Dow AgroSciences (NZ) Ltd
Monitoring Programme
Annual Report
2016-2017

Technical Report 2017-47

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Executive summary

Dow AgroSciences (NZ) Ltd (DAS) operates an industrial agrichemical formulating and packaging facility located at Paritutu Road, New Plymouth, in the Herekawe catchment. This report for the period July 2016 to June 2017 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

The Company holds two resource consents, which include a total of 24 conditions setting out the requirements that the Company must satisfy. The Company holds 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.

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

The Council's monitoring programme for the year under review included four inspections, four sets water samples collected for pesticide analysis, two biomonitoring surveys of receiving waters, and a marine ecology inspection. The Company provided groundwater and air quality monitoring data which was carried out by independent consultants.

The monitoring showed that DAS 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 DAS's activities was registered by the Council. There were no Unauthorised Incidents recording non-compliance in respect of this consent holder during the period under review.

During the year, the Company demonstrated a high level of both environmental performance and administrative compliance with the resource consents.

For reference, in the 2016-2017 year, 74% 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 21% demonstrated a good level of environmental performance and compliance with their consents.

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance remained at a high level in the year under review.

This report includes recommendations for the 2017-2018 year.

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1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2016 to June 2017 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Dow AgroSciences (NZ) Ltd (DAS). DAS operates an industrial agrichemical formulation plant situated at Paritutu Road, New Plymouth, in the Herekawe catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consent held by DAS that relates to discharges of water within the Herekawe catchment, and the air discharge permit held to cover emissions to air from the site.

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

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites though annual programmes;
- the resource consents held by the Company 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 in the Company's site.

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

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

Section 4 presents recommendations to be implemented in the 2017-2018 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

a. the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;

b. physical effects on the locality, including landscape, amenity and visual effects;

c. ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;

d. natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and

e. risks to the neighbourhood or environment.

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

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the Company, this report also assigns them a rating for their environmental and administrative performance during the period under review.

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

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

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

Environmental Performance

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

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

For example:

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

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

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

Administrative performance

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

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

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

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

For reference, in the 2016-2017 year, 74% 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 21% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

DAS 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 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.

Figure 1 Aerial photograph of the DAS Paritutu Road site

1.2.1 History

DAS 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;
- ceasing 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;
- 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;
- the amine neutralisation of glyphosate was ceased in 2013; and
- the esterification of 2,4-D was ceased in 2015.

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. Triclopyr is the highest volume active ingredient.

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

1.2.3 Commodity Herbicides Plant

The amine neutralisation of MCPA recommenced in September 2006, using the same equipment that was used in 2,4-D esterification. Imported MCPA is mixed with dimethylamine (DMA) 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 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, and adjuvants 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 spinosyn and sulfoxaflor 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 DAS 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 DAS'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 a rule in a regional plan, or by national regulations.

DAS 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 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 effects 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.

DAS 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 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 permit is attached to this report in Appendix I.

This summary of consent conditions may not reflect the full requirements of each condition. The consent conditions in full can be found in the resource consent which is appended to this report.

1.4 Monitoring programme: water

1.4.1 Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

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 DAS 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:

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

1.4.3 Site inspections

The DAS site was visited four times during the monitoring period. With regard to consents for the abstraction of or discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company 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 DAS to the 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.

1.4.5 Groundwater monitoring

DAS 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, DAS 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.

DAS 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 DAS's 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 DAS's Paritutu Road plant to look for any evidence of a discharge from the 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 RMA 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 DAS site consisted of three primary components.

1.5.2 Site inspections

The DAS 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 such as stormwater discharges.

1.5.3 Chemical emission sampling

Since 2006-2007, DAS has implemented a policy that all air emission monitoring be undertaken by independent specialist environmental consultants. In 2016-2017, Source Testing New Zealand Ltd carried out and reported on the sampling and analysis of vent and stack emissions.

Monitoring of process vent emissions from the Insecticides, Suspension Concentrates, Granule Herbicides, Herbicides and Commodity Herbicides plants were carried out

Air emissions from the High Temperature Incinerator stack were monitored to check for compliance with consent conditions. It was monitored under typical operating conditions with stack emissions tested for dioxins and furans, hydrogen chloride, total halides, sulphur dioxide, metals and (voluntarily) particulate matter.

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 comparison with 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, DAS 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 2016-2017 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 26 August and 9 December 2016, and 28 March and 14 June 2017.

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

26 August 2016

There were isolated showers with a light north westerly wind during the inspection. Rainfall of 60 mm had been measured in the week prior at the Brooklands Zoo station, nearly all of which had occurred in the preceding two days. SV8000 had recently been drained to accept stormwater from the hazardous substances area. The water level in SV9100 was at 110 m^3 on the staff gauge. The stormwater was clean and clear with some wind blown pollen on the surface. Exposed sides in the ponds were clean.

The incinerator was not running at the time of inspection. Stack testing had been repeated after an erroneous result in the first tests. The new results showed compliance with requirements and incineration was to be resumed upon completion of an internal review.

General site housekeeping was excellent. All roadways and stormwater catchments were clean and clear. The site was very well managed.

The discharge to the Herekawe Stream was sampled, it was clear with no sheen or odour. There was very high flow in the stream with some foaming unrelated to the Dow discharge.

An odour survey was conducted on the roads around the site and no conspicuous odours were noted at any point.

9 December 2016

The weather was fine with a light north westerly wind. A total of 14 mm rainfall had been measured in the previous week at the Brooklands Zoo station. SV8000 was at 500 m^3 on the staff gauge. SV9100 was too low to sample. SV9200 was at 250 m^3 on the staff gauge. The water in both sampled ponds was clean and clear with some wind blown debris present. A small leak into SV9100 from the concrete bund was noted. It was suspected that this originated from SV9000. Chlorpyrifos had recently been detected in SV9000 which had a low water level. This would be retested once the pond had filled.

The incinerator was undergoing a five hour polishing burn to remove built up ash at the time of inspection. All parameters were within consent limits. There had been an automatic shutdown at 1:08 am the previous night due to low flow in the liquid injection line. The controller for the liquid spray nozzle was subsequently replaced.

General site housekeeping was excellent. All roadways and stormwater catchments were clean and clear. The site was very well managed.

The discharge to the Herekawe Stream was not sampled during this round, as the release occurred too late for samples to be collected and returned to the lab in a timely manner. The stream was in moderate flow with no apparent effects from prior discharges.

An odour survey was conducted on the roads around the site with only the smell of freshly cut grass noted.

28 March 2017

The weather was fine with a light easterly wind. Rainfall of 27 mm rainfall had been measured over the last week at the Brooklands Zoo station. SV8000 was just below 400 m^3 on the staff gauge. SV9100 was too low to sample. SV9000 was at 100 m^3 on the staff gauge. The water in both sampled ponds was clean and clear with some wind blown debris present.

There had been a recent weekend spill of approximately 180 litres of Lontrel Advanced (600 g/L clopyralid) on to the driveway in the process area due to a burst pipe flange. The majority of the spill was contained and recovered at the point of loss, though a small amount entered the stormwater system. The process area stormwater ponds were subsequently emptied to sewer via the tradewaste treatment system. The spill containment systems and procedures had worked as designed to prevent any product discharging to the environment.

The incinerator was running well, with only routine maintenance required since the previous inspection. Final stack monitoring of the incinerator for this period was scheduled for 10 April. Monitoring for haloxyfop in the herbicides plant air discharge had been undertaken and assessment of the absorption media condition in the commodities building ventilation system was to be carried out during the week.

General site housekeeping and site management was excellent. All roadways and stormwater catchments were clean and clear. There were no noticeable odours or visible emissions to air during the inspection..

The discharge from SV8000 to the Herekawe Stream was sampled. The stream was in moderate flow with only very slight, short-lived foaming resulting from the DAS discharge.

An odour survey was conducted on the roads around the site with no odours noted.

14 June 2017

There were showers and a strong westerly wind during the inspection. Rainfall of 12 mm had been measured over the last week at the Brooklands Zoo station. Pond SV8000 was at 250 m^3 on the staff gauge, SV9100 was too low to sample and SV9000 was at 100 m^3 on the staff gauge. The water in both sampled ponds was clean and clear with some wind blown debris present in SV9000.

The site was in the middle of a two week maintenance shutdown. Pre-filters in the herbicide plant air treatment system were being replaced at the time of inspection. One outlet valve in SV8000 had been replaced the previous week and the second was to be installed the following day. Protocols for use of the stormwater release valves had been updated to prevent reoccurrence of a recent incident where a miscommunication resulted in a valve being left open for a short period. The incinerator was off line for annual maintenance checks and to prepare for a control system upgrade later in the year.

General site housekeeping and management was excellent. All roadways and stormwater catchments were clean and clear. There were no noticeable odours or visible emissions to air during the inspection.

The discharge from SV8000 to the Herekawe Stream was sampled. The stream was in high flow with only very slight, short-lived foaming resulting from the DAS discharge.

An odour survey was conducted on the roads around the site with no odours noted.

2.1.2 Results of discharge monitoring

All stormwater collected in the four stormwater retention ponds is sampled and analysed by DAS 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 2016-2017 year, a total of 173 stormwater samples were collected and analysed by DAS. On all occasions, the release criteria were met. This included one occasion where the Council were contacted prior to release to confirm that the analysis met the consent conditions due to a herbicide being identified at levels close to the consent limit. This confirmation was received.

Two of the stormwater ponds are also sampled by the 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 2016-2017, sampling was undertaken by an officer from the Council with staff from DAS on 28 August and 9 December 2016, and 28 March and 14 June 2017.

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 2016-2017 are presented in Tables 1 and 2.

