New Zealand Aluminium Smelters Limited

Annual Environmental Monitoring Report 2015

Report to Environment Southland
on consent monitoring and environmental effects of the
Tiwai Aluminium Smelter for the year ending 31 December 2015

Table of Contents

Summary

Introduction

This report contains the results of consent monitoring and environmental effects of the New Zealand Aluminium Smelter for the year ending 31 December 2015.

Main Stack

Main Stack discharges to air were within permit standards during 2015.

Potline Roof Louvres

Potline roof louvre discharges were within permit standards during 2015.

Dust Collector Discharges

Eleven dust collectors were tested during 2015. One dust collector, the Anode reamer, sampled on 27th Nov was over the permit limit of 250mg/Sm^{-3}. Environment Southland were notified. Corrective action was taken and a retest on 1st Dec 2015 gave 28mg/Sm^{-3}.

Dispersion

Wind speeds and direction were generally similar to previous years.

Monthly rainfall for 2015 was variable with the annual total of 911mm being below the 5 year running average of 1039mm. No data was collected in Feb due to the weather computer being un-operational. An estimated figure based on the 10 year average was used as an indication for our records.

Ambient Air

Gaseous and particulate fluoride levels were similar to previous years.

Atmospheric Deposition

Fluoride levels at both sites were similar to previous years.

Vegetation

The fluoride concentrations of ungrazed grass sites during 2015 were similar to the concentrations measured in previous years.

Water Take

Water take from the aquifer was within permit standards for 2015.

Liquid Discharges

Discharges from the North, South, and West drains and of Treated Effluent and their effect on the environment were within permit standards during 2015.

All permit standards were met for Treated Sewage discharges during 2015.

Groundwater monitoring results from the sewage monitoring bores showed no significant changes of analytes during 2015.

Groundwater

Groundwater monitoring around the SCL storage shed and underneath the storage shed showed no significant changes of analytes during 2015. The cathode pad stockpile groundwater showed no significant changes of analytes during 2015.

Landfill

Monitoring of groundwater near the NZAS landfill showed no significant changes of analytes during 2015.

Greenhouse Gas Discharges

Hot metal produced increased by 2% in 2015 compared to 2014. Despite an increase in metal production there was a slight decrease in absolute carbon dioxide emissions during 2015. The emission rate in 2015 was 1.99 t CO_2-e / per tonne of aluminium produced.

Part A - Environmental Management

Introduction

This report summarises NZAS' environmental performance during 2015 and includes results, summaries and comments on discharge permit monitoring. It includes data from some reports forwarded to Environment Southland during the year with additional sections including discharges to air, dispersion conditions, liquid discharges etc. to cover NZAS' discharges to, and effects on, the environment.

The data is provided in tables, summaries, maps and where appropriate as graphs. Analysis of trends and other comments are included where appropriate.

The NZAS Laboratory team provides much of the data within this report. An auditing programme conducted by Environment Southland verifies the validity of this data.

NZAS' Laboratory has maintained accreditation to NZS/ISO/IEC 17025 "General Competence of Calibration and Testing Laboratories". The scope of the accreditation includes Quality Systems to ensure the accuracy of data. Where samples are forwarded to external laboratories for analysis, these laboratories have accreditation to NZS/ISO/IEC 17025

Environmental Incidents

There was one environmental incident reported as a violation to Environment Southland during 2015. In November the Reamer dust collector exceeded the 250mg/m^3 limit due to faulty dust collector bags. The equipment was shut down and the faulty bags were replaced.

Two other incidents were also reported. See section 'Reports to Environment Southland' for details.

Audit Programme

Auditing conducted by Environment Southland (ES) during 2015 included:

Audit Sample Type		Sites	Date	Issues
Ambient Air	1km Hut	1	May	None
Atmospheric Deposition		2	May, Oct	None
Drains	North	3	March, Sept	None
	South	3	March, Sept	None
	West	3	March, Sept	None

Reports to Environment Southland

Two incident reports were issued to Environment Southland in 2015.

Dust from NZAS Landfill

On Saturday 14th November, NZAS received a community complaint from a person in Bluff regarding carbon dust blowing in the wind from the Landfill.

The carbon dust described was located in one small pocket of the Landfill with a working face minimised to avoid excessive fugitive dust. However, on the Saturday the wind was strong enough to disperse the ultrafine carbon material deposited in this location. Immediate actions taken to mitigate the amount of fugitive carbon dust were to wet down the material to reduce the windborne dispersion.

NZAS reported this incident to Environment Southland on Monday 16th November.

NZAS is aware of the problems this ultrafine carbon dust poses and actively works to minimise dust generated via strong winds by ensuring the volume of material being landfilled, handling and storage methods are optimised to prevent this type of dispersion.

Black Smoke from Metal Products Furnaces

On Monday 23rd November, Environment Southland received a complaint from a person at Bluff regarding black smoke discharging from a furnace stack at NZAS.

The furnace was identified as being Y furnace in the vertical direct chill casting area of Metal Products, which is fired by heavy fuel oil (HFO). The furnace was under the process of being hot cleaned and fluxed then charged with scrap prior to casting when there was a burner malfunction (i.e. the burner failed to light) resulting in the burner pump continuing to pump HFO into the furnace until the burner faulted out (within seconds) on a safety circuit.

However, Operators engaged a manual re-set to activate the burners and this pumped additional HFO into the furnace while they attempted to re-start the furnace burners. In this instance the Y furnace HFO burners became blocked with molten aluminium and they failed to ignite resulting in additional unburnt HFO being deposited onto scrap within the furnace. When the burners were finally re-ignited the residual HFO caused a larger than normal amount of black smoke to be discharged from the furnace stack.

Where possible, NZAS endeavours to minimise discharges to air. Note: Air Discharge Permit 203378, Section B1.4 states “There shall be an exemption from this smoke requirement for the purpose of degassing and hot cleaning in Metal Products furnaces. The exemption shall apply for periods of up to 25 minutes not more often than 20 times in a 24 hour day, for all Metal Products furnaces combined.”

Part B - Discharges into Air

Introduction

Discharges into air from the smelter and wharf were covered by Air Discharge Permit Number 93566 prior to June 2006. A new Air Discharge Permit Number 203378 was issued on the 6th June 2006 and amended on 22nd December 2014.

This Chapter covers:

- Main Stack discharges,
- Potline Roof Louvre discharges,
- Fluoride discharges into air,
- Dust Collector discharges,
- Main Stack smoke discharges, and
- Sulphur contents of raw materials and fuels used in the aluminium smelting process.

Main Stack Discharges

Monitoring results

The following tables show the main stack monitoring results for 2015.

The following shows the running twelve monthly averages of the monthly test results.

Parameter	Units	Running 12 month average	
		Permit Limit	2015
Gas flow rate	Sm^3/ min	-	60,700
Total particulate	kg/min	1.70	0.45
Gaseous fluoride	kg/min	0.50	0.22
Particulate fluoride	kg/min	0.20	0.01
Sulphur dioxide	kg/min	21.4	12.8
Total condensable hydrocarbons	kg/min	-	0.06
Polycyclic aromatic hydrocarbons	kg/min	-	0.042

The following table shows the monthly maximum values. Discharges of these contaminants shall not exceed the following maximum values in eleven out of 12 months.

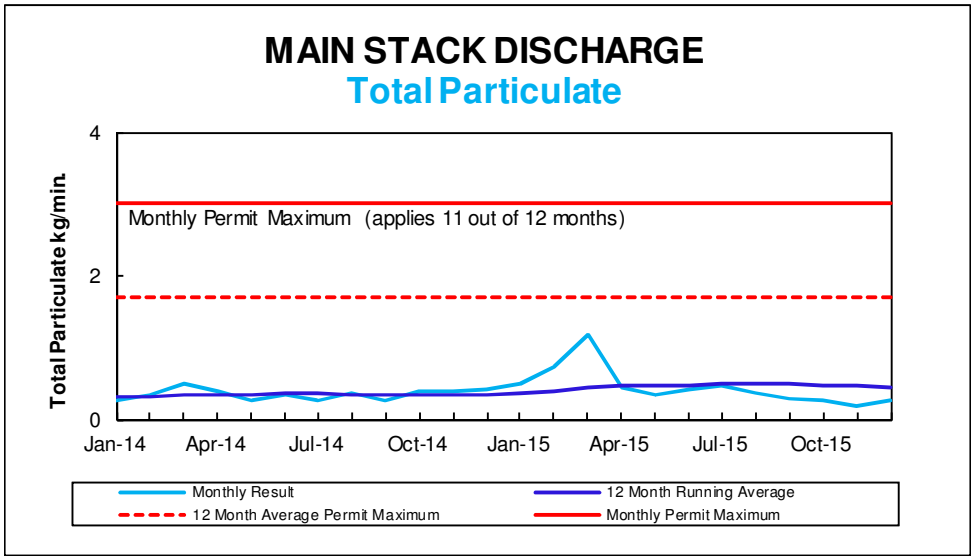
Parameter	Units	Monthly Results Limit applies 11 out of 12 Months		
		Permit Limit	Maximum	Number of times > Limit
Total particulate	kg/min	3.00	0.50	0
Gaseous fluoride	kg/min	0.65	0.26	0
Sulphur dioxide	kg/min	23.0	15.1	0

Main Stack Discharges, continued

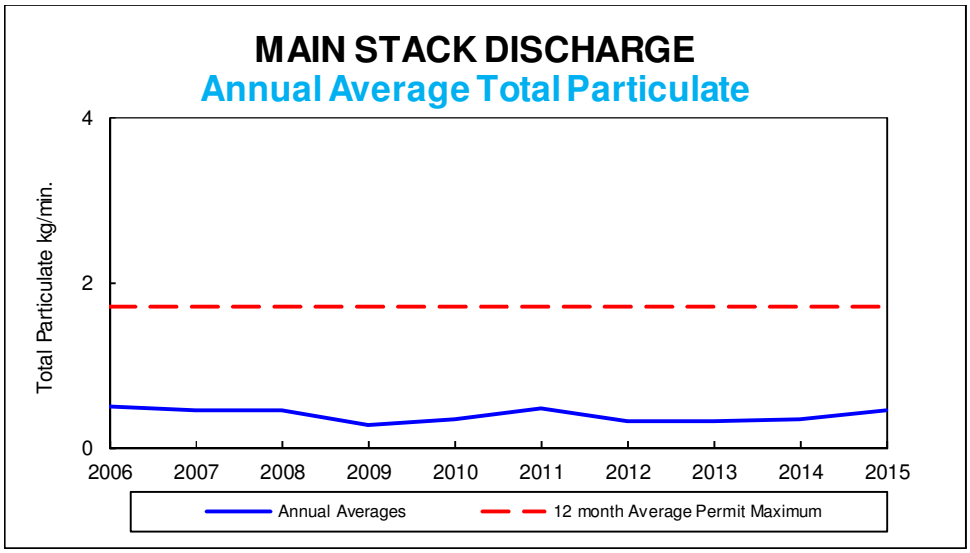
Total particulate

Permit: 12 month running average not to exceed 1.7 kg/min.

The following graph shows both the average monthly and 12 monthly running average main stack total particulate discharge during 2014 and 2015.



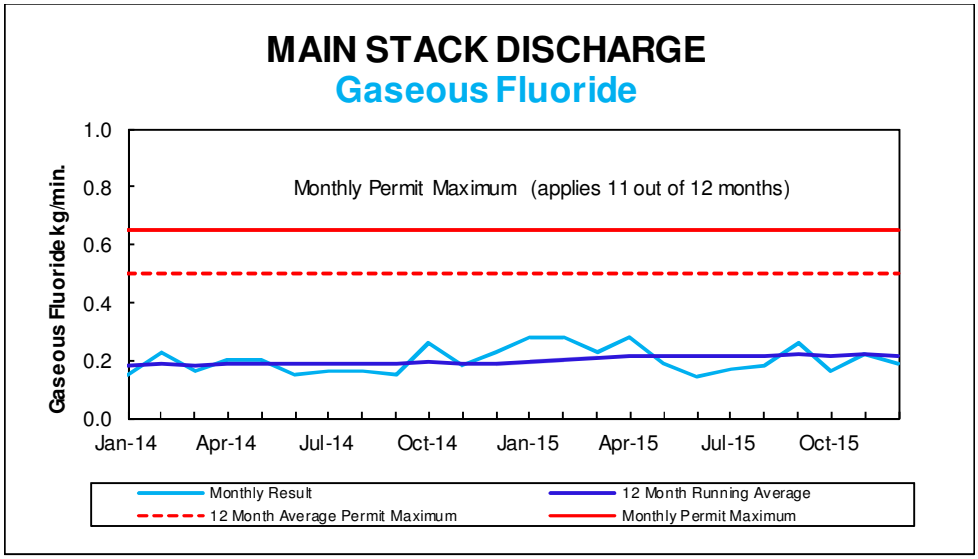
The following graph shows the annual average main stack total particulate discharge.



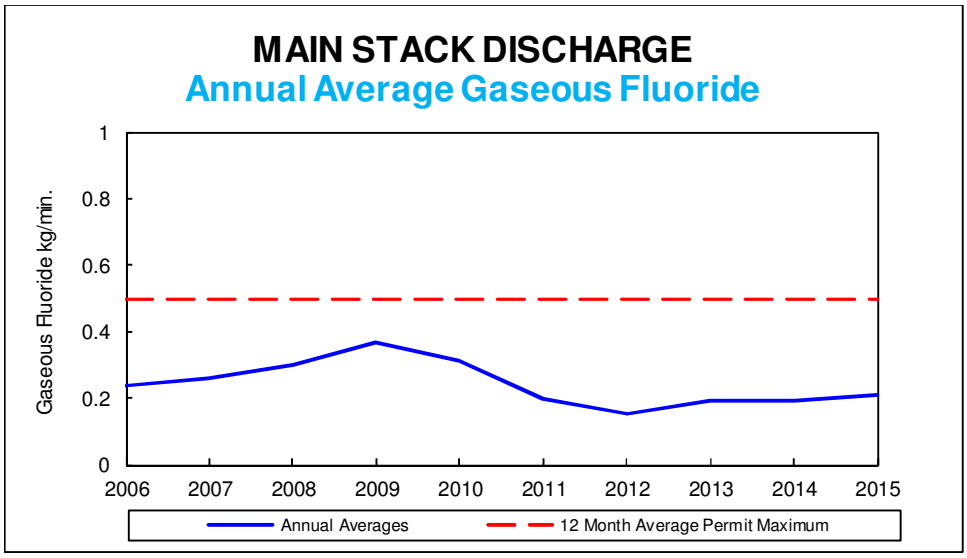
Gaseous fluoride

Permit: 12 month running average not to exceed 0.5 kg/min.

The following graph shows both the average monthly and 12 monthly running average main stack gaseous fluoride discharge during 2014 and 2015.



The following graph shows the annual average main stack gaseous fluoride discharge.

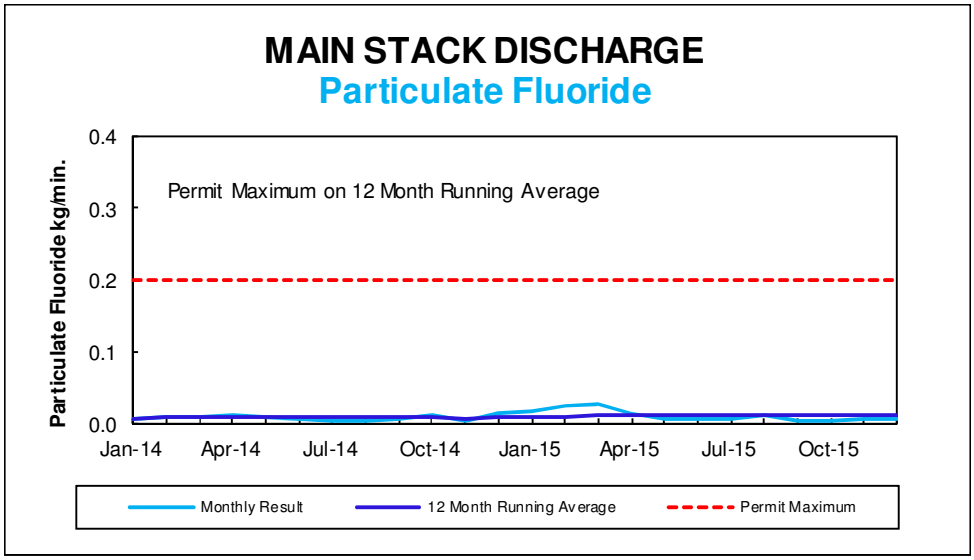


Main Stack Discharges, continued

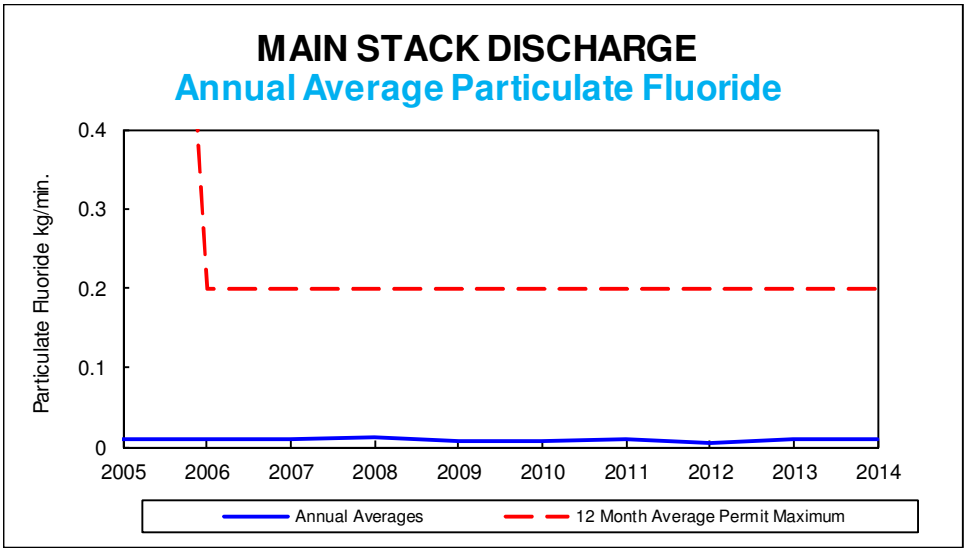
Particulate fluoride

Permit: 12 month running average not to exceed 0.2 kg/min.

The following graph shows both the average monthly and the 12 monthly running average main stack particulate fluoride discharge during 2014 and 2015.



The following graph shows the annual average main stack particulate fluoride discharge.

