloride from the High Temperature Incinerator. New discharge permit 4020-4 retained the concentration limit on dioxins/furans, and changed the mass discharge limit for hydrogen chloride (HCl) to include total halides (HF, HCl and HBr).

Under the Stack Emission Monitoring Plan, discharges from the High Temperature Incinerator stack shall also be monitored annually for particulates, sulphur dioxide and metals.

Monitoring for each type of emission component was carried out during the 2014-2015 period.

2.2.4.1 Dioxins and furans

Special condition 4 on Dow AgroSciences' air discharge consent 4020-4 states that the total concentration of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) from the High Temperature Incinerator Stack shall not exceed 0.1 nanograms per cubic metre (adjusted to 0 degrees Celsius, dry gas basis, 101.3 kPa pressure and 11% oxygen) when calculated as total toxic equivalents using World Health Organization 2005 toxic equivalence factors. Compliance shall be determined based on the average of not less than three samples, each of which shall be taken while the incinerator is fed on different waste types. (Advice Note 3).

Monitoring of the incinerator for dioxin/furan emissions was carried out by independent specialist STNZ using the revised sampling method that was developed in 2007. (A modification was made to the USEPA Method 23 sampling train, in order to lower the detection limit for dioxins/furans). The sampling programme was carried out with separate monitoring of crushed drums, liquid waste and general waste incineration. The amount of crushed drums was double that normally

processed to ensure suitable sample volume. The sampling periods were all four hours.

Testing during incineration of all three waste types occurred on 27 to 29 May 2015. A summary of the results is presented in Table 6.

Table 6 High Temperature Incinerator PCDD/PCDF monitoring results, 2014-2015

Date	Waste type	PCDD/PCDF Concentration (ng/m³ Total WHO-TEQ Upper Bound, not corrected for laboratory blank)	PCDD/PCDF Emission rate (ng/h Total WHO-TEQ Upper Bound, not corrected for laboratory blank)
		Total WHO-TEQ	Total WHO-TEQ
May 2015	Laboratory blank	0.00476	14.4
27 May 2015	Crushed drums	0.0104	33.6
28 May 2015	General waste	0.00697	21.4
29 May 2015	Liquid waste	0.00556	15.5
Average		**0.00764**	**23.5**
Consent limit		**0.1**	

Key
PCDD polychlorinated dibenzodioxins
PCDF polychlorinated dibenzofurans
ng/m³ nanogrammes per cubic metre, adjusted to 0°C, 101.3 kPa, 11% oxygen, dry gas basis
ng/h nanogrammes per hour
WHO-TEQ World Health Organisation – Total Toxic Equivalence

Results are presented in terms of WHO 2005 toxic equivalence factors. Maximum upper bound values are reported, for PCDD/PCDF concentration and emission rate, together with the analytical laboratory blank value.

The average concentration value for the three sampling runs, of 0.00764 ng/m³ WHO-TEQ is less than the limit of 0.1 ng/m³ on consent 4020, by a factor of about 13.

The maximum mass emission rate value for the three sampling runs was 33.6 ng/h WHO-TEQ.

These are highly conservative values, given that no correction is made for the laboratory blank, and that upper bound analytical values are used. The revised sampling method has lowered the detection limits for individual PCDD/PCDF cogeners to the extent that total toxic equivalence (TEQ) for the laboratory blank has become similar to that for the test samples.

2.2.4.2 Total halides (HF, HCl, HBr)

Special condition 5 on consent 4020-4 limits the discharge of total halides from the High Temperature Incinerator Stack to 1.5 kilograms/hour.

Testing for hydrogen fluoride (HF), hydrogen chloride (HCl) and hydrogen bromide (HBr) was done on 26 May 2015. Two-hour samples were collected during a normal burn of crushed drums, liquid waste and general waste. The results are presented in Table 7.

Table 7 High Temperature Incinerator HF, HCl, HBr and Total Halide monitoring results, 2014-2015

Date	Waste type	Concentration mg/m³				Emission rate kg/h			
		HF	HCl	HBr	Total	HF	HCl	HBr	Total
26 May 2015	Crushed drums	15.2	136	<0.01	152	0.0497	0.446	<0.00005	0.495
25 May 2015	General waste	0.80	12.8	<0.02	13.6	0.0025	0.0405	<0.00005	0.0431
25 May 2015	Liquid waste	0.44	5.62	<0.01	6.07	0.0014	0.0179	<0.00005	0.0194
Consent Limit									**1.5**

Key mg/m³ milligrammes per cubic metre, adjusted to 0 degrees Celsius, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/h kilogrammes per hour

The results of the total halide monitoring performed showed that the mass emission rate complied with the maximum limit of 1.5 kg/h, and ranged from 0.0194 to 0.495 kg/h. Bromide concentrations were non-detectable at <0.02 mg/m³ for all samples.

2.2.4.3 Particulate matter

Testing for particulate matter was done on 26 May 2015. Two-hour samples were collected during a normal intermittent burn of crushed drums, general waste and liquid waste. The results are presented in Table 8.

Table 8 High Temperature Incinerator particulate matter monitoring results, 2014-2015

Date	Waste type	Particulate matter Concentration mg/m³	Particulate matter Emission rate kg/h
26 May 2015	Crushed drums	21.3	0.070
26 May 2015	General waste	6.0	0.019
26 May 2015	Liquid waste	24.8	0.079

Key mg/m³ milligrammes per cubic metre, adjusted to 0 degrees Celsius, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/h kilogrammes per hour

The results for particulate matter monitoring performed showed that the mass emission rate ranged from 0.019 to 0.079 kg/h. There is no limit within the consent on mass emission rate of particulate, or on particulate concentration.

2.2.4.4 Sulphur dioxide

Testing for Sulphur dioxide was done on 4 June 2015. One-to-two-hour samples were collected during a normal intermittent burn of crushed drums, general waste and liquid waste. The results are presented in Table 9.

Table 9: High Temperature Incinerator sulphur dioxide monitoring results, 2014-2015

Date	Waste type	Total Sulphur Dioxide Concentration mg/m³	Total Sulphur Dioxide Emission rate kg/h
4 June 2015	Crushed drums	<0.4	<0.001
4 June 2015	General waste	1.3	0.0035
5 June 2015	Liquid waste	1.3	0.0037

Key mg/m³ milligrammes per cubic metre, adjusted to 0 degrees Celsius, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/h kilogrammes per hour

The results for sulphur dioxide monitoring performed showed that the mass emission rate ranged from <0.001 to 0.0037 kg/h. There is no limit with the consent on mass emission rate of sulphur dioxide.

2.2.4.5 Metals

Testing for metals was done on 8 and 9 July 2015. Two-hour samples were collected during a normal intermittent burn of crushed drums, general waste and liquid waste. The results are presented in Table 10.

Table 10: High Temperature Incinerator metals monitoring results, 2014-2015

Metal	Discharge Concentration mg/m³		Emission rate g/h	
	Range	Average	Range	Average
Aluminium	0.0268 – 0.0503	0.354	0.0673 – 0.165	0.103
Antimony	0.0004 – 0.0057	0.0024	0.0010 – 0.144	0.0063
Arsenic	0.0014 – 0.0040	0.0023	0.0036 – 0.130	0.0068
Boron	0.0236 – 0.184	0.124	0.0626 – 0.533	0.353
Cadmium	0.0003 – 0.0009	0.0005	0.0007 – 0.0030	0.0016
Chromium	0.0027 – 0.0043	0.0034	0.0067 – 0.0114	0.0094
Cobalt	<0.0003	<0.0003	<0.0008	<0.0008
Copper	0.0085 – 0.0553	0.0250	0.0226 – 0.181	0.0773
Iron	<0.037 – 0.619	0.246	<0.093 – 2.03	0.779
Lead	0.0085 – 0.151	0.0590	0.0226 – 0.494	0.187
Lithium	0.0017 – 0.0024	0.0020	0.0042 – 0.0064	0.0056
Manganese	0.0065 – 0.0434	0.0197	0.0162 – 0.115	0.0539
Mercury	<0.0007	<0.0007	<0.0020	<0.0020
Molybdenum	0.0016 – 0.0442	0.0162	0.0043 – 0.145	0.0521
Nickel	0.0013 – 0.0065	0.0032	0.0032 – 0.0173	0.0087
Tin	0.0013 – 0.0124	0.0055	0.0034 – 0.0405	0.0171
Vanadium	<0.0019 – 0.0022	0.0020	<0.0063 – 0.0058	0.0057
Zinc	0.107 – 0.545	0.265	0.284 – 1.78	0.809

Key mg/m³ milligrammes per cubic metre, adjusted to 0 degrees Celsius, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
g/h grammes per hour

These results are similar (where comparison is possible) to those found from the metals testing of incinerator emissions that was carried out in March 2013 as part of the assessment of environmental effects for the replacement of consent 4020-3. There is no limit on consent 4020-4 on mass emission rate of metals.

2.2.5 Community consultation

The Company was required by the conditions of the old air consent 4020-3 to hold a public meeting at least annually. There is no specific requirement under the new consent 4020-4 for community consultation, other than that the annual report required under condition 15 shall provide a description of any consultation undertaken and any views put forward by those consulted.

The application for replacement of the air consent was publicly notified in November 2013, following wide community consultation by the Company. One submission was received, from Taranaki District Health Board, and a new consent was issued in November 2014.

No further community consultation was reported in the Air Discharge Annual Report that was produced for the 2014-2015 review period.

2.2.6 Groundwater monitoring

Field investigations into possible groundwater contamination at the site were commenced by Dow AgroSciences in 1993 and concluded in 1996. The site investigation identified two locations where soil and/or groundwater have been impacted by phenoxy herbicides and chlorophenols.

For a history of groundwater monitoring see 'Dow AgroSciences (NZ) Ltd, Monitoring Program Annual Report 2002-2003' Technical Report 2003-72.

In September 2015, the Council received a groundwater management report from Dow AgroSciences covering the period between July 2014 and June 2015 (Appendix VI). The report is based on the results of the groundwater sampling round undertaken in August 2014 by consultant ERM New Zealand Limited.

All 28 existing monitoring wells (five shallow and 23 deep) had been gauged on 6 May 2010 to assess groundwater levels, water column and silt build-up thickness. Groundwater sampling of the seven Groundwater Monitoring Plan wells was carried out between 11 and 13 August 2014 using in-well bladder pumps in accordance with "Low Flow Sampling Methodology".

The results of chlorophenol and phenoxy acid analysis are listed in Table 11.

Table 11 Groundwater monitoring results, August 2014

Well identification No	Phenoxy Herbicides concentration (µg/L)	Chlorophenol concentration (µg/L)
Shallow perimeter wells		
1	ND	ND
21	ND	ND
Deep Perimeter wells		
20	≤0.37	ND
32	NS	NS
41	≤0.17	ND
42	≤0.24	≤0.27
47	NS	NS
Additional non-perimeter wells		
39J	NS	NS
46A	1.28	≤0.44
Trigger levels	50,000	10,000

Phenoxy herbicides [2,4-D; 2,4,5-T; MCPA; MCPB]

Chlorophenols [2,4-DCP; 2,4,5-TCP; 2,4,6-TCP; PCOC]

ND = below laboratory reporting limits (<0.16 µg/L for phenoxy acids and <0.2µg/L for chlorophenols)

NS = not sampled due to either being unsuitable for sampling or not meeting sampling requirements

No phenoxy acid or chlorophenol was detected in either of the shallow perimeter wells (1 and 21).

Of the five deep perimeter wells routinely monitored, two (32 and 47) were not sampled as there was insufficient water within the well. Phenoxy herbicides were detected at three of the deep perimeter wells, at wells 20, 41 and 42 on the northern boundary, at ≤0.37, ≤0.17 and ≤0.24 µg/L, respectively, significantly below the action level of 50,000 µg/L. Chlorophenols were detected at one deep perimeter well, at well 42 on the northern, at ≤0.27 µg/L, significantly below the action level of 10,000 µg/L.

Of the two non-perimeter wells normally monitored, well 39J was not sampled as there was insufficient water within the well. Well 46A, drilled into the andesite south of the stormwater pond, showed low levels of phenoxy herbicides, at 1.28 µg/L, and of chlorophenols, at ≤0.44 µg/L.

Total phenoxy acid herbicide and total chlorophenol concentrations have not exceeded the Groundwater Management Plan trigger levels since sampling rounds began in 1993, and if detected, concentrations typically continue to show a decreasing trend.

Wells 20, 32, 39J, 41 and 47 were redeveloped in August 2013 to provide more reliable groundwater levels for low flow sampling techniques, and to free up the dedicated sampling pump in well 20.

The five-yearly survey of all 28 monitoring wells is next due in 2015-2016.

2.2.7 Technical review report

Special condition 18 on consent 4020-4 requires that:

No later than 30 April 2020 and every six years thereafter, the consent holder shall provide to the Chief Executive, Taranaki Regional Council, a written report which includes:

(a) A review of any relevant technological advances in the reduction or mitigation of discharge to air from the site activities, and the costs and benefits of these advances;

(b) A summary concluding which air discharge and treatment methods will be operated onsite and why; and

(c) A description of any significant changes in air quality assessment methodology since the previous reporting period (including computer modelling techniques and the associated dilution factors set out in Schedule 3) that are likely to materially affect the assessment of environmental effects of the activities authorized by this consent.

It is noted that the assessment of environmental effects that was undertaken in support of the application lodged in November 2013 for replacement of air discharge permit 4020-3 included a comprehensive review of technological advances relevant to the reduction or mitigation of discharges to air from the Paritutu site, and an assessment of issues relevant to the minimisation or mitigation of discharges to air from the site.

The first report under condition 18 is due by 30 April 2020.

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 causes 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 not required to undertake significant additional investigations and interventions, or record incidents, in association with Dow AgroSciences' conditions in resource consents or provisions in Regional Plans.

3. Discussion

3.1 Discussion of site performance

In general, from the inspections of Dow AgroSciences's site and from discussions held with Dow AgroSciences staff, Council officers have concluded that the Company has a comprehensive, carefully documented and well considered approach to all areas of environmental performance. This included written methods for process management and technical control, documentation of processes and emissions, a self monitoring programme implemented by the Company and regular provision of information to the Council. Staff are assigned particular areas of responsibility, so that familiarity and experience are gained. All major air emissions sources have appropriate treatment systems and in most cases general building ventilation is also extracted through similar treatment systems.

One process change was made in 2014-2015. A new product was formulated in the Granulated Herbicides Plant using existing additives, Tordon™ 2G Gold Herbicide.

The Air Discharge Management and Monitoring Plan (ADMMP) required under the new air consent 4020-4 was produced within the timeframe specified, and approved. Additional monitoring of the High Temperature Incinerator emissions was carried out as required under the Stack Emission Monitoring Plan attached to the ADMMP.

Upon application of the "process for relating stack concentrations to air quality limits" as prescibed in Schedule 3 to the new air consent 4020-4, the discharge of contaminants to air was found to be controlled so that ground-level concentrations off-site did not exceed the relevant air quality limits.

The annual report on air emission monitoring was produced as required under consent 4020-4. Compliance with the consent conditions was demonstrated.

The annual report on stormwater discharge monitoring was produced as required under consent 4108-2. Compliance with the consent conditions was demonstrated.

The annual groundwater management report was produced as agreed in the Site Groundwater Management Plan. All groundwater samples from the perimeter wells were found to be significantly below the contaminant action levels.

3.2 Environmental effects of exercise of water permit

Environmental investigations, including biomonitoring of the Herekawe Stream, found no cause for concern over the effects of the discharge of stormwater from the site, or from groundwater from beneath the site.

3.3 Environmental effects of exercise of air discharge permit

The results of emission testing on various plant processes indicate that there is no potential health effect from the primary contaminants discharged from the site, according to recognised guidelines.

3.4 Environmental effects of groundwater movement

Monitoring of groundwater quality beneath the site has confirmed modelling that predicts that historical groundwater contamination at two points beneath the site would not result in any off-site effects, nor detection at the limits of detection used by the Company for its routine monitoring.

3.5 Evaluation of performance

A tabular summary of the Company's compliance record for the year under review is set out in Table 12 to Table 14.

Table 12 Summary of performance for Consent 4108-2

Purpose: *To discharge stormwater from an industrial agrichemical manufacturing site via retention dams together with uncontaminated stormwater from landscape and non-manufacturing areas into the Herekawe Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practicable option	Checking that standard operating procedures to achieve compliance with consent conditions are followed	Yes
2. Stormwater catchment area not to be exceeded	Inspections of plant site	Yes
3. Provision of stormwater management plan	Revised plan received 14 November 2014 and approved by Council	Yes
4. Keeping of discharge records	Inspection by Council and annual report by Dow AgroSciences, received on 21 September 2015	Yes
5. Controls on effect of discharge in receiving water	Inspections, chemical sampling and biomonitoring	Yes
6. Concentration limits upon potential contaminants in discharge	Chemical sampling by Dow AgroSciences with checking by Council	Yes
7. Optional review of consent	Next review date June 2020	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**

Table 13 Summary of performance for Consent 4020-3

Purpose: *To discharge emissions into the air from the manufacture of agrichemical products and associated processes at an agrichemical manufacturing complex*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practicable option	Checking that standard operating procedures to achieve compliance with consent conditions are followed	Yes
2. Minimise discharges	Checking that standard operating procedures to achieve compliance with consent conditions are followed	Yes
3. Biennial report on technological advances in emission reduction	Report received 5 November 2012. No further report required, while consent replacement investigations underway	Yes
4. Notification of plant changes	Liaison and plant inspection. No plant changes made, other than move to two-shift operation	Yes

Purpose: *To discharge emissions into the air from the manufacture of agrichemical products and associated processes at an agrichemical manufacturing complex*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
5. Provision of process control records	Site inspection and provision of annual report by Dow AgroSciences	Yes
6. Provision of formulations details	Site inspection and provision of annual report by Dow AgroSciences	Yes
7. Limits on specific emission components	Continuous monitoring of High Temperature Incinerator by Dow AgroSciences	Yes
8. Limits on general emission components	Discrete sampling of process vents by independent agent	Yes
9. Monitoring exercise of consent	Inspection by Council, continuous monitoring and recording of processes, formulations and emissions by Dow AgroSciences, and independent testing of emissions and effects	Yes
10. Limit on visual effects	Inspection by Council	Yes
11. Limit on hydrogen chloride	Incinerator stack testing by independent agent	Yes
12. Limit on dioxins and furans	Incinerator stack testing by independent agent. More sensitive method developed	Yes
13. Incinerator monitoring records	Inspection by Council and annual report by Dow AgroSciences	Yes
14. Incinerator loading and weather records	Inspection by Council and annual report by Dow AgroSciences	Yes
15. Incinerator oxygen concentration	Continuous monitoring by Dow AgroSciences	Yes
16. Incinerator temperature	Continuous monitoring by Dow AgroSciences	Yes
17. Incinerated liquids halogen limit	Monitored by Dow AgroSciences	Yes
18. Incinerator exhaust temperature	Continuous monitoring by Dow AgroSciences	Yes
19. Ecological effects	Inspection by Council and observation of vegetation	Yes
20. Optional review of consent	Option not available	N/A
21. Liaison with submitters and local community	Liaison made during consent replacement process.	Yes
22. Odour monitoring programme	Inspection by Council and liaison with local community	Yes
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**

Table 14 Summary of performance for Consent 4020-4

Purpose: *To discharge contaminants to air from all activities associated with the current and future operation of an agrichemical formulation and packaging plant*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Maintenance and operation of emission control equipment	Monitoring of activity as necessary by Council Officers and review of the ADMP required by condition 11	Yes

Purpose: *To discharge contaminants to air from all activities associated with the current and future operation of an agrichemical formulation and packaging plant*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
2. Prohibition of offensive odour or dust beyond boundary	Monitoring of activity in accordance with 'FIDOL' technique, as necessary by qualified Council officers	Yes
3. Limits on contaminants, other than from incinerator, beyond site	Testing as detailed in ADMMP	Yes
4. Limit on specific incinerator emission components concentration	Testing as detailed in ADMMP	Yes
5. Limit on specific incinerator emission components mass discharge rate	Testing as detailed in ADMMP	Yes
6. No incineration of certain materials	Inspection by Council, monitoring and recording of processes by Dow AgroSciences	Yes
7. Incinerator monitoring record keeping	Inspection by Council and Annual Report by Dow AgroSciences	Yes
8. Incinerator oxygen concentration	Continuous monitoring by Dow AgroSciences	Yes
9. Incinerator secondary chamber temperature	Continuous monitoring by Dow AgroSciences	Yes
10. Incinerator exhaust gas temperature	Continuous monitoring by Dow AgroSciences	Yes
11. Air Discharge Management and Monitoring Plan	Deadlines for submission are met, and Plan certified by Council. Assessment of implementation at inspection by Council Officers. Draft Plan received 29 January 2015; amended Plan received 28 April 2015, which was approved with minor modification.	Yes
12. Maintenance of Chemical Materials Register for current use	Review of records received by Council	Yes
13. Introduction of new items to Chemical Materials Register	Review of records received by Council	Yes
14. Air monitoring and triggers	Notification received by Council	Yes
15. Annual report on monitoring results, process change, and consultation	Receipt of report by Council. Report received 21 September 2015.	Yes
16. Six-yearly report on technological advances in emission reduction	Receipt of report by Council	N/A
17. Optional review of consent	Next review date June 2020	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administration performance in respect of this consent		**High**

During the year, the Company demonstrated a high level of environmental and high level of administrative performance with the resource consents as defined in Section 1.1.4.