Table 1 Stormwater results for acid herbicides and pH in 2016-2017

Parameter	Maximum concentration detected (mg/L)	
	SV8000 (n=4)	SV9100 (n=3)
2,4,5-T	0.00052	0.00061
2,4-D	0.0033	0.0037
2,4-DB	0.00015	0.00015
MCPA	0.0077	0.0012
MCPB	0.00013	0.00019
Picloram	0.0011	0.0022
Triclopyr	0.00076	0.00053
pH (range)	6.5 - 7.0	6.9 - 7.2

Table 2 Stormwater results for pesticides in 2016-2017

Parameter	Maximum concentration detected (g/m^3 or mg/L)		
	SV8000 (n=4)	SV9100 (n=3)	Maximum
Chlorpyrifos	<0.01	<0.01	<0.01
Chlorpyrifos-methyl	<0.01	<0.01	<0.01
Oxyfluorfen	<0.01	<0.01	<0.01

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 DAS's results from inter-laboratory comparison exercises is presented in Table 3. The results indicate good agreement between laboratories, and compliance with the conditions of stormwater discharge consent 4108.

Table 3 DAS stormwater results from 2016-2017 inter-laboratory comparisons

Consent Item	Consent limit	SV8000 (n=4)	SV9000 (n=4)	SV9100 (n=2)	SV9200 (n=3)
Oil, floatables, suspended solids	None present	Pass	Pass	Pass	Pass
Objectionable odour	None present	Pass	Pass	Pass	Pass
Colour and visual clarity	No change	Pass	Pass	Pass	Pass
pH	6.0 – 9.0	6.7 - 7.4	6.8 - 7.1	6.8 - 7.1	6.7 - 7.0
Total phenoxy herbicides	0.10 mg/L	0.075*	0.075*	0.075*	0.075*
Total organophosphates	0.0005 mg/L	0.0004**	0.0028 - 0.0004**	0.0017 - 0.0004**	0.0004**
Triclopyr	0.10 mg/L	0.025*	0.025*	0.025*	0.025*
Picloram	0.10 mg/L	0.025*	0.025*	0.025*	0.025*
Glyphosate	0.10 mg/L	0.00011***	0.00011***	0.00011***	0.00011***
Oxyfluorfen	0.005 mg/L	0.0026 - 0.00035****	0.00035****	0.00035****	0.00035****

* none detected, assumes 2,4-D, MCPA, MCPB (phenoxy herbicides), and, Triclopyr and Picloram 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

*** none deteted, assumes Glyphosate present at half detection limit of 00022 mg/L

**** none detected, assumes Oxyflurofen present at half detection limit of 0.0007 mg/L

In September 2017, the Council received a stormwater report from DAS covering the period between July 2016 and June 2017. The stormwater report summarises the monitoring and discharge data for the DAS site during the 2016-2017 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 2016-2017. The report is attached in Appendix III.

2.1.3 Groundwater monitoring

Field investigations into possible groundwater contamination at the site were commenced by DAS 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.

The Council received a groundwater management report from DAS covering the period between July 2016 and June 2017. The report is based on the results of the groundwater sampling round undertaken in August 2016 by consultant ERM New Zealand Limited.

Groundwater sampling of the nine Groundwater Monitoring Plan wells was carried out between 15 and 18 August 2016 using in-well bladder pumps in accordance with a "Low Flow Sampling Methodology".

The results of the chlorophenol and phenoxy acid analyses are listed in Table 4.

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

Phenoxy herbicides were detected at three of the deep perimeter wells, at wells 32R, 41 and 42 on the northern boundary, at ≤0.16, ≤0.21 and ≤0.24 µg/L, respectively, significantly below the action level of 50,000 µg/L. Chlorophenols were not detected in the deep perimeter wells.

Non-perimeter well 46A, drilled into the andesite south of the stormwater pond, showed low levels of phenoxy herbicides, at <0.70 µg/L, and of chlorophenols, at ≤0.50 µg/L. Well 39R had slightly higher levels of both phenoxy herbicides (17.5 µg/L) and chlorophenols (≤147.6), however these values were well below the trigger levels (which do not apply to non-perimeter wells anyway as these are sampled for interest and not subject to the established action levels).

Table 4 Groundwater monitoring results August 2016

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	ND	ND
32R	≤0.16	ND
41	≤0.21	ND
42	≤0.24	ND
47R	ND	ND
Additional non-perimeter wells		
39R	17.5	≤147.6
46A	≤0.70	≤0.50
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)

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. Wells 32, 39J and 47 frequently had insufficient water to sample and as a result were decommissioned in August 2015 and replaced with adjacent new wells 32R, 39R, and 47R.

All 28 existing monitoring wells (five shallow and 23 deep) were gauged on 24 September 2015 to assess groundwater levels, water column and silt build-up thickness. This five-yearly survey of all the wells is next due in 2020-2021.

2.1.4 Freshwater biological monitoring

Freshwater biological surveys were undertaken in the Herekawe Stream on 17 February 2017 and 26 April 2017. 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 DAS site or other industrial sites in the vicinity. Decreases in the MCI and $SQMCI_s$ scores between the upstream 'control' site and site downstream of the discharges was more likely attributable to habitat differences between these sites which appeared to be related primarily to flow.

2.1.5 Foreshore marine ecology inspection

A marine ecological inspection was undertaken of the intertidal area at Back Beach on 17 January 2017. 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 sand build up at the top end of the reef. Further down the shore, rocks and boulders were exposed.

Two groundwater seeps were observed flowing down the cliffs to the south west of Paritutu Rock. Flow of these seeps was greater than observed the two previous years, likely related to the heavy rainfall on the days preceding the inspection. 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.

2.2 Air

2.2.1 Inspections

Officers of the Council carried out regular inspections of the DAS Paritutu Road site during the 2016-2017 monitoring period. Scheduled inspections were undertaken on 26 August and 9 December 2016, and 28 March and 14 June 2017.

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. No odours were detected during any of the inspections.

The vents on site were 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 DAS air emissions report

In September 2017, Council received an air emissions report from DAS covering the period from July 2016 to June 2017. The main body of this report is attached in 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 produced. General aspects of air quality management are covered, including the Air Discharge Management and Monitoring Plan (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, Suspension Concentrates, Granule Herbicides, Herbicides and Commodity Herbicides plants were 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.

Sampling was timed and conducted to provide data representative of the various production and formulation processes. The emission component monitored was MCPA (acid and salt).

A summary of the emission test results and associated information is presented in Table 5.

Table 5 Summary of process vent emission monitoring results 2016-2017

Plant	Vent	Emission component	No.	Sampling period	Concentration * µg/m^3	Emission limit**	
						µg/m^3	%
Insecticides	03-5	Chlorpyrifos	3	20-22 Sep 2016	<1.9 - <2.4	132,240	<0.002
Suspension Concentrates	BB600	Spinosad	3	17-19 Oct 2016	<1.0 - <1.7	2,052,000	<0.0001
Granulated Herbicides	03-14	Picloram	3	20 Sep to 3 Oct 2016	<0.06 - <0.08	24,624,000	0.0000003
Herbicides	03-8	Haloxyfop-R methyl ester	3	7-9 March 2017	2.6 – 3.0	6,420	0.05
Commodity Herbicides	48-1	MCPA (acid and salt)	3	4-5 October 2016	<0.43 – 0.57	290,000	0.0002

* 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 of 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/m^3) = air quality limit (µg/m^3) x Dilution Factor

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.

Table 5 presents the emission component concentrations as a percentage of the relevant maximum stack concentrations that are allowed. The highest emission concentration measured was 0.05% of the respective limit, for Haloxyfop-R methyl ester from the Herbicides Plant stack.

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)/m^3, 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)/m^3 (see section 2.2.4).

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 of consent 4020-4).

During 2016-2017, there were three substances with potential to have multiple sources: 2,4-D, MCPA and clopyralid. These materials are used in the Herbicides Plant and the Commodity Herbicides Plant. However, the discontinuation of esterification in the Commodity Herbicides Plant has meant that each of these compounds is now predominantly used in only one plant at a time. Therefore there was no requirement to undertake a determination of multiple sources in 2016-2017.

2.2.4 High Temperature Incinerator

Conditions on DAS'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 2016-2017 period.

2.2.4.1 Dioxins and furans

Special condition 4 on DAS's 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 ng/m^3 (adjusted to 0°C, dry gas basis, 101.3 kPa pressure and 11% oxygen) when calculated as total toxic equivalents using World Health Organisation 2005 toxic equivalence factors. Compliance is determined based on the average of not less than three samples, each of which is taken while the incinerator is fed on different waste types.

Monitoring of the incinerator for dioxin and furan emissions was carried out by independent specialist STNZ using the modified USEPA Method 23 sampling train incorporating a water-cooled probe. The sampling programme was carried out with separate monitoring of crushed drums, liquid waste and general waste incineration. The sampling periods were all four hours.

Testing during incineration of all three waste types occurred on 1 to 3 March 2017. A summary of the results is presented in Table 6.

Table 6 High Temperature Incinerator PCDD/PCDF monitoring results 2016-2017

Date	Waste type	PCDD/PCDF concentration (ng/m^3 Total WHO-TEQ Upper Bound, not corrected for laboratory blank	PCDD/PCDF emission rate (ng/hr Total WHO-TEQ Upper Bound, not corrected for laboratory blank
		Total WHO-TEQ	Total WHO-TEQ
March 2017	Laboratory blank	0.00612	18.4
3 March 2017	Crushed drums	0.00552	17.8
2 March 2017	General waste	0.00558	19.3
1 March 2017	Liquid waste	0.00550	12.6
Average		**0.00553**	**17**
Consent limit		**0.1**	

Key: PCDD polychlorinated dibenzodioxins
PCDF polychlorinated dibenzofurans
ng/m^3 nanograms per cubic metre, adjusted to 0°C, 101.3 kPa, 11% oxygen, dry gas basis
ng/hr nanograms 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, 0.00553 ng/m^3 WHO-TEQ, is less than the limit of 0.1 ng/m^3 on consent 4020 by a factor of about 18.

The maximum mass emission rate value for the three sampling runs was 19.3 ng/hr 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 kg/hr.