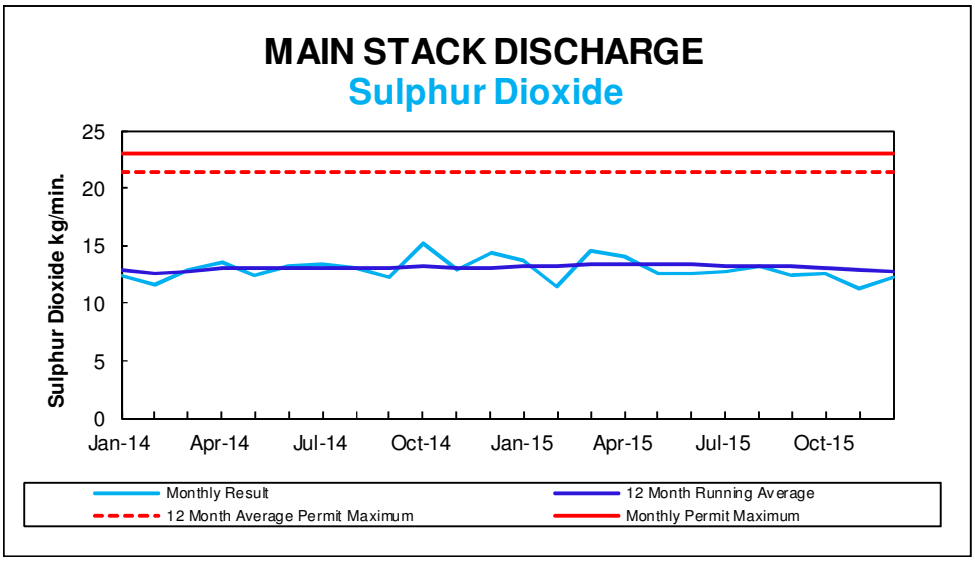


Main Stack Discharges, continued

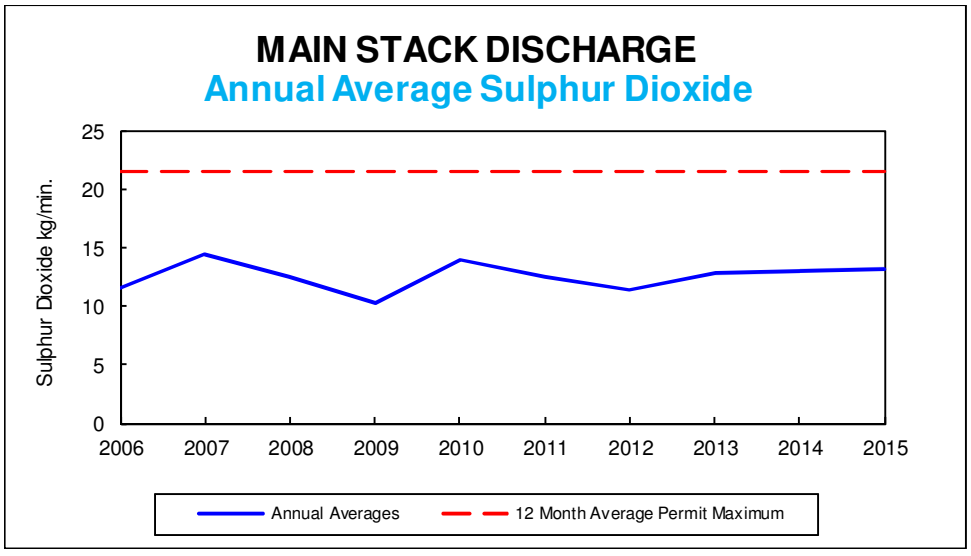
Sulphur Dioxide

Permit: 12 month running average not to exceed 21.4 kg/min.

The following graph shows both the average monthly and 12 monthly running average main stack sulphur dioxide discharge during 2014 and 2015.



The following graph shows the annual average main stack sulphur dioxide discharge.



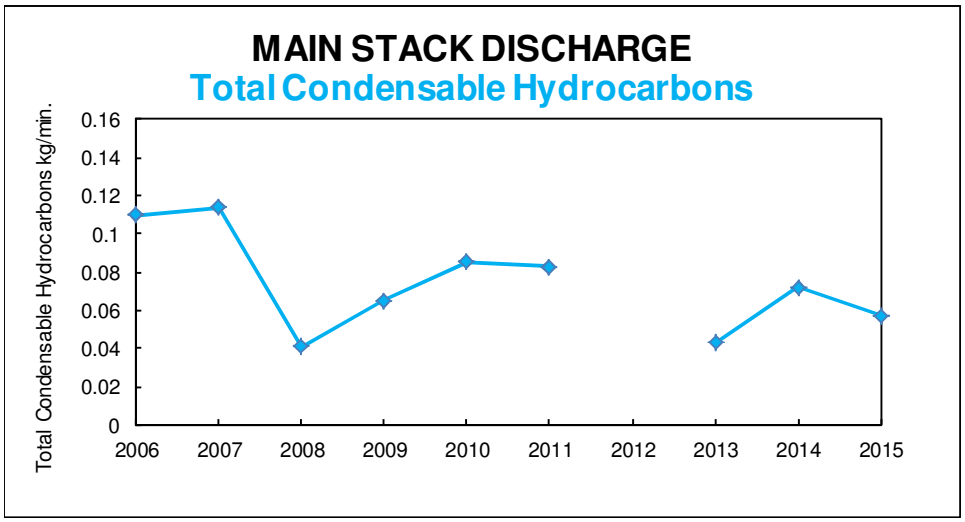
In March the particulate discharge was high due to multiple holed bags in the dry scrubbers \ torbeds. By March 9th the broken bags had been replaced and the particulate monitor on one dry scrubber which was not functional was repaired. The particulate monitors did not indicate elevated results from 9th March.

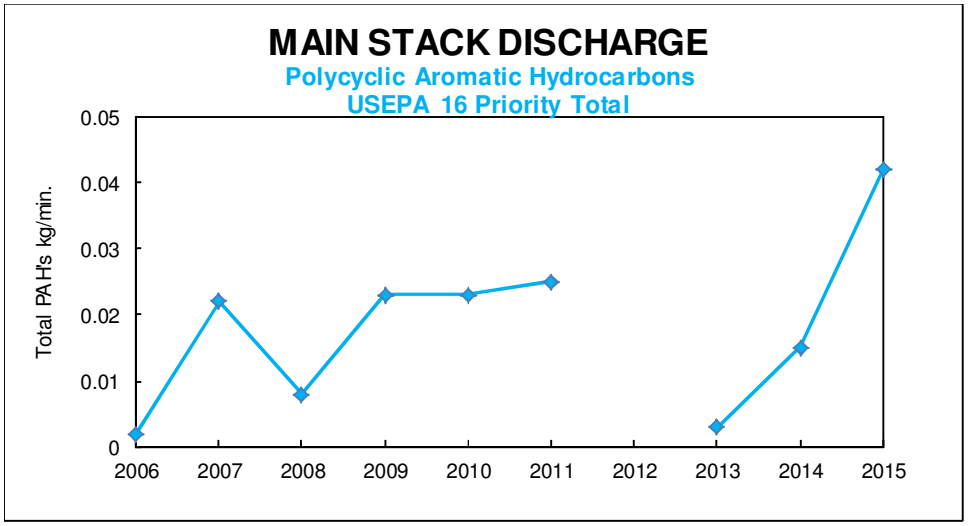
A program to replace all bags in the six south side dry scrubbers commenced in early February and was completed in late May.

Main Stack Discharges, continued

Total Condensable Hydrocarbons and Polycyclic Aromatic Hydrocarbons

The annual analysis for total condensable hydrocarbons (TCH) and 16 USEPA priority PAH's was carried out in May 2015. The following graphs shows the annual TCH discharges and the 16 USEPA priority PAH's.
Note: A dispensation was granted by Environment Southland for NZAS not to carry out this monitoring in 2012.





Comments

The level of total condensable hydrocarbons (TCH) is slightly lower than last year. A slight increase is observed in the levels of the 16 USEPA priority PAH's.

Potline Roof Louvre Discharges

Monitoring results

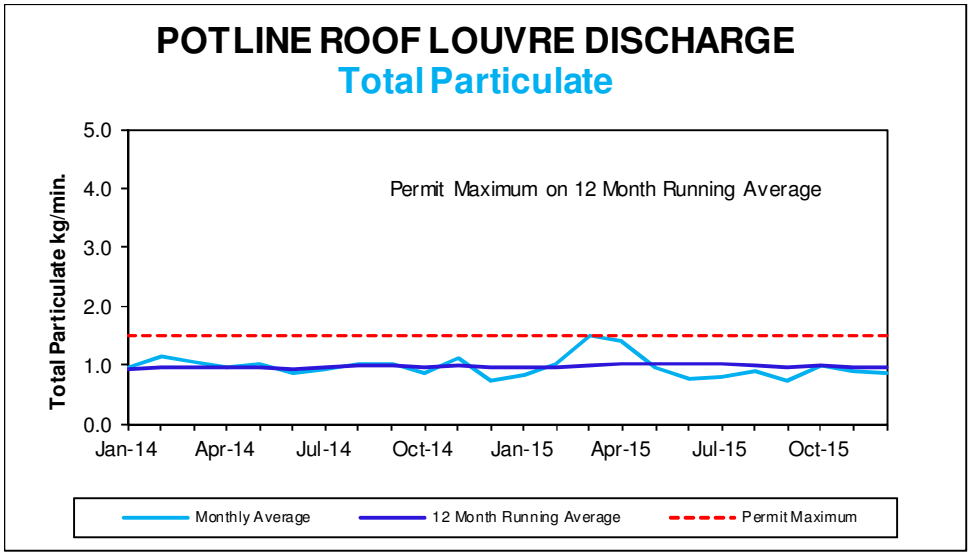
The table below shows the Potline roof louvre monitoring results for 2015. The permit limits are for 12 month running averages. There is no permit limit on maximum emissions in any given month.

Parameter	Units	Running 12 month average		
		Permit Limit	2015	Maximum for any month
Total particulate	kg/min	1.50	0.97	1.50
Gaseous fluoride	kg/min	0.21	0.13	0.32
Particulate fluoride	kg/min	0.30	0.15	0.26
Sulphur dioxide	kg/min	0.55	0.23	0.54

Total particulate

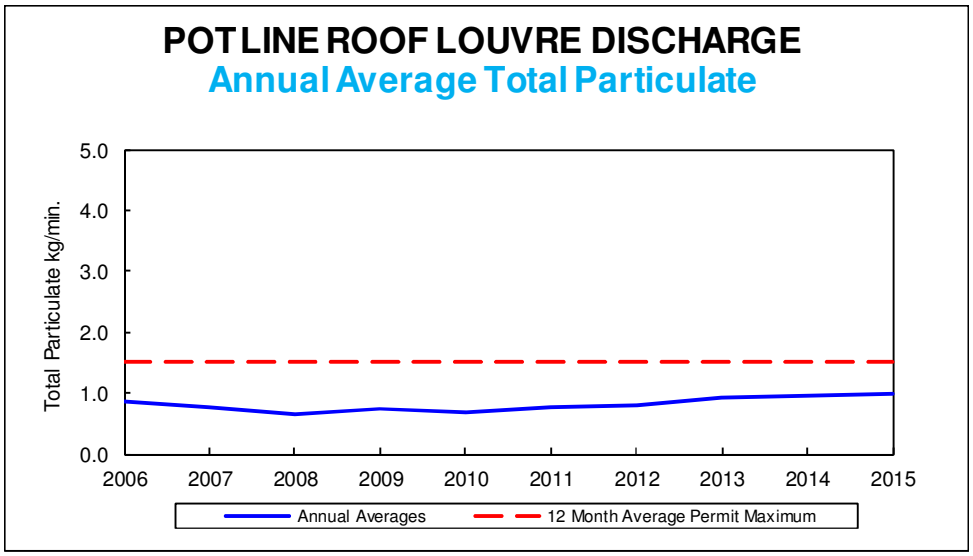
Permit: 12 month running average not to exceed 1.50 kg/min.

The following graph shows both the average monthly and 12 month running average Potline roof louvre total particulate discharge during 2014 and 2015.



Potline Roof Louvre Discharges, continued

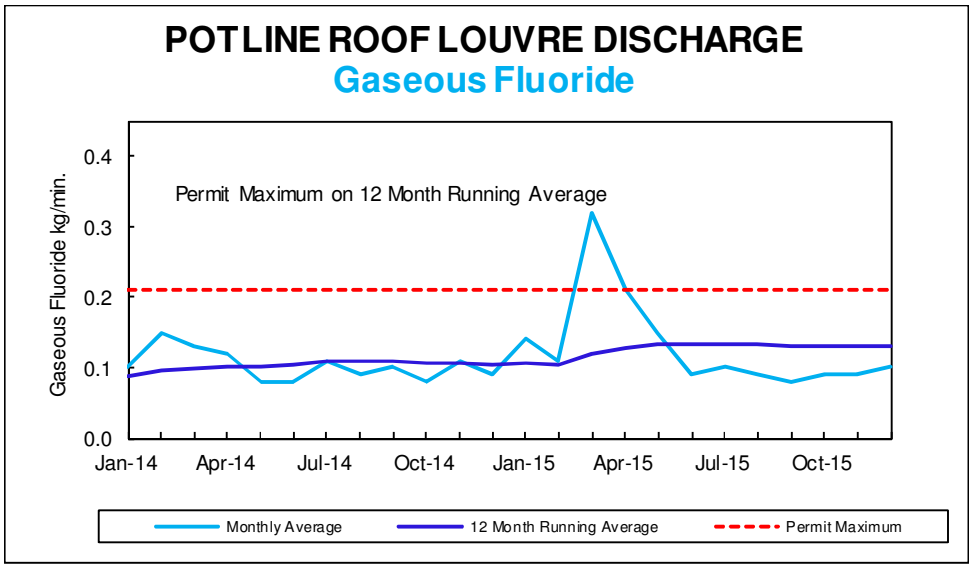
The following graph shows the annual average Potline roof louvre total particulate discharge.



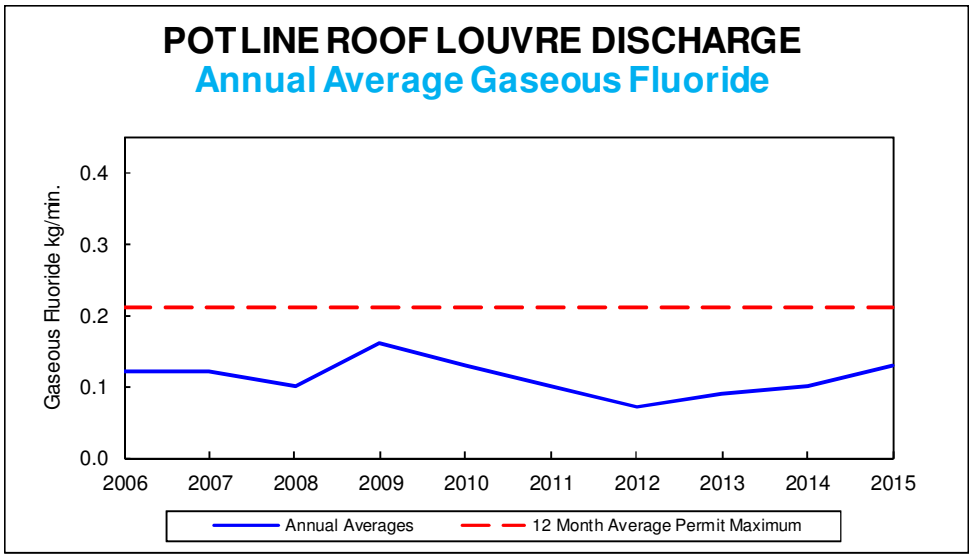
Gaseous fluoride

Permit: 12 month running average not to exceed 0.21 kg/min.

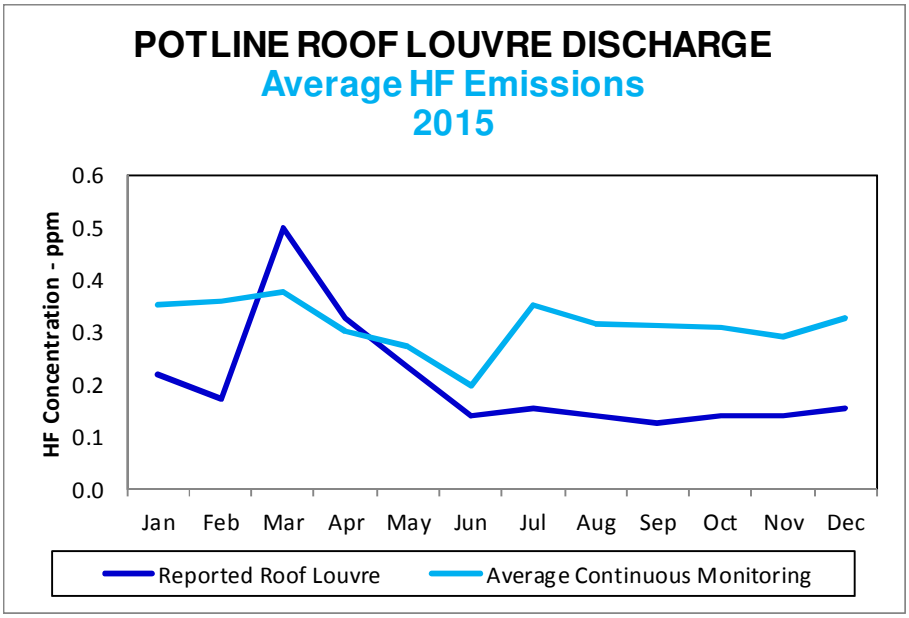
The following graph shows both the average monthly and 12 month running average Potline roof louvre gaseous fluoride discharge during 2014 and 2015.



The following graph shows the annual average Potline roof louvre gaseous fluoride discharge.



The following graph shows the reported Potline Roof Louvre gaseous fluoride emissions in comparison to the Boreal continuous monitoring results.

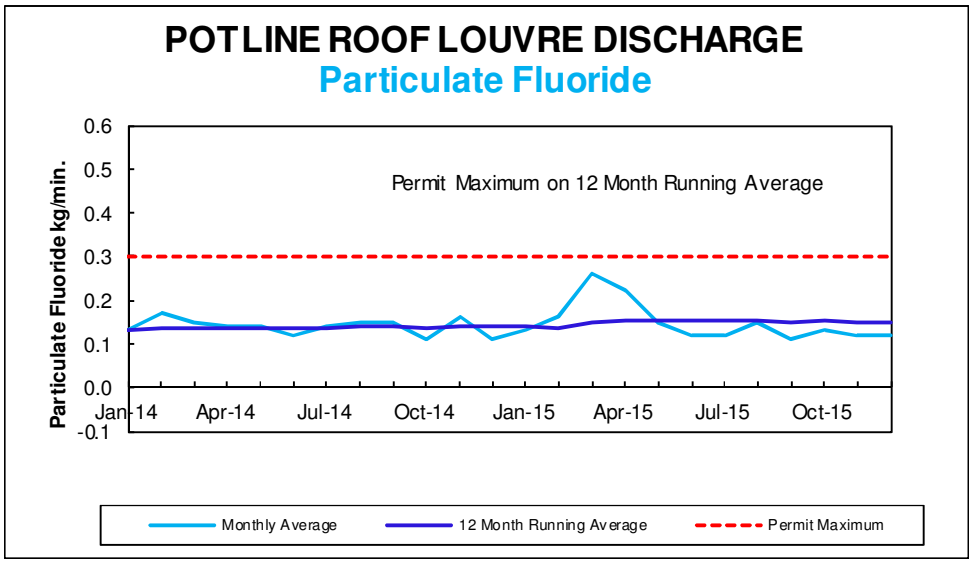


Potline Roof Louvre Discharges, continued

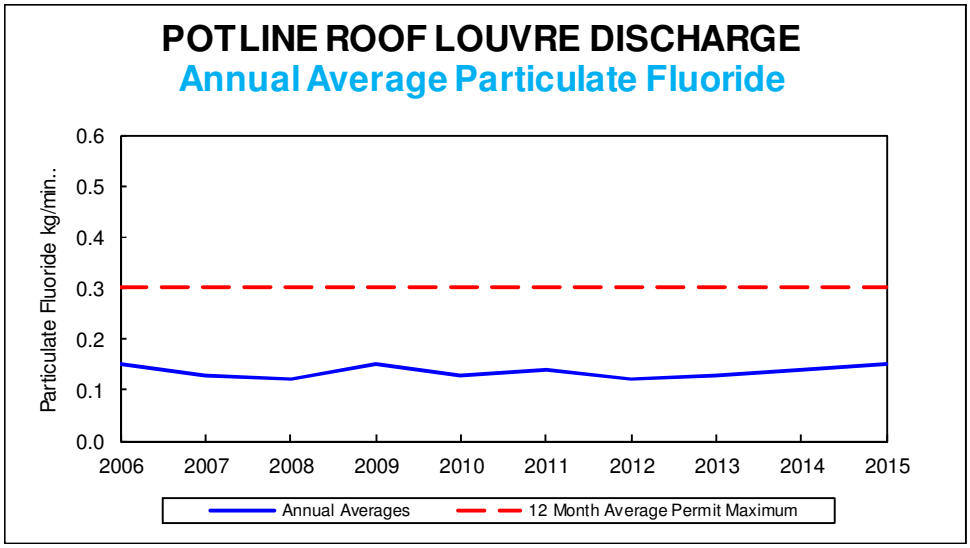
Particulate fluoride

Permit: 12 month running average not to exceed 0.30 kg/min.