3.6 Recommendations from the 2013-2014 Annual Report

In the 2013-2014 Annual Report, it was recommended:

1. THAT monitoring of air emissions from Dow AgroSciences in the 2014-2015 year continue at the same level as in 2013-2014.
2. THAT monitoring of water discharges from Dow AgroSciences in the 2014-2015 year continue at the same level as in 2013-2014.

These recommendations were implemented in the 2014-2015 year in full.

3.7 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, the obligations of the Act in terms of monitoring emissions/discharges and effects, and subsequently reporting to the regional community, 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.

In the case of Dow AgroSciences, the stormwater discharge monitoring programme for 2014-2015 was essentially unchanged from that for 2013-2014 by Dow AgroSciences, on the grounds that Dow AgroSciences had maintained a high level of environmental performance and the existing monitoring program was adequate to provide sufficient data to assess environmental performance.

For air discharge monitoring, changes were made to stack emission testing for the High Temperature Incinerator, following implementation in May 2015 of the Stack Emission Monitoring Plan attached to the Air Discharges Management and Monitoring Plan that is required under new air discharge permit 4020-4. The changes comprised additional annual monitoring, for total halides (instead of hydrogen chloride), sulphur dioxide and metals.

It is now proposed that for 2015-2016, the programme be maintained at the same level as the amended programme for 2014-2015.

Recommendations to this effect are attached to this report.

3.8 Exercise of optional review of consent

Neither of the consents held for operation of the Paritutu agrichemical plant provides for an optional review of the consent in June 2016.

4. Recommendations

1. THAT monitoring of air emissions from Dow AgroSciences in the 2015-2016 year continue at the same level as the amended programme in 2014-2015.
2. THAT monitoring of water discharges from Dow AgroSciences in the 2015-2016 year continue at the same level as in 2014-2015.

Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report:

2,4-D	2,4 di-chloro-phenoxy-acetic acid, a herbicide
2,4-DB	2,4 di-chloro-phenoxy-butanoic acid, a herbicide
2,4,5-T	2,4,5 tri-chloro-phenoxy-acetic acid, a herbicide
AEE	Assessment of environmental effects
AMMP	Air Discharge Management and Monitoring Plan
biomonitoring	Assessing the health of the environment using aquatic organisms
bund	A wall around a tank to contain its contents in case of a leak
Condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20˚C and expressed in mS/m
DMA	Dimethylamine
DMEA	Dimethylethanolamine
Dioxins	See PCDD
g/m^3	Grammes per cubic metre, and equivalent to milligrammes per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures
IPA	Isopropylamine
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 lest 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
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
MCPA	Methyl-chloro-phenoxy-acetic acid, a herbicide
MCPB	Methyl-chloro-phenoxy-butanoic acid, a herbicide
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.
ng/m^3	Nanogrammes per cubic metre
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water
PCDD	Polychlorinated dibenzo-para-dioxins, a contaminant of phenoxy herbicides
PCDF	Polychlorinated dibenzofurans, a contaminant of phenoxy herbicides

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 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
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
SQMCI	Semi-quantitative macroinvertebrate community index;
TCP	Tri-chloro-phenol
Temp	Temperature, measured in °C (degrees Celsius)
Turb	Turbidity, expressed in NTU
µg/m^3	Micrograms per cubic metre
UI	Unauthorised Incident

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

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Appendix I

Resource consents held by Dow AgroSciences (NZ) Ltd

(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:	Dow AgroSciences (NZ) Limited Private Bag 2017 NEW PLYMOUTH
Change To Conditions Date:	11 November 2005 [Granted: 12 June 1996]

Conditions of Consent

Consent Granted:	To discharge emissions into the air from the manufacture of agrichemical products and associated processes at an agrichemical manufacturing complex at or about GR: P19:987-374
Expiry Date:	1 June 2014
Review Date(s):	June 1998, June 2000, June 2002, June 2004, June 2006, June 2008, June 2010, June 2012
Site Location:	89 Paritutu Road, New Plymouth
Legal Description:	Lot 1 DP 10018 Lots 1 & 2 DP 9829 Lot 1 DP 9022 Lot 3 DP 8465 Blk IV Paritutu SD
Catchment:	Herekawe

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

Conditions 1 to 11 – unchanged

1. The consent holder shall at all times adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment associated with the discharges into the air from the site. 'Best practicable option' shall be determined by the Taranaki Regional Council, taking into account the information supplied by the consent holder under condition 3 of this consent, and following review as set out under condition 20 of this consent.

2. The consent holder shall at all times operate, maintain, supervise, monitor and control all processes so that discharges authorised by this consent are maintained at a practicable minimum.

3. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 30 June 1998 and every two years thereafter, a written report:

(a) reviewing technological advances relevant to the reduction or mitigation of any discharge to air from the site, particularly but without limitation discharges of dioxin, how these might be applicable and / or implemented at the site, and the benefits and costs of these advances;

(b) assessing any other issue relevant to the minimisation or mitigation of discharges to air from the site that the Chief Executive, Taranaki Regional Council, considers should be included; and

(c) detailing any inventory of discharges to air from the site of such contaminants as the Chief Executive, Taranaki Regional Council, may from time to time specify following consultation with the consent holder.

4. Prior to undertaking any alteration to the plant, process, or operations as they were specified in the application and supporting documentation lodged with the Taranaki Regional Council for this consent, which may significantly change the nature or quantity of contaminants discharged to air from the site, the consent holder shall consult with the Chief Executive, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.

5. The consent holder shall keep and make available to the Chief Executive, Taranaki Regional Council, upon request, all process control records relevant to air quality, air monitoring data, and documentation of air monitoring programmes, for a period of six months.

6. The consent holder shall keep and make available to the Chief Executive, Taranaki Regional Council, upon request, details of all formulations received, prepared, stored, mixed or otherwise processed on the premises, including but not limited to material safety data sheets and toxicological information and environmental fate information as contained in the agrochemical registration information. The information specific to any formulation shall be retained for a period of six months after that formulation is last processed.

7. The consent holder shall control all discharges of sulphur dioxide, carbon monoxide and nitrogen dioxide, in order that the maximum ground level concentrations of each of these contaminants shall satisfy the guideline values set out in Table 1 of 'Ambient Air Quality Guidelines', July 1994, Ministry for the Environment, when measured as specified in that document. Should the ambient concentration of any contaminant be found to exceed its relevant guideline value, this consent may be reviewed under condition 20.

8. The consent holder shall control all discharges, other than of carbon dioxide or as in condition 7 and 12, so as to ensure that the maximum ground level concentration for any particular contaminant at or beyond the boundary of the site is not increased above background levels:

> by more than 1/30th of the relevant Occupational Threshold Value -- Time Weighted Average for any eight-hour period of measurement, or by any more than the Short Term Exposure Limit for any fifteen-minute period of measurement, or, if no Short Term Exposure Limit is set, by more than three times the Time Weighted Average for any fifteen-minute period of measurement. [Workplace Exposure Standards and Biological Exposure Indices for New Zealand, 1992, Department of Labour].

9. The exercise and the effects of the exercise of this consent shall be monitored to the satisfaction of the Chief Executive, Taranaki Regional Council.

10. The opacity of discharges from the incinerator stacks shall not exceed 20%.

11. The discharge of hydrogen chloride from the incinerator stacks shall not exceed 1.5 kg/hour in aggregate.

Condition 12 – changed

12. The discharge of polychlorinated dibenzodioxins and polychlorinated dibenzofurans from any incinerator stack shall not exceed an average concentration of 0.1 ng/m^3 [adjusted to 0 degrees Celsius, dry gas basis, 101.3 kPa pressure, and 11% oxygen], nor a mass discharge rate of 5.0 µg/hour, when expressed as the equivalent amount of 2,3,7,8 tetrachloro dibenzo-p-dioxin according to NATO toxic equivalent factors. The average concentration shall be determined over not less than 3 sampling runs within any 12-month period, each of which shall be taken while the incinerator is fed on different waste types unless specifically approved otherwise by the Chief Executive, Taranaki Regional Council.

Conditions 13 to 22 – unchanged

13. Without restriction or limitation to conditions 5 or 9, the consent holder shall monitor and record, and make available to the Chief Executive, Taranaki Regional Council, upon request, the following operating parameters on the solid incinerator on a continuous basis:

    (a) oxygen concentration within or at the exit from the secondary combustion chamber;

    (b) carbon monoxide concentration within or at the exit from the secondary combustion chamber;

    (c) temperature within or at the exit of the primary combustion chamber; and

    (d) temperature within or at the exit of the secondary combustion chamber.

    Records shall be retained for a period of six months.

14. Without restriction or limitation to conditions 5 or 9, the consent holder shall record, and make available to the Chief Executive, Taranaki Regional Council, upon request, the feedstock type and loading rate, operating times and the prevailing weather conditions for each incinerator burn, and for the solids incinerator the loading time at which each batch is loaded into the incinerator. Records shall be retained for a period of six months.

15. The oxygen concentration within the secondary combustion chamber of the solids incinerator shall be maintained between 6% and 9% [by volume] as far as is practicable, and shall not be less than 4.5% [by volume], for more than 60 seconds at any time during the incineration of material during any 24-hour period.

16. The temperature in the secondary combustion chamber of the solids incinerator shall not be less than 1100 degrees Celsius, at any time during the incineration of material.

17. The temperature at the exit from the liquids incinerator chamber shall not be less than 1000 degrees Celsius and the total proportion of halogens within the feedstocks shall not exceed 0.8%.

18. The temperature of the exhaust gases from the solids incinerator stack shall not be less than 700 degrees Celsius immediately prior to discharge.

19. The discharges authorised by this consent shall not give rise to any direct significant adverse ecological effect on any off-site ecosystems, including but not limited to habitats, plants, animals, microflora and microfauna.

20. The Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 1998 and every two years thereafter for the purpose of:

    (a) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered and which it is appropriate to deal with at the time of review; or

    (b) requiring the holder to adopt the best practicable option to remove or reduce any adverse effect on the environment caused by any discharge into the air; or

    (c) to alter, add, or delete limits on discharge or ambient concentrations of any contaminants or contaminant.

21. The consent holder and staff of the Taranaki Regional Council shall meet as appropriate and at least once per year, with submitters to the consent and interested members of the local community, in order to discuss any matter relating to the exercise of this resource consent.

22. The Taranaki Regional Council, in conjunction with the consent holder, submitters to the consent and other interested members of the local community shall establish a programme to monitor odours and odour sources.

Signed at Stratford on 11 November 2005

For and on behalf of
Taranaki Regional Council

_____

Chief Executive

Discharge Permit

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

Name of Consent Holder:	Dow AgroSciences (NZ) Limited Private Bag 2017 New Plymouth 4342
Decision Date:	14 October 2014
Commencement Date:	05 November 2014

Conditions of Consent

Consent Granted:	To discharge contaminants to air from all activities associated with the current and future operation of an agrichemical formulation and packaging plant
Expiry Date:	01 June 2044
Review Date(s):	June 2020, June 2026, June 2032, June 2038 and in accordance with special condition 17
Site Location:	89 Paritutu Road, New Plymouth
Legal Description:	Lot 3 DP 8465 Lot 1 DP 9022 Lots 1 & 2 DP9829 Lot 1 DP10018 (Discharge source & site)
Grid Reference (NZTM)	1688529E-5675602N

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 with section 36 of the Resource Management Act 1991.

Special conditions

1. The consent holder shall ensure that all emissions control equipment, including but not limited to that referred to in condition 16(b) is maintained and operated effectively and efficiently at all times.

2. The discharges authorised by this consent shall not give rise to any odour, or dust emissions, at or beyond the boundary of the site that is offensive or objectionable.

3. The discharge of contaminants to air, other than from the High Temperature Incinerator Stack (see conditions 4 and 5) shall be controlled to ensure that the maximum ground-level concentrations off-site do not exceed:

   (a) Subject to condition 3(b),the relevant air quality limits listed in Schedule 1 of this consent and assessed using the process set out in Schedule 3; and

   (b) In the case of emissions due to raw materials or formulations introduced to the site after this consent commences, limits developed in accordance with the approach set out in Schedule 2 and assessed using the process set out in Schedule 3.

   See Advice Notes 1 and 2.

4. The total concentration of polychlorinated dibenzodioxins and polychlorinated dibenzofurans in any discharge from the High Temperature Incinerator Stack shall not exceed 0.1 nanograms per cubic metre (adjusted to 0 degrees Celsius, dry gas basis, 101.3 kPa pressure and 11% oxygen) when calculated as total toxic equivalents using the World Health Organization 2005 toxic equivalence factors.

   See Advice Notes 1 and 3.

5. The rate of discharge of total halides from the High Temperature Incinerator stack shall not exceed 1.5 kg/hour.

   See Advice Note 1.

6. There shall be no incineration of plastics and packaging that contain brominated flame retardants.

7. The consent holder shall record, and make available to the Chief Executive, Taranaki Regional Council upon request:

   a) the carbon monoxide concentration within or at the exit from the secondary combustion chamber;
   b) the feedstock type and loading rate;
   c) operating times; and
   d) the prevailing weather conditions

   for each incinerator burn. Records shall be retained for a period of six months.

8. The oxygen concentration within the secondary combustion chamber of the incinerator shall be maintained between 6% and 9% (by volume) as far as is practicable, and shall not be less than 4.5% (by volume), for more than 60 seconds at any time during the incineration of material during any 24-hour period.

9. The temperature in the secondary chamber of the High Temperature Incinerator shall not be less than 1100 degrees Celsius at any time during the incineration of waste.

10. The temperature of the exhaust gas from the High Temperature Incinerator shall not be less than 1000 degrees Celsius at any time during the incineration of waste.

11. Within three months of the date of commencement of consent, and at intervals not exceeding three years thereafter, the consent holder shall prepare and provide to the Chief Executive, Taranaki Regional Council and the Medical Officer of Health for Taranaki, for comment, a draft Air Discharge Management and Monitoring Plan ("ADMMP") for the site. The ADMMP shall be finalised and submitted to the Chief Executive, Taranaki Regional Council within a further three months. The ADMMP shall be to the satisfaction of the Chief Executive of the Taranaki Regional Council, acting in a technical certification capacity, and shall detail the management and monitoring of air discharges on the site and procedures and methodologies to ensure consent compliance. As a minimum, the ADMMP shall include:

    (a) A summary of the on-site air discharge activities and the nature of the discharges to air from each source on-site;

    (b) A description of how compliance with the conditions of this consent will be achieved;

    (c) A description of the air quality control measures and equipment, and maintenance programme in place for each of the air treatment systems used on-site, including specifically the systems used in the:
        - Commodity Herbicides Plant;
        - Herbicides Plant;
        - Granular Herbicides Plant;
        - Insecticides Plant;
        - High Temperature Incinerator Stack and Building;
        - Raw Material Storage Warehouse;
        - Product Development Laboratory;
        - Bulk Storage Tanks;
        - Natural gas-fired boiler; and
        - Any other air discharge sources on-site.

    (d) Descriptions of the site operating requirements related to the air discharge activities on-site, including:
        - Operating procedures;
        - Monitoring and supervision procedures including any performance indicators ; and
        - Waste processing and discharge logs.

(e) A description of the High Temperature Incinerator operational record-keeping and reporting procedures and requirements including:
- Feedstock type and loading rate, operating times and the prevailing weather conditions for each incinerator burn;
- Continuous monitoring of oxygen, carbon monoxide and temperature;
- Limits on the oxygen concentration at the outlet of the secondary combustion chamber; and
- limits on the halogen content of the feedstock;

(f) A description of the management procedures for the Product Development Laboratory, including management of the air treatment system, to minimise discharges to air to the extent practicable;

(g) A description of any additional air quality limits determined in accordance with condition 3(b);

(h) The consent holder's Air Monitoring Programme including, as a minimum:
- Identification of the contaminants and compounds being monitored;
- A description of the methodology for the air monitoring programme;
- Monitoring locations and frequency; and
- A description of how compliance with consent conditions will be demonstrated.

(i) A description of the Odour Register for the site, which is used to record any observations of odour (both on-site and off-site), the findings of any investigations, and any recommendations that arise; and

(j) A 'Contingency Plan' detailing measures and procedures to be undertaken to avoid or mitigate the adverse environmental effects of any spillage or discharge of contaminants not authorised by this consent. The Contingency Plan shall include the requirement that the Medical Officer of Health for Taranaki be notified as soon as practicable following any contingency event occurring that is likely to adversely affect human health beyond the boundary of the site.

12. At all times the consent holder shall maintain:

(a) A Chemical Materials Register containing details of all of the chemicals or product formulations currently received, prepared, stored, mixed or otherwise processed on-site; and

(b) The Safety Data Sheet, toxicology information and environmental fate information for each chemical and product listed in the Chemical Materials Register; and

(c) Details of the assessments and resulting air quality limits determined in accordance with condition 3(b).

The information required by this condition shall be retained and be made available to the Chief Executive, Taranaki Regional Council upon request.

13. Before any new chemicals or product formulations are introduced to the site for purposes other than research or development, they shall be added to the Chemical Materials Register.

14. For any air monitoring undertaken, the following actions apply:

    (a) If a measured air quality parameter would result, or has resulted in air quality that is 25% or less of the relevant limit referred to in condition 3, then no action is required;

    (b) If the measured air quality parameter would result, or has resulted in air quality that is more than 25% and less than or equal to 50% of the relevant limit referred to in condition 3, the consent holder shall notify the Chief Executive, Taranaki Regional Council within three working days of receipt of the monitoring results;

    (c) If the measured air quality parameter would result, or has resulted in air quality that is more than 50% and less than or equal to 100% of the relevant limit referred to in condition 3, the consent holder shall notify the Chief Executive, Taranaki Regional Council immediately upon receipt of the monitoring results, and investigate, and where appropriate remedy, the cause of the decrease in discharge quality. The consent holder shall notify the Chief Executive, Taranaki Regional Council of the outcomes of any investigations and subsequent actions, within 10 working days of receipt of the monitoring results; and

    (d) If the measured air quality parameter would result, or has resulted in air quality that is greater than 100% of the relevant limit referred to in condition 3, the consent holder shall immediately cease the discharge activity and notify the Chief Executive, Taranaki Regional Council upon receipt of the monitoring results. The consent holder shall then investigate the cause of the decrease in discharge quality, and remedy the cause of the exceedance prior to any recommencement of the discharge activity. A summary report shall be provided to the Chief Executive, Taranaki Regional Council within 10 working days of the original notification.

15. Before 30 September each year the consent holder shall provide to the Chief Executive, Taranaki Regional Council the following information for the 12 month period ending on the previous 30 June:

    (a) The results of all air quality monitoring that the consent holder has undertaken under the Air Monitoring Programme in accordance with condition 11(h);

    (a) A description of any process changes or changes to emission control technology that have been implemented at the site; and

    (c) A description of any consultation undertaken and any views put forward by those consulted.