Testing for hydrogen fluoride (HF), hydrogen chloride (HCl) and hydrogen bromide (HBr) was undertaken on 16 and 17 March 2017. 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 2016-2017

Date	Waste type	Concentration mg/m³				Emission rate kg/hr			
		HF	HCl	HBr	Total	HF	HCl	HBr	Total
17 March 2017	Crushed drums	8.60	55.6	<0.02	64.2	0.0275	0.178	<0.0001	0.2050
16 March 2017	General waste	1.99	12.0	<0.02	14.0	0.0052	0.032	<0.0001	0.0369
16 March 2017	Liquid waste	<0.02	<0.2	<0.02	<0.3	<0.0001	<0.001	<0.0001	<0.0007
Consent limit									**1.5**

Key: mg/m³ milligrams per cubic metre, adjusted to 0°C, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/hr kilograms per hour

The results of the total halide monitoring performed showed that the mass emission rate ranged from <0.0007 to 0.205 kg/hr, complying with the maximum limit of 1.5 kg/hr. Bromide concentrations were non-detectable at <0.02 mg/m³ for all samples.

2.2.4.3 Particulate matter

Testing for particulate matter was undertaken on 16 and 17 March 2017. 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. The results for particulate matter monitoring performed showed that the mass emission rate ranged from 0.078 to 0.223 kg/hr. There is no limit within the consent on mass emission rate of particulate, or on particulate concentration.

Table 8 High Temperature Incinerator particulate matter monitoring results 2016-2017

Date	Waste type	Particulate matter Concentration mg/m³	Particulate matter Emission rate kg/hr
17 March 2017	Crushed drums	31.2	0.100
16 March 2017	General waste	29.7	0.078
16 March 2017	Liquid waste	84.6	0.223

Key: mg/m³ milligrams per cubic metre, adjusted to 0°C, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/hr kilograms per hour

2.2.4.4 Sulphur dioxide

Testing for Sulphur dioxide was undertaken on 2 and 3 May 2017. 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 2016-2017

Date	Waste type	Sulphur dioxide Concentration mg/m³	Sulphur dioxide Emission rate kg/hr
2 May 2017	Crushed drums	5.5	0.0208
2 May 2017	General waste	13.4	0.0455
3 May 2017	Liquid waste	0.53	0.0018

Key: mg/m³ milligrams per cubic metre, adjusted to 0°C, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/hr kilograms per hour

The results for sulphur dioxide monitoring performed showed that the mass emission rate ranged from 0.0018 to 0.0455 kg/hr. There is no limit with the consent on mass emission rate of sulphur dioxide.

2.2.4.5 Metals

Testing for metals was carried out on 3 to 5 May 2017. 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 2016-2017

Metal	Discharge Concentration mg/m^3		Emission rate g/hr	
	Range	Average	Range	Average
Aluminium	0.0943 – 3.05	1.20	0.295 – 11.2	4.28
Antimony	0.0003 – 0.0054	0.0029	0.0008 – 0.0199	0.0099
Arsenic	0.0011 – 0.0057	0.0028	0.0034 – 0.0210	0.0096
Boron	0.0433 – 12.5	4.60	0.135 – 45.8	16.6
Cadmium	0.0002 – 0.0013	0.0009	0.0006 – 0.0049	0.0030
Chromium	0.0034 – 0.0412	0.0164	0.0104 – 0.1290	0.0520
Cobalt	<0.0002 – 0.0002	0.0002	<0.0007 – 0.0008	0.0008
Copper	0.0070 – 0.163	0.0694	0.0218 – 0.6000	0.2450
Iron	0.0308 – 0.261	0.1300	0.0931 – 0.9560	0.4530
Lead	0.0017 – 0.0050	0.0034	0.0052 – 0.0182	0.0115
Lithium	0.0008 – 0.0046	0.0021	0.0025 – 0.0167	0.00743
Manganese	0.0042 – 0.0086	0.0060	0.0130 – 0.0317	0.0201
Mercury	<0.0016 - <0.0019	<0.0017	<0.0051 - <0.0062	<0.0056
Molybdenum	0.0018 – 0.0131	0.0067	0.0056 – 0.0395	0.0214
Nickel	0.0018 – 0.0068	0.0038	0.0056 – 0.0204	0.0122
Tin	0.0006 – 0.0048	0.0022	0.0020 – 0.0175	0.0078
Vanadium	<0.0018 – 0.0018	0.0018	<00056 – 0.0066	0.0061
Zinc	0.0655 – 0.110	0.1400	0.205 – 1.02	0.486

Key: mg/m^3 milligrams per cubic metre, adjusted to 0°C, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
g/hr grams 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

DAS 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.

No community consultation was reported in the Air Discharge Annual Report that was produced for the 2016-2017 review period.

2.2.6 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 authorised 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 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 2016-2017 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

Two minor events were reported by DAS during the year:

- On 11 October 2016 DAS notified the Council of a sudden burn event in the High Temperature Incinerator, likely due to residual material in a drum. This resulted in the oxygen concentration in the secondary combustion chamber dropping below 4.5% for 84 seconds, slightly longer than the 60 seconds allowed by special condition 8 of consent 4020-4. The Company's drum handling procedures were updated to prevent reoccurrence.

- On 20 September 2016 DAS informed the Council that notification had been received from STOS of a noticeable agrichemical odour at their neighbouring site to the east of DAS. The odour was sourced to the unloading of chemicals while an external roller door was open. The door was subsequently fixed.

No enquiries or complaints from other parties regarding these events were received by DAS or the Council, and no additional investigations were required.

3 Discussion

3.1 Discussion of site performance

In general, from the inspections of the site and from discussions held with staff, Council officers have concluded that DAS 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 DAS 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.

Two new products were introduced to the site during 2016-2017; Closer™ insecticide and Rexade™ GoDRI™ herbicide.

Upon application of the "process for relating stack concentrations to air quality limits" as prescribed in Schedule 3 of 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 consents

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

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.

3.3 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 used by DAS for its routine monitoring.

3.4 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 11-12.

Table 11 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 no-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	Plan up to date	Yes
4. Keeping of discharge records	Inspection by Council and annual report by DAS received in September 2017	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 DAS with validation by Council	Yes
7. Optional review provision re environmental effects	Not scheduled for consideration during year under review. Next consideration June 2020	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**High** **High**

N/A = not applicable

Table 12 Summary of performance for consent 4020-4

Purpose: ***To discharge contaminants to air from all activities associated with 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 ADMMP required by condition 11	Yes
2. Prohibition of offensive odour or dust beyond boundary	Monitoring of activity as necessary by qualified Council officers	Yes
3. Limits on contaminants, other than from incinerator, beyond the site	Testing as detailed in ADMMP	Yes

Purpose: *To discharge contaminants to air from all activities associated with current and future operation of an agrichemical formulation and packaging plant*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
4. Limit on specific incinerator emission components	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 DAS	Yes
7. Incinerator monitoring record keeping	Inspection by Council and Annual Report by DAS	Yes
8. Incinerator oxygen concentration	Continuous monitoring by DAS.	One inconsequential exceedance of limit.
9. Incinerator secondary chamber temperature	Continuous monitoring by DAS	Yes
10. Incinerator exhaust gas temperature	Continuous monitoring by DAS	Yes
11. Air Discharge Management and Monitoring Plan	Plan up to date	Yes
12. Maintenance of Chemical Materials Register for current use	Review of records received by Council	Yes
13. Introduction of new items to Chemical Material Register	Data sheets received	Yes
14. Air Monitoring and triggers	No action required	Yes
15. Annual report on monitoring results, process change, and consultation	Report received September 2017	Yes
16. Six-yearly report on technological advances in emission reduction	Due April 2020	N/A
17. Review of consent	Not scheduled for consideration during year under review. Next consideration June 2020	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**High** **High**

Table 13 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2005-06	4108-1	1			
	4020-3	1			
2006-07	4108-1	1			
2006-07	4020-3	1			
2007-08	4108-1	1			
	4020-3		1		
2008-09	4108-2	1			
	4020-3		1		
2009-10	4108-2	1			
	4020-3	1			
2010-11	4108-2	1			
	4020-3		1		
2011-12	4108-2	1			
	4020-3		1		
2012-13	4108-2	1			
	4020-3	1			
2013-14	4108-2	1			
	4020-3	1			
2014-15	4108-2	1			
	4020-4	1			
2015-16	4108-2	1			
	4020-4	1			
2016-17	4108-2	1			
	4020-4	1			
Totals		20 (83%)	4 (17%)		

During the year, DAS demonstrated an overall high level of both environmental performance and administrative compliance with the resource consents as defined in Section 1.1.4.

3.5 Recommendation from the 2015-2016 Annual Report

In the 2015-2016 Annual Report, it was recommended:

THAT monitoring of consented activities at the DAS Paritutu Road plant in the 2016-2017 year is altered slightly from 2015-2016, by updating the air monitoring requirements to reflect the recent changes to the stack emissions monitoring plan, and removing the annual glyphosate testing of stormwater.

This recommendation was implemented.

3.6 Alterations to monitoring programmes for 2017-2018

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account:

- the extent of information already made available through monitoring or other means to date;
- its relevance under the RMA;
- the Council's obligations to monitor consented activities and their effects under the RMA;
- the record of administrative and environmental performances of the consent holder; and
- reporting to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki exercising resource consents.

It is proposed that for 2017-2018 the monitoring programme remains unchanged from that of 2016-2017.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site(s) in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2017-2018.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the DAS Paritutu Road plant in the 2017-2018 year continue at the same level as in 2016-2017.
2. THAT should there be issues with environmental or administrative performance in 2017-2018, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Glossary of common terms and abbreviations

The following abbreviations and terms may be 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.
ADMMP	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 the case of a leak.
Conductivity	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	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
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.
Incident Register	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
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	Nanograms 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 a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
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	Trichlorophenol.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.