The following graph shows both the average monthly and 12 month running Potline roof louvre particulate fluoride discharge during 2014 and 2015.



The following graph shows the annual average data for Potline roof louvre particulate fluoride discharge.

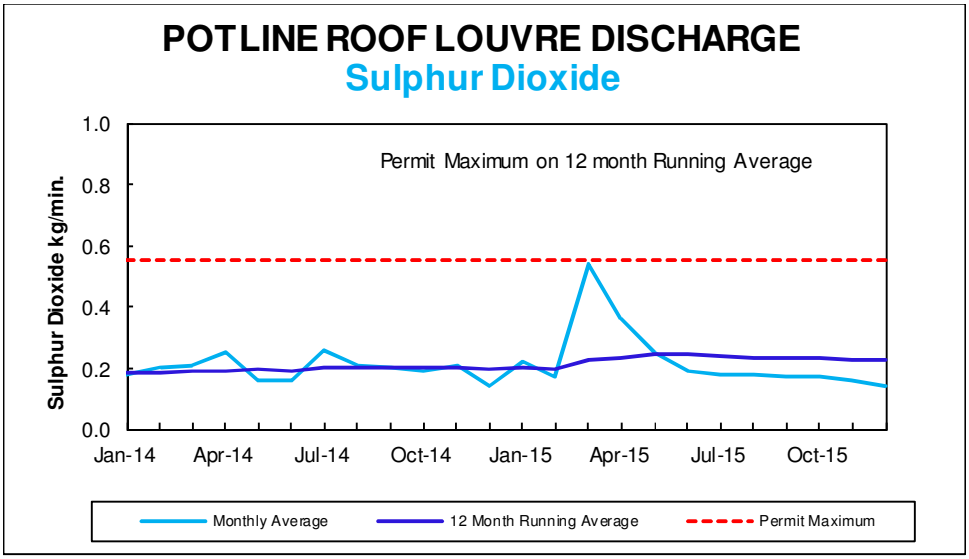


Potline Roof Louvre Discharges, continued

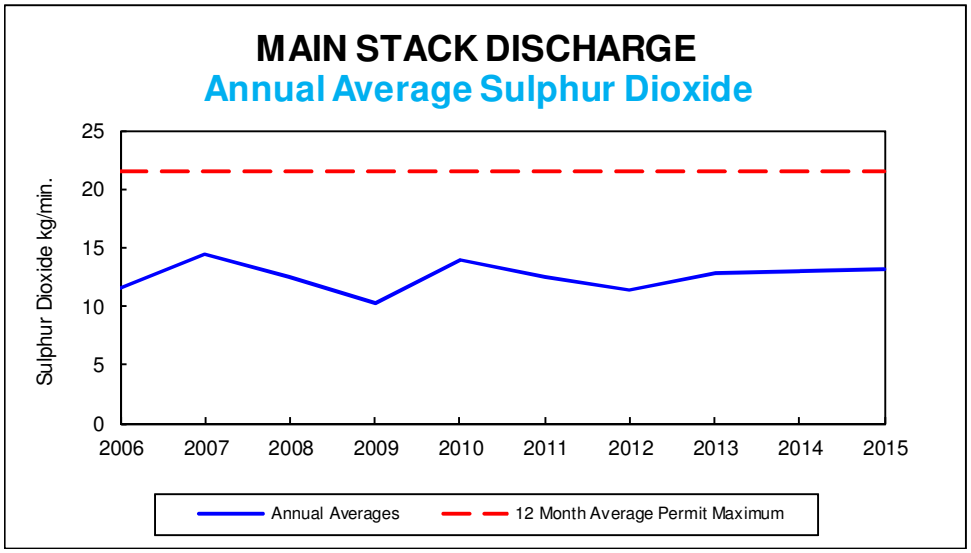
Sulphur dioxide

Permit: 12 month running average not to exceed 0.55 kg/min.

The following graph shows both the average monthly and 12 month running Potline roof louvre sulphur dioxide discharge during 2014 and 2015.



The following graph shows the annual average Potline roof louvre sulphur dioxide discharge.



Potline Roof Louvre Discharges, continued

Comments

The results for March were all elevated. This was due to reduced draft to Reduction Lines 1A, 1B & 2A (where the sampling manifold is located) which are connected to the south side dry scrubbers. This draft was reduced by approximately 20% while the re-bagging programme was being undertaken in these dry scrubbers. The reduced draft to these Reduction Lines caused an increase in discharges through the Potline roof louvres. During the period of reduced draft, additional attention to ensure all reduction cell hoods and doors were sealed correctly was undertaken.

The Boreal data between late February and late June is not representative of actual emissions occurring during this period. At this time the eastern Boreal instrument which measures gaseous fluoride in the roof of Potlines was removed and sent to Canada for urgent refurbishment and recalibration. This resulted in gaseous fluoride data being measured only in the western end of the Potlines and not in centre passage or the eastern end of the Potlines. Simultaneously between early March and early June at least one of the south side dry scrubbers was continually off-line for re-bagging which caused the draft to cells in Potlines 1A, 1B and 2A to be reduced with the result of increased roof louvre emissions in those Bays. As the east end Boreal was not operational the increase in roof louvre emissions of gaseous fluoride in Potlines 1A, 1B and 2A was not measured.

The discharge of total particulate, sulphur dioxide, particulate fluoride and gaseous fluoride from the Potline roof louvres were within permit limits for 2015.

Line 4 remained closed for 2015 with the Gas Flow Rate for Roof Louvre emissions remaining at 720,800 Sm^3/min.

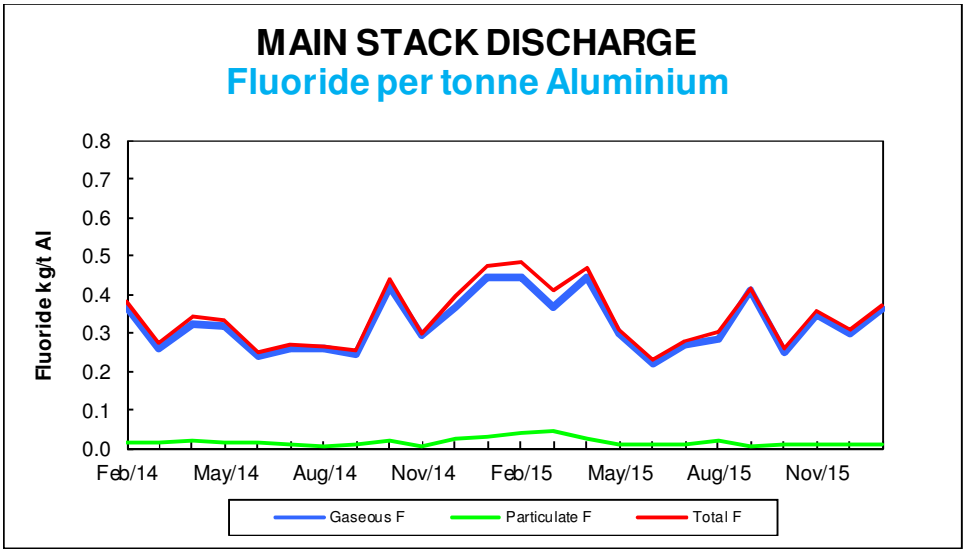
Fluoride Discharges

Performance data

The table below shows the fluoride discharges expressed as a ratio of hot aluminium metal production during 2015.

Parameter	Units	2015	Maximum for any month
Main Stack			
• Gaseous fluoride	kg/t Al	0.34	0.44
• Particulate fluoride	kg/t Al	0.02	0.04
• Total fluoride	kg/t Al	0.36	0.49
Reduction Line Roof Louvres			
• Gaseous fluoride	kg/t Al	0.21	0.51
• Particulate fluoride	kg/t Al	0.24	0.41
• Total fluoride	kg/t Al	0.45	0.92
Plant			
• Gaseous fluoride	kg/t Al	0.55	0.87
• Particulate fluoride	kg/t Al	0.26	0.46
• Total fluoride	kg/t Al	0.81	1.33

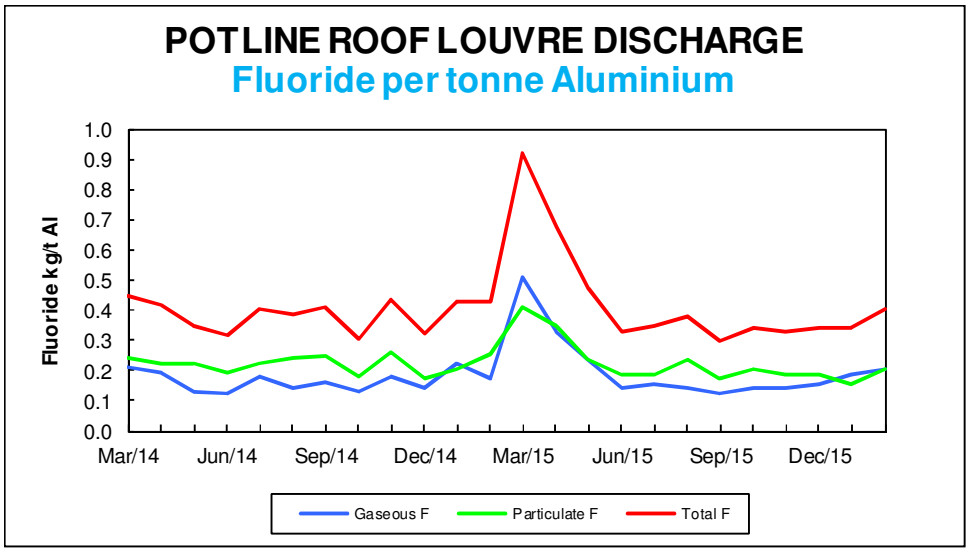
The following graph shows the monthly main stack fluoride per tonne aluminium discharge during 2014 and 2015.



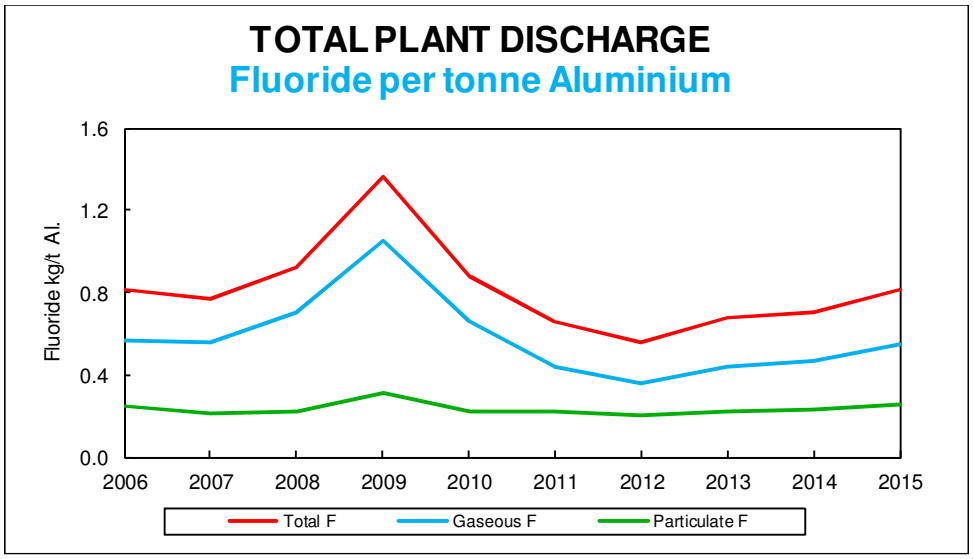
Fluoride Discharges, continued

Performance data, Continued

The following graph shows the average monthly Potline roof louvre fluoride per tonne aluminium discharge during 2014 and 2015.



The following graph shows the average total plant fluoride per tonne aluminium for the last 10 years.



Comments

The annual total fluoride discharge rate from the plant for 2015 remains similar to previous years.

Dust Collector Discharges

Permit Conditions:

Shall not exceed	250	mg/Sm^3
Action shall be taken if concentration exceeds	100	mg/Sm^3.

Monitoring results

The table below shows the Dust Collector monitoring results for 2015. The table reflects the new Air Discharge Permit standards, which came into effect in June 2006. The Permit requires that all dust collectors be tested once every two years.

Dust Collector	Date 2015	Total Particulate discharge ($mg/Sm^{3)}$	Flow Rate (Sm^3/min)
Carbon Rodding Butt Fines Cleaner	4 Dec	83	396
Carbon Rodding Butt Fines Cleaner	4 Dec	92	396
Anode Reamer - *Retest*	1 Dec	28	243
Anode Reamer	27 Nov	289	252
Carbon Rodding Coarse Cleaner	14 Oct	11	654
Carbon Rodding Coarse Cleaner	13 Oct	7	644
Flakt	1 Oct	7	1279
Flakt	1 Oct	16	1279
Wharf Corner	29 Sept	1	144
Wharf Corner	29 Sept	2	144
Day Bin 1	8 April	2	98
Day Bin 1	31 Mar	11	98
East East Reclaim	30 April	20	348
East East Reclaim	30 April	11	348
Sicon	16 April	1	42
Sicon	18 Feb	1	31
Day Bin 2	13 Feb	1	56
Day Bin 2	12 Feb	1	56
Day Bin 3	20 Jan	1	50
Day Bin 3	16 Jan	1	50
Ball Mill	12 Jan	83	144

Comments

All dust collectors tested during 2015, except the Anode Reamer, were found to be within the consent level of 250 mg/Sm^3. The Anode Reamer tested on 27th Nov 2015 was 289 $mg/Sm^{3.}$ Corrective action was taken and the unit retested on the 1st Dec 2015, it tested well below the trigger limit of 100 mg/Sm^3.

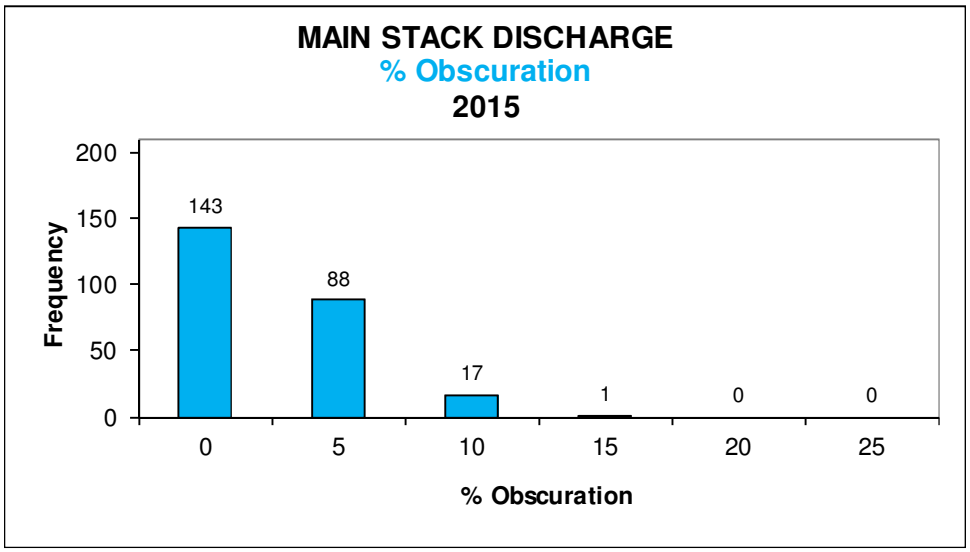
Dust Collector Discharges, - continued

The following table details the data for dust collectors monitored in 2014 that was omitted from the 2014 report. Although the data was omitted in the report the comments section addressed the issues of the East West Reclaim over the consent level and the Ball Mill & Mill East being close to and over the action limit.

Dust Collector	Date 2014	Total Particulate discharge (mg/$Sm^{3)}$	Flow Rate (Sm^3/min)
Ball Mill	7 Nov	54	157
East West Reclaim	3 Dec	8	89
East West Reclaim	20 Nov	428	84
T2 Tower	6 Nov	15	142
T2 Tower	4 Nov	8	142
Coke Store	27 Oct	1	226
Coke Store	23 Oct	1	226
Mill East	21 Oct	72	167
Mill East	14 Oct	80	163
Mill East	10 Oct	109	163
Ball Mill	7 Oct	201	140
Ball Mill	3 Oct	97	145
Nuisance	10 Sept	1	397
Nuisance	8 Aug	1	438

Main Stack Smoke Discharges

Main Stack smoke discharges were determined by visual observations using the standard Ringlemann chart. The following graph summarises the observations recorded during 2015.



During 2015 there was an increase in the frequency of observations in the 1 to 5% range, a decrease in the 10% range and no observations greater than 15%. The majority of the observations were 0%.

Sulphur Content of Raw Materials and Fuels

The following table shows the maximum, minimum, and average sulphur content of raw materials and fuels delivered to the smelter during 2015.

Material	Units	Permit Maximum	2015 Annual Average	2015 Maximum	2015 Minimum
Petroleum Coke	%	4	2.73	3.08	2.29
Pitch	%	1	0.55	0.64	0.37
Heavy Fuel Oil	%	3.5	2.44	2.60	2.30

Comments

All shipments of raw materials and fuels during 2015 met the permit standards for sulphur content.

During 2015 the average sulphur content of the Petroleum Coke decreased from 3.04% in 2014 to 2.73% in 2015. The average sulphur content of the Heavy fuel oil has decreased from 2.9% in 2014 to 2.44% in 2015. Sulphur content of Pitch has increased slightly.

Part C - Dispersion Conditions

Introduction

This chapter covers the monitoring of meteorological conditions at the Tiwai Point meteorological station. These conditions effect the dispersion of discharges into air from the smelter. The data includes:

- the distribution of wind strength,
- the distribution of wind direction, and
- rainfall.

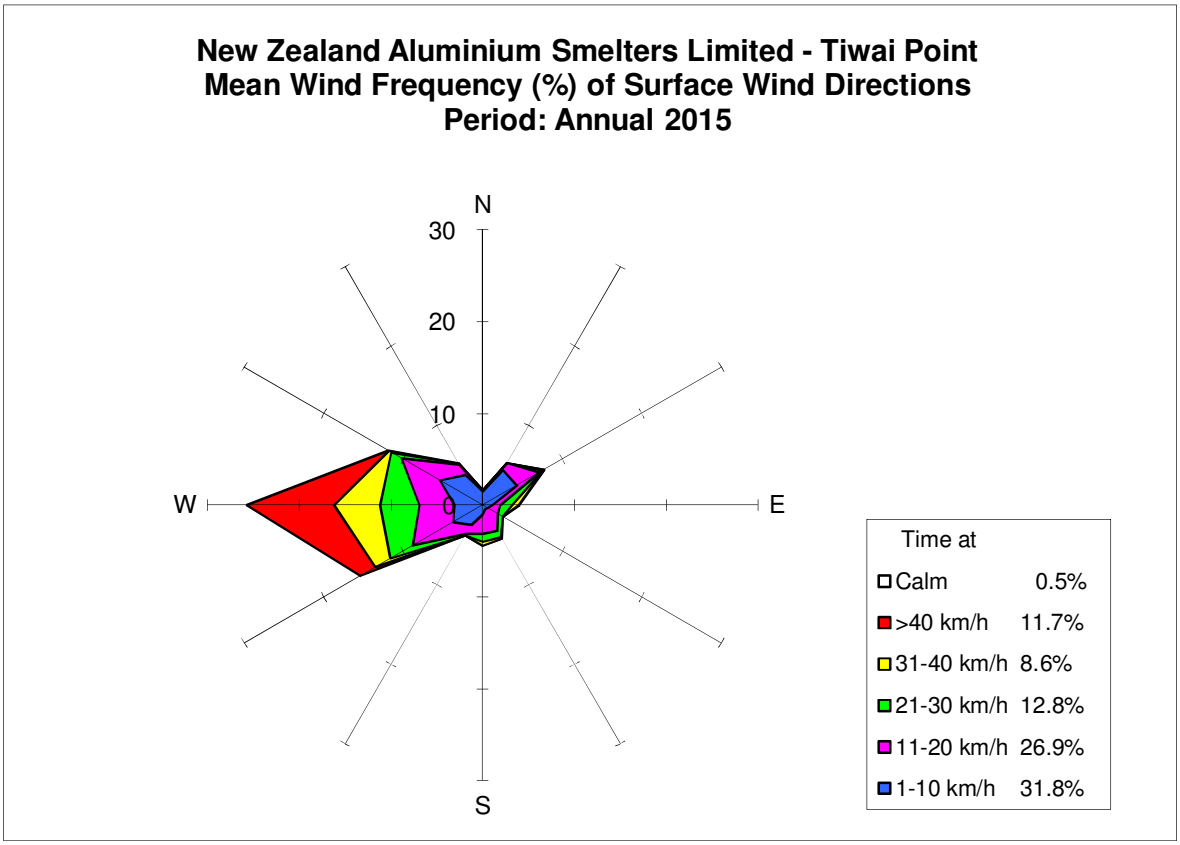
Meteorological Conditions

The mean wind frequency diagram on the following page shows that the 2015 wind pattern was dominated by westerly winds. Dispersion conditions are similar to previous years.