16. No later than 30 April 2020 and every six years thereafter, the consent holder shall provide to the Chief Executive, Taranaki Regional Council, a written report which includes:

    (a) A review of any relevant technological advances in the reduction or mitigation of discharges to air from the site activities, and the costs and benefits of these advances;

    (b) A summary concluding which air discharge and treatment methods will be operated on-site and why; and

    (c) A description of any significant changes in air quality assessment methodology since the previous reporting period (including computer modelling techniques and the associated dilution factors set out in Schedule 3) that are likely to materially affect the assessment of environmental effects of the activities authorised by this consent.

17. In accordance with section 128 and 129 of the Resource Management Act 1991, the Chief Executive, 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:

    (a) During the month of June 2020 and/or June 2026, and/or June 2032, and/or June 2038 for the purpose of ensuring that the conditions are adequate to avoid, remedy or mitigate 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 that time; and

    (b) Within three months of receiving any report provided pursuant to condition 16 to direct the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment.

Signed at Stratford on 14 October 2014

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Advice Notes

1. Compliance with the limits in conditions 3, 4, and 5 shall be demonstrated by monitoring, or, as described in the ADMMP, by the use of air emission technology that has been designed to ensure any discharge meets those limits.

2. The methodology used for relating stack concentrations to air quality limits shall be determined in accordance with the process provided for in Schedule 3 of this consent.

3. If any monitoring is undertaken to assess compliance with condition 4, compliance shall be determined based on the average of not less than 3 samples, each of which shall be taken while the incinerator is fed on different waste types.

SCHEDULE 1: Air quality limits applying beyond the boundary of the site

The air quality limits for the one hour and the 24-hour average will apply at any location beyond the site boundary. The air quality limits for the annual average will apply at any land on which any residential activity (excluding any temporary or transient residential activity) is established.

Agrichemical actives

Substance	Air quality limit (annual average)
2,4-D acid, esters and salts	2 µg/m^3
2,4-DB acid and salts	4 µg/m^3
aminopyralid acid and amine salts	10 µg/m^3
Buprofezin	2 µg/m^3
Chlorpyrifos	0.57 µg/m^3
chlorpyrifos-methyl	1.9 µg/m^3
clopyralid acid and amine salts	30 µg/m^3
cyhalofop-butyl	0.6 µg/m^3
dicamba acid and amine salts	57 µg/m^3
Fenpyroximate	2 µg/m^3
Florasulam	10 µg/m^3
fluroxypyr, methylheptyl ester	153 µg/m^3
glyphosate acid and amine salts	191 µg/m^3
haloxyfop-R methyl ester	0.06 µg/m^3
lambda cyhalothrin	3.7 µg/m^3

MCPA acid, esters and salts	10 µg/m^3
MCPB acid and salts	2 µg/m^3
(s)-methoprene	10 µg/m^3
methoxyfenozide	19 µg/m^3
myclobutanil	6 µg/m^3
Oxyfluorfen	0.6 µg/m^3
picloram acid, esters and salts	57 µg/m^3
Quinoxyfen	38 µg/m^3
Spinetoram	6 µg/m^3
Spinosad	4 µg/m^3
Sulfoxaflor	6 µg/m^3
triclopyr, ester and amine salt	6 µg/m^3

Note: most of the toxicity data makes no distinction between the individual substances and their esters, amines, or salt forms. The air quality limit specified is a total, inclusive of all forms of the active.

Other compounds

Substance	Air quality limit	Averaging period
Benzene	3.6 µg/m^3	Annual
2,4-dichlorophenol	0.6 µg/m^3	Annual
2-ethyl hexanol	160 µg/m^3	Annual
Diethanolamine	3 µg/m^3	Annual
diethylene glycol monoethyl ether	27 µg/m^3	Annual
Dimethylamine	9 µg/m^3	Annual
dimethylethanolamine	50 µg/m^3	Annual
dipropylene glycol monomethyl ether	310 µg/m^3	Annual
EDTA	5 µg/m^3 120 µg/m^3	Annual 24-hour
Ethylbenzene	570 µg/m^3 1,000 µg/m^3	Annual 24-hour
Isopropylamine	12 µg/m^3	Annual
Monoethanolamine	7.5 µg/m^3	Annual
Naphthalene	3 µg/m^3	Annual
N-methyl-2-pyrrolidone	100 µg/m^3	Annual
propylene glycol	120 µg/m^3	24-hour
sodium bicarbonate	5 µg/m^3	Annual

Substance	Air quality limit	Averaging period
sodium hydroxide	2 µg/m^3	Annual
triethanolamine	5 µg/m^3	Annual
1,2,4-trimethylbenzene	20 µg/m^3	Annual
toluene (as a component in some distillate solvents)	5000 µg/m^3	Annual
triisopropanolamine	40 µg/m^3	Annual
xylene (as a component in some distillate solvents)	870 µg/m^3	Annual

SCHEDULE 2: Process for developing air quality limits for emissions associated with new raw materials or formulations.

The air quality limit for any particular contaminant shall be determined in accordance with the hierarchy set out in the Good Practice Guide (GPG) for Assessing Discharges to Air from Industry (Ministry for the Environment, June 2008), or another hierarchy as may be specified in the ADMMP.

In the event that no recognised air quality criteria (as described in the GPG) are available, a limit will be developed by calculating the air concentration that would give rise to an exposure equivalent to one tenth of the Acceptable Daily Intake (or equivalent) set by the New Zealand Environmental Protection Agency, Joint FAO/WHO Meeting on Pesticide Residues (JMPR) or European Commission. This procedure is described in Appendices E5 and E8, Dow AgroSciences (NZ) Ltd: Technical Air Quality Assessment - Discharges to Air – Paritutu Road Site, New Plymouth, Volume 2, prepared by Graham Environmental Consulting Ltd and Tonkin & Taylor Ltd, 31 October 2013.

The air quality limits for the one hour and the 24-hour average will apply at any location beyond the site boundary. The air quality limits for the annual average will apply at land on which any residential activity (excluding any temporary or transient residential activity) is established.

SCHEDULE 3: Process for relating stack concentrations to air quality limits.

Assessment of compliance with the air quality limits in Schedule 1 and those determined in accordance with Schedule 2 can be achieved based on actual or potential stack emissions, by using the following formula:

Maximum stack concentration ($\mu g/m^3$) = air quality limit ($\mu g/m^3$) x Dilution Factor

Where:

a) The stack concentration of any particular contaminant may be measured by stack emission testing or estimated based on the measured stack concentration of another representative contaminant and corrected for differences in molecular weight and vapour pressure; and

b) The Dilution Factor is taken from:

i. the following table for the averaging period specified for the relevant air quality criterion; or

ii. where the relevant averaging period is annual average and a residential activity (excluding any temporary or transient residential activity) has established within the hatched area shown on Figure 1 attached, the results of an atmospheric dispersion modelling study carried out to a similar standard as that provided with the application.

Where multiple sources of an individual contaminant are involved, individual stack concentrations for that contaminant will be determined to ensure that the air quality limit is complied with on a cumulative basis.

Plant stack	Dilution Factor		
	1-hour average	24-hour average	Annual average
Commodity Herbicides	750	1,300	29,000
Herbicides	550	1,150	107,000
Granular Herbicides	1,300	2,400	432,000
Insecticides – Emulsifiable Concentrates	700	1,250	232,000
Insecticides – Suspension Concentrates	1,500	2,750	513,000

SCALE 1: 5000
0 50 100 150 200 250 (m)

Aerial photo sourced from Google Earth(Copyright: 2009). Images Copyright: Image @ 2013 DigitalGlobe. Flown 23/02/2013.

Property boundaries sourced from Land Information New Zealand data as at 8-Jul-2013 (Crown Copyright Reserved).

Tonkin & Taylor
Environmental and Engineering Consultants
105 Carlton Gore Road, Newmarket, Auckland

DRAWN	RBS	Aug 14
DRAFTING CHECKED		
APPROVED		
CADFILE: 85 199.200-ADP-F1.dwg		
SCALES (AT A4 SIZE): 1: 5000		
PROJECT No. 85 199.200		

DOW AGROSCIENCES (NZ) LTD
AIR DISCHARGE PERMIT
PARITUTU, NEW PLYMOUTH
Site Plan

FIG. No. Figure 1

REV. 0

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Discharge Permit

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

Name of Consent Holder:	Dow AgroSciences (NZ) Limited Private Bag 2017 NEW PLYMOUTH
Consent Granted Date:	4 September 2008

Conditions of Consent

Consent Granted:	To discharge stormwater from an industrial agrichemical manufacturing site via retention dams together with uncontaminated stormwater from landscape and non-manufacturing areas into the Herekawe Stream at or about (NZTM) 1688226E-5675009N
Expiry Date:	1 June 2026
Review Date(s):	June 2014, June 2020
Site Location:	89 Paritutu Road, New Plymouth
Site Legal Description:	Lot 3 DP 8465 Lot 1 DP 9022 Lots 1 & 2 DP 9829 Lot 1 DP 10018
Catchment:	Herekawe

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 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 on the environment from the exercise of this consent.

2. The stormwater discharged shall be collected from a catchment area of no more than 16 hectares.

3. The consent holder shall maintain, and comply with at all times, a stormwater management plan, approved by the Chief Executive, Taranaki Regional Council, detailing measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not licensed by this consent, and measures to avoid, remedy or mitigate the environmental effects of such a discharge.

4. The consent holder shall keep records of the date and time that the stormwater discharges begin and end, the volume of water discharged, and the results of all physicochemical testing carried out on water discharged to the Herekawe Stream. These records shall be made available to the Chief Executive, Taranaki Regional Council, upon request.

5. After allowing for a mixing zone of 25 metres from the point of discharge, the discharge shall not give rise to any of the following effects in the Herekawe Stream:

   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) any significant adverse effects on aquatic life.

6. Concentrations of the following components shall not be exceeded in the discharge:

Component	**Concentration**
Total phenoxy herbicides [2,4-D, MCPA and MCPB]	0.10 mg/L
Total organophosphates [chlorpyrifos and chlorpyrifos-methyl]	0.0005 mg/L
Triclopyr 0.10	mg/L
Picloram 0.10	mg/L
Glyphosate	0.10 mg/L
Oxyfluorfen	0.005 mg/L
pH [range]	6.0 – 9.0

This condition shall apply prior to the entry of the stormwater into the Herekawe Stream, at designated sampling points approved by the Chief Executive, Taranaki Regional Council.

7. 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 2014 and/or June 2020, 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 4 September 2008

For and on behalf of
Taranaki Regional Council

_____

Director-Resource Management

Appendix II

List of 255 pesticide residues analysed for in Dow AgroSciences stormwater

GC/MS MULTI RESIDUE METHOD (FWA-02)

The sample is extracted and further purified using gel permeation chromatography. Measurement is performed using gas chromatography - mass spectrometry.

Specific Residues reportable and MDLs can be matrix dependent.

MDL = Method Detection Limit

№	COMPOUND	MDL (mg/kg)	№	COMPOUND	MDL (mg/kg)	№	COMPOUND	MDL (mg/kg)	№	COMPOUND	MDL (mg/kg)
1	acetochlor	0.001	65	DDE (o,p')	0.001	129	flumiclorac-pentyl	0.001	193	piperophos	0.001
2	alachlor	0.001	66	DDE (p,p')	0.001	130	flumioxazin	0.001	194	pirimicarb	0.001
3	aldrin	0.001	67	DDT (o,p')	0.001	131	fluquinconazole	0.001	195	pirimiphos-methyl	0.001
4	allidochlor	0.001	68	DDT (p,p')	0.005	132	flusilazole	0.001	196	pretilachlor	0.001
5	ametryn	0.001	69	deltamethrin	0.005	133	flutolanil	0.001	197	prochloraz	0.001
6	anilofos	0.001	70	demeton-S-methyl	0.001	134	flutriafol	0.001	198	procymidone	0.001
7	atrazine	0.001	71	diazinon	0.001	135	fluvalinate	0.001	199	profenofos	0.001
8	azaconazole	0.001	72	dichlobenil	0.001	136	fonofos	0.001	200	promecarb	0.001
9	azinphos-methyl	0.005	73	dichlofenthion	0.001	137	fosthiazate	0.001	201	prometryn	0.001
10	azoxystrobin	0.001	74	dichlofluanid	0.001	138	furalaxyl	0.001	202	propachlor	0.001
11	benalaxyl	0.001	75	dichloran	0.001	139	furathiocarb	0.001	203	propargite	0.001
12	bendiocarb	0.001	76	dicofol	0.001	140	haloxyfop-etotyl	0.001	204	propazine	0.001
13	benfluralin	0.001	77	dichlorvos	0.001	141	haloxyfop-methyl	0.001	205	propetamphos	0.001
14	benodanil	0.001	78	diclobutrazol	0.001	142	heptachlor	0.001	206	propham	0.001
15	benoxacor	0.001	79	diclofop-methyl	0.001	143	heptachlor-endo-epoxide	0.005	207	propiconazole	0.001
16	BHC-alpha	0.001	80	dieldrin	0.001	144	heptachlor-exo-epoxide	0.001	208	propoxur	0.001
17	BHC-beta	0.001	81	diethofencarb	0.001	145	heptenophos	0.005	209	propyzamide	0.005
18	BHC-delta	0.001	82	difenoconazole	0.001	146	hexachlorobenzene	0.001	210	prothiofos	0.001
19	BHC-gamma (lindane)	0.001	83	diflufenican	0.001	147	hexaconazole	0.001	211	pyraclostrobin	0.001
20	bifenox	0.005	84	dimepiperate	0.001	148	hexazinone	0.001	212	pyraflufen-ethyl	0.001
21	bifenthrin	0.001	85	dimethenamid	0.001	149	indoxacarb	0.001	213	pyrazophos	0.001
22	bioresmethrin	0.001	86	dimethoate	0.005	150	iodofenphos	0.001	214	pyributicarb	0.001
23	bitertanol	0.001	87	dimethomorph	0.001	151	iprobenfos	0.001	215	pyridaben	0.001
24	bromacil	0.005	88	dimethylvinphos	0.001	152	iprodione	0.001	216	pyridaphenthion	0.001
25	bromobutide	0.001	89	dioxabenzofos	0.001	153	iprovalicarb	0.001	217	pyrimethanil	0.001
26	bromophos-ethyl	0.001	90	diphenamid	0.001	154	isazofos	0.001	218	pyrimidifen	0.001
27	bromophos-methyl	0.001	91	diphenylamine	0.001	155	isofenphos	0.001	219	pyriminobac-methyl(E)	0.001
28	bromopropylate	0.001	92	disulfoton	0.001	156	isoprocarb	0.001	220	pyriminobac-methyl(Z)	0.001
29	bupirimate	0.001	93	dithiopyr	0.001	157	isoprothiolane	0.001	221	pyriproxyfen	0.001
30	buprofezin	0.001	94	edifenphos	0.001	158	kresoxim-methyl	0.001	222	quinalphos	0.005
31	butachlor	0.001	95	endosulfan sulphate	0.001	159	lactofen	0.001	223	quinoxyfen	0.001
32	butafenacil	0.001	96	endosulfan (alpha)	0.001	160	leptophos	0.001	224	quintozene	0.001
33	butamifos	0.001	97	endosulfan (beta)	0.005	161	malathion	0.001	225	quizalofop-ethyl	0.001
34	cadusafos	0.001	98	endrin	0.001	162	mepronil	0.001	226	simazine	0.001
35	carbaryl	0.005	99	EPN	0.005	163	metalaxyl	0.001	227	simeconazole	0.001
36	carbofuran	0.001	100	epoxiconazole	0.001	164	methacrifos	0.001	228	simetryn	0.001
37	carboxin	0.001	101	EPTC	0.001	165	methidathion	0.001	229	tebuconazole	0.001
38	carfentrazone-ethyl	0.001	102	esprocarb	0.001	166	methiocarb	0.001	230	tebufenpyrad	0.001
39	chlordane-cis	0.001	103	ethalfluralin	0.001	167	metolachlor	0.001	231	tecnazene	0.001
40	chlordane-trans	0.001	104	ethiofencarb	0.001	168	mevinphos	0.001	232	tefluthrin	0.001
41	chlorfenapyr	0.001	105	ethion	0.001	169	molinate	0.001	233	terbacil	0.001
42	chlorfenvinphos	0.001	106	ethoprophos	0.001	170	myclobutanil	0.005	234	terbufos	0.001
43	chlorobenzilate	0.001	107	etoxazole	0.001	171	napropamide	0.001	235	terbuthylazine	0.001
44	chlorothalonil	0.001	108	etridiazole	0.001	172	nitrofen	0.001	236	terbutryne	0.001
45	chlorpropham	0.001	109	etrimfos	0.001	173	nitrothal-isopropyl	0.001	237	tetrachlorvinphos	0.001
46	chlorpyrifos	0.001	110	famphur	0.001	174	norflurazon	0.005	238	tetraconazole	0.001
47	chlorpyrifos-methyl	0.001	111	fenamiphos	0.001	175	oxadiazon	0.001	239	tetradifon	0.001
48	chlorthal-dimethyl	0.001	112	fenarimol	0.001	176	oxadixyl	0.001	240	thenylchlor	0.001
49	chlozolinate	0.001	113	fenchlorphos	0.001	177	oxyfluorfen	0.001	241	thiobencarb	0.001
50	clodinafop-propargyl	0.001	114	fenitrothion	0.005	178	paclobutrazol	0.001	242	thiometon	0.001
51	clomazone	0.001	115	fenobucarb	0.001	179	parathion	0.001	243	tolclofos-methyl	0.001
52	cloquintocet-1-methylhexyl	0.001	116	fenoxanil	0.001	180	parathion-methyl	0.001	244	tolyfluanid	0.001
53	coumaphos	0.001	117	fenoxaprop-ethyl	0.001	181	penconazole	0.001	245	tralkoxydim	0.005
54	cyanazine	0.001	118	fenoxycarb	0.001	182	pendimethalin	0.001	246	triadimefon	0.001
55	cyanophos	0.001	119	fenpropathrin	0.001	183	permethrin	0.005	247	triadimenol	0.001
56	cyflufenamid	0.001	120	fenpropimorph	0.001	184	phenthoate	0.001	248	triallate	0.001
57	cyfluthrin	0.005	121	fensulfothion	0.001	185	phorate	0.001	249	triazophos	0.001
58	cyhalofop-butyl	0.001	122	fenthion	0.001	186	phorate-sulphone	0.001	250	tribufos	0.001
59	cyhalothrin	0.001	123	fenvalerate	0.001	187	phorate-sulphoxide	0.001	251	trifloxystrobin	0.001
60	cypermethrin	0.005	124	fipronil	0.001	188	phosalone	0.001	252	trifluralin	0.001
61	cyproconazole	0.001	125	flamprop-methyl	0.001	189	phosmet	0.001	253	uniconizole-P	0.001
62	cyprodinil	0.001	126	fluacrypyrim	0.001	190	phosphamidon	0.001	254	vinclozolin	0.001
63	DDD (o,p')	0.001	127	fluazifop-P-butyl	0.001	191	picolinafen	0.001	255	XMC	0.001
64	DDD (p,p')	0.001	128	fluazinam	0.005	192	piperonyl butoxide	0.001			

Appendix III

Dow AgroSciences Annual Stormwater Report 2014-2015

16 36334

Dow AgroSciences

Stormwater Discharge Report

1 July 2014 – 30 June 2015

Consent No. 4108-2

21 September 2015

Table of Contents

Introduction

Discharge of stormwater from the Paritutu Site is subject to the conditions detailed in discharge permit 4108-2 issued by the Taranaki Regional Council.

In order to comply with these conditions, stormwater from the production plant, dangerous goods storage compound, despatch store, incinerator, and roads in these areas is directed to stormwater retention ponds. The water collected in these ponds is sampled and analysed before being released. The sampling, analysis and release procedures are outlined in standard operating procedures.

Drainage from process areas is segregated from non-process areas to reduce the potential for contamination of stormwater. Areas around storage tanks and process equipment, located outside buildings in the production area, are contained by bunding. This water is discharged to the site trade waste system.

Stormwater from the southern part of the site drains directly to the New Plymouth District Council stormwater drain and then to the Herekawe Stream. This part of the site is a predominantly open grassed area surrounding a parking area, two storage buildings, the closed Pilot Plant and the access road to the site. Specific controls for stormwater from the storage buildings and storage tank bunds are in place to direct stormwater to the trade waste system.