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

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Appendix I

Resource consents held by Dow AgroSciences (NZ) Limited

(For a copy of the signed resource consent
please contact the TRC Consents 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 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: 85199.200-ADP-F1.dwg		
SCALES (AT A4 SIZE) 1:5000		
PROJECT No. 85199.200		

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

FIG. No. Figure 1 REV. 0

85199.200/CAD/85199.200-ADP-F1.dwg F1 21/08/2014 2:14:10 pm

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 DAS 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 MOLs can be matrix dependent.
MDL Method Detection Limit

No	COMPOUND	MDL (mg/kg)
1	acetochlor	0.001
2	alachlor	0.001
3	aldrin	0.001
4	allidochlor	0.001
5	ametryn	0.001
6	anilotos	0.001
7	atrazine	0.001
8	azaconazole	0.001
9	azinphos-methyl	0.005
10	azoxystrobin	0.001
11	benalaxyl	0.001
12	bendiocarb	0.001
13	benfluralin	0.001
14	benodanil	0.001
15	benoxacor	0.001
16	BHC-alpha	0.001
17	BHC-beta	0.001
18	BHC-delta	0.001
19	BHC-gamma (lindane)	0.001
20	bifenox	0 005
21	biferahrin	0.001
22	bioresmethrin	0001
23	bitedanol	0.001
24	bromacil	0.005
25	bromobutide	0.001
26	bromophos-ethyl	0.001
27	bromophos-methyl	0.001
28	bromopropylate	0.001
29	bupinmate	0.001
30	buprofezin	0.001
31	butachlor	0.001
32	butafenacil	0.001
33	butamifos	0.001
34	cadusafos	0.001
35	carbaryl	0.005
36	carbofuran	0.001
37	carboxin	0.001
38	carfentrazone-ethyl	0.001
39	chlordane-cis	0.001
40	chlordane-trans	0.001
41	chlorienapyr	0.001
42	chlorlenvinphos	0.001
43	chlorobenzilate	0.001
44	chlorothalonil	0.001
45	chtorpropham	0.001
46	chlorpyrifos	0.001
47	chlorpyrifos-methyl	0.001
48	chlorthal-dimethyl	0.001
49	chtozolinate	0.001
50	clodinafop-propargyl	0.001
51	clomazone	0.001
52	cloquintocet-1 anethylhexyl	0.001
53	cournaphos	0.001
54	cyanazine	0.001
55	cyanophos	0.001
56	cyflufenamid	0.001
57	cyfluthrin	0.005
58	cyhalofop-butyl	0.001
59	cyhalothrin	0.001
60	cypermethrin	0.005
61	cyproconazole	0.001
62	cyprodinil	0.001
63	DDD (o,p')	0.001
64	DDD (p,p')	0.001
65	DDE (o,p')	0.001
66	DDE (p,p')	0.001
67	DDT (o,p')	0.001
68	DDT (p,p')	0.005
69	deltamethrin	0.005
70	demeton-S-methyl	0.001
71	diazinon	0.001
72	dichlobenil	0.001
73	dichlofenthion	0.001
74	dichlofluanid	0.001
75	dichloran	0.001
76	dicofol	0.001
77	dichlorvos	0.001
78	diclobutrazol	0.001
79	diclofop-methyl	0.001
80	dieldrin	0.001
81	diethofencarb	0.001
82	difenoconazole	0.001
83	diflufenican	0.001
84	dimepiperate	0.001
85	dimethenamid	0.001
86	dimethoate	0.005
87	dimethomorph	0.001
88	dimethylvinphos	0.001
89	dioxabenzofos	0.001
90	diphenamid	0.001
91	diphenylamine	0.001
92	disulfoton	0.001
93	daltiopyr	0.001
94	edifenphos	0.001
95	endosulfan sulphate	0.001
96	endosulfan (alpha)	0.001
97	endosulfan (beta)	0.005
98	endrin	0.001
99	EPN	0.005
100	epoxiconazole	0.001
101	EPTC	0.001
102	esprocarb	0.001
103	ethalfluralin	0.001
104	ethiofencarb	0.001
105	ethion	0.001
106	ethoprophos	0.001
107	etoxazole	0.001
108	etridiazole	0.001
109	etrimfos	0.001
110	famphur	0.001
111	fenamiphos	0.001
112	fenarimol	0.001
113	fenchlorphos	0.001
114	fenitrothion	0 005
115	fenobucarb	0.001
116	fenoxanil	0.001
117	fenoxaprop-ethyl	0.001
118	fenoxycarb	0.001
119	fenpropathrin	0.001
122	fenpropimorph	0.001
121	fensulfothion	0.001
122	fenthion	0.001
123	fenvalerate	0.001
124	fipronil	0.001
125	flamprop-methyl	0.001
126	fluacrypyrim	0.001
127	fluazifop-P-butyl	0.005
128	fluazinam	
129	flumiclorac-pentyl	0.001
130	flumioxazin	0.001
131	fluquinconazole	0.001
132	flusilazole	0.001
133	flutolanil	0.001
134	flutriafol	0.001
135	fluvalinate	0.001
136	fonotos	0.001
137	fosthiazate	0.001
138	furalaxyl	0.001
139	furathiocarb	0.001
140	haloxyfop-e1otyl	0.001
141	haloxyfop-methyl	0.001
142	heptachlor	0.001
143	heptachlor-endo-epoxide	0.005
144	heptachlor-exo-epoxide	0.001
145	heptenophos	0.005
146	hexachlorobenzene	0.001
147	hexaconazote	0.001
148	hexazinone	0.001
149	indoxacarb	0.001
150	iodofenphos	0.001
151	iprobenfos	0.001
152	iprodione	0.001
153	iprovalicarb	0.001
154	isazofos	0.001
155	isofenphos	0.001
156	isoprocarb	0.001
157	isoprothiolane	0.001
158	kresoxim-methyl	0.001
159	lactofen	0.001
160	leptophos	0.001
161	malathion	0.001
162	mepronil	0.001
163	metalaxyl	0.001
164	methacrifos	0.001
165	methidathion	0.001
166	methiocarb	0.001
167	metolachlor	0.001
168	mevinphos	0.001
169	molinate	0.001
170	myclobulanil	0.005
171	napropamide	0.001
172	nitrofen	0.001
173	nitrothal-isopropyl	0.001
174	norflurazon	0.005
175	oxadiazon	0.001
176	oxadixyl	0.001
177	oxyfluorfen	0.001
178	paclobutrazol	0.001
179	parathion	0.001
180	parathion-methyl	0.001
181	penconazole	0.001
182	pendimethalin	0.001
183	permethrin	0.005
184	phenthoate	0.001
185	phorate	0.001
186	phorate-sulphone	0.001
187	phorate-sulphoxide	0.001
188	phosalone	0.001
189	phosmet	0.001
190	phosphamidon	0.001
191	picolinafen	0.001
192	piperonyl butoxide	0,001
193	piperophos	0.001
194	pirimicarb	0.001
195	pirimiphos-methyl	0.001
196	pretilachlor	0.001
197	prochloraz	0.001
198	procymidone	0.001
199	profenofos	0.001
200	promecarb	0.001
201	prometryn	0.001
202	propachlor	0.001
203	propergite	0.001
204	propazine	0.001
205	propetamphos	0.001
206	propham	0.001
207	propiconazole	0.001
208	propoxur	0.001
209	propyzamide	0.005
210	prothiofos	0.001
211	pyraclostrobn	0.001
212	pyraflufen-ethyl	0.001
213	pyrazophos	0.001
214	pyributicarb	0.001
215	pyridaben	0.001
216	pyridaphenthion	0.001
217	pyrimethanil	0.001
218	pyrimidifen	0.001
219	pyriminobac-methyl(E)	0.001
220	pyriminobac-methyl(Z)	0.001
221	pyriproxyfen	0.001
222	quinalphos	0.005
223	quinoxyfen	0.001
224	quintozene	0.001
225	quizalofop-ethyl	0.001
226	simazine	0.001
227	simeconazole	0.001
228	simettyn	0.001
229	tebuconazole	0.001
230	tebufenpyrad	0.001
231	tecnazene	0,001
232	tefluthrin	0.001
233	terbacil	0.001
234	terbufos	0.001
235	terbuthylazine	0.001
236	terbutryne	0.001
237	tetrachlorvinphos	0.001
238	tetraconazole	0.001
239	tetradifon	0.001
240	thenylchlor	0.001
241	thiobencarb	0.001
242	thiometon	0.001
243	tolclofos-methyl	0.001
244	tolyfluanid	0.001
245	tralkozychm	0.005
246	triadimefon	0.001
247	triadimenol	0.001
248	triallate	0.001
249	triazophos	0.001
250	tribufos	0.001
251	trifloxystrobin	0.001
252	trifluralin	0.001
253	uniconizole-P	0.001
254	vinclozolin	0.001
255	XMC	0.001

Appendix III

DAS Annual Stormwater Report 2016-2017

Dow AgroSciences

Stormwater Discharge Report

1 July 2016 - 30 June 2017

Consent No. 41 08-2

5 September 2017

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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, 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 SV91 00 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 storm water 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 storm water 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 173 discharges from the stormwater retention ponds to the Herekawe Stream, during the monitoring period of 1 July 2016 to 30 June 2017.

On all occasions (100%) the conditions of the discharge consent were met, that is, there were no breaches of the consent conditions. This included one occasion when the Taranaki Regional Council were contacted prior to release to confirm that the analysis met the consent conditions due to a herbicide being identified at levels close to the consent limit. This confirmation was received. 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 2016 to 30 June 2017.

Incident Review

During the monitoring year (1 July 2016 to 30 June 2017) there were zero incidents resulting in breaches of the discharge resource consent conditions.

Appendices

Appendix 1: Stormwater discharged to the Herekawe Stream (2016-17)

Appendix IV

Biomonitoring reports

To	Job Managers, Scott Cowperthwaite & Callum MacKenzie
From	Scientific Officer, Darin Sutherland
Doc No	1849538
Report No	DS073
Date	13 April 2017

Biomonitoring of the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges, surveyed in February 2017

Introduction

This biological survey was the first of two scheduled for the Herekawe Stream in the 2016-2017 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 first survey was due in spring 2016 but due to rain delays the first survey was instead completed in the summer of 2017 and a second survey is scheduled for the autumn of 2017. The previous survey (DS049) was performed in summer 2016 as scheduled. The results from surveys performed since the 2001-02 monitoring years are discussed in reports referenced at the end of this report.