The following table shows the predominant winds and total rainfall recorded for each month during 2015.

Month	Predominant Wind Direction	Rainfall (mm)
January	West & East	39
February	No Data	64 estimated
March	West	64
April	All directions observed but North & ESE the least amount of time	85
May	West	71
June	West	137
July	West	74
August	West & northeast	52
September	West & northeast	57
October	West	133
November	West	74
December	West	62

Total rainfall for the year is 911mm. The five year running average is 1039mm. The long term average is 1104mm of rainfall.



Comments

No data was collected during February as the weather computer was not operational due to a lightning strike. The 10 year average figure was used as an indication for our records. No data was collected from 5/8/15 to 18/8/15 due to a faulty gauge.

The weather station that was historically located behind the pine trees on the North West point of the peninsula was relocated on 16th December 2015 (in consultation with NIWA). It has been relocated inside the smelter perimeter away from environmental obstructions that may influence data collected (GPS Location New Zealand Map Grid reference E2156254 N5392665). No data was collected for about 1½ days while the station was being moved.

Part D - Ambient Air

Introduction

This chapter covers the monitoring for gaseous and particulate fluorides in ambient air at two monitoring sites. The No 1 Bore site is monitored twice a year with a one month sampling period. The 1km Hut site is located on Rio Tinto Alcan freehold land and is sampled on a weekly basis.

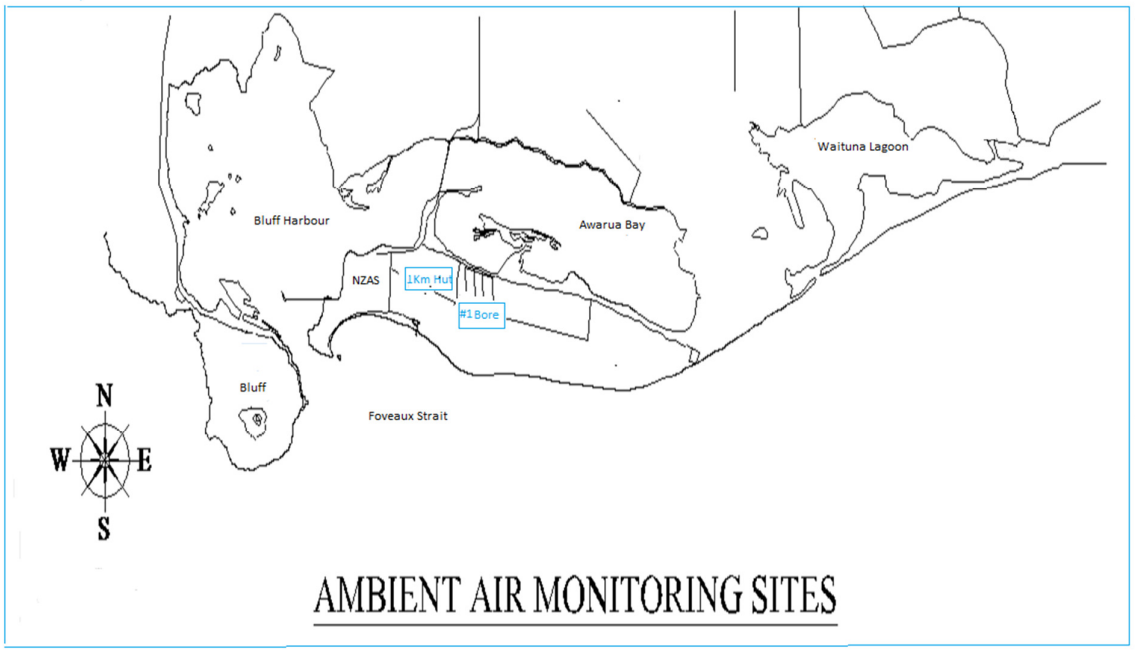
Permit Limits

No limits apply to the 1Km Hut site for particulate and gaseous fluoride. A gaseous fluoride limit applies to the No. 1 Bore Hut site.

The sampling and analysis method used is referenced to AS 3580.1991 and has a detection limit of 0.1 $\mu g/m^3$.

Site Locations

The locations of the monitoring sites are shown in following map.



Ambient Air at 1 Kilometre Hut

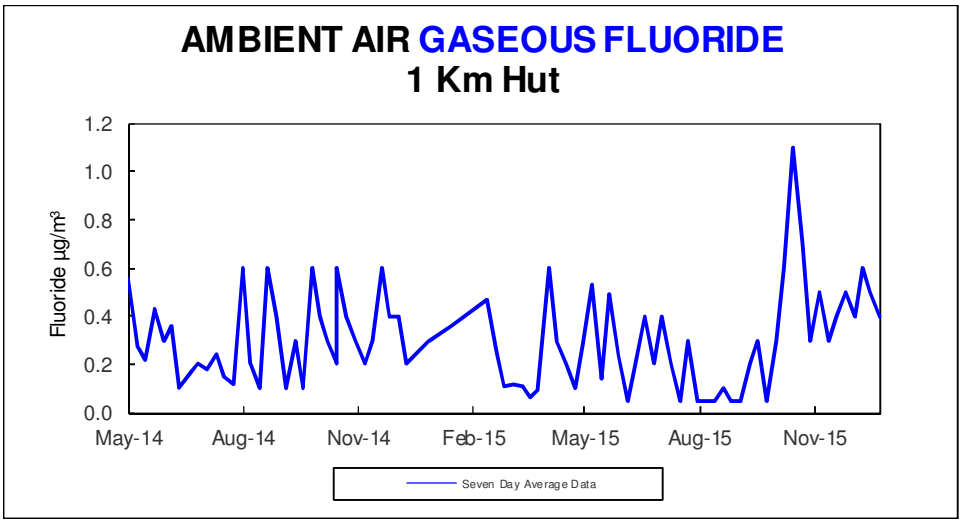
Monitoring results

The following table summarises the monitoring results during 2014 and 2015. The sampling frequency for ambient air fluoride at this site is seven days.

Parameter	Units	2014	2015
Gaseous Fluoride Concentration			
• Max 7 day average	µg/m^3	0.80	1.10
• Max monthly average	µg/m^3	0.50	0.60
• Annual average	µg/m^3	0.35	0.28
Particulate fluoride concentration			
• Max 7 day average	µg/m^3	0.60	1.10
• Max monthly average	µg/m^3	0.40	0.60
• Annual average	µg/m^3	0.13	0.15

Gaseous fluoride

The following graph shows the seven-day average gaseous fluoride results for this site.

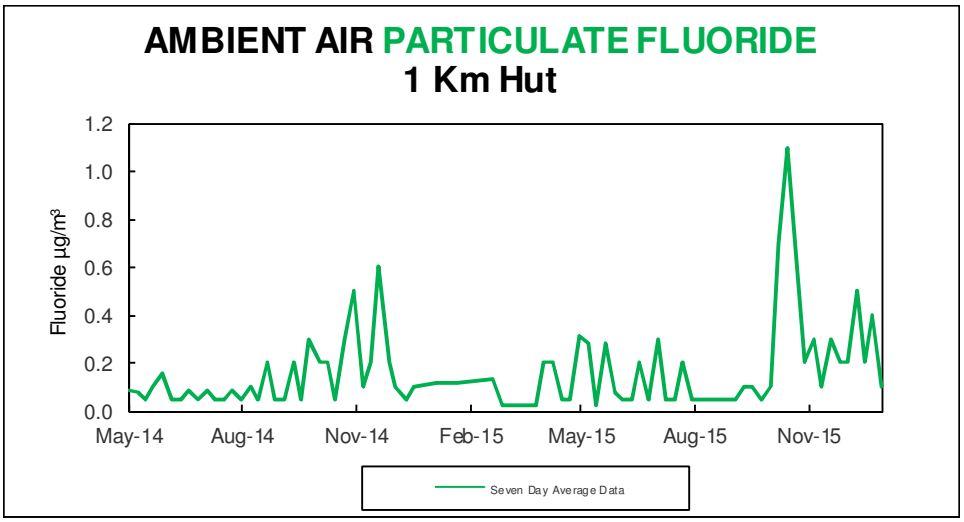


Note: Concentrations < 0.1 µg/m^3 are plotted as 0.05 µg/m^3

Ambient Air at 1 Kilometre Hut, continued

Particulate Fluoride

The following graph shows the seven-day average particulate fluoride results for this site.



Note: Concentrations < 0.1 µg/m^3 are plotted as 0.05 µg/m^3

Comments

Concentrations of gaseous & particulate fluoride were within the normal range for the 1km hut site throughout 2015 with the exception of week ending 16th October for both particulate and gaseous. For most of this week there had been very strong westerly winds with the 10th October having a maximum wind speed of 20.9ms^{-1} that would have caused dispersion to the 1km hut site.

Ambient Air at No. 1 Bore on Tiwai Peninsula

Monitoring results

The following table summarises the monitoring results during 2014 and 2015 for the No. 1 Bore site located on Tiwai Peninsula.

Site	Parameter	Units	Limit	2014	2015
No. 1 Bore	Gaseous Fluoride				
	• Max 7 day average	µg/m^3	1.0	N.D.	N.D.
	• Max monthly average	µg/m^3	0.5	0.20	0.10
	• Annual average	µg/m^3		< 0.1	< 0.1
	Particulate Fluoride				
	• Max 7 day average	µg/m^3		N.D.	N.D.
	• Max monthly average	µg/m^3		< 0.1	0.10
	• Annual average	µg/m^3		< 0.1	< 0.1

N.D: Not Determined.

Comments

Gaseous and particulate fluoride concentrations are similar to those previously reported.

Part E - Atmospheric Deposition

Introduction

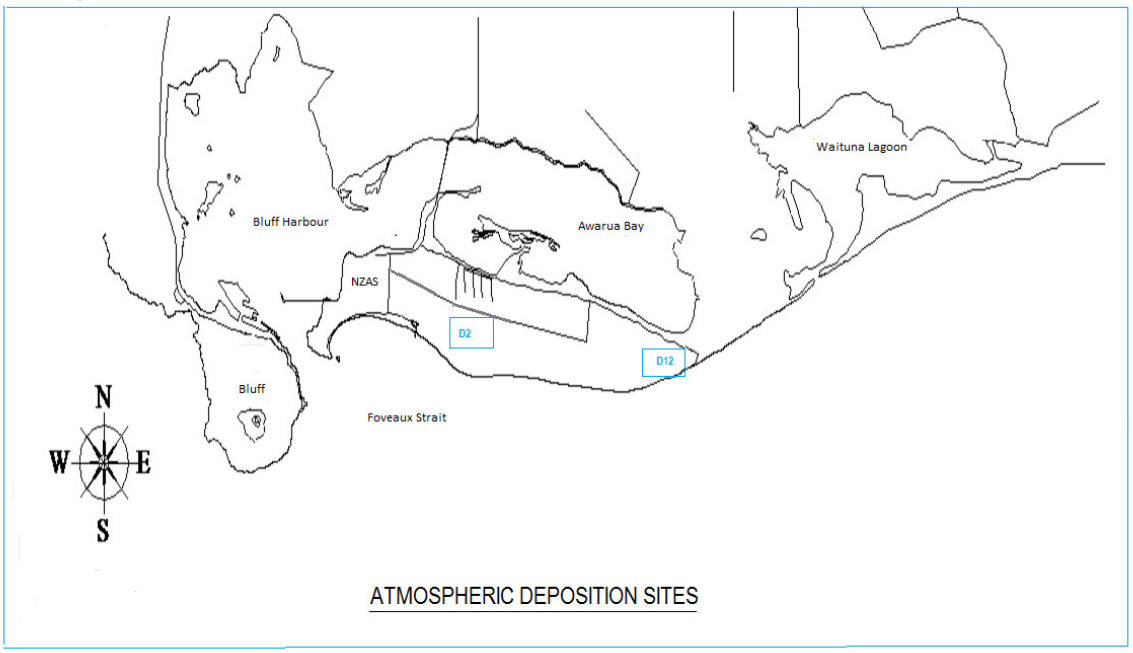
This chapter covers the monitoring of atmospheric deposition at two monitoring sites.

Permit Guidelines

No guidelines are applicable to the two monitoring sites that are located on Tiwai land

Site Locations

The locations of the monitoring sites are shown in the following map.



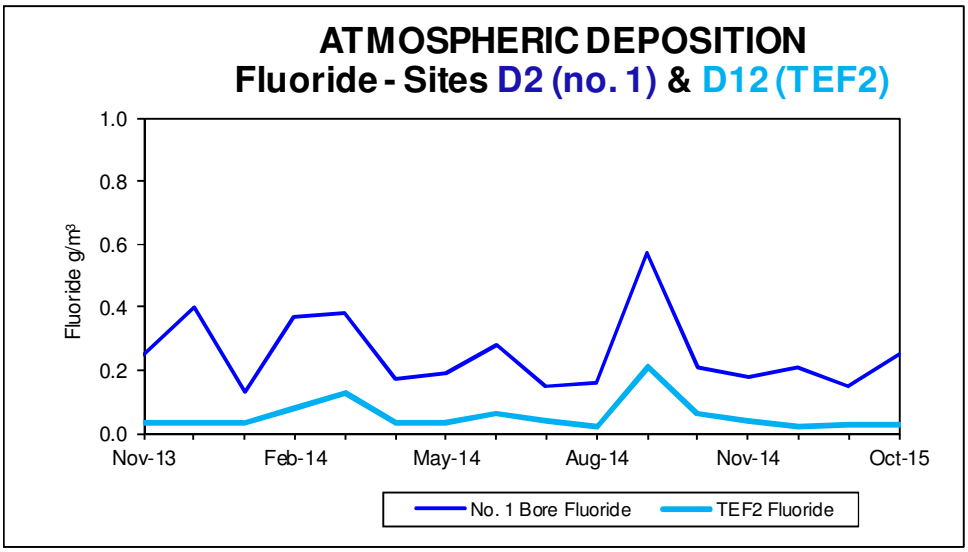
ATMOSPHERIC DEPOSITION SITES

Atmospheric Deposition Monitoring Results

Fluoride Deposition

The fluoride atmospheric deposition during 2015 is summarised in the following table.

Site	Units	Mar-15	Oct-15
D2. (No1 Bore)	g/m^3	0.15	0.25
D12. (TEF2)	g/m^3	< 0.05	< 0.05



Comments

Fluoride levels at both sites are similar to previous years

Part F - Fluoride in Ungrazed Grass

Introduction

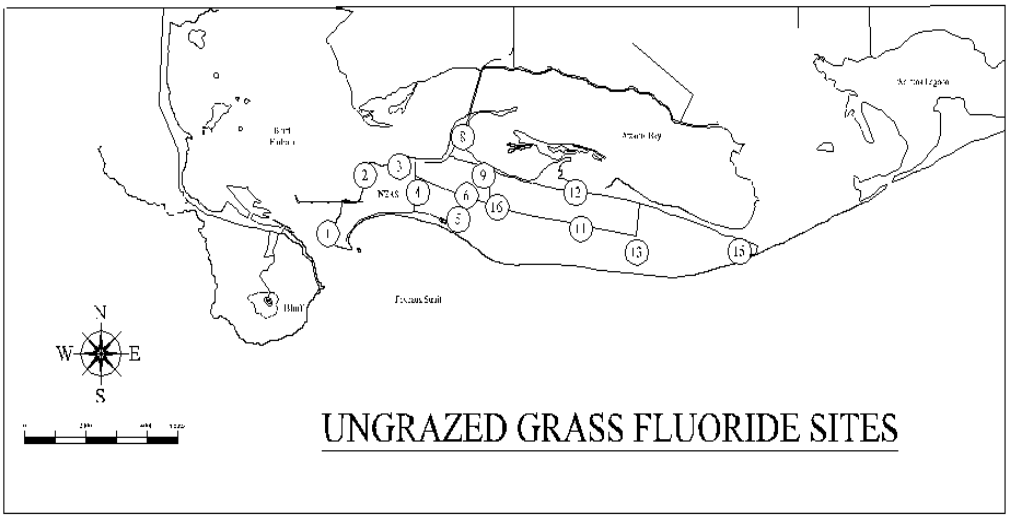
This chapter covers the monitoring of fluoride in ungrazed grasses at 13 monitoring sites located on Tiwai Peninsula.

Permit Guidelines

There are no guidelines since changes were made to the Discharge to Air Consent in December 2014.

Site Locations

The ungrazed grass monitoring sites are shown on the following map.



Ungrazed Grass Monitoring Results

Annual average fluoride concentrations

The following table summarises monitoring results of ungrazed vegetation sites for 2014 and 2015.

Site	Permit Guideline mg/kg	2014 Average mg/kg	2015 Average mg/kg
1	NA	6	8
2	NA	58	42
3	NA	49	43
4	NA	510	650
5	NA	15	17
6	NA	97	56
8	NA	14	7
9	NA	22	13
11	NA	8	9
12	NA	13	11
13	NA	6	5
15	NA	6	5
16	NA	19	22

NA – Guideline not applicable.

Comments

Sites on Tiwai Peninsula are similar to concentration levels measured in previous years.