There are four stormwater retention ponds on the site:

i. **Concrete stormwater retention pond: SV9100**

Stormwater enters this system through a series of under/over separators and then discharges into SV9100. This pond collects water from the production plant and roads in this area.

ii. **Concrete stormwater retention pond: SV9000**

When SV9100 is full, the water overflows into SV9000. This pond collects water from the production plant and roads in this area.

iii. **HDPE stormwater retention pond: SV9200**

This pond collects stormwater from the incinerator and roads in this area. Stormwater in this pond is discharged through SV9100 when it is empty.

iv. **HDPE stormwater retention pond: SV8000**

This pond collects stormwater from the despatch and dangerous goods areas and roads in this area.

Changes Made During The Year

Stormwater System Changes

Other than carrying out routine maintenance, no physical changes were made to the stormwater system during the period.

Consent Changes

No consent changes occurred during the reported period.

Monitoring & Discharge

Conditions

Performance Criteria

1) *Adopting best practicable option to prevent or minimise any adverse effects on the environment.*

2) *Stormwater discharge from catchment area of no more than 16 hectares.*

3) *Compliance with the stormwater management plan (standard operating procedure) at all times.*

4) *Records of stormwater sampling, analysis and discharge shall be kept and made available for review by the Taranaki Regional Council.*

5) *After allowing for a mixing zone of 25 metres from the point of discharge, the discharge shall not give rise to any of the following effects on the Herekawe Stream:*

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 any objectionable odour;*
d) *any significant adverse effects on aquatic life.*

6) *Discharge shall not exceed the following limits prior to the entry of stormwater into the Herekawe Stream:*

Total phenoxy herbicides	*0.10*	*mg/L*
Total organophosphates	*0.0005*	*mg/L*
Triclopyr	*0.10*	*mg/L*
Picloram	*0.10*	*mg/L*
Glyphosate	*0.10*	*mg/L*
Oxyfluorfen	*0.005*	*mg/L*
pH	*6.0 – 9.0*	

7 *The consent may be reviewed in 2014 and 2020.*

Monitoring

Stormwater collected in the four stormwater retention ponds is sampled and analysed before release to the Herekawe Stream.

In the rare event that stormwater does not meet the release criteria, the Company will identify the source of the contamination so corrective actions can be implemented to prevent a reoccurance. Prompt attention is given to the containment and clean-up of any spills/leaks on site.

If an incident occurs and impacts the standard management of the stormwater system the Company will discuss the specific details and obtain the any necessary approvals from the Taranaki Regional Council, before any action is taken. Water may be treated, or an alternative method of disposal identified such as, seeking approval from the New Plymouth District Council to pump to the site trade waste system.

Results

There were a total of 124 discharges from the stormwater retention ponds to the Herekawe Stream, during the monitoring period of 1 July 2014 to 30 June 2015.

On all occasions (100%) the conditions of the discharge consent were met, that is, there were no breaches of the consent conditions. For details refer to Appendix 1 attached to this report.

Biological Monitoring

Conditions

Performance Criteria

Discharge shall not cause an adverse biological impact on the receiving water.

Monitoring

The Taranaki Regional Council has undertaken regular biomonitoring of the Herekawe Stream to assess the impact stormwater discharges from industrial sites in the area have on the stream bed fauna and microflora. The surveys have been carried out at six monthly intervals since April 1986.

Three sites are sampled during each survey period:

1. *Upstream of Centennial Drive culvert and stormwater discharges;*
2. *Downstream of stormwater discharges and approximately 75m above the coast; and*
3. *Downstream of stormwater discharges and approximately 50m above the coast.*

Results

Results from the biological monitoring studies are held by the Taranaki Regional Council.

General

Stormwater Quality Inspections

Regular stormwater quality inspections, including collection of stormwater samples for interlaboratory testing, were undertaken by officers of the Taranaki Regional Council during 1 July 2014 to 30 June 2015.

Incident Review

During the monitoring year (1 July 2014 to 30 June 2015) there were zero incidents resulting in breaches of the discharge resource consent conditions.

Appendices

Appendix 1: Stormwater discharged to the Herekawe Stream (2014-15)

APPENDIX 1: Stormwater discharged to the Herekawe Stream (2014-15)

Only stormwater from the Paritutu site which meets the consent conditions will be released to the Herekawe Stream, or with approval from the Taranaki Regional Council.

Year : **1 July 2014 - 30 June 2015**

"-" = Insufficient stormwater to test for release, or requires treatment
Y = Retention pond met the discharge criteria, approved and released
N = Retention pond did not meet the discharge criteria and was released

Date	Stormwater Retention Pond				Comments
	SV9000	SV9100	SV9200	SV8000	
	N. Conc.	S. Conc.	S. HDPE	W. HDPE	
2-Jul-14	Y	Y	-	Y	
3-Jul-14	-	-	Y	-	
16-Jul-14	Y	Y	-	Y	
31-Jul-14	Y	Y	Y	Y	
5-Aug-14	Y	Y	Y	Y	
15-Aug-14	Y	Y	-	Y	
20-Aug-14	Y	-	Y	-	
12-Sep-14	Y	Y	-	Y	
17-Sep-14	Y	Y	-	Y	
18-Sep-14	-	-	Y	-	
25-Sep-14	Y	Y	-	Y	
30-Sep-14	-	-	-	Y	
1-Oct-14	Y	Y	-	-	
17-Oct-14	Y	Y	-	Y	
28-Oct-14	Y	Y	-	Y	
30-Oct-14	Y	Y	Y	Y	
6-Nov-14	Y	Y	-	Y	
7-Nov-14	-	-	Y	-	
13-Nov-14	Y	Y	-	Y	
20-Nov-14	Y	Y	-	Y	
21-Nov-14	-	-	Y	-	
9-Dec-14	Y	Y	Y	Y	
11-Dec-14	Y	Y	-	-	
12-Dec-14	-	-	Y	Y	
7-Jan-15	Y	Y	-	Y	
2-Feb-15	Y	Y	Y	Y	
5-Feb-15	-	-	-	Y	
11-Mar-15	Y	Y	Y	Y	
26-Mar-15	Y	Y	-	Y	
31-Mar-15	Y	Y	-	Y	
1-Apr-15	-	-	Y	-	
9-Apr-15	Y	Y	-	Y	
10-Apr-15	-	-	Y	-	
13-Apr-15	Y	Y	-	Y	
23-Apr-15	Y	-	Y	Y	
28-Apr-15	Y	Y	-	Y	
30-Apr-15	-	-	Y	-	
8-May-15	Y	Y	-	Y	
13-May-15	Y	Y	-	Y	
14-May-15	-	-	Y	-	
15-May-15	Y	Y	-	Y	
21-May-15	Y	Y	Y	Y	
4-Jun-15	Y	Y	-	Y	
5-Jun-15	-	-	Y	-	
17-Jun-15	Y	Y	-	Y	
18-Jun-15	-	-	Y	-	
20-Jun-15	Y	Y	Y	Y	
23-Jun-15	Y	-	Y	Y	
Total "Y"	35	32	22	35	
Total "N"	0	0	0	0	

Total number of discharges which met the permit criteria and released: **124**

Total number of discharges which did not meet the permit criteria and released: **0**

Appendix IV

Biomonitoring reports on Herekawe Stream 2014-2015

To Job Managers, David Olsen & James Kitto
From Freshwater Biologist, CR Fowles
Doc No 1448809
Report No CF626
Date 15 December 2014

Biomonitoring of the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges, surveyed in October 2014

Introduction

This biological survey was the first of two scheduled for the Herekawe Stream in the 2014-2015 monitoring year to assess whether there had been any detrimental effects on the Herekawe Stream from stormwater discharges originating from STOS, DowAgro Sciences, Chevron, Origen Energy and NPDC. The previous survey (CF603) was performed in summer, 2014 as scheduled. The results from surveys performed since the 2001-02 monitoring year are discussed in reports referenced at the end of this report.

Methods

The standard '400 ml kick-net' and sweep-sampling' techniques were used to collect streambed macroinvertebrates at a 'control' site ('kick-net') and another downstream site ('kick-net' and 'sweep-sampling') in the Herekawe Stream (Table 1, Figure 1) on 16 October 2014. The 'sweep-sampling' technique is very similar to Protocol C2 (soft-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001). The 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the same protocols.

Table 1 Biomonitoring sites in the Herekawe Stream in relation to stormwater discharges

Site No.	Site Code	GPS Reference	Location
1	HRK 000085	E1688283 N5674972	Upstream of Centennial Drive culvert and stormwater discharges
2	HRK 000094	E1688201 N5675010	Downstream of stormwater discharges, approx. 75 m above coast

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly `sensitive' taxa were assigned the highest scores of 9 or 10, while the most `tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a

scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' taxa inhabit less polluted waterways.

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 & 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower, ranging from 0 to 10 $SQMCI_s$ units.

Figure 1 Biomonitoring sites in the Herekawe Stream

Results

At the time of this mid morning survey, the water temperature in the Herekawe Stream was 12.8˚ C at both of the sites. No stormwater discharges were occurring from the right bank or the left bank outfalls at the time of the survey. The channel at site 1 was narrow and constrained by gabion baskets on the banks and bed of the stream where the substrate was comprised mainly of sand, gravels, and cobbles with some silt, wood, and boulders. The stream at this site had a low, clear, uncoloured, swift flow and there were thin periphyton mats and patchy filamentous algae on the bed. Macrophytes were recorded at the edges of the stream at this partially shaded site.

The substrate at site 2 was comprised mainly of sand and some wood with a small proportion of boulders. The site can periodically be affected by salt water under extremely high tide and very low flow conditions. The clear, uncoloured, low flow at this site was slightly deeper and slower moving than at site 1 upstream due in part to log jams further downstream. There were patchy filamentous algae but no periphyton mats noted on the harder substrate components of the bed during the survey. Aquatic macrophytes were recorded at intervals along the stream margins. The small area of macrophytes was sweep-sampled at site 2 and the woody substrate and the limited area of boulder substrate were kick-sampled for macroinvertebrates at this site.

The survey was performed 18 days after a fresh in excess of 3 times median flow and 74 days after a fresh in excess of 7 times median flow in the catchment in accordance with Taranaki Regional Council biomonitoring fieldwork protocols.

Macroinvertebrates

A number of surveys have been performed previously at these two sites. Results of the current and past surveys are summarised in Table 2 and the results of the current survey presented in Table 3.

Table 2 Results of the current and previous surveys (since April 1986) performed at sites 1 and 2 in the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges

Site	Number of previous surveys	Numbers of taxa			MCI values		
		Median	Range	16 Oct 2014	Median	Range	16 Oct 2014
1	57	18	11-23	19	86	68-99	91
2	57	15	9-22	18	71	54-96	73

Table 3 Macroinvertebrate fauna of the Herekawe Stream in relation to Omata Tank Farm and other stormwater discharges sampled on 16 October 2014

Taxa List	Site Number	MCI score	1	2
	Site Code		HRK000085	HRK000094
	Sample Number		FWB14289	FWB14290
ANNELIDA (WORMS)	Oligochaeta	1	A	VA
HIRUDINEA (LEECHES)	Hirudinea	3	-	R
MOLLUSCA	*Potamopyrgus*	4	XA	XA
	Sphaeriidae	3	R	C
CRUSTACEA	Ostracoda	1	-	R
	Paracalliope	5	XA	VA
	Paratya	3	-	R
	Paranephrops	5	R	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	C	-
	Coloburiscus	7	C	-
	Zephlebia group	7	R	R
PLECOPTERA (STONEFLIES)	*Acroperla*	5	R	-
ODONATA (DRAGONFLIES)	*Xanthocnemis*	4	-	R
	Antipodochlora	5	R	-
HEMIPTERA (BUGS)	*Sigara*	3	-	R
COLEOPTERA (BEETLES)	Elmidae	6	C	-
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	-	R
TRICHOPTERA (CADDISFLIES)	*Aoteapsyche*	4	-	R
	Hydrobiosis	5	R	-
	Psilochorema	6	R	-
	Oxyethira	2	R	-
	Triplectides	5	C	A
DIPTERA (TRUE FLIES)	*Aphrophila*	5	C	-
	Chironomus	1	-	C
	Orthocladiinae	2	A	R
	Polypedilum	3	R	R
	Tanypodinae	5	-	C
	Austrosimulium	3	C	-
ACARINA (MITES)	Acarina	5	-	C
		No of taxa	19	18
		MCI	91	73
		SQMCIs	4.4	3.7
		EPT (taxa)	7	3
		%EPT (taxa)	37	17

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Site 1 (upstream of stormwater discharges)

A moderate richness of 19 taxa was recorded at this site, which was one taxon more than the median number of taxa from previous surveys at this site (Table 2) and similar to richnesses typically found in the lower reaches of small coastal streams elsewhere in Taranaki (TRC, 1999 (updated 2014)).

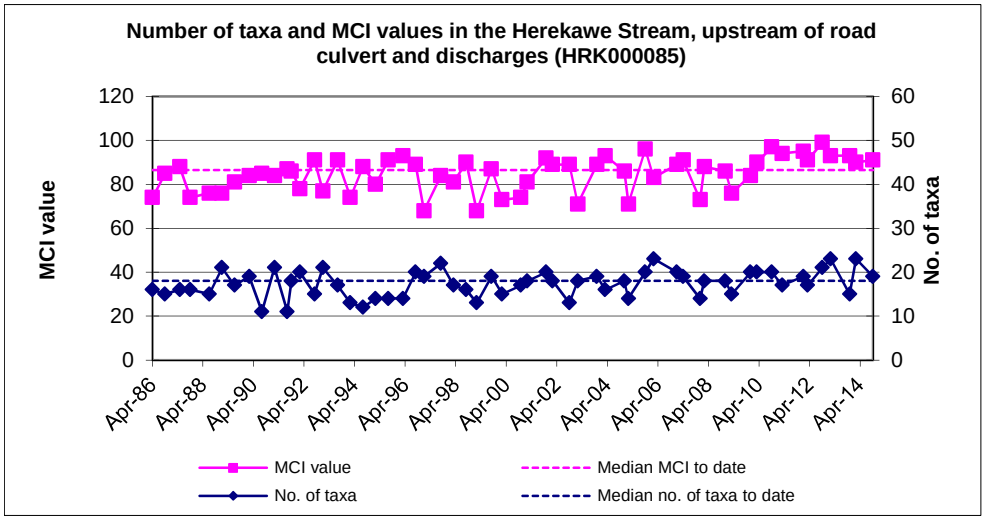

Figure 2 Number of taxa and MCI values in the Herekawe Stream upstream of the Centennial Road culvert since monitoring began in 1986

There were only four taxa dominant in the community (Table 3). These included one 'moderately sensitive' taxon [extremely abundant amphipod (*Paracalliope*)] and three 'tolerant' taxa [extremely abundant snail (*Potamopyrgus*); oligochaete worms, and orthoclad midges]. Most of these taxa are commonly found in habitats typical of the lower gradient reaches of small coastal streams, all of which are particularly abundant in association with periphyton and/or aquatic macrophytes. However, some of the more 'sensitive' taxa also present at this site (e.g. mayflies, stonefly, beetles, and some caddisflies) are associated with swifter flowing, harder substrates, and also amongst aquatic vegetation (e.g. amphipods, craneflies, and caddisflies).

Characteristic macroinvertebrate taxa in the communities at this site prior to this spring 2014 survey are listed in Table 4.

Table 4 Characteristic taxa (abundant, very abundant, extremely abundant) recorded in the Herekawe Stream at Centennial Drive between April 1986 and February 2014 [57 surveys], and by the spring 2014 survey

Taxa List		MCI Score	Total abundances	% of Surveys	Survey Summer 2014
ANNELIDA	Oligochaeta	1	34	60	A
MOLLUSCA	*Potamopyrgus*	4	57	100	XA
CRUSTACEA	Ostracoda	1	2	4	
	Paracalliope	5	36	63	XA
EPHEMEROPTERA	*Austroclima*	7	4	7	
	Coloburiscus	7	11	19	
PLECOPTERA	*Acroperla*	5	1	2	
TRICHOPTERA	*Aoteapsyche*	4	1	2	
	Oxyethira	2	12	21	
	Triplectides	5	12	21	
DIPTERA	*Aphrophila*	5	4	7	
	Orthocladiinae	2	26	46	A
	Polypedilum	3	2	4	
	Austrosimulium	3	17	30	

Prior to the current survey, 14 taxa had characterised the community at this site on occasions. These have comprised six 'moderately sensitive' and eight 'tolerant' taxa i.e. an absence of 'highly sensitive' taxa and a relatively high proportion of 'tolerant' taxa as would be expected in the lower reaches of a small coastal stream. Predominant taxa have included only the one 'moderately sensitive' taxon [amphipod (*Paracalliope*)] and two 'tolerant' taxa [oligochaete worms and snail (*Potamopyrgus*)]. This snail taxon has characterised this site's community on every occasion.

Four of the historically characteristic taxa were dominant in the spring 2014 community and comprised all three of the predominant taxa (above) together with another one 'tolerant' taxon which previously had been characteristic of this site's communities on 46% of occasions (Table 4).The two taxa which were recorded as extremely abundant in this spring survey had characterised this site's communities on 63% to 100% of past surveys.

The MCI score (91 units) reflected the presence of a significant proportion of 'sensitive' taxa (63% of richness). The score was five units above the median of scores, but eight units lower than the maximum, found by previous surveys (Table 2, Figure 2). It was also a significant (Stark, 1998) 13 units higher than the median score found by 194 previous surveys of sites below 25 masl in similar lowland coastal streams (TRC, 1999 (updated, 2014)). The moderate $SQMCI_s$ value of 4.4 units (Table 3) reflected the numerical dominance of the 'tolerant' snail and 'sensitive' amphipod in particular at this site. The presence of a relatively high proportion of 'sensitive' taxa indicated reasonably good physicochemical water quality conditions preceding this survey.

Site 2 (downstream of stormwater discharges)

A slightly above median richness of 18 taxa was found at this slower flowing site although it was noticeably more sandier and less of a cobble-boulder substrate habitat than usual. This richness was one taxon fewer than recorded upstream (Table 2, Figure 3) although it should be noted that ten of these taxa (56% of richness) were recorded as rarities (less than 5 individuals per taxon). Although eight of these taxa were also present at the upstream site 1 and the two sites shared three of the dominant taxa (with one fewer tolerant taxon and one additional 'moderately sensitive' taxon characteristic at this site (2)), the two sites had only 28% of taxa in common of the total taxa (29) found over this short reach. No 'highly sensitive' taxa found at either site.

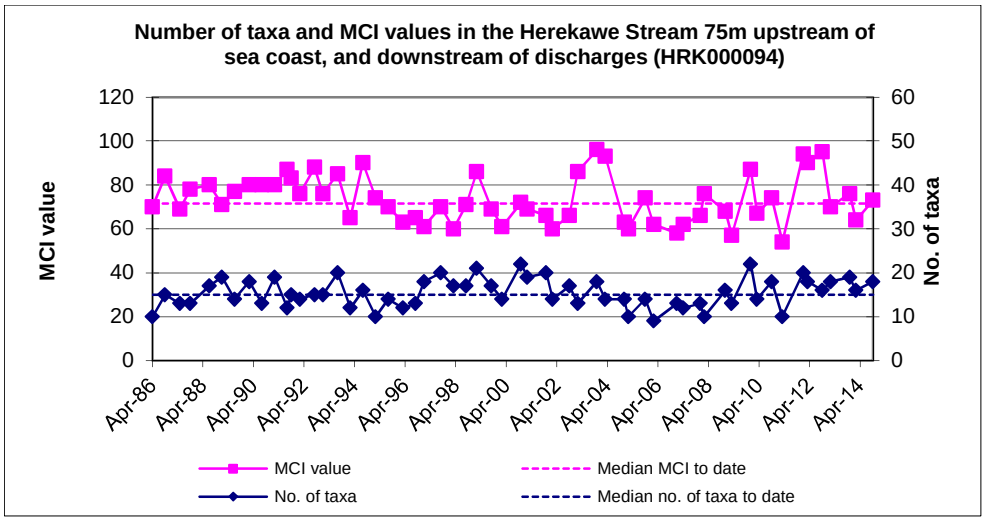

Figure 3 Number of taxa and MCI values in the Herekawe Stream downstream of industrial stormwater discharges since monitoring began in 1986

There was an increase (of 30%) in the proportion of 'tolerant' taxa in this community with 67% of the total taxa number. This was due mainly to the overall loss of five 'sensitive' taxa present (some as rarities) at the upstream site. Taxa characteristic of this community included the one 'moderately sensitive' taxa and three of the 'tolerant' taxa dominant at the upstream site together with another one 'moderately sensitive' taxon [vegetation-cased caddisfly (*Triplectides*)] and loss of one 'tolerant' taxon [orthoclad midges].