Methods

The standard '400 ml kick-net' technique was used to collect streambed macroinvertebrates at a 'control' site and another downstream site in the Herekawe Stream (Table 1, Figure 1) on 16 February 2017. The 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

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

Site No	Site code	Grid reference	Location
1	HRK000085	E1688283 N5674972	Upstream of Centennial Drive culvert and stormwater discharges
2	HRK000094	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 abundances scored based on the categories presented in Table 5.

Table 2 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	500+

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 collected 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. A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000) (Table 3). More 'sensitive' communities inhabit less polluted waterways. A difference of 10.83 units or more in MCI values is considered significantly different (Stark 1998).

Table 3 Macroinverbrate health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2015) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

Grading	MCI
Excellent	>140
Very Good	120-140
Good	100-119
Fair	80-99
Poor	60-79
Very Poor	<60

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. A difference of 0.83 units or more in $SQMCI_s$ values is considered significantly different (Stark 1998).

Figure 1 Biomonitoring sites in the Herekawe Stream

Results

Site habitat characteristics and hydrology

This summer survey was performed under low flow conditions, 11 days after a fresh in excess of 3 times and 13 days after a fresh of 7 times median flow (flow gauge at the Mangaoraka Stream at Corbett Rd). The survey followed a relatively dry spring period with only one significant river fresh recorded over the preceding month, which was well in excess of 7 times median flow. The water temperature was 15.3°C at site 1 and 15.9°C at site 2. At site 1 the water speed was steady, water uncoloured and clear while at site 2 the water speed was slow, water colour grey, and cloudy.

There was a light brown coloured dirty discharge coming from a stormwater drain on the true left bank at the time of the survey (Figure 2). There had been no rain recently. 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. The stream at this site had no periphyton mats, and patchy filamentous algae, moss and wood on the streambed. Macrophytes were recorded at the edge of this partially shaded site on this occasion.

Figure 2 Light brown discharge from stormwater drain at time of survey

The substrate at site 2 was also comprised mainly of sand. The site can periodically be affected by salt water intrusion under extremely high tide and very low flow conditions. There was no periphyton mats or filamentous algae but there was patchy leaves and wood on the bed during the survey. Macrophytes were recorded along the stream margins.

Macroinvertebrates

A number of surveys have been performed previously at these two sites. Results of the current and past surveys are summarised in Table 4 and the results of the current survey presented in Table 5.

Table 4 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 No.	N	No of taxa			MCI value			SQMCI$_s$ value		
		Median	Range	Current survey	Median	Range	Current survey	Median	Range	Current survey
1	61	18	11-29	23	87	68-100	92	4.0	1.7-4.7	4.5
2	61	15	9-22	18	72	54-97	69	3.7	1.7-4.5	3.4

Table 5 Macroinvertebrate fauna of the Herekawe Stream in relation to Omata Tank Farm and other stormwater discharges sampled on 16 February 2017

Taxa List	Site Number	MCI score	1	2
	Site Code		HRK000085	HRK000094
	Sample Number		FWB17101	FWB17102
ANNELIDA (WORMS)	Oligochaeta	1	C	A
	Lumbricidae	5	R	-
MOLLUSCA	*Potamopyrgus*	4	XA	XA
	Sphaeriidae	3	-	R
CRUSTACEA	Ostracoda	1	R	A
	Paracalliope	5	VA	A
	Talitridae	5	R	-
	Paratya	3	-	R
	Paranephrops	5	R	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	A	-
	Coloburiscus	7	C	-
PLECOPTERA (STONEFLIES)	*Megaleptoperla*	9	C	-
	Zelandobius	5	R	-
ODONATA (DRAGONFLIES)	*Xanthocnemis*	4	-	R
HEMIPTERA (BUGS)	*Anisops*	5	-	A
	Microvelia	3	-	R
	Sigara	3	-	VA
COLEOPTERA (BEETLES)	Elmidae	6	VA	-
	Dytiscidae	5	-	R
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	C	-
	Hydrobiosis	5	C	-
	Oxyethira	2	-	R
	Pycnocentria	7	R	-
	Pycnocentrodes	5	R	-
	Triplectides	5	A	A
DIPTERA (TRUE FLIES)	*Aphrophila*	5	C	-
	Chironomus	1	-	VA
	Maoridiamesa	3	R	-
	Orthocladiinae	2	R	-
	Polypedilum	3	R	-
	Tanypodinae	5	-	R
	Paradixa	4	-	R
	Austrosimulium	3	C	R
	Tanyderidae	4	R	-
ACARINA (MITES)	Acarina	5	-	C
		No of taxa	23	18
		MCI	92	69
		SQMCIs	4.5	3.4
		EPT (taxa)	9	1
		%EPT (taxa)	39	6

'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 macroinvertebrate community richness of 23 taxa was found at site 1 ('control' site) at the time of the summer survey. This was five more than the historical median for this site and nine taxa higher than the previous survey on February 2016 (Table 4, Figure 3).

The MCI score of 92 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the historical median MCI score of 87 units. The current MCI score was significantly higher (Stark, 1998) than the preceding survey (81 units).

The $SQMCI_S$ score of 4.0 units was not significantly different (Stark, 1998) to the median MCI score of 4.0 units,

preceding survey (3.5 units) and to the median of similar streams (4.0 units, TRC, 2016a) (Stark, 1998) (Table 4).

The community was characterised by one 'tolerant' taxon ['tolerant' snails (*Potamopyrgus*)] and four 'moderately sensitive' taxa [amphipod (*Paracalliope*, mayfly (*Austroclima*), elmid beetles, and caddisfly (*Triplectides*)] (Table 5).

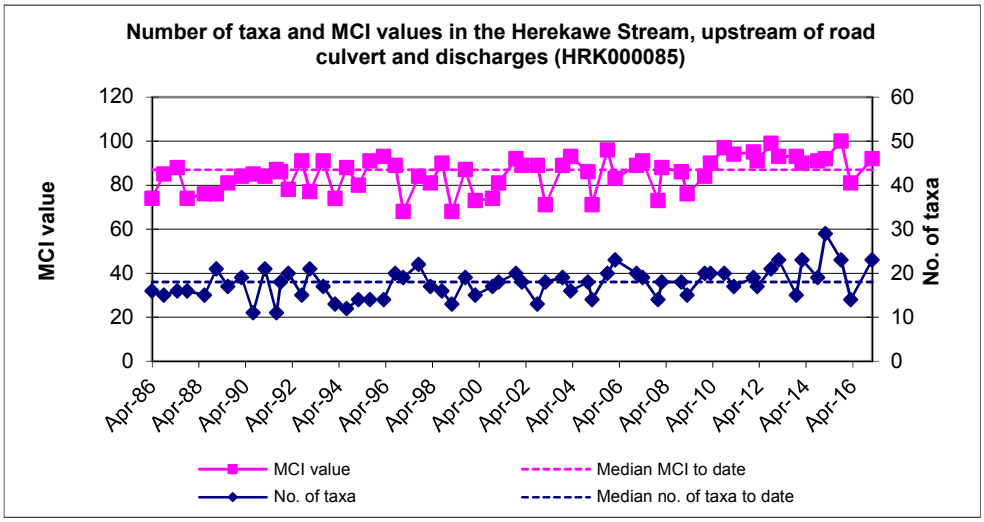

Figure 3 Number of taxa and MCI values in the Herekawe Stream upstream of the Centennial Road culvert since monitoring began in 1986

Site 2 (downstream of stormwater discharges)

A moderate macroinvertebrate community richness of 18 taxa was found at site 2 ('primary impact' site). This was three more than the historical median for this site and one taxon higher than the previous survey on October 2016 (Table 4, Figure 4).

The MCI score of 69 units indicated a community of 'poor' biological health which was not significantly different to the historical median (72 units). The MCI score was also not significantly different (Stark, 1998) to the preceding survey (72 units).

The $SQMCI_S$ score of 3.4 units was not significantly different (Stark, 1998) to the median MCI score of 3.7 units, preceding survey (3.8 units), and to the median for similar streams (4.0 units, TRC, 2016a) (Stark, 1998) (Table 4).

The community was characterised by four 'tolerant' taxa [snails (*Potamopyrgus*), seed shrimp (Ostracoda), true bug (*Sigara*) and blood worms (*Chironomus*))] and one 'moderately sensitive' taxon [caddisfly (*Triplectides*)] (Table 5).

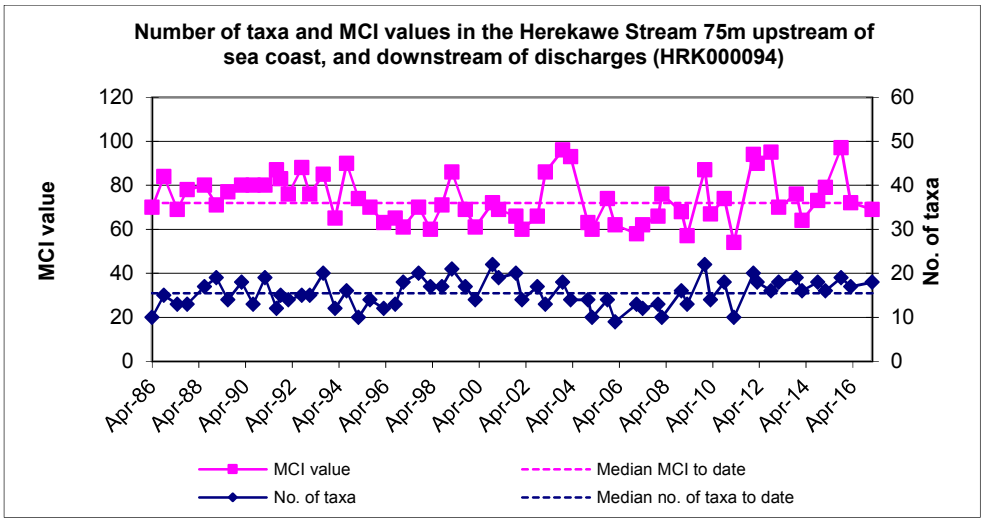

Figure 4 Number of taxa and MCI values in the Herekawe Stream downstream of industrial stormwater discharges since monitoring began in 1986

Discussion and conclusions

Macroinvertebrate richness at the 'control' site (site 1) was five taxa higher than the 'impact' site (site 2) but both sites had moderate levels of taxa richness indicating that there had been no significant toxic charges occurring preceding the survey. Furthermore, taxa richness at both sites was higher than the historical medians. Taxa richness is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to toxic discharges such as petrochemicals that could be discharged by the Omata Tank Farm. Macroinvertebrates when exposed to toxic chemicals may die and be swept downstream or deliberately drift downstream as an avoidance mechanism (catastrophic drift). The lack of any discernible impact on taxa richness at site 2 strongly indicates that no toxic discharges have been occurring.