Part I - Water Take

Introduction

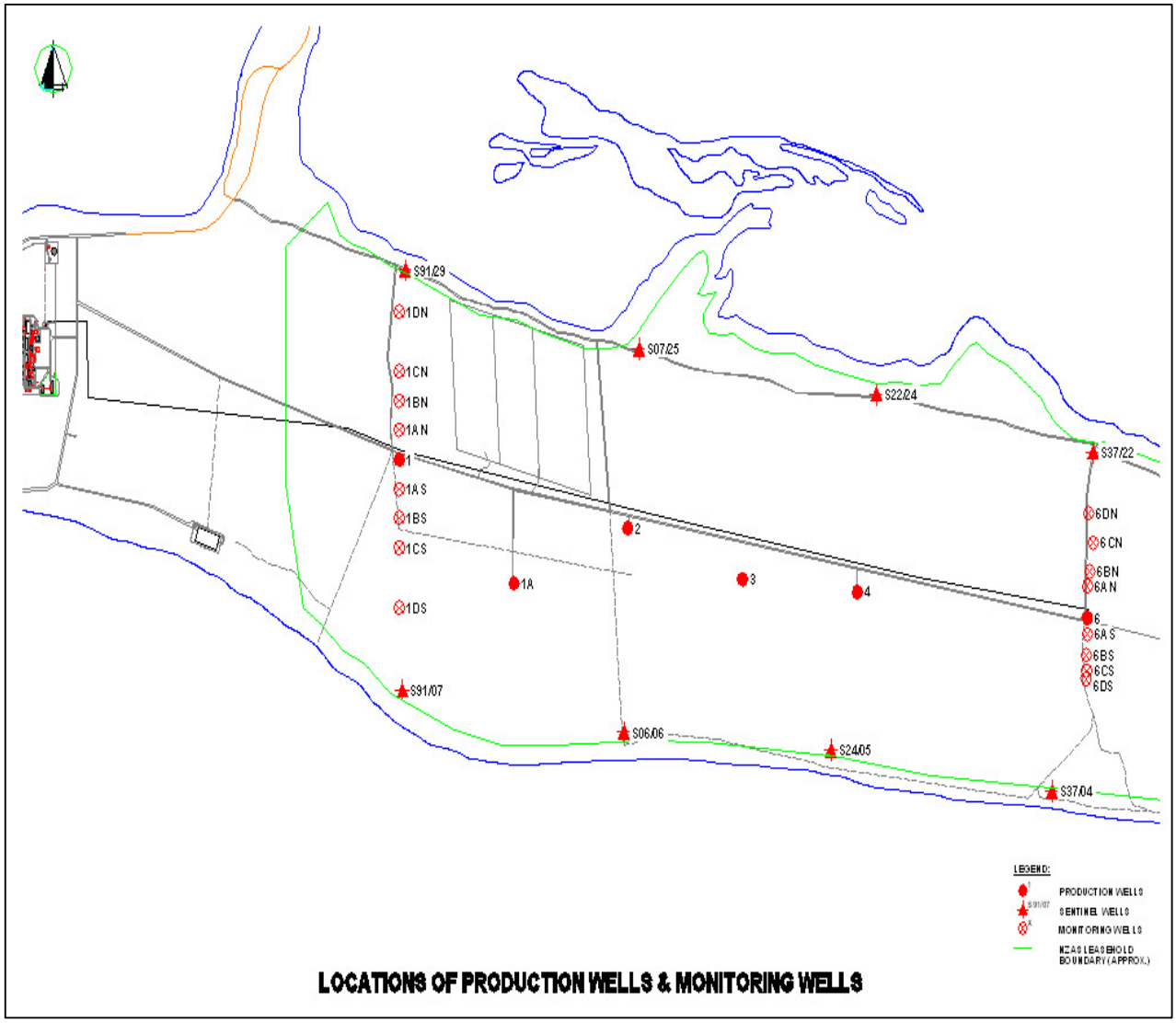
Water Take from the aquifer on Tiwai Peninsula is covered by Consent Number 202958 issued by Southland Regional Council on the 12th September 2005.

Permit Conditions

Total abstraction rate not to exceed 4,564 m^3/day.
Results of monitoring to be reported to the Council by the 31st March each year.

Site Locations

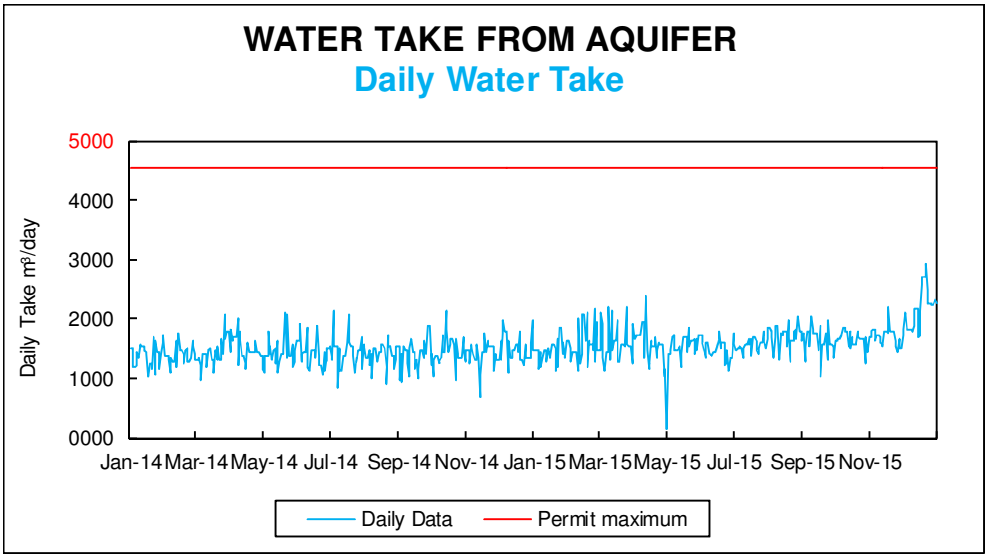
The locations of the Production and Monitoring Water Wells are shown in the following map.



Water Take from Aquifer

Monitoring Results

The total volume of water taken from the aquifer was recorded daily until early December 2012. Due to organisational restructuring the readings are no longer done in the weekends or public holidays. The practice now is to take the reading on the first available day and record the average. The data is displayed in the graph below.



The table below summarises the daily data on a monthly basis.

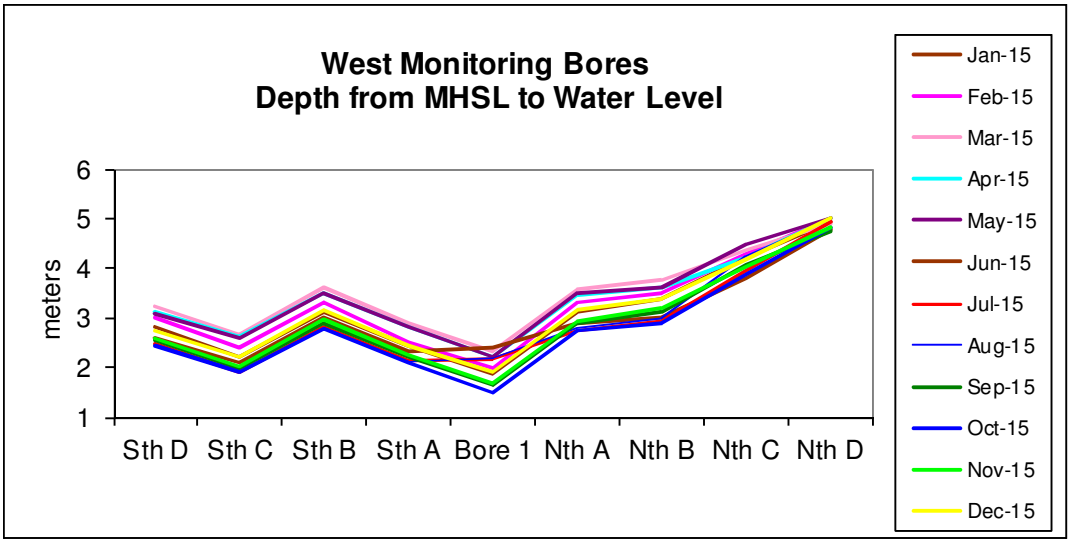
Daily Water Take		
Date	Average m^3/day	Maximum m^3/day
Jan-15	1470	1858
Feb-15	1601	2165
Mar-15	1584	2210
Apr-15	1621	2396
May-15	1516	1864
Jun-15	1474	1800
Jul-15	1569	1783
Aug-15	1734	2045
Sep-15	1634	2026
Oct-15	1665	1862
Nov-15	1702	2187
Dec-15	2142	2913

Water Take from Aquifer, continued

The following tables and graphs show the water level for each monitoring bore around production bores 1 and 6, measured while pumping from the production bores.

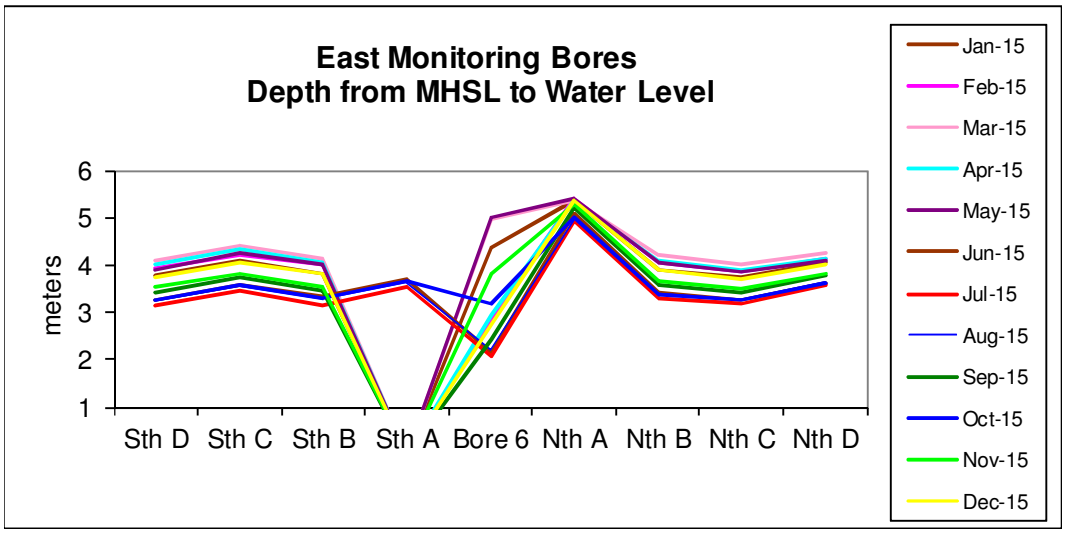
West Monitoring Bore Water Levels
(from Mean High Sea Level in metres)
Total well depth in Italics

Date	South				Bore 1	North			
	D	C	B	A		A	B	C	D
	5.64	*5.50*	*5.50*	*4.62*	*16.4*	*5.32*	*5.30*	*5.55*	*5.27*
Jan-15	2.80	2.22	3.80	2.43	1.87	3.13	3.39	4.22	4.94
Feb-15	3.00	2.40	4.00	2.53	2.00	3.30	3.50	4.30	5.00
Mar-15	3.25	2.68	4.15	2.91	2.33	3.59	3.77	4.36	4.92
Apr-15	3.13	2.62	4.06	2.80	2.21	3.47	3.62	4.23	5.00
May-15	3.10	2.60	4.00	2.80	2.20	3.50	3.60	4.50	5.00
Jun-15	2.60	2.10	3.33	2.31	2.39	2.91	3.00	3.82	4.80
Jul-15	2.46	1.90	3.16	2.12	2.19	2.76	2.95	3.96	4.93
Aug-15	2.45	1.92	3.29	2.10	2.20	2.80	3.00	4.22	5.00
Sep-15	2.56	2.00	3.46	2.21	1.63	2.89	3.13	4.06	4.75
Oct-15	2.45	1.90	3.30	2.09	1.51	2.73	2.89	3.88	4.83
Nov-15	2.60	2.03	3.54	2.26	1.70	2.95	3.18	4.04	4.83
Dec-15	2.75	2.21	3.80	2.44	1.90	3.15	3.40	4.20	5.00



Water Take from Aquifer, continued

East Monitoring Bore Water Levels (from Mean High Sea Level in metres) *Total well depth in Italics*									
Date	South				Bore 6	North			
	D	C	B	A		A	B	C	D
	4.32	*5.35*	*5.79*	*3.82*	*8.6*	*5.46*	*5.4*	*5.45*	*5.5*
Jan-15	3.79	4.08	3.80	dry	4.39	5.37	3.90	3.73	4.04
Feb-15	3.95	4.23	4.00	dry	2.85	5.40	4.05	3.85	4.15
Mar-15	4.11	4.42	4.15	dry	4.96	5.36	4.22	4.02	4.27
Apr-15	4.00	4.33	4.06	dry	2.94	5.37	4.10	3.91	4.15
May-15	3.90	4.25	4.00	dry	5.00	5.40	4.05	3.85	4.10
Jun-15	3.26	3.59	3.33	3.71	2.15	5.07	3.44	3.28	3.62
Jul-15	3.15	3.45	3.16	3.54	2.08	4.92	3.31	3.18	3.58
Aug-15	3.25	3.55	3.29	3.65	2.20	5.00	3.40	3.30	3.65
Sep-15	3.42	3.72	3.46	dry	2.41	5.22	3.58	3.43	3.79
Oct-15	3.26	3.57	3.30	3.66	3.19	5.00	3.39	3.25	3.61
Nov-15	3.53	3.83	3.54	dry	3.80	5.30	3.66	3.50	3.83
Dec-15	3.75	4.05	3.80	dry	2.75	5.35	3.90	3.70	4.00



Comments

Water levels in the monitoring bores have not changed significantly during 2015. Bore South A was dry for 8 of the 12 months as reflected in the graph above.

Part J - Liquid Discharges and Their Effects

Introduction

Liquid discharges from the smelter are covered by Discharge Permits issued by the Southland Regional Council. These permits commenced in June 2006.

This chapter gives details of the monitoring results for each permit.

Permit Limits

The following table shows the permit limits applying to the discharges to water and onto land.

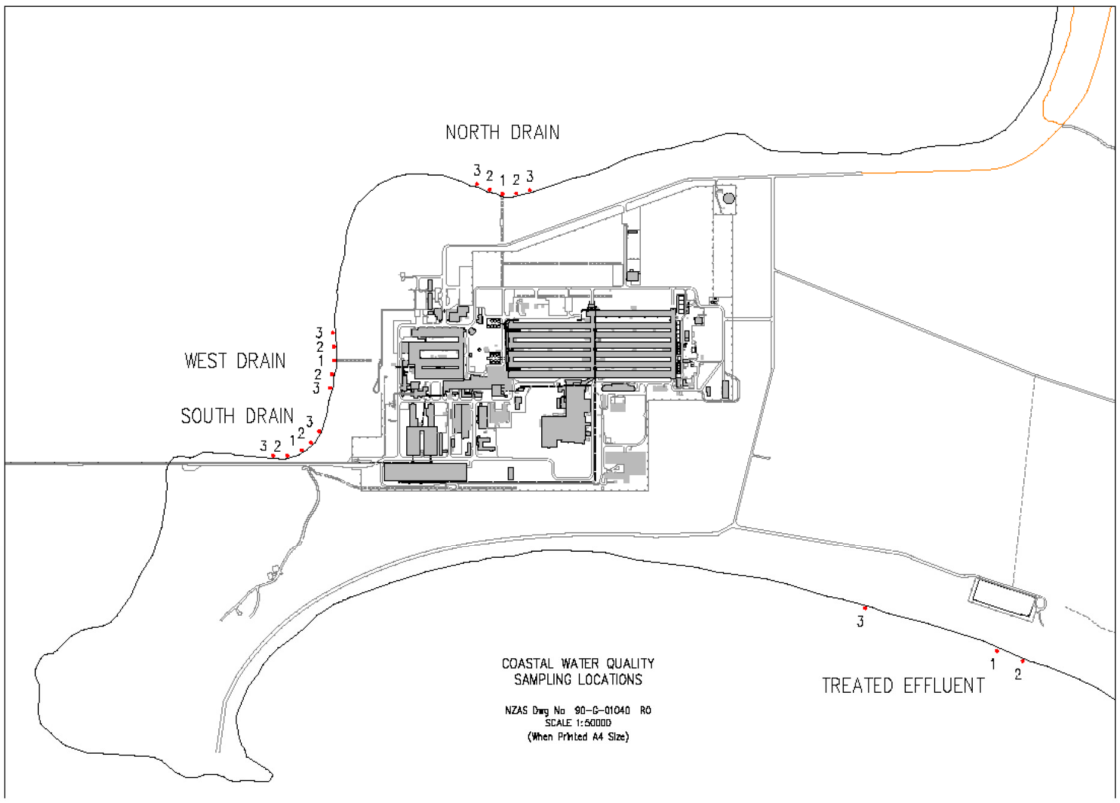
	Units	Limit
North, South, and West Drain		
• Quarterly average total suspended solids	g/m^3	30
Treated effluent		
• Maximum daily discharge	m^3/day	140
• Total suspended solids	g/m^3	100
• Free cyanide	g/m^3	20
Treated sewage		
• Maximum daily flow	m^3/day	295
• Biochemical oxygen demand	kg/day	18
• Total suspended solids	kg/day	8

The following permit limits apply to coastal water monitoring sites:

- The natural temperature of the water shall not be changed by more than 3^0C and the natural temperature of the water shall not exceed 25^0C;
- Any pH change and/or any discharge of a contaminant into the water or water into water or onto the seabed shall not result in a loss of biological diversity or a change in community composition;
- The concentration of dissolved oxygen shall exceed 80% of saturation concentration;
- Fish or other aquatic organisms shall not be rendered unsuitable for human consumption by the presence of contaminants;
- There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water;
- Aquatic life is not adversely affected by the taking of any physical, chemical or biological constituent from the water;
- Visual clarity shall not be diminished by more than 20%;
- The water shall not be rendered unsuitable for bathing by the presence of contaminants;
- The water shall not be altered in those characteristics which have a direct bearing upon cultural or spiritual values;
- The quarterly average fluoride concentration at drain coastal water monitoring sites shall not exceed $2g/m^3$ based on the results of representative samples collected each week; and
- The fluoride concentration in any representative drain coastal water monitoring sample collected weekly shall not exceed $5g/m^3$.

Site Locations

The locations of liquid discharges and their monitoring sites are shown in the following map.



Discharge Monitoring

The discharges from the North, South and West Drains are sampled once each week. The temperature of each discharge is measured once each year as part of the annual seawater quality monitoring survey.

The discharge of treated sewage is sampled over a 24 hour period once each month.

The discharge of treated effluent from the cathode pad treatment facility is sampled once per batch of treated effluent.

Coastal Water Monitoring

Coastal water quality is determined by comparing the results of monitoring at coastal water monitoring sites with the results at control sites. The coastal water monitoring sites are chosen to monitor the effects of discharges on coastal waters. The control sites are chosen to best represent the background coastal water quality.

Some coastal water monitoring is undertaken each time a drain discharge is sampled.

Additional coastal water monitoring for drain discharges is undertaken annually.

Annual coastal water monitoring is undertaken for the discharge of treated effluent.

Sewage Land Disposal Area Groundwater Monitoring

Groundwater near the sewage land disposal area is monitored by sampling from one upstream bore north of the disposal area, and one downstream bore south of the disposal area.

Monitoring is carried out at about six monthly intervals.

North Drain Discharges

Introduction

Discharges from the North Drain are covered by Discharge Permit & Coastal Permit Consent No. 203373 which commenced on 6 June 2006.

Discharge monitoring results

The following table summarises the North Drain discharge monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Average	2015 Average
Total Suspended solids	g/m^3		9.3	12.3
• Maximum Quarterly Average	g/m^3	30	10.6	15.1
• No. of Times Quarterly Average >30 g/m^3		0	0	0
pH			7.7	7.6
Fluoride	g/m^3		4.0	5.3
Conductivity	µS/cm		45157	43220

Coastal water monitoring results

The following table summarises the North Drain weekly coastal water monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Average	2015 Average
Fluoride	g/m^3		1.3	1.3
• Maximum Quarterly Average	g/m^3	2	1.4	1.4
• No. of Times Quarterly Average >2.0 g/m^3		0	0	0
• Maximum Individual Sample	g/m^3	5	2.2	2.2
• No of Times Individual Sample > 5.0 g/m^3			0	0
pH			8.1	8.1
Conductivity	µS/cm		51218	51366
Visible Oil - No. of times Observed			0	0

North Drain Discharges continued.

Control Site water monitoring results

The following table summarises the North Drain weekly control site water monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Average	2015 Average
Fluoride	g/m^3		1.3	1.3
• Maximum Quarterly Average	g/m^3	2	1.4	1.4
• No. of Times Quarterly Average >2.0 g/m^3		0	0	0
• Maximum Individual Sample	g/m^3	5	2.2	2.2
• No of Times Individual Sample > 5.0 g/m^3			0	0
pH			8.1	8.1
Conductivity	µS/cm		51218	51366
Visible Oil - No. of times Observed			0	0

Annual Monitoring results

The following table summarises the North Drain annual coastal water monitoring results during 2015 and shows a comparison with 2014 results.