Characteristic macroinvertebrate taxa in the communities at this site prior to this spring 2014 survey are listed in Table 5.

Table 5 Characteristic taxa (abundant, very abundant, extremely abundant) recorded in the Herekawe Stream downstream of Centennial Drive between April 1986 and February 2014 [57 surveys], and by the spring 2014 survey

Taxa List		MCI Score	Total abundances	% of Surveys	Survey
					Spring 2014
NEMERTEA	Nemertea	3	1	2	
ANNELIDA	Oligochaeta	1	32	56	VA
MOLLUSCA	*Physa*	3	1	2	
	Potamopyrgus	4	53	93	XA
	Sphaeriidae	3	2	4	
CRUSTACEA	Ostracoda	1	10	18	
	Paracalliope	5	28	49	VA
	Paratya	3	2	4	
EPHEMEROPTERA	*Coloburiscus*	7	5	9	
ODONATA	*Xanthocnemis*	4	1	2	
HEMIPTERA	*Sigara*	3	3	5	
TRICHOPTERA	*Hydrobiosis*	5	2	4	
	Oxyethira	2	15	26	
	Triplectides	5	8	14	A
DIPTERA	*Aphrophila*	5	4	7	
	Chironomus	1	12	21	
	Maoridiamesa	3	1	2	
	Orthocladiinae	2	35	61	
	Polypedilum	3	4	7	
	Empididae	3	1	2	
	Austrosimulium	3	8	14	
ACARINA	Acarina	5	2	4	

Prior to the current survey, 22 taxa had characterised the community at this site on occasions. These have comprised six 'moderately sensitive' and sixteen 'tolerant' taxa i.e. an absence of 'highly sensitive' taxa and a very high proportion of 'tolerant' taxa as would be expected in the lower reaches of a small coastal stream, particularly with a softer, more sedimented substrate. Predominant taxa have included only the three 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), and orthoclad midges].

Four of the historically characteristic taxa were dominant in the current survey community and comprised two of the predominant 'tolerant' taxa (above) together with another two 'moderately sensitive' taxa which previously had been characteristic of this site's communities (Table 5). The three taxa which were recorded as very or extremely abundant at the time of this spring survey had characterised this site's communities on 49% to 93 % of past surveys.

The MCI value of 73 units was an insignificant two units higher than the median of previous values (Table 2) but a significant (Stark 1998) 18 units less than the score recorded at site 1. This was due to the much smaller proportion of 'sensitive' taxa in the community (particularly the absence of two mayfly taxa, all stoneflies, beetles and free-living caddisflies which are more commonly associated with harder substrates and swifter flow conditions), as a result of the more ponded and slower flow of water and the higher proportion of fine-sedimented substrate at this site. This reflected the very different habitat to that at the upstream 'control' site 1, rather than the effects of stormwater discharges. Ponding as a result of log jams, together with sand inundation and saltwater penetration have occurred at this site in the past as a result of very high tides coincident with low stream flow conditions. However, a number of the differences between the communities at sites 1 and 2 related to the presence/absence of taxa rarities (less than five individuals per taxon), rather than significant differences in individual taxon abundances. The major significant downstream decrease in the numerical abundance of one individual 'tolerant' taxon and decreased numerical abundance of one 'moderately sensitive' individual taxon recorded between sites, resulted in a decrease of only 0.7 unit in $SQMCI_s$ value at the downstream site 2, indicative of the relative similarity in numerically most dominant (characteristic) taxa between sites.

Discussion

The MCI values recorded since monitoring of these sites began in 1986 are illustrated in Figure 4.

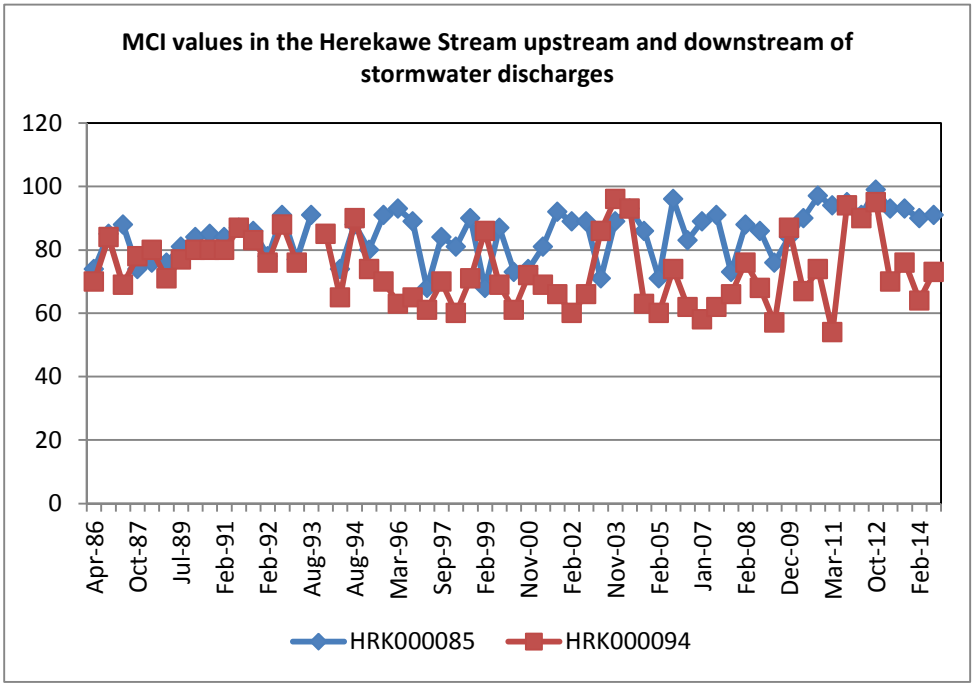

Figure 4 MCI values at sites upstream (site 1) and downstream (Site 2) of the stormwater discharges from the Omata tank farm area since monitoring began in 1986

There was a distinct change in the MCI values in 1995 when values at site 2 decreased markedly in comparison with those recorded at site 1, upstream of the culvert. Between March and September 1995 the habitat in the Herekawe Stream at site 2 changed significantly. Prior to the September 1995 survey, the stream at this site had a more riffle-like habitat. Although the water was slower flowing (compared to site 1), the stream had been shallower and contained a greater proportion of cobbles. A natural dam of debris and rocks appeared downstream between these two surveys, causing the stream to pond around site 2, becoming deeper and very slow flowing. The substrate became more dominated by silt and

macrophyte beds developed. This habitat generally supports fewer 'sensitive' taxa and therefore MCI values generally reflected a poorer community. The very low flow conditions surveyed at the time of post 2002 summer surveys however, indicated more similar conditions at site 2 to pre-1995 habitat, particularly the absence of aquatic macrophytes, reversing recent trends in MCI scores. Ponding at site 2 became more apparent again during many of the last fifteen (spring and summer) surveys, and at the time of the current survey, with the MCI value reflecting such a habitat.

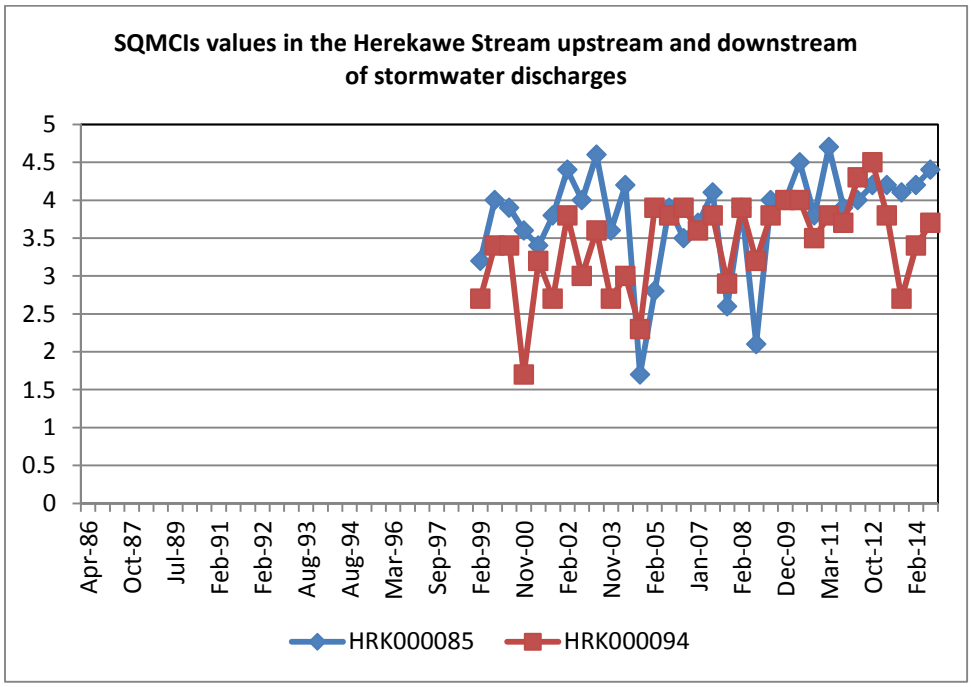

Figure 5 SQMCI$_s$ values for surveys conducted in the Herekawe Stream since 1999 (when SQMCI$_s$ was first implemented)

The SQMCI$_s$ values over the surveys conducted since 1999 suggest that while there have been differences in community composition, it is likely that the dominant taxa on many occasions were similar between sites, and SQMCI$_s$ values at both sites have followed a similar pattern (Figure 5). The exception has been certain post-2004 surveys when the SQMCI$_s$ highlighted some significant differences in community composition at site 2 in terms of increased abundances within several individual 'sensitive' taxa in a downstream direction. Since this date, with a few exceptions (spring 2008, spring 2010, and spring 2013), the two sites have had relatively similar SQMCI$_s$ values.

It is unlikely that any differences in macroinvertebrate communities between site 1 and site 2 in recent years have been due to stormwater discharges from the Omata Tank Farm, NPDC or DowAgro Sciences. There have been no records of major changes to community compositions, i.e. significant loss of characteristic taxa, at the site (2) below these discharges, indicative of minimal impacts of stormwater discharges.

Conclusions

This spring 2014 survey of the Herekawe Stream performed under low flow conditions indicated that the streambed communities had not been detrimentally affected by discharges of stormwater to the stream from the Omata Tank Farm, New Plymouth District Council, or other industrial sites. The macroinvertebrate communities at the sites both upstream and downstream of the discharges contained quite different proportions of 'sensitive'

macroinvertebrate taxa which were most probably related to variations in stream habitat with a lower proportion present at the slower flowing, more sedimented downstream site where log jams accentuated the more ponded flow, but the two sites had similar numerically most dominant (characteristic) taxa.

The numbers of taxa and MCI scores were insignificantly different and higher than the respective medians of results found by previous surveys at each site. The MCI value downstream was 18 units lower than that recorded upstream at the time of this spring survey due to marked physical habitat differences (softer substrate and slower flowing nature of the site) downstream of the discharges. This was a similar deterioration in MCI score to that found by several previous surveys principally since the mid 1990's when habitat changed markedly at the downstream site and typical of the historical median MCI difference (15 units). There was a much lower proportion of 'sensitive' taxa in the community at this site, although there was minimal change in the composition of the dominant taxa.

Larger differences in the MCI value between sites 1 and 2 have been illustrated by historical data since 1995. Before 1995 both of these sites contained similar numbers of taxa and MCI values. A change in the habitat occurred at site 2 in 1995 when the faster flowing stream with substrate more characteristic of a riffle altered to a slow flowing, deeper, and ponded area with silt and from time to time macrophyte beds dominating the substrate. Saltwater penetration as far upstream as the road culvert (Figure 1), under extremely high tide and very low stream flow conditions, may have influenced community composition at site 2 on occasions. These changes in habitat are more likely to be the cause of lower MCI values at this downstream site since 1995 and at the time of the current survey rather than stormwater discharges from the Omata Tank Farm area. [However, under the low flow conditions of some of the more recent summer surveys, this trend in MCI scores was reversed (e.g. in 2009, 2010, and 2011) and in spring 2012].

Summary

The Council's standard 'kick-sampling' and 'sweep-sampling' techniques were used at two established sites, to collect streambed macroinvertebrates from the Herekawe Stream. Samples were sorted and identified to provide the number of taxa (richness) and MCI and $SQMCI_s$ scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_S$ takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities. It may be the more appropriate index if non-organic impacts are occurring.

Significant differences in either the MCI or $SQMCI_s$ between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

This spring macroinvertebrate survey indicated that the discharge of treated stormwater and discharges from the Omata Tank Farm or Dow Agro Sciences sites had not had any detrimental effect on the macroinvertebrate communities of the stream. A significant change in the MCI scores between the upstream 'control' site and site downstream of the discharges was more attributable to habitat differences between these sites. However, there were few changes in the number and composition of dominant taxa in communities in a downstream

direction (as reflected in a moderate decrease in $SQMCI_s$ scores) and there were no significant changes in terms of historical community compositions at the downstream site.

The macroinvertebrate communities of the stream were generally dominated by few taxa and proportionately more 'tolerant' taxa. Taxonomic richnesses (numbers of taxa) were lower at the time of this spring survey at the upstream site but slightly higher at the downstream site, compared to the previous summer survey, while MCI scores were both higher (by 1 to 9 units).

MCI and $SQMCI_s$ scores indicated that the stream communities deteriorated from 'fair' (upstream) to 'poor' health at the slower flowing, weedier downstream site, where the health was below the typical condition recorded in similar small Taranaki coastal streams. However, the relatively recent community initiatives to create the Herekawe walkway and extensive adjacent riparian planting in the 1.5 km reach immediately upstream of Centennial Drive (Report: CF485) should maintain or contribute towards a gradual improvement in stream health over future years, and it is noted that this spring MCI score at the upstream site was 5 units above the median for the 28-year period of monitoring. This site has recently shown a more positive improvement in MCI scores which has become a statistically significant temporal trend for the 19-year period between 1995 and 2014 (TRC, 2014b).

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To Job Managers, Scott Cowperthwaite & James Kitto
From Freshwater Biologist, CR Fowles
Doc No 1481258
Report No CF643
Date 12 March 2015

Biomonitoring of the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges, surveyed in February 2015

Introduction

This biological survey was the second of two scheduled for the Herekawe Stream in the 2014-2015 monitoring year to assess whether there had been any detrimental effects on the Herekawe Stream from stormwater discharges originating from STOS, DowAgro Sciences, Chevron, Origen Energy and NPDC. The previous survey (CF626) was performed in spring, 2014 as scheduled. The results from surveys performed since the 2001-02 monitoring year are discussed in reports referenced at the end of this report.

Methods

The standard '400 ml kick-net' and sweep-sampling' techniques were used to collect streambed macroinvertebrates at a 'control' site ('kick-net') and another downstream site ('kick-net' and 'sweep-sampling') in the Herekawe Stream (Table 1, Figure 1) on 20 February 2015. The 'sweep-sampling' technique is very similar to Protocol C2 (soft-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001). The 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the same protocols.

Table 1 Biomonitoring sites in the Herekawe Stream in relation to stormwater discharges

Site No.	Site Code	GPS Reference	Location
1	HRK 000085	E1688283 N5674972	Upstream of Centennial Drive culvert and stormwater discharges
2	HRK 000094	E1688201 N5675010	Downstream of stormwater discharges, approx. 75 m above coast

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly `sensitive' taxa were assigned the highest scores of 9 or 10, while the most `tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a

scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' taxa inhabit less polluted waterways.

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 & 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower, ranging from 0 to 10 $SQMCI_s$ units.

Figure 1 Biomonitoring sites in the Herekawe Stream

Results

At the time of this mid morning survey, the water temperature in the Herekawe Stream ranged from 17.5˚ C to 17.8˚ C between the two sites. No stormwater discharges were occurring from the right bank or the left bank outfalls at the time of the survey. The channel at site 1 was narrow and constrained by gabion baskets on the banks and bed of the stream where the substrate was comprised mainly of sand, gravels, wood, and gabion material with some cobbles and boulders. The stream at this site had a low, slightly turbid, uncoloured, swift flow and there were patchy filamentous algae and leaves on the bed. Macrophytes were recorded at the edges of the stream at this partially shaded site.

The substrate at site 2 was comprised mainly of sand with some wood and a smaller proportion of boulders. The site can periodically be affected by salt water intrusion under extremely high tide and very low flow conditions. The slightly turbid, uncoloured, low flow at this site was deeper and much slower moving than at site 1 upstream mainly due to log jams further downstream. There were patchy filamentous algae but no periphyton mats noted on the harder substrate components of the bed during the survey. Aquatic macrophytes were recorded at intervals along the stream margins. A small area of macrophytes was sweep-sampled at site 2 and the woody substrate and the limited area of boulder substrate were kick-sampled for macroinvertebrates at this site.

The survey was performed 18 days after a fresh in excess of 3 times median flow and 72 days after a fresh in excess of 7 times median flow in the catchment in accordance with Taranaki Regional Council biomonitoring fieldwork protocols.

Macroinvertebrates

A number of surveys have been performed previously at these two sites. Results of the current and past surveys are summarised in Table 2 and the results of the current survey presented in Table 3.

Table 2 Results of the current and previous surveys (since April 1986) performed at sites 1 and 2 in the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges

Site	Number of previous surveys	Numbers of taxa			MCI values		
		Median	Range	20 Feb 2015	Median	Range	20 Feb 2015
1	58	18	11-23	29	87	68-99	92
2	58	15	9-22	16	72	54-96	79

Table 3 Macroinvertebrate fauna of the Herekawe Stream in relation to Omata Tank Farm and other stormwater discharges sampled on 20 February 2015

Taxa List	Site Number	MCI score	1	2
	Site Code		HRK000085	HRK000094
	Sample Number		FWB15168	FWB15169
NEMERTEA	Nemertea	3	R	-
ANNELIDA (WORMS)	Oligochaeta	1	A	A
HIRUDINEA (LEECHES)	Hirudinea	3	R	R
MOLLUSCA	*Potamopyrgus*	4	XA	XA
	Sphaeriidae	3	R	R
CRUSTACEA	Ostracoda	1	R	C
	Paracalliope	5	XA	VA
	Paratya	3	-	C
	Paranephrops	5	R	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	C	-
	Coloburiscus	7	C	-
	Zephlebia group	7	-	R
PLECOPTERA (STONEFLIES)	*Megaleptoperla*	9	A	-
HEMIPTERA (BUGS)	*Anisops*	5	-	R
	Saldula	5	-	R
	Sigara	3	-	R
COLEOPTERA (BEETLES)	Elmidae	6	VA	R
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	R	-
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	C	-
	Hydrobiosis	5	C	-
	Hydropsyche (Orthopsyche)	9	R	-
	Polyplectropus	6	R	R
	Psilochorema	6	R	-
	Hudsonema	6	R	-
	Oxyethira	2	R	-
	Pycnocentrodes	5	C	-
	Triplectides	5	A	VA
DIPTERA (TRUE FLIES)	Eriopterini	5	R	-
	Hexatomini	5	R	-
	Paralimnophila	6	R	-
	Chironomus	1	R	A
	Orthocladiinae	2	R	-
	Tanypodinae	5	-	C
	Empididae	3	R	-
	Austrosimulium	3	A	-
		No of taxa	29	16
		MCI	92	79
		SQMCIs	4.6	4.1
		EPT (taxa)	11	3
		%EPT (taxa)	38	19

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Site 1 (upstream of stormwater discharges)

A high richness of 29 taxa was recorded at this site, which was eleven taxa more than the median number of taxa and six taxa more than the maximum richness from previous surveys at this site (Table 2) and above richnesses typically found in the lower reaches of small coastal streams elsewhere in Taranaki (TRC, 2015a). However, 17 of these taxa were present only as rarities.