Site 2 had a MCI score of 69 units which was a significant (Stark, 1998) 23 units lower than site 1 but only three units lower than the historical median. Site 1 had a historical median MCI score 15 units higher than site 2 indicating that the 'control' site usually had a healthier macroinvertebrate community compared with the 'impact' site. The 'control' site had a significant increase in MCI score (11 units) compared with the previous survey while the 'impact' site had a non-significant decrease (3 units) which might reflect better water quality above site 1 but not site 2.

The $SQMCI_s$ can be more sensitive to organic pollution compared with the MCI. Site 2 had a $SQMCI_s$ score of 3.4 units which was significantly lower (Stark, 1998) to site 1 (by 0.9 units) but was not significantly lower than what was normal for lowland coastal streams (4.0 units, TRC, 2016a). It was a typical score for the site as it was close to the historic median (within 0.3 units). Site 1 had a slightly higher than normal score (by 0.5 units). The significant difference between the 'control' and 'primary impact' sites was congruent with the MCI results but was not as strong result (0.9 units is the cut off for being significant).

The community composition between the two sites had some similarities such as high numbers of snails and amphipods as would be expected given there proximity to each other but also suggests that site 2 is more lentic (pond like) than site 1 as evidenced by the slow/ still water favouring species at site 2 (e.g. all three true bug species *Anisops*, *Microvelia* and *Sigara*). Unfortunately, taxa that prefer slower moving water typically have lower tolerance values which can distort MCI and $SQMCI_s$ scores and therefore it can be difficult to distinguish between water quality and habitat type in such cases.

There is no evidence that stormwater discharges have been having a toxic effect on the macroinvertebrate community at site 2 and highly significant differences in MCI score are probably due to habitat differences, particularly the more pond-like nature at site 2. However, very fine suspended sediment can have a deleterious effect on macroinvertebrates (such as what was discharging at the time of the survey but no silt was noted on the streambed at site 2) and therefore it cannot be ruled out that a combination of habitat and water quality differences produced the recorded results. However, given that there is usually a significant difference between

site 1 and 2 for MCI scores, this would indicate that either stormwater discharges were having a chronic (long term) effect which persistently lowered the health of the macroinvertebrate community at site 2 or that more likely habitat quality (which has been relatively stable and therefore a long term influence in all the surveys), is the overriding factor structuring macroinvertebrate communities in the lower Herekawe Stream.

Summary

The Council's standard 'kick-sampling' technique was 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.

Taxa richness is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to toxic discharges. Macroinvertebrates when exposed to toxic chemicals may die and be swept downstream or deliberately drift downstream as an avoidance mechanism (catastrophic drift). 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 taxa richness, community composition, the MCI or $SQMCI_s$ between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

There was a typical, moderate taxa richness at both sites indicating that stormwater discharges were not having a toxic effect on macroinvertebrate communities. There was a highly significant decrease in MCI scores from 'fair' (upstream) to 'poor' health at the downstream site, but the scores were typical for both sites.

This summer macroinvertebrate survey indicated that the discharge of treated stormwater and discharges from the Omata Tank Farm or Dow Agro Sciences sites was unlikely to have had a significant effect on the macroinvertebrate communities of the stream. A significant decrease in the MCI scores between the upstream 'control' site and site downstream of the discharges was more likely attributable to habitat differences between these sites which appeared to be related primarily to flow.

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To	Job Managers, Scott Cowperthwaite & Callum MacKenzie
From	Scientific Officer, Darin Sutherland
Doc No	1902689
Report No	DS075
Date	21 July 2017

Biomonitoring of the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges, surveyed in April 2017

Introduction

This biological survey was the second of two scheduled for the Herekawe Stream in the 2016-2017 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 first survey was due in spring 2016 but due to rain delays the first survey was instead completed in the summer of 2017 and this second survey was completed in autumn of 2017. The results from surveys performed since the 2001-02 monitoring years are discussed in reports referenced at the end of this report.

Methods

The standard '400 ml kick-net' technique was used to collect streambed macroinvertebrates at a 'control' site and another downstream site in the Herekawe Stream (Table 1, Figure 1) on 26 April 2017. The 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

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

Site No	Site code	Grid reference	Location
1	HRK000085	E1688283 N5674972	Upstream of Centennial Drive culvert and stormwater discharges
2	HRK000094	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 abundances scored based on the categories presented in Table 2.

Table 2 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	500+

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 collected 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. A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000) (Table 3). More 'sensitive' communities inhabit less polluted waterways. A difference of 10.83 units or more in MCI values is considered significantly different (Stark 1998).

Table 3 Macroinverbrate health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2015) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

Grading	MCI
Excellent	>140
Very Good	120-140
Good	100-119
Fair	80-99
Poor	60-79
Very Poor	<60

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. A difference of 0.83 units or more in $SQMCI_s$ values is considered significantly different (Stark 1998).

Figure 1 Biomonitoring sites in the Herekawe Stream

Results

Site habitat characteristics and hydrology

This autumn survey was performed under moderate flow conditions (approximately median flow), 10 days after a fresh in excess of 3 times median flow and 12 days after a fresh in excess of 7 times median flow (flow gauge at the Mangaoraka River at Corbett Rd). The survey followed a relatively wet summer period with several freshes recorded over the preceding month. The water temperature was 12.3°C at site 1 and 11.8°C at site 2. At site 1 the water speed was steady, water uncoloured and clear while at site 2 the water speed was slow, water uncoloured and clear.

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. The stream at this site had no periphyton mats or filamentous algae. Macrophytes were recorded on the bed of this partially shaded site during the survey.

The substrate at site 2 was also comprised mainly of sand but more silt was evident that at site 1. The site can periodically be affected by salt water intrusion under extremely high tide and very low flow conditions. There was no periphyton mats or filamentous algae. Macrophytes were recorded on the streambed.

Macroinvertebrates

A number of surveys have been performed previously at these two sites. Results of the current and past surveys are summarised in Table 4 and the results of the current survey presented in Table 5.

Table 4 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 No.	N	No of taxa			MCI value			$SQMCI_s$ value		
		Median	Range	Current survey	Median	Range	Current survey	Median	Range	Current survey
1	61	18	11-29	15	88	68-100	97	4.0	1.7-4.7	4.8
2	61	16	9-22	17	72	54-97	84	3.7	1.7-4.5	3.7

Table 5 Macroinvertebrate fauna of the Herekawe Stream in relation to Omata Tank Farm and other stormwater discharges sampled on 26 April 2017

Taxa List	Site Number	MCI score	1	2
	Site Code		HRK000085	HRK000094
	Sample Number		FWB17219	FWB17220
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	-	R
ANNELIDA (WORMS)	Oligochaeta	1	C	VA
MOLLUSCA	*Potamopyrgus*	4	A	XA
	Sphaeriidae	3	-	R
CRUSTACEA	Ostracoda	1	-	C
	Paracalliope	5	VA	VA
	Paranephrops	5	R	R
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	R	-
	Zephlebia group	7	R	-
PLECOPTERA (STONEFLIES)	*Megaleptoperla*	9	C	R
HEMIPTERA (BUGS)	*Sigara*	3	-	A
COLEOPTERA (BEETLES)	Elmidae	6	R	R
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	R	-
	Polyplectropus	6	-	R
	Psilochorema	6	-	R
	Triplectides	5	C	A
DIPTERA (TRUE FLIES)	*Paralimnophila*	6	R	-
	Chironomus	1	-	A
	Tanypodinae	5	-	R
	Tanytarsini	3	R	-
	Sciomyzidae	3	R	-
	Austrosimulium	3	C	R
ACARINA (MITES)	Acarina	5	R	C
		No of taxa	15	17
		MCI	97	84
		SQMCIs	4.8	3.7
		EPT (taxa)	5	4
		%EPT (taxa)	33	24
'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 macroinvertebrate community richness of 15 taxa was found at site 1 ('control' site) at the time of the autumn survey. This was three less than the historical median for this site (18 taxa) and eight taxa less than the previous survey (23 taxa) on February 2016 (Table 4, Figure 2).

The MCI score of 97 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the historical median MCI score of 88 units and to the preceding survey (92 units). The score of 97 units was only three units off the maximum score ever recorded for the site (100 units).

The $SQMCI_S$ score of 4.8 units was not significantly different (Stark, 1998) to the median MCI score of 4.0 units, and to the preceding survey (4.0 units) (Stark, 1998) (Table 4).

The community was characterised by one 'tolerant' taxon ['tolerant' snails (*Potamopyrgus*)] and one 'moderately sensitive' taxon [amphipod (*Paracalliope*)] (Table 5).