Site	Parameter	Units	Limit	2014	2015
Discharge	Temperature	°C		14.5	16.2
Seawater	Temperature	°C	<25	15	16.2
	Dissolved oxygen	mg/L	>= 5	9.9	8.1
	Dissolved Oxygen Saturation	%	>80	98	88.3
Control	Temperature	°C	<25	15	15.9
	Dissolved oxygen	mg/L	>= 5	9.9	8.2
	Dissolved Oxygen Saturation	%	>80	99	85.1
	Change to temperature	°C	3	0	0.3

Comments

Discharges from the North Drain were within permit limits during 2015.

South Drain Discharges

Introduction

Discharges from the South Drain are covered by Discharge Permit & Coastal Permit Consent No. 203373 which commenced on 6 June 2006.

Discharge monitoring results

The following table summarises the South Drain discharge monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Average	2015 Average
Total Suspended solids	g/m^3		2.3	2.5
• Maximum Quarterly Average	g/m^3	30	3.1	4.2
• No. of Times Quarterly Average >30 g/m^3		0	0	0
pH			6.6	6.6
Fluoride	g/m^3		5.3	5.0
Conductivity	µS/cm		368	434

Coastal water monitoring results

The following table summarises the South Drain weekly coastal water monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Average	2015 Average
Fluoride			1.3	1.3
• Maximum Quarterly Average	g/m^3	2	1.3	1.4
• No. of Times Quarterly Average >2.0 g/m^3	g/m^3	0	0	0
• Maximum Individual Sample		5	1.5	1.5
• No of Times Individual Sample > 5.0 g/m^3	g/m^3		0	0
pH			8.1	8.1
Conductivity			50149	50183
Visible Oil - No. of times Observed			0	0

South Drain Discharges, continued

Control Site water monitoring results

The following table summarises the South Drain weekly control site water monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Result	2015 Result
Fluoride	g/m^3		1.3	1.3
• Maximum Quarterly Average	g/m^3		1.3	1.4
• No. of Times Quarterly Average >2.0 g/m^3			0	0
• Maximum Individual Sample	g/m^3		1.5	1.6
• No of Times Individual Sample > 5.0 g/m^3			0	0
pH			8.1	8.1
Conductivity	µS/cm		49913	50466
Visible Oil - No. of times Observed			0	0

Annual monitoring results

The following table summarises the South Drain annual water monitoring results during 2015 and shows a comparison with 2014 results.

Site	Parameter	Units	Limit	2014	2015
Discharge	Temperature	°C		17.5	16.7
Seawater	Temperature	°C	<25	17.2	13.9
	Dissolved oxygen	mg/L	>= 5	10.1	10.3
	Dissolved Oxygen Saturation	%	>80	106	100
Control	Temperature	°C	<25	17.2	14.3
	Dissolved oxygen	mg/L	>= 5	10.3	10.4
	Dissolved Oxygen Saturation	%	>80	105	101
	Change to temperature	°C	3	0	0.4

Comments

Discharges from the South Drain were within permit limits during 2015.

West Drain Discharges

Introduction

Discharges from the West Drain are covered by Discharge Permit & Coastal Permit Consent No. 203373 which commenced on 6 June 2006.

Discharge monitoring results

The following table summarises the West Drain discharge monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Average	2015 Average
Total Suspended solids	g/m^3		9.7	9.8
• Maximum Quarterly Average	g/m^3	30	11.4	14.6
• No. of Times Quarterly Average >30 g/m^3		0	0	0
pH			7.3	7.4
Fluoride	g/m^3		2.2	2.1
Conductivity	µS/cm		7019	11820

Coastal water monitoring results

The following table summarises the West Drain weekly coastal water monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Average	2015 Average
Fluoride			1.3	1.3
• Maximum Quarterly Average	g/m^3	2	1.3	1.3
• No. of Times Quarterly Average >2.0 g/m^3	g/m^3	0	0	0
• Maximum Individual Sample		5	1.7	1.4
• No of Times Individual Sample > 5.0 g/m^3	g/m^3		0	0
pH			8.1	8.1
Conductivity			51006	51390
Visible Oil - No. of times Observed			0	0

West Drain Discharges, continued

Control Site water monitoring results

The following table summarises the West Drain weekly coastal water monitoring results during 2015 and shows a comparison with 2014 results.

Parameter	Units	Limit	2014 Result	2015 Result
Fluoride	g/m^3		1.3	1.3
• Maximum Quarterly Average	g/m^3		1.3	1.3
• No. of Times Quarterly Average >2.0 g/m^3			0	0
• Maximum Individual Sample	g/m^3		1.4	1.4
• No of Times Individual Sample > 5.0 g/m^3			0	0
pH			8.1	8.1
Conductivity	µS/cm		49913	50466
Visible Oil - No. of times Observed			4	0

Annual water monitoring results

The following table summarises the West Drain annual water monitoring results during 2015 and shows a comparison with 2014 results.

Site	Parameter	Units	Limit	2014	2015
Discharge	Temperature	°C		14.6	14.6
Seawater	Temperature	°C	<25	15.3	14.4
	Dissolved oxygen	mg/L	>= 5	10.2	9.9
	Dissolved Oxygen Saturation	%	>80	99	97.1
Control	Temperature	°C	<25	15.2	14.6
	Dissolved oxygen	mg/L	>= 5	9.9	9.9
	Dissolved Oxygen Saturation	%	>80	99	97.4
	Change to temperature	°C	3	0	0.2

Comments

Discharges from the West Drain were all within permit limits during 2015.

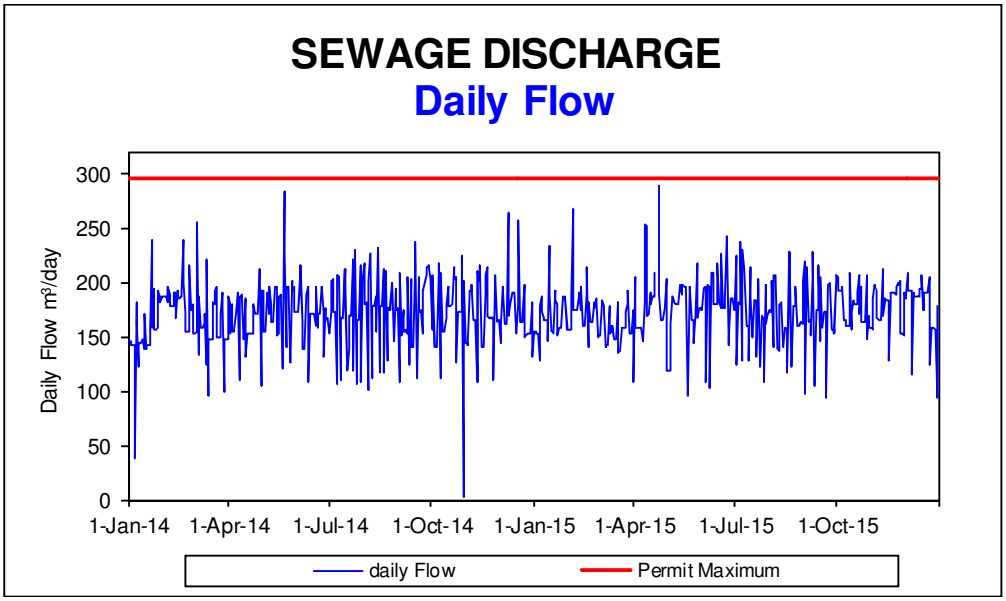
Treated Sewage Discharges

Introduction

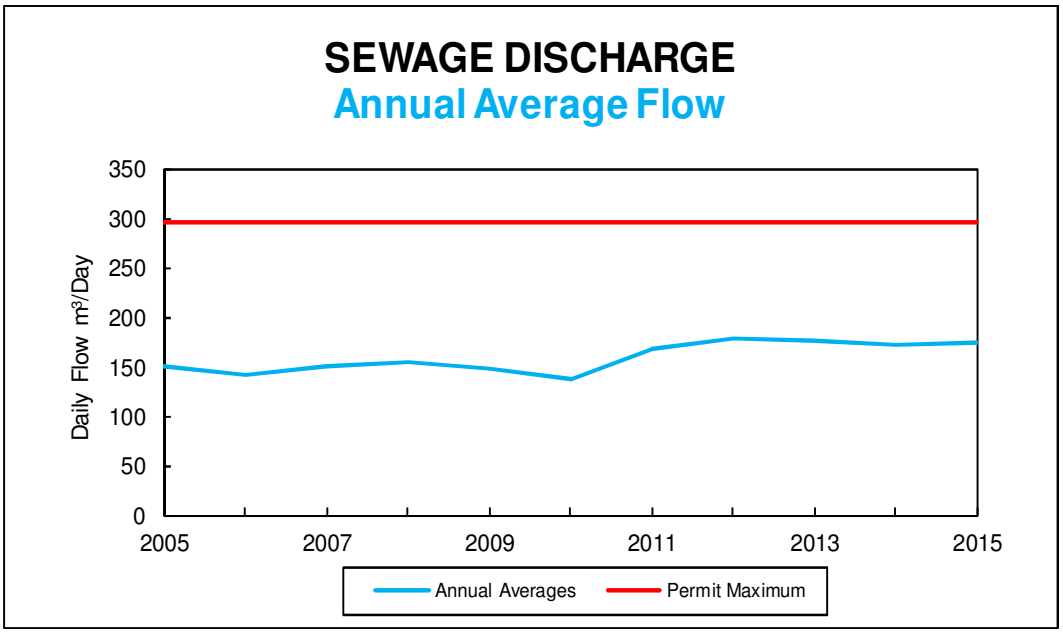
Discharges of treated sewage onto land are covered by Discharge Permit Number 203376, which was granted on 6 June 2006.

Discharge monitoring results

The following graph shows the daily sewage discharge flow during 2014 and 2015. The permit limit for daily flow is 295m^3/day.

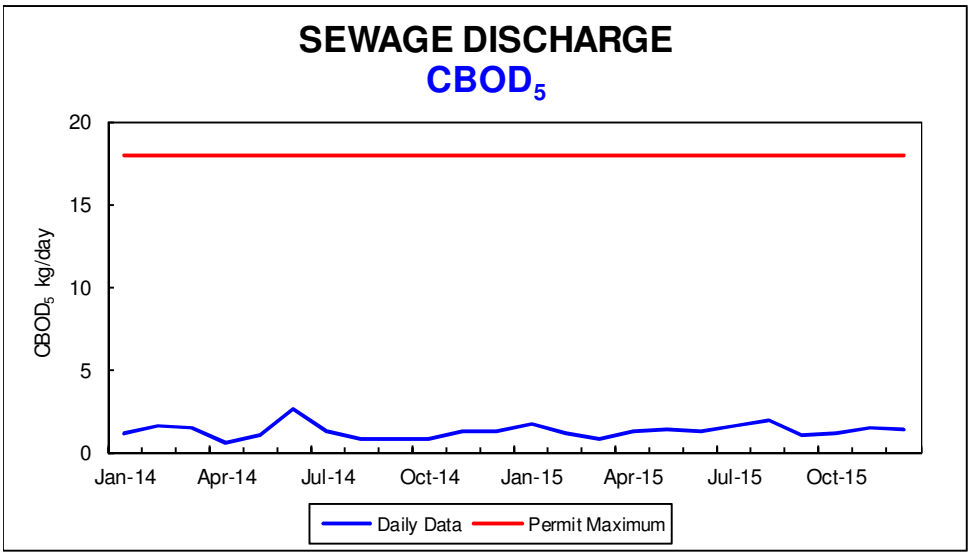


The following graph shows the annual average daily sewage discharge flow into the sewage treatment facility.

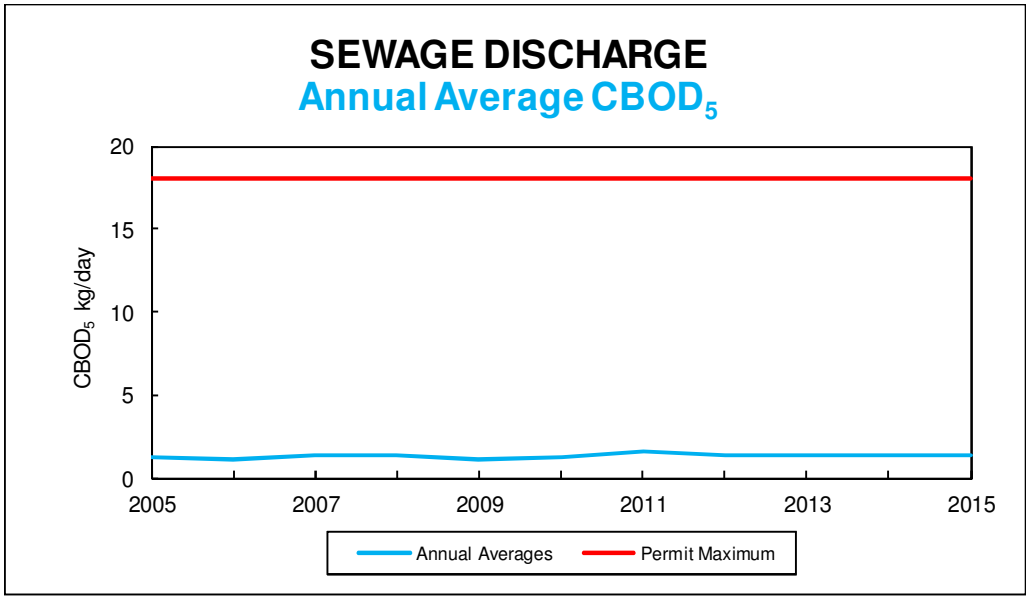


Treated Sewage Discharges, continued

The following graph shows the monthly carbonaceous biochemical oxygen demand ($CBOD_5$) discharge from the sewage treatment plant during 2014 and 2015. The permit limit for $CBOD_5$ is 18kg/day.

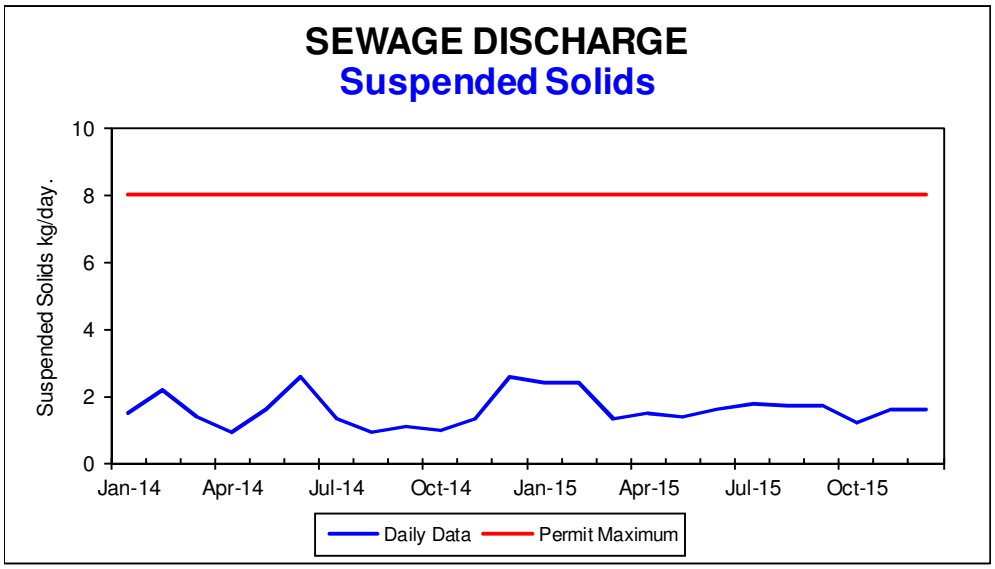


The following graph shows the annual average $CBOD_5$ discharge from the sewage treatment plant.

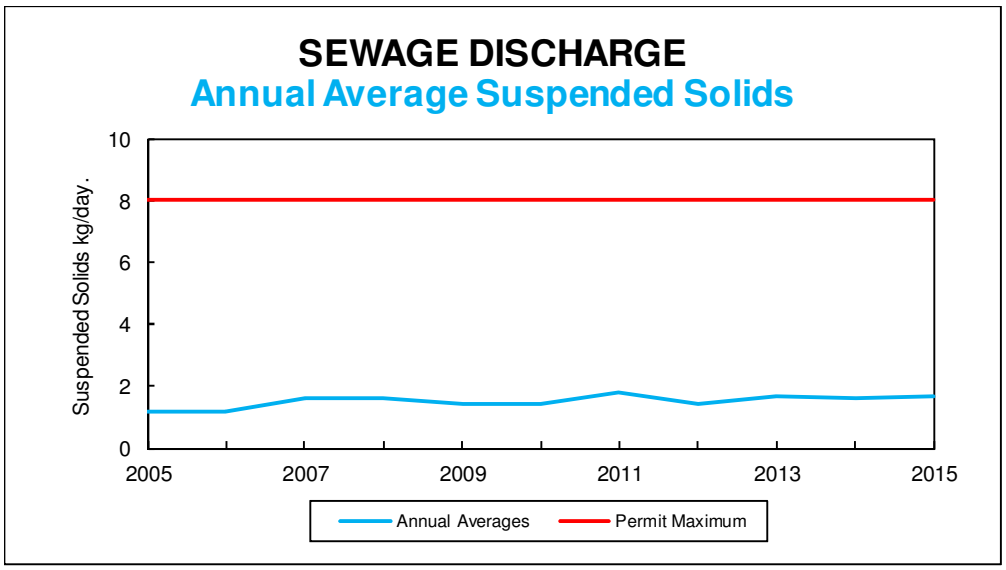


Treated Sewage Discharges, continued

The following graph shows the monthly suspended solids in the discharge from the sewage treatment plant during 2014 and 2015. The permit limit for suspended solids is 8 kg/day.



The following graph shows the annual average suspended solids discharge from the sewage treatment plant.



Treated Sewage Discharges, continued

Land disposal area groundwater monitoring results

The following table summarises the results of groundwater monitoring near to the area where sewage is discharged to land. The location of the bores is shown in the Site Locations map on page 43.

Parameter	Units	2014 Average	2015 Average	Previous Range (post commission)
North Bore (Upstream)				
Faecal coliforms	MPN/100 ml	Absent	Absent	< 2
Total phosphorus	g/m^3	0.18	0.38	0.046 - 0.68
Total ammoniacal-N	g/m^3	0.016	< 0.01	< 0.01 - 0.03
Nitrate-N	g/m^3	<0.01	<0.01	< 0.01 - 0.058
Total Nitrogen	g/m^3	0.16	0.13	0.02 - 0.4
pH		8.1	7.9	7.4 - 8.1
Conductivity	µS/cm	349	371	305 - 372
Chlorinated Aliphatic HC	g/m^3	N.D	B.L	B.L.
South Bore (Downstream)				
Faecal coliforms	MPN/100 ml	Absent	Absent	< 2 - 65
Total phosphorus	g/m^3	0.047	0.02	< 0.01 - 0.14
Total ammoniacal-N	g/m^3	<0.01	<0.01	< 0.01 - 0.02
Nitrate-N	g/m^3	0.22	0.22	< 0.01 - 0.54
Total Nitrogen	g/m^3	0.67	0.43	0.05 - 0.78
pH		7.7	7.6	6.8 - 7.9
Conductivity	µS/cm	360	446	227 - 503
Chlorinated Aliphatic HC	g/m^3	N.D	B.L	B.L.

HC = Hydrocarbons N.D. = Not determined.
B.L. = Below limit of detection for each of the 23 compounds determined.

Chlorinated Aliphatic Hydrocarbons only determined biennially.

Comments

The discharges of treated sewage onto land during 2015 were similar to previously seen. The upstream North Bore has shown an increase in phosphorus in 2015.