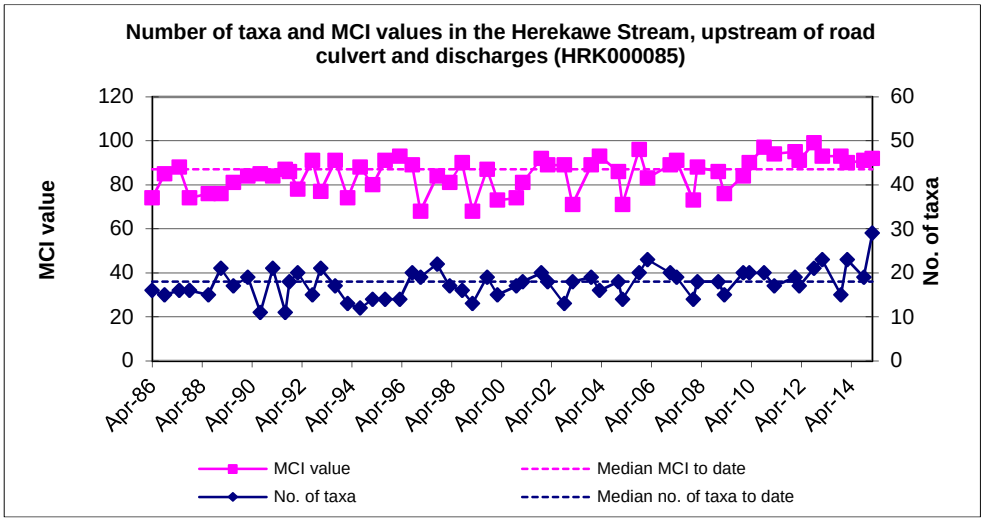

Figure 2 Number of taxa and MCI values in the Herekawe Stream upstream of the Centennial Road culvert since monitoring began in 1986

There were seven taxa dominant in the community (Table 3) which included one 'highly sensitive' taxon [stonefly (*Megaleptoperla*)], three 'moderately sensitive' taxa [extremely abundant amphipod (*Paracalliope*), elmid beetles, and vegetation-cased caddisfly (*Triplectides*)], and three 'tolerant' taxa [extremely abundant snail (*Potamopyrgus*); oligochaete worms, and sandfly (*Austrosimulium*)]. Several of these taxa are commonly found in habitats typical of the lower gradient reaches of small coastal streams, most of which are particularly abundant in association with periphyton and/or aquatic macrophytes. However, some of the more 'sensitive' taxa also present at this site (e.g. mayflies, stonefly, beetles, and some caddisflies) are associated with swifter flowing, harder substrates, and also amongst aquatic vegetation (e.g. amphipods, craneflies, and other caddisflies).

Characteristic macroinvertebrate taxa in the communities at this site prior to this summer 2015 survey are listed in Table 4.

Prior to the current survey, 14 taxa had characterised the community at this site on occasions. These have comprised six 'moderately sensitive' and eight 'tolerant' taxa i.e. an absence of 'highly sensitive' taxa and a relatively high proportion of 'tolerant' taxa as would be expected in the lower reaches of a small coastal stream. Predominant taxa have included only the one 'moderately sensitive' taxon [amphipod (*Paracalliope*)] and two 'tolerant' taxa [oligochaete worms and snail (*Potamopyrgus*)]. This snail taxon has characterised this site's community on every occasion.

Table 4 Characteristic taxa (abundant, very abundant, extremely abundant) recorded in the Herekawe Stream at Centennial Drive between April 1986 and October 2014 [58 surveys], and by the summer 2015 survey

Taxa List		MCI Score	Total abundances	% of Surveys	Survey
					Summer 2015
ANNELIDA	Oligochaeta	1	35	60	A
MOLLUSCA	*Potamopyrgus*	4	58	100	XA
CRUSTACEA	Ostracoda	1	2	3	
	Paracalliope	5	37	64	XA
EPHEMEROPTERA	*Austroclima*	7	4	7	
	Coloburiscus	7	11	19	
PLECOPTERA	*Acroperla*	5	1	2	
	Megaleptoperla	9	0	0	A
COLEOPTERA	Elmidae	6	0	0	VA
TRICHOPTERA	*Hydropsyche (Aoteapsyche)*	4	1	2	
	Oxyethira	2	12	21	
	Triplectides	5	12	21	A
DIPTERA	*Aphrophila*	5	4	7	
	Orthocladiinae	2	27	47	
	Polypedilum	3	2	3	
	Austrosimulium	3	17	29	A

Five of the historically characteristic taxa were dominant in the summer 2015 community and comprised all three of the predominant taxa (above) together with another one 'moderately sensitive' and one 'tolerant' taxa which previously had been characteristic of this site's communities on 21% and 29% of occasions respectively and two taxa ('moderately sensitive' elmid beetles and 'highly sensitive' stonefly (*Megaleptoperla*)) not previously found in abundance at this site (Table 4). The two taxa which were recorded as extremely abundant in this summer survey had characterised this site's communities on 64% to 100% of past surveys.

The MCI score (92 units) reflected the presence of a significant proportion of 'sensitive' taxa (59% of richness). The score was five units above the median of scores, but seven units lower than the maximum, found by previous surveys (Table 2, Figure 2). It was also a significant (Stark, 1998) 14 units higher than the median score found by 194 previous surveys of sites below 25 masl in similar lowland coastal streams (TRC, 2015a). The moderate $SQMCI_s$ value of 4.6 units (Table 3) reflected the numerical dominance of the 'tolerant' snail and 'sensitive' amphipod and elmid beetles in particular at this site. The presence of a relatively high proportion of 'sensitive' taxa indicated reasonably good physicochemical water quality conditions preceding this survey.

Site 2 (downstream of stormwater discharges)

A slightly above median richness of 16 taxa was found at this slower flowing site although it was noticeably more sandier and less of a cobble-boulder substrate habitat than usual. This richness was much reduced (by 13 taxa) from that recorded upstream (Table 2, Figure 3) and it should be noted that eight of these taxa (50% of richness) were also recorded as rarities (less than 5 individuals per taxon). Although ten of these taxa were also present at the upstream site 1 and the two sites shared four of the dominant taxa (with one fewer 'highly sensitive' taxon and one fewer 'moderately sensitive' taxon characteristic at this site (2)), the two sites had only 29% of taxa in common of the total taxa (35) found over this short reach. No 'highly sensitive' taxa were found at this site compared with two such taxa at site 1.

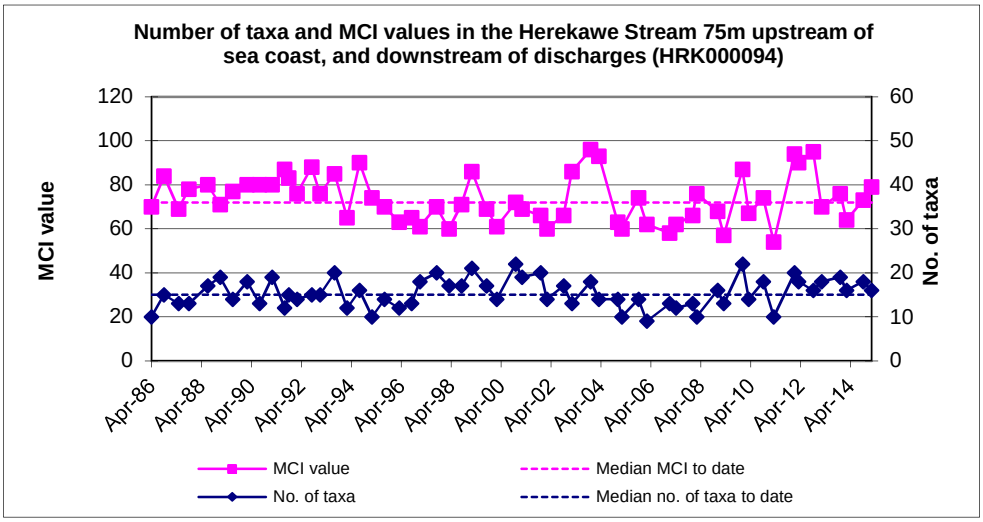

Figure 3 Number of taxa and MCI values in the Herekawe Stream downstream of industrial stormwater discharges since monitoring began in 1986

There was an increase (of 9%) in the proportion of 'tolerant' taxa in this community with 50% of the total taxa number. This was mainly due to the loss of 13 'sensitive' taxa present (some as rarities) at the upstream site. Taxa characteristic of this community included two of the 'moderately sensitive' taxa and one of the 'tolerant' taxa dominant at the upstream site together with another one 'tolerant' taxon [midge (*Chironomus*)] and loss of one 'highly sensitive', one 'moderately sensitive', and one 'tolerant' taxa.

Characteristic macroinvertebrate taxa in the communities at this site prior to this summer 2015 survey are listed in Table 5.

Table 5 Characteristic taxa (abundant, very abundant, extremely abundant) recorded in the Herekawe Stream downstream of Centennial Drive between April 1986 and October 2015 [58 surveys], and by the summer 2015 survey

Taxa List		MCI Score	Total abundances	% of Surveys	Survey
					Summer 2015
NEMERTEA	Nemertea	3	1	2	
ANNELIDA	Oligochaeta	1	33	57	A
MOLLUSCA	*Physa*	3	1	2	
	Potamopyrgus	4	54	93	XA
	Sphaeriidae	3	2	3	
CRUSTACEA	Ostracoda	1	10	17	
	Paracalliope	5	29	50	VA
	Paratya	3	2	3	
EPHEMEROPTERA	*Coloburiscus*	7	5	9	
ODONATA	*Xanthocnemis*	4	1	2	
HEMIPTERA	*Sigara*	3	3	5	
TRICHOPTERA	*Hydrobiosis*	5	2	3	
	Oxyethira	2	15	26	
	Triplectides	5	9	16	VA
DIPTERA	*Aphrophila*	5	4	7	
	Chironomus	1	12	21	A
	Maoridiamesa	3	1	2	
	Orthocladiinae	2	35	60	
	Polypedilum	3	4	7	
	Empididae	3	1	2	
	Austrosimulium	3	8	14	
ACARINA	Acarina	5	2	3	

Prior to the current survey, 22 taxa had characterised the community at this site on occasions. These have comprised six 'moderately sensitive' and sixteen 'tolerant' taxa i.e. an absence of 'highly sensitive' taxa and a very high proportion of 'tolerant' taxa as would be expected in the lower reaches of a small coastal stream, particularly with a softer, more sedimented substrate. Predominant taxa have included only three 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), and orthoclad midges] and one 'moderately sensitive' taxon [amphipod (*Paracalliope*)].

Five of the historically characteristic taxa were dominant in the current survey community and comprised three of the predominant 'tolerant' taxa (above) together with another one 'moderately sensitive' and one 'tolerant' taxa which previously had been characteristic of this site's communities (Table 5). The three taxa which were recorded as very or extremely abundant at the time of this summer survey had characterised this site's communities on 16% to 93 % of past surveys.

The MCI value of 79 units was an insignificant seven units higher than the median of previous values (Table 2) but a significant (Stark 1998) 13 units less than the score recorded at site 1. This was due to the smaller proportion of 'sensitive' taxa in the community (particularly the absence of one mayfly taxon, stonefly, and several caddisflies which are more commonly associated with harder substrates and swifter flow conditions), as a result of the more ponded and slower flow of water and the higher proportion of fine-sedimented substrate at this site. This reflected the very different habitat to that at the upstream 'control' site 1, rather than the effects of stormwater discharges. Ponding as a result of log jams, together with sand inundation and saltwater penetration have occurred at this site in the past as a result of very high tides coincident with low stream flow conditions. However, a number of the differences between the communities at sites 1 and 2 related to the presence/absence of taxa rarities (less than five individuals per taxon), rather than significant differences in individual taxon abundances. The major significant downstream decrease in the numerical abundance of one 'highly sensitive' and one 'moderately sensitive' taxa recorded between sites, resulted in a decrease of only 0.5 unit in $SQMCI_s$ value at the downstream site 2, indicative of the relative similarity in numerically most dominant (characteristic) taxa between sites.

Discussion

The MCI values recorded since monitoring of these sites began in 1986 are illustrated in Figure 4.

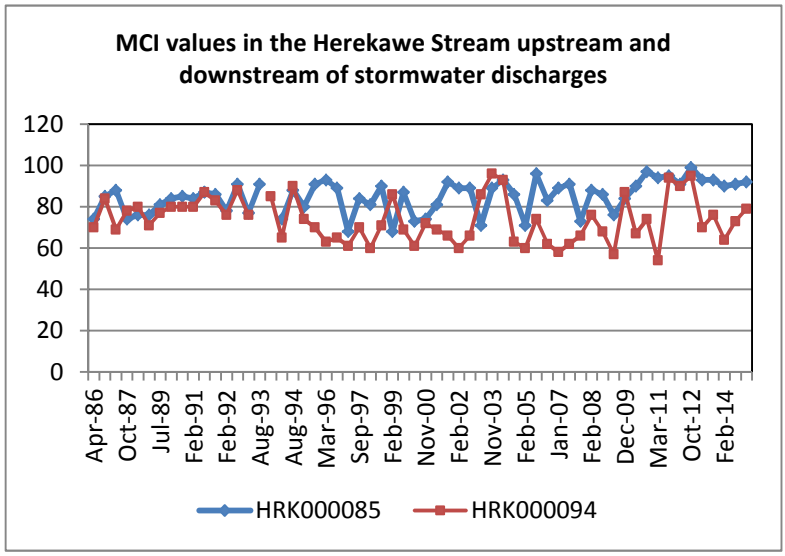

Figure 4 MCI values at sites upstream (site 1) and downstream (Site 2) of the stormwater discharges from the Omata tank farm area since monitoring began in 1986

There was a distinct change in the MCI values in 1995 when values at site 2 decreased markedly in comparison with those recorded at site 1, upstream of the culvert. Between March and September 1995 the habitat in the Herekawe Stream at site 2 changed significantly. Prior to the September 1995 survey, the stream at this site had a more riffle-like habitat. Although the water was slower flowing (compared to site 1), the stream had been shallower and contained a greater proportion of cobbles. A natural dam of debris and rocks appeared downstream between these two surveys, causing the stream to pond around site 2, becoming deeper and very slow flowing. The substrate became more dominated by silt and macrophyte beds developed. This habitat generally supports fewer 'sensitive' taxa and therefore MCI values generally reflected a poorer community. The very low flow conditions surveyed at the time of post 2002 summer surveys however, indicated more similar conditions at site 2 to pre-1995 habitat, particularly the absence of aquatic macrophytes, reversing recent trends in MCI scores. Ponding at site 2 became more apparent again during many of the last sixteen (spring and summer) surveys, and at the time of the current survey, with the MCI value reflecting such a habitat.

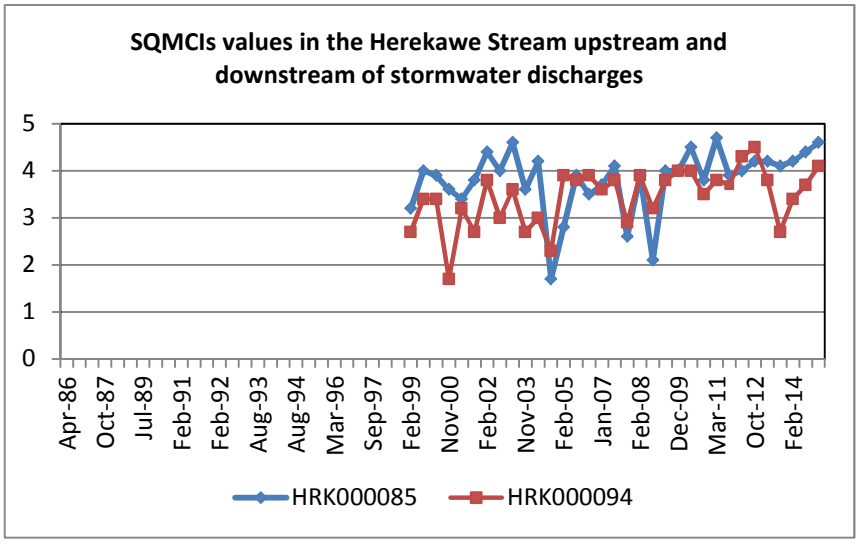

Figure 5 SQMCI$_s$ values for surveys conducted in the Herekawe Stream since 1999 (when SQMCI$_s$ was first implemented)

The SQMCI$_s$ values over the surveys conducted since 1999 suggest that while there have been differences in community composition, it is likely that the dominant taxa on many occasions were similar between sites, and SQMCI$_s$ values at both sites have followed a similar pattern (**Error! Reference source not found.**). The exception has been certain post-2004 surveys when the SQMCI$_s$ highlighted some significant differences in community composition at site 2 in terms of increased abundances within several individual 'sensitive' taxa in a downstream direction. Since this date, with a few exceptions (spring 2008, spring 2010, and spring 2013), the two sites have had relatively similar SQMCI$_s$ values.

It is unlikely that any differences in macroinvertebrate communities between site 1 and site 2 in recent years have been due to stormwater discharges from the Omata Tank Farm, NPDC or DowAgro Sciences. There have been no records of major changes to community compositions, i.e. significant loss of characteristic taxa, at the site (2) below these discharges, indicative of minimal impacts of stormwater discharges.

Conclusions

This summer 2015 survey of the Herekawe Stream performed under very low flow conditions indicated that the streambed communities had not been detrimentally affected by discharges of stormwater to the stream from the Omata Tank Farm, New Plymouth District Council, or other industrial sites. The macroinvertebrate communities at the sites upstream and downstream of the discharges contained different proportions of 'sensitive' macroinvertebrate taxa which were most probably related to variations in stream habitat with a lower proportion present at the slower flowing, more sedimented downstream site where log jams accentuated the more ponded flow, but the two sites had relatively similar numerically most dominant (characteristic) taxa.

The number of taxa at site 1 was higher than previously found at this site, whereas taxa richness at site 2 and MCI scores were insignificantly different and higher than the respective medians of results found by previous surveys at these sites. The MCI value downstream was 13 units lower than that recorded upstream at the time of this summer survey due to marked physical habitat differences (softer substrate and slower flowing nature of the site) downstream of the discharge outlets. This was a similar deterioration in MCI score to that found by several previous surveys principally since the mid 1990's when habitat changed markedly at the downstream site and typical of the historical median MCI difference (15 units). There was a lower proportion of 'sensitive' taxa in the community at this site, although there was minimal change in the composition of the characteristic taxa, particularly the predominant components.

Larger differences in the MCI value between sites 1 and 2 have been illustrated by historical data since 1995. Before 1995 both of these sites contained similar numbers of taxa and MCI values. A change in the habitat occurred at site 2 in 1995 when the faster flowing stream with substrate more characteristic of a riffle altered to a slow flowing, deeper, and ponded area with silt and from time to time macrophyte beds dominating the substrate. Saltwater penetration as far upstream as the road culvert (Figure 1), under extremely high tide and very low stream flow conditions, may have influenced community composition at site 2 on occasions. These changes in habitat are more likely to be the cause of lower MCI values at this downstream site since 1995 and at the time of the current survey rather than stormwater discharges from the Omata Tank Farm area. [However, under the low flow conditions of some of the more recent summer surveys, this trend in MCI scores was reversed (e.g. in 2009, 2010, and 2011, and in spring 2012)].

Summary

The Council's standard 'kick-sampling' and 'sweep-sampling' techniques were used at two established sites, to collect streambed macroinvertebrates from the Herekawe Stream. Samples were sorted and identified to provide the number of taxa (richness) and MCI and $SQMCI_s$ scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_S$ takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities. It may be the more appropriate index if non-organic impacts are occurring.

Significant differences in either the MCI or $SQMCI_s$ between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

This summer macroinvertebrate survey indicated that the discharge of treated stormwater and discharges from the Omata Tank Farm or Dow Agro Sciences sites had not had any recent detrimental effect on the macroinvertebrate communities of the stream. A significant change in the MCI scores between the upstream 'control' site and site downstream of the discharges was more attributable to habitat differences between these sites. However, there were few significant changes in the number and composition of dominant taxa in communities in a downstream direction (as reflected in a moderate decrease in $SQMCI_s$ scores) and there were no significant changes in terms of historical community compositions at the downstream site.