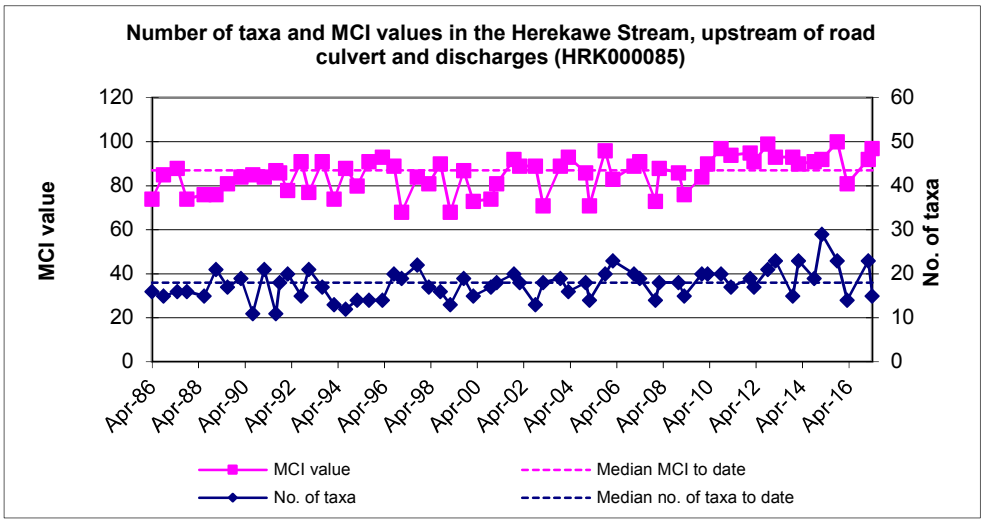

Figure 2 Number of taxa and MCI values in the Herekawe Stream upstream of the Centennial Road culvert since monitoring began in 1986

Site 2 (downstream of stormwater discharges)

A moderate macroinvertebrate community richness of 17 taxa was found at site 2 ('primary impact' site). This was one more than the historical median (16 taxa) for this site and one taxon lower than the previous survey (18 taxa) (Table 4, Figure 3).

The MCI score of 84 units indicated a community of 'fair' biological health which was significantly higher (Stark, 1998) than the historical median (72 units) by 12 units and to the preceding survey (69 units).

The $SQMCI_S$ score of 3.7 units was the same as the median MCI score of 3.7 units and not significantly different to the preceding survey (3.4 units) (Stark, 1998) (Table 4).

The community was characterised by four 'tolerant' taxa [oligochaete worms, snails (*Potamopyrgus*), true bug (*Sigara*) and blood worms (*Chironomus*)] and two 'moderately sensitive' taxa [amphipod (*Paracalliope*) and caddisfly (*Triplectides*)] (Table 5).

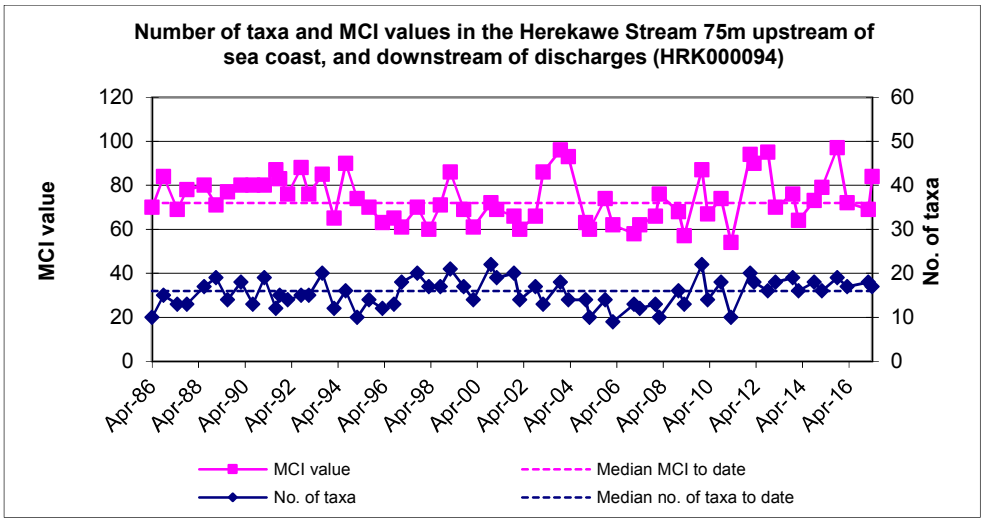

Figure 3 Number of taxa and MCI values in the Herekawe Stream downstream of industrial stormwater discharges since monitoring began in 1986

Discussion and conclusions

Macroinvertebrate richness at the 'control' site (site 1) was only two taxa higher than the 'impact' site (site 2) and both sites had moderate levels of taxa richness indicating that there had been no significant toxic charges occurring preceding the survey. Furthermore, taxa richness at both sites was similar to the historical medians (1-3 taxa). Taxa richness is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to toxic discharges such as petrochemicals that could be discharged by the Omata Tank Farm. Macroinvertebrates when exposed to toxic chemicals may die and be swept downstream or deliberately drift downstream as an avoidance mechanism (catastrophic drift). The lack of any discernible impact on taxa richness at site 2 strongly indicates that no toxic discharges have been occurring.

MCI scores indicated that both sites had 'fair' macroinvertebrate health which was higher than historical medians and the preceding survey. For site 2 ('impact' site) the MCI score was significantly higher than the historical median (by 12 units) and to the preceding survey (by 12 units), indicating better than normal macroinvertebrate health at the site. However, there was a significant decrease in MCI from the 'control' site to the 'impact' site indicating a deterioration in macroinvertebrate health.

The $SQMCI_s$ can be more sensitive to organic pollution compared with the MCI. Both sites had $SQMCI_s$ scores not significantly different from historic medians but there was a significant deterioration from site 1 to site 2, congruent with the MCI result.

The community composition between the two sites had some similarities such as high numbers of snails and amphipods as would be expected given there proximity to each other and similar to previous survey results (see DS073). Also, in keeping with previous results, the community composition also suggests that site 2 is more lentic (pond like) than site 1, as evidenced by the different water speeds recorded at the sites (steady vs slow), and by the presence of slow/ still water favouring species at site 2 such as the water bug, *Sigara*, which was abundant at site 2 but not recorded at site 1. Unfortunately, taxa that prefer slower moving water typically have lower tolerance values which can distort MCI and $SQMCI_s$ scores and make it difficult to distinguish between water quality impacts and habitat differences. The slower water speed will also enable increased deposition of fine sediment (e.g. silt), confounding attempts to elucidate whether stormwater discharges for example are

There is no evidence that stormwater discharges have been having a toxic effect on the macroinvertebrate community at site 2. Significant differences in MCI and $SQMCI_s$ scores are probably due to habitat differences, particularly the more pond-like nature at site 2. However, fine suspended and deposited sediment can have a deleterious effect on macroinvertebrates (there was 10% silt on the streambed at site 1 and 25% silt at site 2) and therefore it cannot be ruled out that a combination of habitat and water quality differences produced the recorded results. However, given that there is usually a significant difference between site 1 and 2 for MCI scores, this would indicate that either stormwater discharges were having a chronic (long term) effect which persistently lowered the health of the macroinvertebrate community at site 2 or that more likely habitat quality (which has

been relatively stable and therefore a long term influence in all the surveys), is the overriding factor structuring macroinvertebrate communities in the lower Herekawe Stream.

Summary

The Council's standard 'kick-sampling' technique was 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.

Taxa richness is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to toxic discharges. Macroinvertebrates when exposed to toxic chemicals may die and be swept downstream or deliberately drift downstream as an avoidance mechanism (catastrophic drift). 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 taxa richness, community composition, the MCI or $SQMCI_s$ between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

There was a typical, moderate taxa richness at both sites indicating that stormwater discharges were not having a toxic effect on macroinvertebrate communities.

There was a significant decrease in MCI and $SQMCI_s$ scores from the upstream 'control' site to the downstream 'impact' site, but the indices were either not significantly different to historic medians, or for the 'impact' site, significantly higher than the historic median suggesting better than normal macroinvertebrate health at the site.

This autumn macroinvertebrate survey indicated that the discharge of treated stormwater and discharges from the Omata Tank Farm or Dow Agro Sciences sites was unlikely to have had a significant effect on the macroinvertebrate communities of the stream. A significant decrease in the MCI and $SQMCI_s$ scores between the upstream 'control' site and site downstream of the discharges was more likely attributable to habitat differences between these sites which appeared to be related primarily to flow.

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Appendix V

Marine ecological report

Memorandum

To Job Manager, Callum MacKenzie
From Scientific Officer - Marine Ecology, Emily Roberts
File #1805223
Date 17 Jan 2017

Marine Ecological Inspection at Back Beach for Dow Agro Sciences

A marine ecological inspection was undertaken on 17 Jan 2017 at 08:00 NZDT (low tide at 07:59 NZDT, 0.6 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 with a light southerly breeze. There had been heavy/moderate rain two days prior to the inspection (14 mm in New Plymouth on 15 Jan 2017) and dry conditions the day before the inspection.

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 2016-2017 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.

Two groundwater seeps were observed flowing down the cliffs to the south west of Paritutu Rock. Flow of these seeps was greater than observed the two previous years, likely related to the heavy rainfall on the days preceding the inspection. 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 west of Paritutu Rock

Photograph 3 Reef with encrusting animals (little back mussels) and algae (*Scytothamnus* sp., *Corallina officinalis* and *Endarachne binghamiae*)

Photograph 3 Sea anemone *Isocradactis magna*

Emily Roberts

Scientific Officer - Marine Ecology

Appendix VI

DAS Annual Air Discharge Report 2016-2017

Dow AgroSciences

Air Discharge Report

1 July 2016 - 30 June 2017

Consent No. 4020-4.0

31 August 2017

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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 2016-17 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 2016-17 year, the following process changes were made.

- Two new products were introduced to the site:
  - o Closer™ Insecticide
  - o Rexade™ GoDRI™ Herbcide

Emission Control Technology Changes

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

Permit Changes

No changes were made to the air discharge permit during the year.

Monitoring Changes

No changes were made to the monitoring program during the year.

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

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, September 2016, Source Testing New Zealand Limited, issued October 2016.*

The formulating and packing activities carried out during the reporting 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.

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 20th to 22th September 2016.

ii. The maximum concentration of chlorpyrifos in the air discharged from the vent was less than 2.4 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 2.4 µg/m^3; which is less than 0.002% of the discharge consent maximum stack concentration of 132,240 µg/m^3 for chlorpyrifos.