Treated Effluent Discharges

Introduction

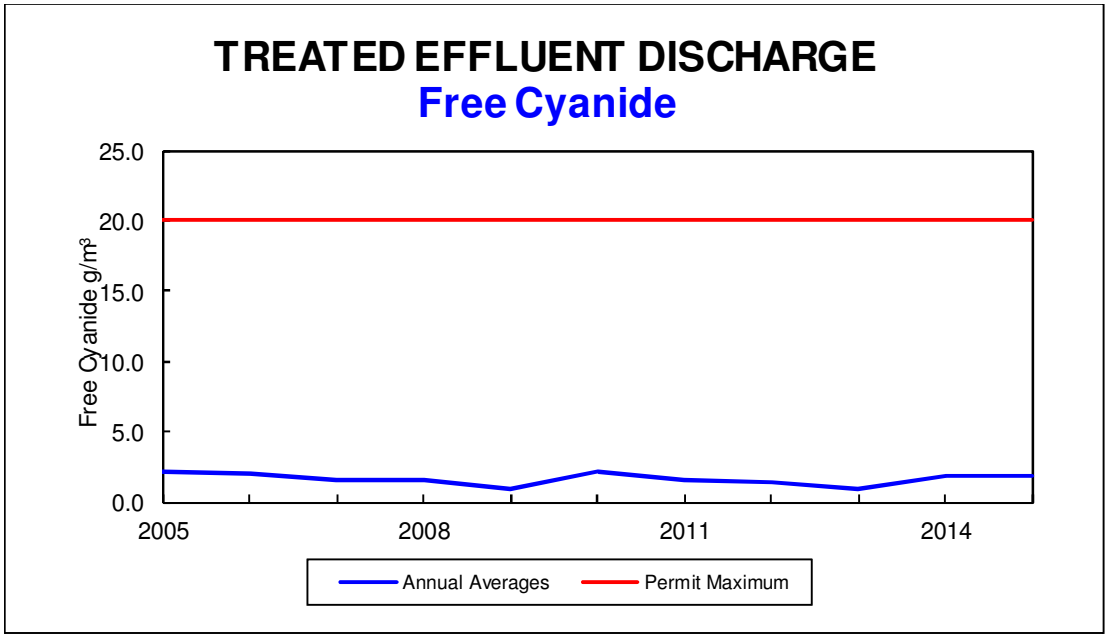
Discharges of treated effluent into Foveaux Strait are covered by Coastal Permit Number 203375 which commenced on 6 June 2006.

Discharge monitoring results

The following table summarises the results of treated effluent discharge monitoring during 2015 and shows a comparison with the 2014 results.

Parameter	Units	Limits	2014 Result	2015 Result
Maximum daily discharge	m^3/day	140	80	80
Suspended Solids				
Maximum Concentration	g/m^3	100	48	38
Average Concentration			6.2	5.0
No.> 100 g/m^3		0	0	0
Free Cyanide				
Maximum Concentration	g/m^3	20	8.3	4.3
Average Concentration			2.1	1.9
No.> 20 g/m^3		0	0	0

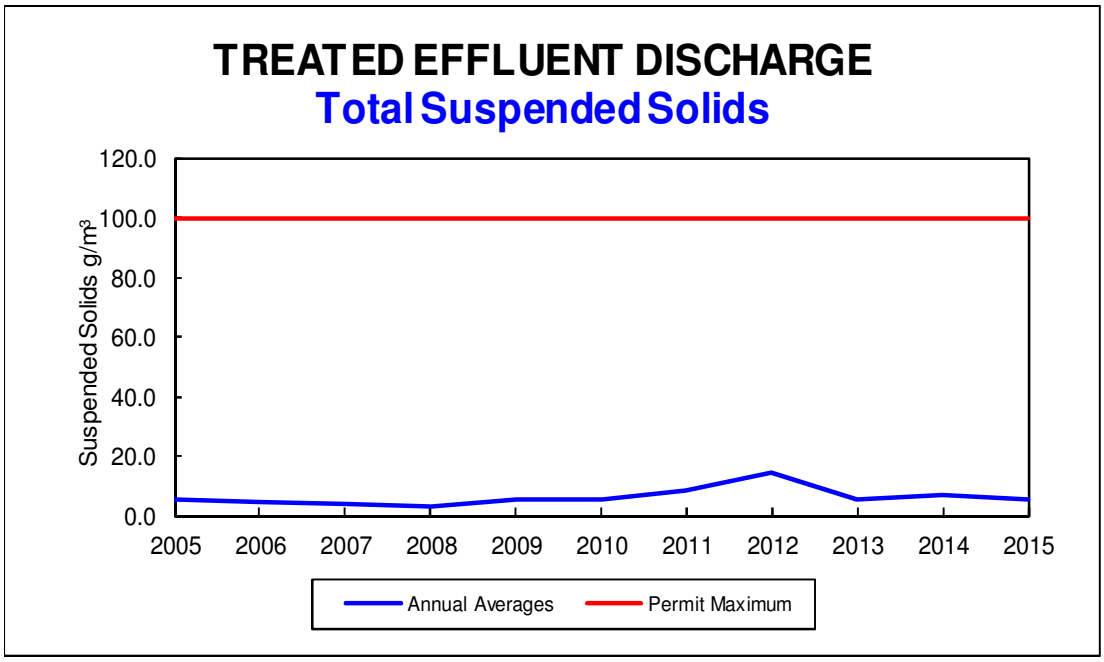
The following graph shows the annual average free cyanide concentration of treated effluent discharged.



Treated Effluent Discharges, continued

Discharge monitoring results, continued

The following graph shows the annual average total suspended solids concentration of treated effluent discharged.



Discharge rate

The following table shows the average, maximum and minimum discharge rates for the discharge of treated effluent to Foveaux Strait during 2013, 2014 and 2015.

There were 33 discharges throughout 2015 with a total volume of m^3 discharged.

Parameter	Units	2013 Result	2014 Result	2015 Result
Average Discharge Rate	L/min	5	5	5
Maximum Discharge Rate	L/min	5	5	5
Minimum Discharge Rate	L/min	5	5	5

Treated Effluent Discharges, continued
Annual Coastal Water Monitoring Results

The following table summarises the annual coastal water monitoring for the discharge of treated effluent.

Site	Parameter	Units	Limit	2014	2015
Coastal	Fluoride	$g.m^{-3}$		1.2	1.3
	Total Cyanide	$g.m^{-3}$		<0.008	<0.008
	Conductivity	µS/cm		53100	50668
	pH			8.1	8.1
	Dissolved Oxygen	mg/L	>=5	10.7	11.8
	% Saturation	%	>80	103	104
	Temperature	℃	<25	14	9
Control	Fluoride	$g.m^{-3}$		1.2	1.3
	Total Cyanide	$g.m^{-3}$		<0.008	<0.008
	Conductivity	µS/cm		53400	50360
	pH			8.1	8.1
	Dissolved Oxygen	mg/L	>=5	10.7	11.7
	% Saturation	%	>80	105	106
	Temperature	℃	<25	14.4	9
	Change to Temperature	℃	3	0	0.2

Condition of the diffuser

The Cathode Outfall Discharge Structure including the diffuser was inspected on 14th December. The structure was found to be in good condition in an upright position on the seafloor as intended. Growth on the structure was found to be similar to other years. The structure was scraped clean making sure to leave any small snails in place. The snails seem to stop the sea tulips attaching themselves to the structure. All discharge tubes were cleaned of growth and blockages removed.

Cathode discharge pipe

In June the discharge pipe to the sea was found to be broken and a section lost at the low tide area. A new pipe was laid in August and discharges recommenced. The new pipe was found to be twisted and broken in September. This was re-joined and buried in October. The pipe subsequently became exposed at the low tide line and was again buried in December.

Comments

All discharges of treated effluent were within permit limits during 2015.

Part K - Landfill Operations

Introduction

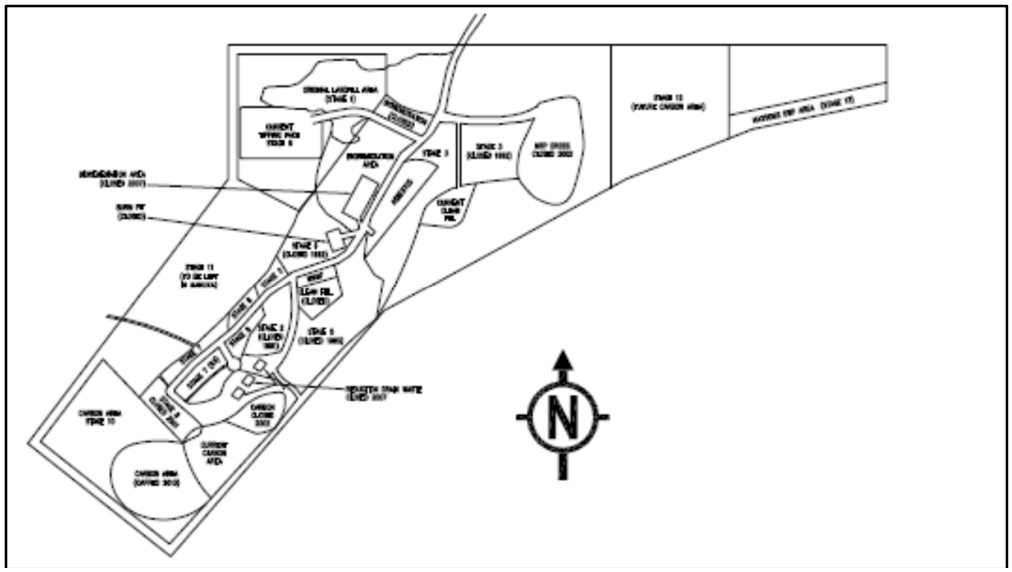
Operation of the landfill on the smelter's Tiwai Point property is covered by Discharge Permit No. 202196 issued by the Southland Regional Council on 8 December 2004.

The general operation of the on-site landfill is outlined in the NZAS Landfill Management Plan. Additional details on the proposed operations during 2015 are included in the following sections:

- proposed operation at the landfill for the next twelve months,
- comments on operations for 2015, and
- 2015 groundwater monitoring results.

Proposed Operation For 2016

The operation of the General waste, Clean fill and MMMF areas will continue with no major changes proposed for 2016. Those areas have capacity for many years of future landfilling and do not requiring any structural changes within the next 12 months.



Carbon Waste

The current carbon waste tipping area was opened in 2002 and it is anticipated that there is capacity for landfill at current rate for another 12 months assuming no change to current operations. Carbon waste will be deposited to the north east of the adjacent 2010 capped pile. The NZAS consent allows for a new tipping area to be opened in the future at the NZAS lanfill. Investigations into possible new tipping areas are continuing including the possibility of backfilling the MRP area as the dross is mined out by Taha.

Comments on Operations for 2015

General Waste

The general waste tip had the gravel wall extended on the western side to shelter from the westerly winds. The face was worked from the west to the east along the access road. The long term intentions are to increase the height of the area rather than enlarge the foot print. The general waste area was progressively capped with pea gravel as per the Landfill Management Plan.

Man Made Mineral Fibre Area

The existing man made mineral fibre bunker was created in 2012 and was closed during 2015. A new pit was dug south of the old pit for the remainder of 2015 and future use.

Metal Reclamation Plant Stockpile

Dross delivered from the MRP stockpile to the Taha plant for the aluminium to be extracted stopped in February 2015 as Taha continued to experience off-site storage problems with their products. Less dross than expected was removed from the MRP stockpile.

Carbon Dust Tipping Area

Drain pipes were added to the carbon pile to prevent pooling of rain water in the area. Fine material is delivered to a purposely built earth bunker and left to compact before moved to the general tipping face.

Timber Stockpile

In the second half of 2015 new waste wood was added to the existing landfill pile. Staff and contractors were allowed to remove waste wood from site for firewood. Chipping of the wood at the landfill is planned for 2016.

Amount and Type of Materials Deposited

Introduction

As per NZAS' consent conditions for landfill operations, a report detailing waste sent to landfill is required to be submitted every second year. The last full report was for the calendar year 2013.

The previous method used to estimate the annual quantity of waste deposited at the NZAS landfill was very labour intensive as it required that waste to be weighted before landfilled.

In December 2013 TrueSouth Surveyors performed a baseline of the NZAS landfill using UAV and photogrammetry. This method involves taking photos and spatial measurements with a drone. Survey was repeated in Dec 2014 and Jan 2016. The following areas are surveyed:

- general waste,
- clean fill,
- carbon,
- MRP dross, and
- Haysom's dross

The January 2016 survey provided the following estimates for volumes of material deposited during 2015:

Waste deposited at NZAS Landfill in 2015		
Waste Material	**Increase (m3)**	**Comments**
General pile	882	>50% gravel mixed in to cover waste
Clean pile	463	
Carbon pile	1593	
MRP dross	**-497**	Material removed and processed into Ouvea

To ensure that the new method is reliable the Haysom's dross pile was measured as a control site. This pile had no material added or removed during 2015. The following results were obtained:

Control Sites		
Waste Material	**Increase (m3)**	**Comments**
2003 Haysoms dross	-301	3 cm average decrease in height due to weeds sprayed on the pile.

The table above shows that the aerial survey method is highly accurate if no vegetation is present. There is no vegetation on the current general, clean, carbon or MRP piles.

Comments on Carbon Pile

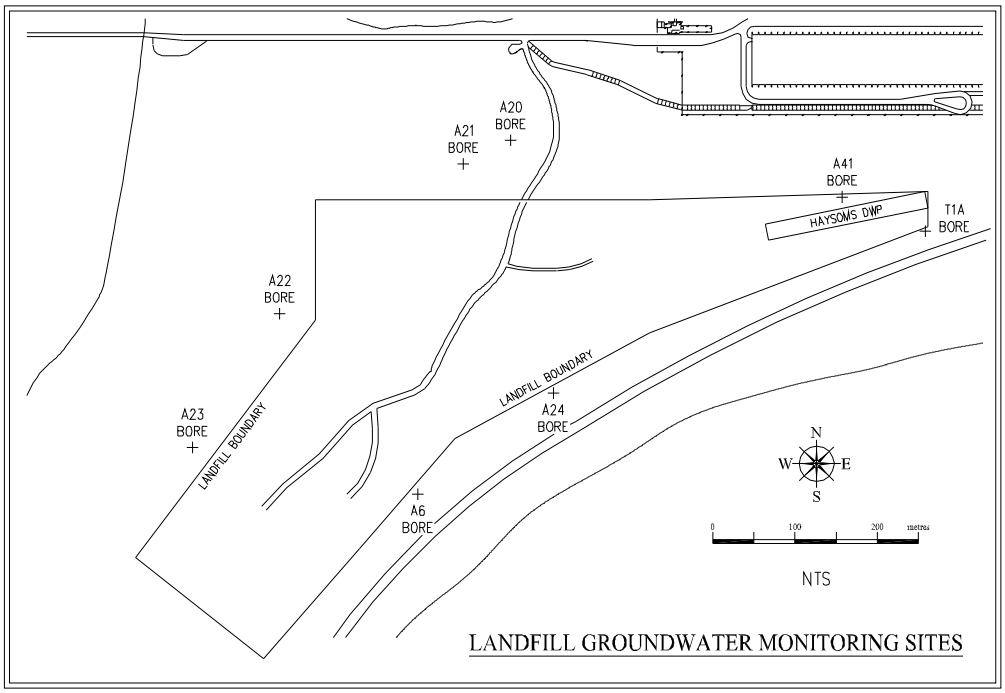
The individual waste streams deposited in the carbon area is weighed and summarized in table below. The increase is mainly due to less carbon waste recycled back into the process so more high purity metal can be produced. This trend may continue as NZAS is continuously striving to optimise the production of pure aluminium.

Measured Process Waste to the NZAS Carbon Pile By Material 2012 - 2015				
Material	**2012**	**2013**	**2014**	**2015**
Alumina	25	12	53	30
Carbon	2389	2320	2562	2744
Furnace Slag (Carbon)	171	283	333	386
Reject Bath	85	120	14	59
Resistor Coke (Carbon)	330	528	606	648
Miscellaneous (Mixture)	120	325	30	54
Total Process (tonnes)	**3120**	**3588**	**3598**	**3921**

Landfill Groundwater Monitoring

Site locations

The locations of the groundwater monitoring bores are as shown in the following map. Three of the bores are north (upstream) of the landfill, and there are three bores south east and two bores west (downstream) of the landfill.



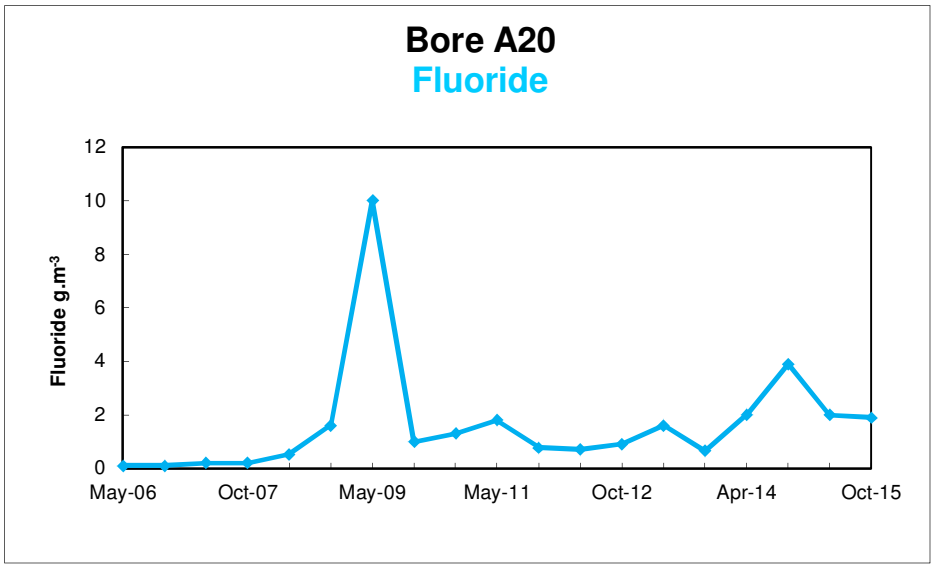
Landfill Groundwater Monitoring, Continued

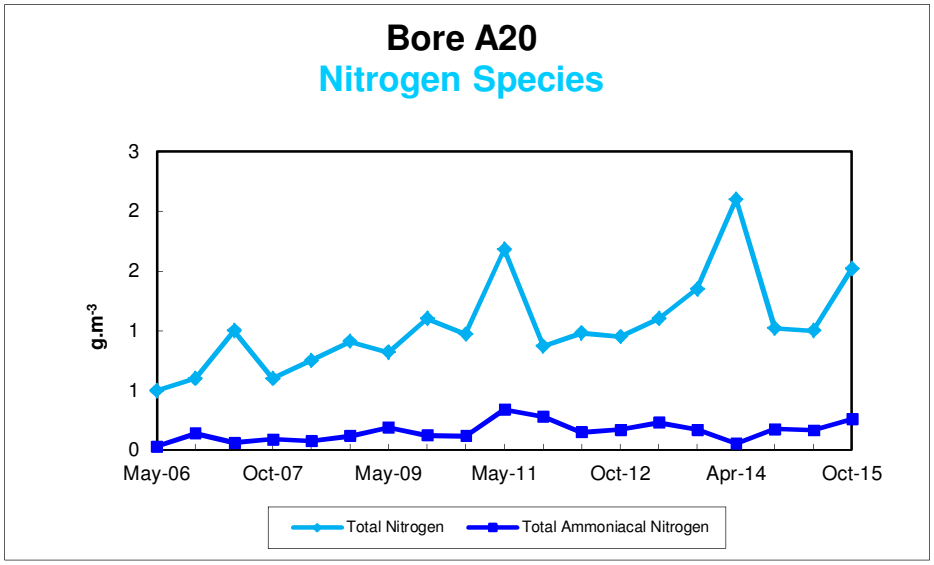
Bore A20 monitoring results

The table below shows a summary of results from samples collected from bore A20 during 2014 and 2015. Bore A20 is located north of the landfill (upstream).