The macroinvertebrate communities of the stream were generally dominated by a limited number of taxa and several were 'tolerant' taxa. Taxonomic richnesses (numbers of taxa) were higher at the time of this summer survey at the upstream site but slightly lower at the downstream site, compared to the previous spring survey, while MCI scores were both higher (by 1 to 6 units).

MCI and $SQMCI_s$ scores indicated that the stream communities deteriorated from 'fair' (upstream) to 'poor' health at the slower flowing, weedier downstream site, where the health was below the typical condition recorded in similar small Taranaki coastal streams. However, the relatively recent community initiatives to create the Herekawe walkway and extensive adjacent riparian planting in the 1.5 km reach immediately upstream of Centennial Drive (Report: CF485) should maintain or contribute towards a gradual improvement in stream health over future years, and it is noted that this summer MCI score at the upstream site was 5 units above the median for the 29-year period of monitoring. This site has recently shown a more positive improvement in MCI scores which has become a statistically significant temporal trend for the 19-year period between 1995 and 2014 (TRC, 2015).

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Appendix V

Biomonitoring report on
Back Beach
2014-2015

Memorandum

To Job Manager, James Kitto
From Scientific Officer - Marine Ecology, Emily Roberts
File #1512081
Date 18 May 2015

Marine Ecological Inspection at Back Beach for Dow Agro Sciences

A marine ecological inspection was undertaken on 18 May 2015 at 1415 NZDT (low tide at 1552 NZDT, 0.2 m) of the intertidal area from the base of Paritutu Rock to approximately 200 m south of Paritutu. At the time of the inspection the weather was fine but very windy, with strong south to south-westerly gusts. There had been no significant rain for a couple of days preceding the inspection, however, rainfall the week before the inspection had been extremely heavy on occasions.

The purpose of this inspection was to ascertain whether activities of the adjacent Dow Agro Sciences plant were having any observable environmental effects on the intertidal communities at Back Beach. The inspection was undertaken as part of the 2014-2015 monitoring programme for this company.

An intertidal reef area is present at the north eastern end of Back Beach at the base of Paritutu Rock. The outer landward edges of the reef are subject to fluctuating levels of sand, and during this inspection there was substantial sand build up at the top end of the reef. Further down the shore, rocks and boulders were exposed, but there were no cobbles present higher on the shore.

Two groundwater seeps were observed flowing down the cliffs to the south of Paritutu Rock. The groundwater had no noticeable odour. The seeps flowed across the beach and over the reef before reaching the sea. These flows did not appear to be deleteriously affecting the reefs, as abundant limpets and little back mussels were present close to the flows.

A diverse range of algae and animal species were present on the reef. *Scytothamnus* sp. was abundant and several other algae were common, including encrusting *Corallina* spp., *Corallina officinalis*, *Endarachne binghamiae*, *Laurencia thryisifera, Ralfsia sp.* and *Ulva* sp. A variety of filter feeders (little black mussels, barnacles, anemones), grazers (limpets, chitons, top-shells) and crabs were present. From observations made during this inspection, the diversity of reef biota is typical to that seen at other local intertidal reefs in the Taranaki region.

Photograph 1 Reef at the base of Paritutu Rock

Photograph 2 Groundwater seeps to the south of Paritutu Rock

Photograph 2 Reef with encrusting animals (little back mussels) and algae (*Scytothamnus* sp., *Corallina officinalis* and *Endarachne binghamiae*)

Emily Roberts

Scientific Officer - Marine Ecology

Appendix VI

Dow AgroSciences Annual Air Discharge Report 2014-2015

1636325

Dow AgroSciences

Air Discharge Report

1 July 2014 – 30 June 2015

Consent No. 4020-4.0

21 September 2015

Table of Contents

Introduction

Dow AgroSciences (NZ) Ltd formulates agricultural chemicals at the New Plymouth site. All sources of air emissions from the Dow AgroSciences site are permitted by Air Discharge Permit (Consent 4020-4.0) granted and monitored by the Taranaki Regional Council ("TRC").

This report details the following for the 2014-15 year:

(a) The results obtained from all air quality monitoring undertaken during the year
(b) A description of changes to processes, emission control technology, consent conditions and products made during the year
(c) A description of any consultation undertaken during the year and any views put forward by those consulted

Changes Made During the Year

Process Changes

During the 2014-15 year, the following process changes were made.

One new product was manufactured in the Granulated Herbicides Plant using existing actives:

- Tordon^{TM} 2G Gold Herbicide

Emission Control Technology Changes

No changes were made to emission control equipment during the year.

Permit Changes

During the year the air discharge permit was renewed. The new consent (4020-4.0) took effect from 5 November 2014.

Monitoring Changes

All required monitoring was completed during the year.

The monitoring plan was adjusted for the new consent and draft Air Discharge Management and Monitoring Plan (ADMMP) which resulted in the following changes:

i) The incinerator monitoring program included the following additional items:

- Particulate Matter
- Sulphur Dioxide
- Metals

Process Vents

Permit Conditions

Special Condition 2

The discharges authorised by this consent shall not give rise to any odour, or dust emissions, at or beyond the boundary of the site that is offensive or objectionable.

Special Condition 3

The discharge of contaminants to air, other than from the High Temperature Incinerator Stack (see conditions 4 and 5) shall be controlled to ensure that the maximum ground level concentrations off-site do not exceed:

(a) Subject to condition 3(b), the relevant air quality limits listed in schedule 1 of this consent and assessed using the process set out in Schedule 3; and

(b) In the case of emissions due to raw materials or formulations introduced to the site after this consent commences, limits developed in accordance with the approach set out in schedule 2 and assessed using the process set out in Schedule 3

Special Condition 14

For any air monitoring undertaken, the following conditions apply:

(a) If a measured air quality parameter would result, or has resulted in, air quality that is 25% or less of the relevant limit referred to in condition 3, then no action is required.

Subsequent sub-clauses (b) to (d) outline actions for results of 25% and higher.

Insecticides Plant (Vent No. 03-5)

Permit Conditions

Emission Component: Chlorpyrifos

Air Quality Limit from Schedule 1: 0.57 µg/m^3 (annual average)

Dilution Factor from Schedule 3: 232,000 (annual average)

Maximum Stack Concentration: 132,240 µg/m^3

Sampling Plan & Methods

An Air Quality Scientist with STNZ (Source Testing New Zealand Limited, Wellington) was commissioned by Dow AgroSciences (NZ) Ltd to undertake air discharge monitoring of the Insecticides Plant, coordinate the analyses of the samples with an accredited laboratory and prepare a report.

For details of the sampling methodology and quality control refer to Appendix 1 *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Insecticides Plant, January 2015, Source Testing New Zealand Limited, issued February 2015.*

The formulating and packing activities carried out during the sampling period were typical for the Insecticides Plant.

Plant Operating Conditions

Chlorpyrifos is an organophosphate active ingredient used in liquid insecticide formulations. Chlorpyrifos is obtained in a solid form and melted in a hot water bath before use. Chlorpyrifos is pumped into a vessel containing solvent(s) and emulsifiers. The product is mixed, transferred to a bulk tank and packed.

Emissions may occur during the melting and pump-out of the active ingredient and during the packing of finished product.

Local exhaust ventilation removes vapour from the drum pump-out station, the top of the blending vessel, the bulk tank and the pack-off point. The extracted air is passed through a wet scrubber (BS1400) containing alkaline sodium hypochlorite solution before being vented to atmosphere.

The process technician monitors the condition of the scrubber solution. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council.

Air Discharge Monitoring Results

For details of the Insecticide Plant air discharge monitoring results refer to Appendix 1: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Insecticides Plant, January 2015, Source Testing New Zealand Limited, issued February 2015.*

i. Three (3) samples were collected for chlorpyrifos from the Insecticides Plant vent during the batch formulating and packing of chlorpyrifos based products, over the periods 13th to 14th January 2015.

ii. The maximum concentration of chlorpyrifos in the air discharged from the vent ranged from being less than 0.8 µg/m^3 to less than 2.3 µg/m^3 (corrected to 0°C, 101.3 kPa dry gas basis).

iii. The results of the chlorpyrifos analysis indicated concentrations less than the limit of detection for the sampling method.

Conclusion

Under normal operating conditions, the maximum emission of chlorpyrifos from the Insecticides Plant vent (#03-5) was less than 2.3 $\mu g/m^3$; which is less than 0.002% of the discharge consent maximum stack concentration of 132,240 $\mu g/m^3$ for chlorpyrifos.

These results indicate the performance of the Insecticides Plant meets the conditions of the air discharge permit.

Suspension Concentrates Plant (Vent No. BB600)

Permit Conditions

Emission Components:	Spinosad Spinetoram
Air Quality Limit from Schedule 1:	4 µg/m^3 Spinosad (annual average) 6 µg/m^3 Spinetoram (annual average)
Dilution Factor from Schedule 3:	513,000 (annual average)
Maximum Stack Concentration:	2,052,000 µg/m^3 Spinosad 3,078,000 µg/m^3 Spinetoram

Sampling Plan & Methods

An Air Quality Scientist with STNZ (Source Testing New Zealand Limited, Wellington) was commissioned by Dow AgroSciences (NZ) Ltd to undertake air discharge monitoring of the Suspension Concentrates Plant (formerly identified as the Spinosad Plant), coordinate the analyses of the samples with an accredited laboratory and prepare a report.

For details of the sampling methodology and quality control refer to Appendix 2: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Spinosad Plant, November 2014, Source Testing New Zealand Limited, issued December 2014.*

The formulating and packing activities carried out during the sampling period were typical for the Suspension Concentrates Plant.

Plant Operating Conditions

Spinosad and spinetoram are naturally produced metabolites from living organisms and are the active ingredients used in several liquid insecticide formulations. Spinosad and spinetoram are obtained in a solid form and loaded into a vessel containing solvent(s) and emulsifiers. The product is mixed and packed.

The process ventilation system extracts air from the loading hood and blender area. The process air passes through a bag filter, pre-filter and absolute filter before discharge.

The process technician monitors the condition of, and the pressure across, the filters. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council.

Air Discharge Monitoring Results

For details of the Suspension Concentrates Plant air discharge monitoring results refer to Appendix 2: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Spinosad Plant, November 2014, Source Testing New Zealand Limited, issued December 2014.*

i. Three (3) samples were collected, during the loading of the spinetoram technical (solid) and mixing of the finished product, from the Suspension Concentrates Plant vent over the period of 11th to 13th November 2014.

ii. The maximum concentration of spinetoram in the air discharged from the vent ranged from less than 1 $\mu g/m^3$ to less than 4 $\mu g/m^3$ (corrected to 0°C, 101.3 kPa dry gas basis).

iii. The results of the spinetoram analysis indicated concentrations less than the limit of detection for the sampling method.

Conclusion

Under normal operating conditions, the maximum emission of spinetoram from the Suspension Concentrates Plant vent (#BB600) was less than 4 $\mu g/m^3$; which is less than 0.0002% of the discharge consent maximum stack concentration of 3,078,000 $\mu g/m^3$ for spinetoram.

These results indicate the performance of the Suspension Concentrates Plant meets the conditions of the air discharge permit.

Granulated Herbicides Plant (Vent No. 03-14)

Permit Conditions

Emission Components: Picloram

Air Quality Limit from Schedule 1: 57 µg/m^3 Picloram acid, esters and salts (annual average)

Dilution Factor from Schedule 3: 432,000 (annual average)

Maximum Stack Concentration: 24,624,000 µg/m^3 Picloram

Sampling Plan & Methods

An Air Quality Scientist with STNZ (Source Testing New Zealand Limited, Wellington) was commissioned by Dow AgroSciences (NZ) Ltd to undertake air discharge monitoring of the Granulated Herbicides Plant, coordinate the analyses of the samples with an accredited laboratory and prepare a report.

For details of the sampling methodology and quality control refer to Appendix 3: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Granulated Herbicides Plant, November 2014, Source Testing New Zealand Limited, issued December 2014.*

The formulating and packing activities carried out during the sampling period were typical for the Granulated Herbicides Plant.

Plant Operating Conditions

Picloram is a herbicide active ingredient used in a granule formulation. Picloram is obtained in a solid form and neutralised in solution with either amine or potassium hydroxide before being mixed with and dried onto inert granules.

The process ventilation system extracts air from the loading hood, blender and packing area. The process air passes through a bag filter and absolute filter before discharge. Product caught on the filters is returned to the following batches.

The process technician monitors the condition of, and the pressure across, the filters. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council.

Air Discharge Monitoring Results

For details of the Granulated Herbicides Plant air discharge monitoring results refer to Appendix 3: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Granulated Herbicides Plant, November 2014, Source Testing New Zealand Limited, issued December 2014.*

i. Three (3) samples were collected for picloram from the Granulated Herbicides Plant vent during the batch formulating and packaging over the period 11th to 13th November 2014.

ii. The maximum concentration of picloram in the air discharged from the vent was 0.49 µg/m^3 (corrected to 0°C, 101.3 kPa dry gas basis).

Conclusion

Under normal operating conditions, the maximum emission of picloram from the Granulated Herbicides Plant vent (#03-14) was 0.49 µg/m^3; which is 0.000002% of the discharge consent maximum stack concentration of 24,624,000 µg/m^3 for picloram.

These results indicate the performance of the Granulated Herbicides Plant meets the conditions of the air discharge permit.

Herbicides Plant (Vent No. 03-8)

Permit Conditions

Emission Components: 2,4-D (acid and ester)

Air Quality Limit from Schedule 1: 2 µg/m^3 2,4-D acid, esters and salts (annual average)

Dilution Factor from Schedule 3: 107,000 (annual average)

Maximum Stack Concentration: 214,000 µg/m^3 2,4-D (acid and ester)

Sampling Plan & Methods

An Air Quality Scientist with STNZ (Source Testing New Zealand Limited, Wellington) was commissioned by Dow AgroSciences (NZ) Ltd to undertake air discharge monitoring of the Herbicides Plant, coordinate the analyses of the samples with an accredited laboratory and prepare a report.

For details of the sampling methodology and quality control refer to Appendix 4: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Herbicides Plant, June 2015, Source Testing New Zealand Limited, issued July 2015.*

The packing activities carried out during the sampling period were typical for the Herbicides plant.

Plant Operating Conditions

2,4-D ester as the formulated product is a liquid and is pumped from a bulk tank and packed.

The process ventilation system extracts air from the packing area. The process air passes through pre-filters followed by activated carbon filters before discharge.

The process technician monitors the condition of the pre-filters and activated carbon filters. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council.

Air Discharge Monitoring Results

While only 2,4-D ethylhexyl ester was being used in the Herbicides Plant when the emissions monitoring was carried out, there is potential for the ester to hydrolyse to the acid in the process ventilation system. Hence both 2,4-D acid and 2,4-D ethylhexyl ester discharges were monitored and reported as a Total 2,4-D discharged.

For details of the Herbicides Plant air discharge monitoring results refer to Appendix 4: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Herbicides Plant, June 2015, Source Testing New Zealand Limited, issued July 2015.*

i. A total of three (3) samples were collected on the 8th to 9th June 2015, during the packing of the finished 2,4-D ethylhexyl ester product.

ii. The maximum concentration of Total 2,4-D (acid and ester) in the air discharged from the vent ranged from less than 0.3 µg/m^3 to less than 0.4 µg/m^3 (corrected to 0°C, 101.3 kPa dry gas basis)

iii The results of the 2,4-D analysis indicated concentrations less than the limit of detection for the sampling method.

Conclusion

Under normal operating conditions, the maximum emission of Total 2,4-D (acid and ester) from the Herbicides Plant vent (#03-8) was less than 0.4 $\mu g/m^3$; which is less than 0.0002% of discharge consent maximum stack concentration of 214,000 $\mu g/m^3$ for 2,4-D.

These results indicate the performance of the Herbicides Plant meets the conditions of the air discharge permit.

Commodity Herbicides Plant (Vent No. 48-1)

Permit Conditions

Emission Components:	2,4-D (acid and ester) 2-ethylhexanol
Air Quality Limit from Schedule 1:	2 µg/m^3 2,4-D acid, esters and salts (annual average) 160 µg/m^3 2-ethylhexanol (annual average)
Dilution Factor from Schedule 3:	29,000 (annual average)
Maximum Stack Concentration:	58,000 µg/m^3 2,4-D (acid and ester) 4,640,000 µg/m^3 2-ethylhexanol

Sampling Plan & Methods

An Air Quality Scientist with STNZ (Source Testing New Zealand Limited, Wellington) was commissioned by Dow AgroSciences (NZ) Ltd to undertake air discharge monitoring of the Commodity Herbicides Plant, coordinate the analyses of the samples with an accredited laboratory and prepare a report.

For details of the sampling methodology and quality control refer to Appendix 5: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Commodity Herbicides Plant, March 2015, Source Testing New Zealand Limited, issued April 2015.*

The production and formulating activities carried out during the sampling period were typical for the Commodity Herbicides Plant.

Plant Operating Conditions

2,4-D acid is esterified with an alcohol (2-ethylhexanol) into 2,4-D ester, which is an active ingredient used in various herbicide formulations. The 2,4-D ester is mixed with solvent(s) and emulsifiers to formulate the finished 2,4-D ester. It is tested and transferred to a bulk tank to be packed in the Herbicides Plant at a later date.

The process ventilation system extracts air from the loading hood and process areas. The process air passes through a caustic scrubber and activated carbon filter before discharge.

The process technician monitors the condition of the caustic scrubber and the activated carbon filters. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council.

Air Discharge Monitoring Results

For details of the Commodity Herbicides Plant air discharge monitoring results refer to Appendix 5: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Commodity Herbicides Plant, March 2015, Source Testing New Zealand Limited, issued April 2015.*

a. 2,4-D (acid & ester)

i. Three (3) samples were collected for 2,4-D acid and 2,4-D ethylhexyl ester from the Commodity Herbicides Plant vent over the period 18th to 20th March 2015.

ii. The maximum concentration in the air discharged from the vent for Total 2,4-D (acid and ester) was 2.0 µg/m^3 (corrected to 0°C, 101.3 kPa dry gas basis).

iii. The results of the 2,4-D ester analysis indicated concentrations less than the limit of detection for the sampling method. The maximum concentration in the air discharged from the vent for Total 2,4-D (acid and ester) includes an estimate for 2,4-D ester based on half the limit of detection.

b. 2-Ethylhexanol

i. Three (3) samples were collected for 2-ethylhexanol from the Commodity Herbicides Plant vent over the period 19th to 20th March 2015.

ii. The maximum concentration of 2-ethylhexanol in the air discharged from the vent was 0.2 µg/m^3 (corrected to 0°C, 101.3 kPa dry gas basis).

Conclusion

Under normal operating conditions, the maximum emission of Total 2,4-D (acid and ester) from the Commodity Herbicides Plant vent (#48-1) was 2.0 µg/m^3; which is 0.003% of the discharge consent maximum stack concentration of 58,000 µg/m^3 for 2,4-D.

Under normal operating conditions, the maximum emission of 2-ethylhexanol from the Commodity Herbicides Plant vent (#48-1) was 0.2 µg/m^3; which is 0.00004% of the discharge consent maximum stack concentration of 4,640,000 mg/m^3 for 2-ethylhexanol.

These results indicate the performance of the Commodity Herbicides Plant meets the conditions of the air discharge permit.

Multiple Sources of an Individual Contaminant

Schedule 3

Where multiple sources of an individual contaminant are involved, individual stack concentrations for that contaminant will be determined to ensure the air quality is complied with on a cumulative basis

Applicable Situations

This requirement applies to Total 2,4-D (acid and esters) which may be emitted from both the Herbicides Stack and the Commodities Herbicides Stack

Permit Conditions

Emission Components: 2,4-D (acid and ester)

Air Quality Limit from Schedule 1: 2 µg/m^3 2,4-D acid, esters and salts (annual average)

Results

TABLE 1: Calculated Concentration of Total 2,4-D Outside Site Boundary

Vent	Maximum Stack Concentration µg/m^3	Dilution factor from Schedule 3	Calculated Concentration µg/m^3
Commodity Herbicides Plant	2.0	29,000	0.000069
Herbicides Plant	<0.4	107,000	<0.0000037
Total			**0.000073**

Conclusion

Under normal operating conditions, the cumulative maximum Total 2,4-D (acid and ester) concentration beyond the boundary of the site from both the Commodity Herbicides Plant and the Herbicides Plant was 0.000073 µg/m^3. This is 0.004% of the discharge consent limit of 2 µg/m^3 for 2,4-D.