This indicates 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

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 Suspension Concentrates Plant, October 2016, Source Testing New Zealand Limited, issued November 2016.*

The formulating and packing activities carried out during the reporting 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*.*

i. Three (3) samples were collected, during the loading of the spinosad technical (solid) and mixing of the finished product, from the Suspension Concentrates Plant vent over the period of 1 7th to 1 9th October 2016.

ii. The maximum concentration of spinosad in the air discharged from the vent was less than 1.7 µg/m^3 (corrected to 0°C, 101.3 kPa dry gas basis).

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

Conclusion

Under normal operating conditions, the maximum emission of spinosad from the Suspension Concentrates Plant vent (#BB600) was less than 1.7 µg/m^3; which is less than 0.0001% of the discharge consent maximum stack concentration of 2,052,000 µg/m^3 for spinosad.

This indicates 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

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, September - October 2016, Source Testing New Zealand Limited, issued October 2016.*

The formulating and packing activities carried out during the reporting 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.

i. Three (3) samples were collected for picloram from the Granulated Herbicides Plant vent during the batch formulating and packaging over the period 20th September to 3th October 2016.

ii. The maximum concentration of picloram in the air discharged from the vent was less than 0.06 µg/m^3 (corrected to 0°C, 101.3 kPa dry gas basis).

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

Conclusion

Under normal operating conditions, the maximum emission of picloram from the Granulated Herbicides Plant vent (#03-14) was less than 0.06 µg/m^3; which is 0.0000003% of the discharge consent maximum stack concentration of 24,624,000 µg/m^3 for picloram.

This indicates 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)
Haloxyfop-R methyl ester

Air Quality Limit from Schedule 1: 2 µg/m^3 2,4-D acid, esters and salts (annual average)
0.06 µg/m^3 haloxyfop-R methyl ester (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)
6420 µg/m^3 haloxyfop-R methyl ester

Sampling Plan

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, March 2017, Source Testing New Zealand Limited, issued July 2017.*

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

Plant Operating Conditions

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

For details of the Herbicides Plant air discharge monitoring results refer to Appendix 4.

i. Three (3) samples were collected for haloxyfop-R methyl ester from the Herbicides Plant vent during the batch formulating and packaging of haloxyfop-R methyl ester based products over the period 7th to 9th March 2017.

ii. The maximum concentration of haloxyfop-R methyl ester in the air discharged from the vent was 3.0 µg/m^3 (corrected to 0°C, 101.3 kPa dry gas basis).

Conclusion

Under normal operating conditions, the maximum emission of haloxyfop-R methyl ester from the Herbicides Plant vent (#03-8) was 3.0 µg/m^3; which is

0.05% of the discharge consent maximum stack concentration of 6420 µg/m^3 for haloxyfop-R methyl ester.

This indicates 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: MCPA (acid and salt)

Air Quality Limit from Schedule 1: 10 µg/m^3 MCPA acid, esters and salts (annual average)

Dilution Factor from Schedule 3: 29,000 (annual average)

Maximum Stack Concentration: 290,000 µg/m^3 MCPA (acid)

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, October 2016, Source Testing New Zealand Limited, issued October 2016.*

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

Plant Operating Conditions

MCPA acid is reacted with amine (dimethylamine) to produce an aqueous solution of the amine salt. 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.

i. Three (3) samples were collected for MCPA acid and salts from the Commodity Herbicides Plant vent over the period 4th to 5th October 2016.

ii. The maximum concentration in the air discharged from the vent for Total MCPA (acid and salt) was 0.57 µg/m3 (corrected to 0°C, 101.3 kPa dry gas basis).

Conclusion

Under normal operating conditions, the maximum emission of MCPA (acid and salts) from the Commodity Herbicides Plant vent (#48-1) was 0.57 µg/m^3; which is 0.0002% of the discharge consent maximum stack concentration of 290,000 µg/m^3 for MCPA.

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

There are three substances that have the potential to have multiple sources: 2,4-D, MCPA and clopyralid. These materials are used in the Herbicides Plant and the Commodity Herbicides Plant.

However, the discontinuation of esterification in the Commodity Herbicides Plant in 2015-16 has meant that each of these compounds is now predominantly used in only one plant at a time.

During 2016-17 no indicator compound monitored was common between the two plants.

Conclusion

This requirement had no application during the 2016-17 year.

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 nano grams 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 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 March and May 2017, Source Testing New Zealand Limited, issued June 2017.*

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

a Dioxins & Furans (PCDD/PCDF)

i. Over the period 1st to 3rd March 2017, 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 0.00558 ng/m^3 WHO-TEQ (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) being the upper bound level for general waste.

TABLE 1: 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)
3 Mar 2017	Crushed Drums	0.00552	17.8
2 Mar 2017	General Waste	0.00558	19.3
1 Mar 2017	Liquid Waste	0.00550	12.6
Mar 2017	**Laboratory Blank[2]**	**0.00612**	**18.4**

[1] Corrected to 0ºC, 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 Halides (HF, HCl, HBr)

i. On the 16th and 17th March 2017 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 maximum mass emission rate of total halides from the Incinerator was 0.205 kg/hr.

iv. Bromide concentrations were non-detectable at <0.02 mg/m^3, for all waste streams. The general waste manifest indicates no brominated fire retardant containing materials were incinerated.

TABLE 2: Total Halide Maximum Concentration & Emission Rate

Date	Waste Type	Total Halide Concentration (mg/m^3)[1]	Total Halide Emission Rate (kg/hr)
17 Mar 2017	Crushed Drums	64.2	0.205
16 Mar 2017	General Waste	14.0	0.0369
16 Mar 2017	Liquid Waste	<0.3	<0.0007

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

c. Particulate Matter

i. On the 16th and 17th March 2017 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 maximum concentration of particulate matter was 84.6 mg/m^3 (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) with the maximum particulate matter mass emission rate being 0.223 kg/hr.

TABLE 3: Total Particulate Concentration & Emission Rate

Date	Waste Type	Total Particulate Concentration (mg/m^3)[1]	Total Particulate Emission Rate (kg/hr)
17 Mar 2017	Crushed Drums	31.2	0.100
16 Mar 2017	General Waste	29.7	0.078
16 Mar 2017	Liquid Waste	84.6	0.223

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

d. Sulphur Dioxide (SO_2)

i. On the 2nd to 3rd May 2017 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 maximum concentration of sulphur dioxide was 13.4 mg/m^3 (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) with the maximum sulphur dioxide mass emissionrate being 0.0455 kg/hr.

TABLE 5: Total Sulphur Dioxide Concentration & Emission Rate

Date	Waste Type	Total Sulphur Dioxide Concentration (mg/m^3)[1]	Total Sulphur Dioxide Emission Rate (kg/hr)
2 May 2017	Crushed Drums	5.5	0.0208
2 May 2017	General Waste	13.4	0.0455
3 May 2017	Liquid Waste	0.53	0.0018

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

e Metals

i. On the 3rd to 5th May 2017 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	0.0943 - 3.05	1.20	0.295 - 11.2	4.28
Antimony	0.0003 - 0.0054	0.0029	0.0008 - 0.0199	0.0099
Arsenic	0.0011 - 0.0057	0.0028	0.0034 - 0.0210	0.0096
Boron	0.0433 - 12.5	4.60	0.135 - 45.8	16.6
Cadmium	0.0002 - 0.0013	0.0009	0.0006 - 0.0049	0.0030
Chromium	0.0034 - 0.0412	0.0164	0.0104 - 0.129	0.0520
Cobalt	<0.0002 - 0.0002	0.0002	<0.0007 - 0.0008	0.0008
Copper	0.0070 - 0.163	0.0694	0.0218 - 0.600	0.245
Iron	0.0308 - 0.261	0.130	0.0931 - 0.956	0.453
Lead	0.0017 - 0.0050	0.0034	0.0052 - 0.0182	0.0115
Lithium	0.0008 - 0.0046	0.0021	0.0025 - 0.0167	0.00743
Manganese	0.0042 - 0.0086	0.0060	0.0130 - 0.0317	0.0201
Mercury	<0.0016 - <0.0019	<0.0017	<0.0051 - <0.0062	<0.0056
Molybdenum	0.0018 - 0.0131	0.0067	0.0056 - 0.0395	0.0214
Nickel	0.0018 - 0.0068	0.0038	0.0056 - 0.0204	0.0122
Tin	0.0006 - 0.0048	0.0022	0.0020 - 0.0175	0.0078
Vanadium	<0.0018 - 0.0018	0.0018	<0.0056 - 0.0066	0.0061
Zinc	0.0655 - 0.110	0.140	0.205 - 1.02	0.486

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

Conclusion

Under normal operating conditions, the maximum emission of PCDD/PCDF from the incinerator stack was 0.00558 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 0.205 kg/hr, which is below the discharge consent limit of 1.5 kg/hr.

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

General

Air Quality Inspections

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

Incident Review

Sudden Burn whilst incinerating crushed drums

On 11 October 2016 the incinerator experienced a rapid increase in temperature and decrease in oxygen level whilst burning crushed drums. This resulted in oxygen levels dipping below 4.5% for 84 seconds which is in excess of the maximum of 60 seconds in any 24 hour period allowed by special condition 8 of the consent.

Investigation identified the most likely cause to be residual material left in a drum after pump out. Updates to both the drum pump-out and drum crushing procedure were made as a result.

The incident was notified to the Taranaki Regional Council on 11 October 2016 and a summary of the investigation forwarded on 23 November 2016.

Consultation

No consultation was carried out during the year.

Appendices

Appendix 1 Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Insecticides Plant, September 2016, Source Testing New Zealand Limited, issued October.

Appendix 2: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Suspension Concentrates Plant, October 2016, Source Testing New Zealand Limited, issued November 2016.

Appendix 3: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Granulated Herbicides Plant, September - October 2016, Source Testing New Zealand Limited, issued October 2016.

Appendix 4: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Herbicides Plant, March 2017, Source Testing New Zealand Limited, issued April 2017.

Appendix 5: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Commodity Herbicides Plant, October 2016, Source Testing New Zealand Limited, issued October 2016.

Appendix 6: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Compliance Monitoring March and May 2017, Source Testing New Zealand Limited, issued June 2017