These results indicate that the air quality performance relating to Total 2,4-D from the Commodity Herbicides Plant and the Herbicides Plant is complied with on a cumulative basis.

Incinerator

High Temperature Incinerator (Vent No. 64-1)

Permit Conditions

Special Condition 4

The total concentration of polychlorinated dibenzodioxins and polychlorinated dibenzofurans in any discharge from the High Temperature Incinerator Stack shall not exceed 0.1 nanograms per cubic metre (adjusted to 0 degrees Celsius, dry gas basis, 101.3 kPa pressure and 11% oxygen) when calculated as total toxic equivalents using the World Health Organisation 2005 toxic equivalence factors.

Special Condition 5

The rate of discharge of total halides from the High Temperature Incinerator Stack shall not exceed 1.5 kg/hr.

Special Condition 6

There shall be no incineration of plastics and packaging that contain brominated flame retardants.

Special Condition 8

The oxygen concentration within the secondary combustion chamber of the incinerator shall be maintained between 6% and 9% (by volume) as far as is practicable, and shall not be less than 4.5% (by volume) for more than 60 seconds at any time during the incineration of material during any 24-hour period.

Special Condition 9

The temperature in the secondary chamber of the High Temperature Incinerator shall not be less than 1100 degrees Celsius at any time during the incineration of waste.

Special Condition 10

The temperature of the exhaust gas from the High Temperature Incinerator shall not be less than 1000 degrees Celsius at any at any time during the incineration of waste.

Sampling Plan & Methods

An Air Quality Scientist with STNZ (Source Testing New Zealand Limited, Wellington) was commissioned by Dow AgroSciences (NZ) Ltd to undertake air discharge monitoring of the Incinerator, coordinate the analyses of the samples with an accredited laboratory and prepare a report.

For details of the sampling methodology and quality control refer to: Appendix 6: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Compliance Monitoring May - July 2015, Source Testing New Zealand Limited, issued September 2015.*

The waste incinerated during the sampling programmes was typical of waste disposed of through the incinerator.

Incinerator Operating Conditions

The high temperature incinerator typically operates up to seven days/week and up to 24 hours/day, for the majority of the year. It is used to burn solid and liquid waste from the formulating and packaging plants. This waste includes all chemically contaminated materials including: packaging, contaminated drums, used protective clothing and production plant wastes. The liquids nozzle allows the burning of liquid wastes such as wash water.

Every day the high temperature incinerator is operated a log sheet is completed during the day detailing various operating parameters and including the times at which waste was placed in the high temperature incinerator, the quantity and a description of the waste. The primary and secondary chamber temperatures, and stack gas oxygen and carbon monoxide concentrations are continuously monitored and recorded on a chart which is attached to each log sheet at the completion of the "burn". Process messages and alarms are printed and this is attached to each log sheet. This information is retained for future reference and available for inspection during visits by officers of the Taranaki Regional Council. All information relating to the operating conditions during the sampling runs is also retained.

Air Discharge Monitoring Results

STNZ carried out annual compliance monitoring of the high temperature incinerator using the modified USEPA Method 23 sampling train incorporating a water-cooled probe.

For details of the incinerator air discharge monitoring results refer to: Appendix 6: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Compliance Monitoring May - July 2015, Source Testing New Zealand Limited, issued September 2015.*

a. Dioxins & Furans (PCDD/PCDF)

i. Over the period 27th to 29th May 2015, the incinerator was monitored for discharges of dioxins and furans (PCDD/PCDF).

ii. Four-hour samples were collected from each of the following three streams: crushed drums, liquid waste, and general waste.

iii. The concentrations of PCDD/PCDF for all three waste streams were low, the overall maximum concentration being 0.0104 ng/m^3 WHO-TEQ (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) being the upper bound level for crushed drums.

TABLE 2: PCDD/PCDF Maximum Concentration & Emission Rate

Sampling Date	Waste Type	PCDD/PCDF Concentration (ng/m^3 Total WHO-TEQ Upper Bound)[1] (Not corrected for laboratory blank)	PCDD/PCDF Emission Rate (ng/hr Total WHO-TEQ Upper Bound) (Not corrected for laboratory blank)
27 May 15	Crushed Drums	0.0104	33.6
28 May 15	General Waste	0.00697	21.4
29 May 15	Liquid Waste	0.00556	15.5
May 2015	**Laboratory Blank[2]**	**0.00476**	**14.4**

1 Corrected to 0°C, 101.3 kPa, 11% oxygen, dry gas basis

2 Equivalent concentrations and mass emissions rates using the laboratory blank concentrations and the average emission testing data

b. Total Halide (HF, HCl, HBr)

i. On the 26th May 2015 the incinerator was monitored for discharges of hydrogen fluoride, hydrogen chloride and hydrogen bromide.

ii. Two-hour samples were collected from each of the following waste sources: crushed drums, liquid waste, and general waste.

iii. The results of the Total Halide air discharges showed that the mass emissions of Total Halides from the Incinerator ranged from 0.019 to 0.495 kg/hr.

iv. Bromide concentrations were non-detectable at less than 0.02 mg/m^3, for all samples.

TABLE 3: Total Halide Maximum Concentration & Emission Rate

Date	Waste Type	Total Halide Concentration (mg/m^3)[1]	Total Halide Emission Rate (kg/hr)
26 May 2015	Crushed Drums	151	0.496
26 May 2015	General Waste	13.6	0.0431
26 May 2015	Liquid Waste	6.07	0.0194

[1] Corrected to 0°C, 101.3 kPa, 11% oxygen, dry gas basis

c. Particulate Matter

i. On the 26th May 2015 the incinerator was monitored for discharges of particulate matter.

ii. One 2-hour sample was collected from each of the following waste sources: crushed drums, liquid waste, and general waste.

iii. The results of the particulate matter air discharge monitoring showed that the concentration of particulate matter ranged from 6.0 to 24.8 mg/m^3 (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) with the particulate matter mass emissions ranging from 0.019 to 0.079 kg/hr.

TABLE 4: Total Particulate Concentration & Emission Rate

Date	Waste Type	Total Particulate Concentration (mg/m^3)[1]	Total Particulate Emission Rate (kg/hr)
26 May 2015	Crushed Drums	21.3	0.070
26 May 2015	General Waste	6.0	0.019
26 May 2015	Liquid Waste	24.8	0.079

[1] Corrected to 0°C, 101.3 kPa, 11% oxygen, dry gas basis

d. Sulphur Dioxide (SO_2)

i. On the 4th to 5th June 2015 the incinerator was monitored for discharges of Sulphur Dioxide.

ii. One 1 to 2-hour sample was collected from each of the following waste sources: crushed drums, liquid waste, and general waste.

iii. The results of the sulphur dioxide air discharge monitoring showed that the concentration of sulphur dioxide ranged from <0.4 to 1.3 mg/m^3 (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) with the sulphur dioxide mass emissions ranging from <0.001 to 0.0037 kg/hr.

TABLE 5: Total Sulphur Dioxide Concentration & Emission Rate

Date	Waste Type	Total Particulate Concentration (mg/m^3)[1]	Total Particulate Emission Rate (kg/hr)
4 June 2015	Crushed Drums	<0.4	<0.001
4 June 2015	General Waste	1.3	0.0035
5 June 2015	Liquid Waste	1.3	0.0037

[1] Corrected to 0°C, 101.3 kPa, 11% oxygen, dry gas basis

e. Metals

i. On the 8th to 9th June 2015 the incinerator was monitored for discharges of metals.

ii. One 2-hour sample was collected from each of the following waste sources: crushed drums, liquid waste, and general waste.

iii. The results of the metals monitoring are given in the following table.

TABLE 6: Total Metal Concentration & Emission Rate

Metal	Discharge Concentration (mg/m^3)[1]		Emission Rate (g/hr)	
	Range	Average	Range	Average
Aluminium	0.0268 – 0.0503	0.354	0.0673 – 0.165	0.103
Antimony	0.0004 – 0.0057	0.0024	0.0010 – 0.144	0.0063
Arsenic	0.0014 – 0.0040	0.0023	0.0036 – 0.130	0.0068
Boron	0.0236 – 0.184	0.124	0.0626 – 0.533	0.353
Cadmium	0.0003 – 0.0009	0.0005	0.0007 – 0.0030	0.0016
Chromium	0.0027 – 0.0043	0.0034	0.0067 – 0.0114	0.0094
Cobalt	<0.0003	<0.0003	<0.0008	<0.0008
Copper	0.0085 – 0.0553	0.0250	0.0226 – 0.181	0.0773
Iron	<0.037 – 0.619	0.246	<0.093 – 2.03	0.779
Lead	0.0085 – 0.151	0.0590	0.0226 – 0.494	0.187
Lithium	0.0017 – 0.0024	0.0020	0.0042 – 0.0064	0.0056
Manganese	0.0065 – 0.0434	0.0197	0.0162 – 0.115	0.0539
Mercury	<0.0007	<0.0007	<0.0020	<0.0020
Molybdenum	0.0016 – 0.0442	0.0162	0.0043 – 0.145	0.0521
Nickel	0.0013 – 0.0065	0.0032	0.0032 – 0.0173	0.0087
Tin	0.0013 – 0.0124	0.0055	0.0034 – 0.0405	0.0171
Vanadium	<0.0019 – 0.0022	0.0020	<0.0063 – 0.0058	0.0057
Zinc	0.107 – 0.545	0.265	0.284 – 1.78	0.809

[1] Corrected to 0°C, 101.3 kPa, 11% oxygen, dry gas basis

Conclusion

Under normal operating conditions, the maximum emission of PCDD/PCDF from the incinerator stack was 0.0104 ng/m^3 WHO-TEQ, which is less than the discharge consent limit of 0.1 ng/m^3 WHO-TEQ (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis).

Under normal operating conditions, the maximum emission of Total Halides from the incinerator stack was 0.495 kg/hr, which is below the discharge consent limit of 1.5 kg/hr.

Under normal operating conditions, the maximum emission of hydrogen bromide from the incinerator stack was non-detectable, which is in accordance with discharge consent special condition 6.

These results indicate the performance of the Incinerator meets the conditions of the air discharge permit.

General

Consultation

Air Discharge Management and Monitoring Plan

A draft Air Discharge Management and Monitoring Plan (ADMMP) was submitted to the Chief Executive, Taranaki Regional Council and the Medical Officer of Health for Taranaki on 29 January 2015 in accordance with Special Condition 11 of the Air Discharge Permit.

Feedback from the review was incorporated into the ADMMP and further review rounds were initiated. As at 30 June 2015 the ADMMP was awaiting finalisation after update to reflect the agreed modifications.

Air Quality Inspections

Officers of the Taranaki Regional Council undertook regular air quality inspections during the period.

Incident Review

No incidents occurred during the 2014-15 period.

Appendices

Appendix 1: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Insecticides Plant, January 2015, Source Testing New Zealand Limited, issued February 2015.

Appendix 2: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Spinosad Plant, November 2014, Source Testing New Zealand Limited, issued December 2014.

Appendix 3: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Granulated Herbicides Plant, November 2014, Source Testing New Zealand Limited, issued December 2014.

Appendix 4: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Herbicides Plant, June 2015, Source Testing New Zealand Limited, issued July 2015.

Appendix 5: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Commodity Herbicides Plant, March 2015, Source Testing New Zealand Limited, issued April 2015.

Appendix 6: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Compliance Monitoring May - July 2015, Source Testing New Zealand Limited, issued September 2015.

Appendix VII

Dow AgroSciences Annual Groundwater Monitoring Report 2014-2015

Dow AgroSciences

Groundwater Management Report New Plymouth site

1 July 2014 – 30 June 2015

21 September 2015

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1. INTRODUCTION

Dow AgroSciences (NZ) Ltd (formerly DowElanco (NZ) Ltd) has proactively conducted an Environmental Assessment Project (EAP) at the Paritutu Road (New Plymouth) site to assess the impacts of historical operations on groundwater. Field investigations commenced in 1993 and concluded in May 1996. The site investigation identified two locations where soil and/or groundwater have been impacted by constituents of concern. The constituents of concern fall into two groups, Phenoxy Acidic Herbicides and Chlorophenols.

From 1997 until August 2000 the evaluation of groundwater and protection of soil and groundwater on the site was subject to the conditions detailed in the Environmental Assessment Project Management Plan (28 July 1997). From September 2000, the evaluation of groundwater and protection of soil and groundwater on the site is subject to the conditions detailed in the Environmental Assessment Project Management Plan (August 2000).

The installation and use of piezometers is subject to conditions detailed in TRK0016WLL issued by the Taranaki Regional Council (TRC). Detailed standard operating procedures have been developed and implemented to ensure compliance with these conditions.

The last *Environmental Assessment Project (EAP) Report* was submitted to the Taranaki Regional Council on 28 March 2001. In June 2001, the Taranaki Regional Council approved the replacement of the Environmental Assessment Project Management Plan (August 2000) with the Groundwater Management Plan (June 2001). The Taranaki Regional Council agreed to the frequency of groundwater monitoring being changed from biannual to annual and supported the closure of several investigative wells no longer of use.

Dedicated sampling pumps were installed into all the sampling wells in May 2002.

The detection limit for Chlorophenols and Phenoxy Acidic Herbicides was 30 µg/L up until 2004. From 2005, the detection limit changed to 0.05 µg/L for Chlorophenols and 0.3 µg/L for Phenoxy Acidic Herbicides when a contract laboratory was commissioned to undertake the analyses. In 2012, the laboratory reporting limits for Phenoxy Acidic Herbicides was 0.04 µg/L and for Chlorophenols was 0.05 µg/L.

As part of the annual sampling of designated groundwater wells, the results from monitoring carried out in August 2014, are attached to this report along with a copy of the original report from ERM New Zealand Limited.

2. CHANGES MADE DURING THE PERIOD

2.1 YEAR 2014-2015

2.1.1 No changes were made to the Groundwater Management Plan during the reporting year.

3. AQUIFER MONITORING

3.1 SHALLOW AQUIFER

3.1.1 Performance Criteria

Sampling of groundwater from site perimeter shallow aquifer wells 1 and 21 to be carried out and analysed for the following analytes at the laboratory reporting limits specified:

Phenoxy Acidic Herbicides	0.04 µg/L
Chlorophenols	0.05 µg/L

Results of sampling and analysis to be reported to the Taranaki Regional Council.

As per the Groundwater Monitoring Plan (June 2001) the following action levels were established in consultation with the Taranaki Regional Council:

Total Phenoxy Acidic Herbicides *[2,4-D, MCPA, 2,4,5-T & MCPB]*	50,000 µg/L
Total Chlorophenols *[2,4-DCP, PCOC, 2,4,5-TCP & 2,4,6-TCP]*	10,000 µg/L

Results in excess of these action levels to be reported to the Taranaki Regional Council as soon as practicable.

3.1.2 Monitoring

The sampling frequency for the shallow perched aquifer was once per quarter (every 3 months) for the first year (1998), then every 6 months for the next 2 years (1999 and 2000), then annually from 2001 onwards.

As per the monitoring schedule detailed in the Groundwater Management Plan (June 2001) and agreement with the TRC, groundwater sampling was carried out in August 2014.

3.1.3 Results

The total Phenoxy Acidic Herbicides and total Chlorophenol concentrations for groundwater samples collected during the period are detailed in Table 1 of this report.

3.2 DEEPER REGIONAL AQUIFER

3.2.1 Performance Criteria

Sampling of groundwater from site perimeter deep regional aquifer wells 20, 32, 41, 42 and 47 to be analysed for the following analytes at the laboratory reporting limits specified:

Phenoxy Acidic Herbicides	0.04 µg/L
Chlorophenols	0.05 µg/L

Results of sampling and analysis to be reported to the Taranaki Regional Council.

As per the Groundwater Monitoring Plan (June 2001) the following action levels were established in consultation with the Taranaki Regional Council:

Total Phenoxy Acidic Herbicides *[2,4-D, MCPA, 2,4,5-T & MCPB]*	50,000 µg/L
Total Chlorophenols *[2,4-DCP, PCOC, 2,4,5-TCP & 2,4,6- TCP]*	10,000 µg/L

Results in excess of these action levels to be reported to the Taranaki Regional Council as soon as practicable.

Note: Non-site perimeter Wells 39J and 46A are also sampled for interest but are not subject to the established action levels.

3.2.2 Monitoring

The sampling frequency for the deeper regional aquifer was once per quarter (every 3 months) for the first year (1998), then every 6 months for the next 2 years (1999 and 2000), then annually from 2001 onwards.

As per the monitoring schedule detailed in the Groundwater Management Plan (June 2001) and agreement with the TRC, groundwater sampling was carried out in August 2014.

3.2.3 Results

The total Phenoxy Acidic Herbicides and total Chlorophenol concentrations for groundwater samples collected during the period are detailed in Table 1 of this report.

4. GROUNDWATER RESULTS SUMMARY

The shallow perimeter wells (1 and 21) showed no concentrations above the laboratory reporting limits.

Deep perimeter wells 32 and 47 could not be sampled due to insufficient water within the monitoring well.

In the other deep perimeter wells (20, 41 and 42) very low concentrations were detected above the laboratory reporting limits. Deep perimeter wells 20 and 41 showed low levels of total Phenoxy Acidic Herbicides (≤0.37 µg and (≤0.17 µg respectively) with no Chlorophenols detected. Deep perimeter well 42 showed low levels of total Phenoxy Acidic Herbicides (≤0.24 µg/L) and total Chlorophenols (≤0.27 µg/L). All levels were well below the action levels of 50,000 µg/L for total Phenoxy Acidic Herbicides and 10,000 µg/L for total Chlorophenols.

Non-perimeter well 39J could not be sampled due to insufficient water within the monitoring well whilst non-perimeter well 46A showed low levels of total Phenoxy Acidic Herbicides (1.28 µg/L) and total Chlorophenols (≤0.44 µg/L).

These non-perimeter wells are sampled for interest and are not subject to the established action levels.

5. GROUNDWATER FLOW DIRECTION

Gauging of all available wells was conducted on the 6th May 2010, confirming consistency with historical groundwater flow evaluations [*refer to 2010 Groundwater Monitoring Event, Dow AgroSciences, Paritutu Road, New Plymouth, issued February 2012 by ERM New Zealand Limited., Figures 3 & 4*].

In accordance with the Groundwater Management Plan (June 2001), gauging will be conducted every five years. The next gauging event will be carried out in 2015.

6. LIST OF TABLES

APPENDIX

Table 1: Total Phenoxy Acidic Herbicides and Total Chlorophenol Concentrations for New Plymouth Groundwater (August 2014)

Well Identification No.	Phenoxy Acidic Herbicides[1] Concentration (ug/L)	Chlorophenol[2] Concentration (ug/L)
Shallow Perimeter Wells:		
1	ND[3]	ND[3]
21	ND[3]	ND[3]
Deep Perimeter Wells:		
20	≤0.37	ND[3]
32	NS[4]	NS[4]
41	≤0.17	ND[3]
42	≤0.24	≤0.27
47	NS[4]	NS[4]
Additional Non-perimeter Wells:		
39J	NS[4]	NS[4]
46A	1.28	≤0.44
Trigger Levels	50,000	10,000

Note [1]: Phenoxy Acidic Herbicides [2,4-D; 2,4,5-T; MCPA; MCPB]
Note [2]: Chlorophenols [2,4-DCP; 2,4,5-TCP; 2,4,6-TCP; PCOC]
Note [3]: ND = Below laboratory reporting limits (<0.16 µg/L for Phenoxy Acidic Herbicides and <0.2 µg/L for Chlorophenols)
Note [4]: NS = Not sampled due to either being unsuitable for sampling or not meeting sampling requirements

All samples collected were obtained using in-well bladder pumps, in accordance with "Low Flow Sampling Methodology" except for MW32, MW47 and MW39J due to insufficient water within monitoring wells