Analyte	Units	2014 Average	2015 Average	Range (since Commissioning)
Temperature	^0C	N.D.	12.3	7.5 - 13.4
pH		5.8	5.9	5.1 - 7.2
Conductivity	µS/cm	756	856	644 - 1063
Alkalinity	g/m^3	19	31	8 - 240
Carbonaceous BOD5	g/m^3	<2	<2	<1 - 6
Total Nitrogen	g/m^3	1.60	1.30	0.1 - 2.1
Total Ammoniacal Nitrogen	g/m^3	0.12	0.21	0.02 - 0.34
Fluoride	g/m^3	3.00	2.00	0.03 - 11
Sulphate	g/m^3	34	34	25 - 55
Total Iron	g/m^3	2.04	7.05	0.46 - 26
Total Petroleum Hydrocarbons	g/m^3	N.D.	<1	<1 - 11.6
Total Kjeldahl Nitrogen	g/m^3	0.93	1.24	0.2 - 1.67
Nitrate Nitrogen	g/m^3	N.D.	<0.2	<0.002 - 14
Nitrite Nitrogen	g/m^3	N.D.	<0.2	<0.002 - 0.014
Weak Acid Dissociable Cyanide	g/m^3	N.D.	<0.001	<0.001 - 0.1
Boron	g/m^3	N.D.	0.066	0.032 - 0.067
Manganese	g/m^3	N.D.	0.153	0.111 - 0.394
Nickel	g/m^3	N.D.	0.0042	0.0018 - 0.01
Potassium	g/m^3	N.D.	4	2.9 - 4.1
Vanadium	g/m^3	N.D.	0.0073	<0.001 - 0.0079

N.D: Not analysed – only required biennially.


Bore A20
Fluoride
Fluoride g.m-3
12
10
8
6
4
2
0
May-06
Oct-07
May-09
May-11
Oct-12
Apr-14
Oct-15

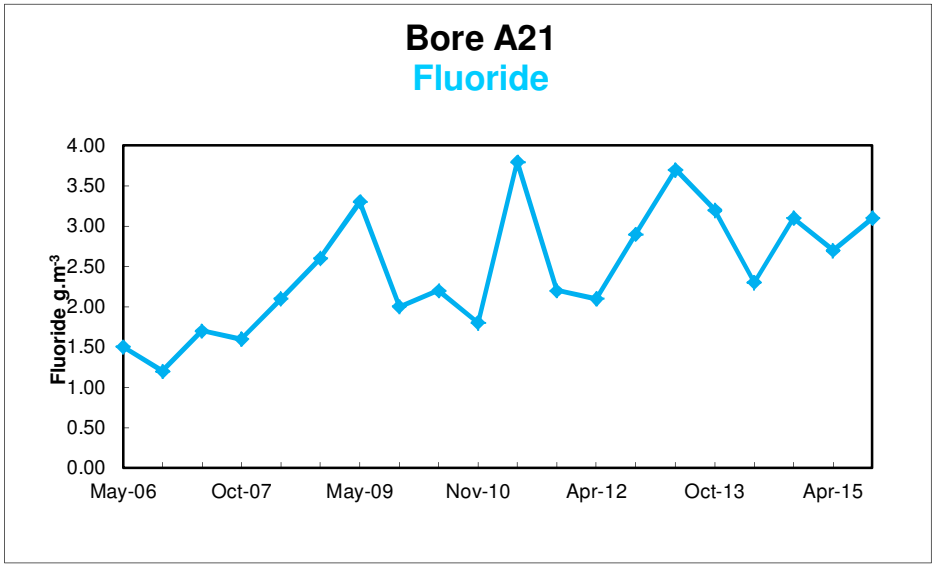

Bore A20
Nitrogen Species
g.m-3
3
2
2
1
1
0
May-06
Oct-07
May-09
May-11
Oct-12
Apr-14
Oct-15
Total Nitrogen
Total Ammoniacal Nitrogen

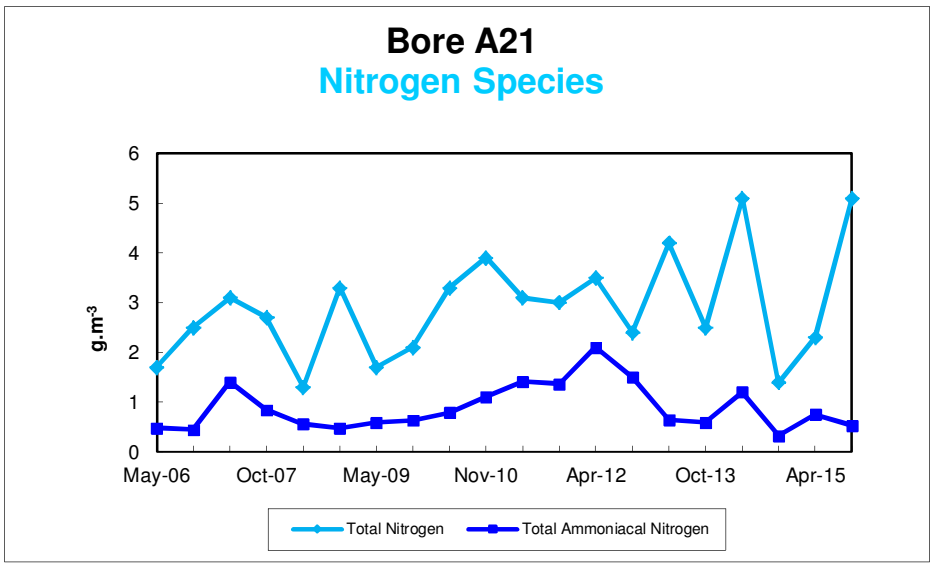
Bore A21 monitoring results

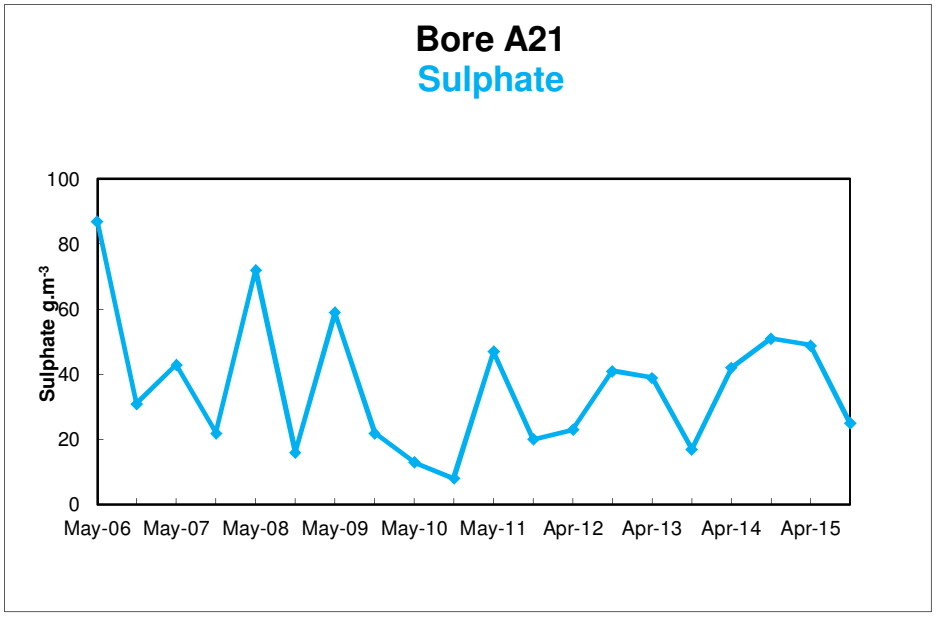
The table below shows a summary of results from samples collected from bore A21 during 2014 and 2015. Bore A21 is located north of the landfill (upstream).

Analyte	Units	2014 Average	2015 Average	Range (since Commissioning)
Temperature	^0C	N.D.	11.7	6.5 - 13.7
pH		5.8	5.8	5.1 - 6.9
Conductivity	µS/cm	1115	766	502 - 1723
Alkalinity	g/m^3	15	32	1 - 160
Carbonaceous BOD5	g/m^3	<2	<2	<0.1 - 16
Total Nitrogen	g/m^3	3.2	3.7	0.7 - 8
Total Ammoniacal Nitrogen	g/m^3	0.8	0.6	0.1 - 4.6
Fluoride	g/m^3	2.7	2.9	0.2 - 3.8
Sulphate	g/m^3	47	37	8 - 114
Total Iron	g/m^3	0.8	10.1	0.66 - 94.6
Naphthalene	mg/m^3	<0.1	<0.1	<0.1 - 1
Anthracene	mg/m^3	<0.1	<0.1	<0.02 - 0.2
Phenanthrene	mg/m^3	<0.1	<0.1	<0.005 - 0.2
Fluoranthene	mg/m^3	<0.1	<0.1	<0.02 - 0.2
Total Petroleum Hydrocarbons	g/m^3	N.D.	<1	<1 - 7.3
Total Kjeldahl Nitrogen	g/m^3	N.D.	2.2	0.8 - 6.5
Nitrate Nitrogen	g/m^3	N.D.	0.06	0 - 29
Nitrite Nitrogen	g/m^3	N.D.	0.01	<0.002 - 0.028
Weak Acid Dissociable Cyanide	g/m^3	N.D.	0.00	<0.001 - 0.1
Boron	g/m^3	N.D.	0.103	0.07 - 0.154
Manganese	g/m^3	N.D.	0.091	0.064 - 0.473
Nickel	g/m^3	N.D.	0.0039	<0.0005 - 0.007
Potassium	g/m^3	N.D.	7	5 - 11
Vanadium	g/m^3	N.D.	0.01	0.001 - 0.043

N.D: Not analysed – only required biennially.


Bore A21
Fluoride
Fluoride g.m-3
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
May-06
Oct-07
May-09
Nov-10
Apr-12
Oct-13
Apr-15


Bore A21
Nitrogen Species
g.m-3
6
5
4
3
2
1
0
May-06
Oct-07
May-09
Nov-10
Apr-12
Oct-13
Apr-15
Total Nitrogen
Total Ammoniacal Nitrogen


Bore A21
Sulphate
Sulphate g.m-3
100
80
60
40
20
0
May-06
May-07
May-08
May-09
May-10
May-11
Apr-12
Apr-13
Apr-14
Apr-15

Landfill Groundwater Monitoring, Continued

Bore A41 monitoring results

The table below shows a summary of results from samples collected from bore A41 during 2014 and 2015. Bore A41 is located north of the Hansoms' area (upstream).

Analyte	Units	2014 Average	2015 Average	Range (since Commissioning)
pH	-	6.7	6.7	5.9 - 7.9
Alkalinity	g/m^3	53	46	11.1 - 170
Temperature	^0C	N.D.	11.7	5.9 - 7.9
Conductivity	µS/cm	462	465	282 - 984
Carbonaceous BOD_5	g/m^3	<2	<2	0.5 - 1
Fluoride	g/m^3	1.2	1.2	0.25 - 5
Sulphate	g/m^3	25	22	19.2 - 47
Total Iron	g/m^3	0.15	0.10	0.04 - 0.63
Boron	g/m^3	N.D.	0.06	0.04 - 4.1
Manganese	g/m^3	N.D.	<0.01	<0.01 - 0.023
Potassium	g/m^3	N.D.	0.97	0.27 - 4.8
Vanadium	g/m^3	N.D.	<0.002	<0.002 - 0.011
Nickel	g/m^3	N.D.	0.0007	0.0005 - 0.004
Ammoniacal-Nitrogen	g/m^3	<0.01	<0.01	0.005 - 0.16
Total Nitrogen	g/m^3	1.28	0.68	0.39 - 26
Total Kjeldahl Nitrogen	g/m^3	0.51	0.45	0.28 - 3.1
Nitrate Nitrogen	g/m^3	N.D.	0.22	0.22 - 23
Nitrite Nitrogen	g/m^3	N.D.	0.01	<0.002 - 0.2
Total Petroleum Hydrocarbons	g/m^3	N.D.	<1	<1
Weak Acid Dissociable Cyanide	g/m^3	N.D.	0.0005	0.0005 - 0.0035

N.D: Not analysed – only required biennially.

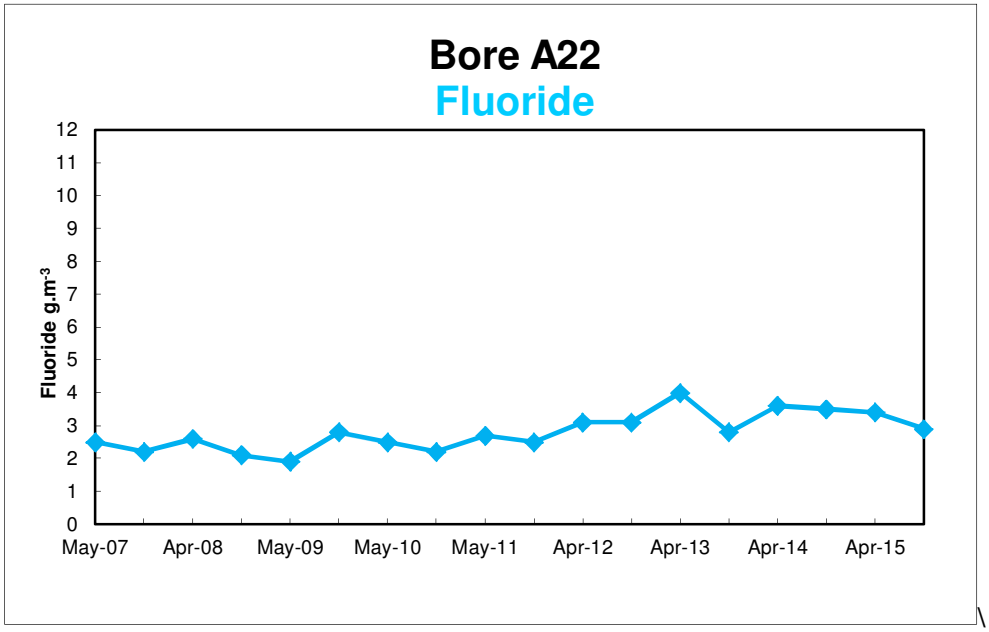
Landfill Groundwater Monitoring, Continued

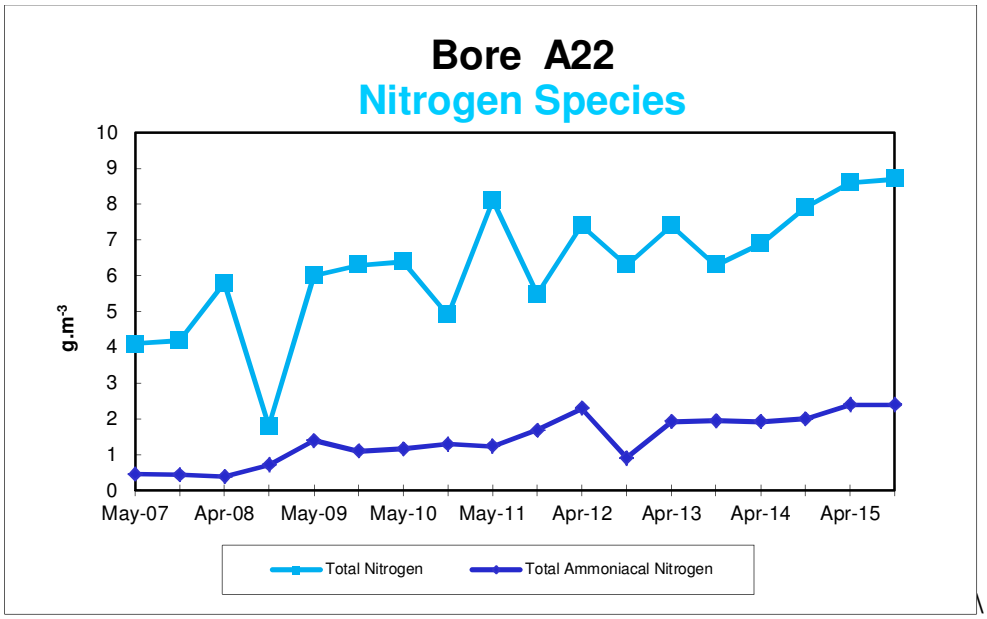
Bore A22 monitoring results

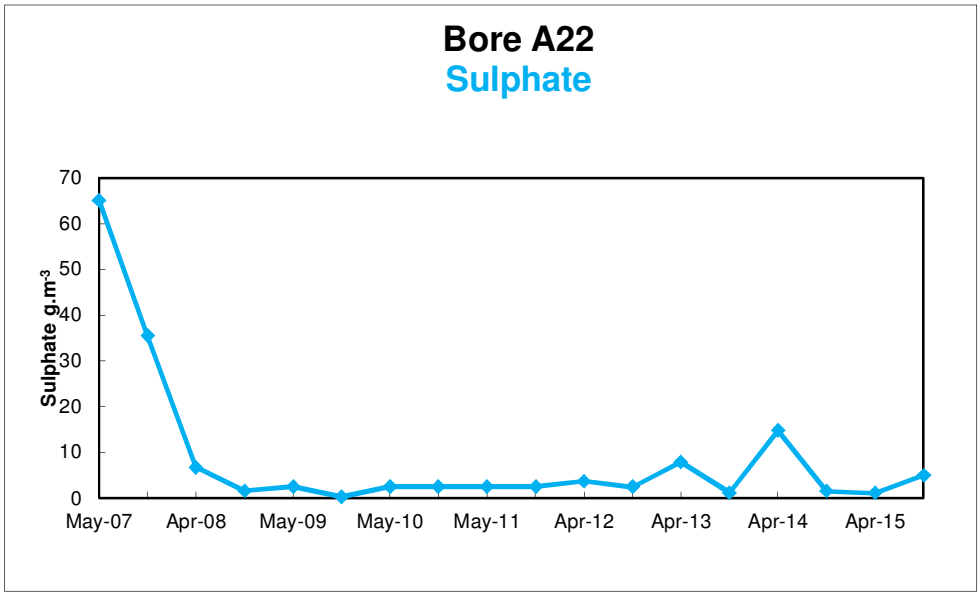
The table below shows the averages of results from samples collected from bore A22 during 2014 and 2015. Bore A22 is located west of the landfill.

Analyte	Units	2014 Average	2015 Average	Range (since Commissioning)
Temperature	^0C	N.D.	11.1	8.6 - 12.1
pH		5.0	4.9	4.2 - 7.3
Conductivity	µS/cm	588	601	354 - 1204
Alkalinity	g/m^3	12	10	1 - 294
Carbonaceous BOD5	g/m^3	5	5.5	<1 - 15
Total Nitrogen	g/m^3	7.4	8.7	0.42 - 8.6
Total Ammoniacal Nitrogen	g/m^3	1.97	2.40	0.01 - 2.4
Fluoride	g/m^3	3.6	3.2	0.03 - 4
Sulphate	g/m^3	8	3	0 - 165
Total Iron	g/m^3	1.98	1.83	0.59 - 3.45
Total Petroleum Hydrocarbons	g/m^3	N.D.	<1	<1 - 3.45
Total Kjeldahl Nitrogen	g/m^3	7.9	8.7	0.9 - 8.6
Nitrate Nitrogen	g/m^3	N.D.	0.1	<0.02 - 0.2
Nitrite Nitrogen	g/m^3	N.D.	0.1	<0.002 - 0.13
Weak Acid Dissociable Cyanide	g/m^3	N.D.	0.0034	<0.001 - 0.1
Boron	g/m^3	N.D.	0.055	0.006 - 0.071
Manganese	g/m^3	N.D.	0.0175	0.0049 - 0.394
Nickel	g/m^3	N.D.	0.0031	0.0007 - 0.01
Potassium	g/m^3	N.D.	5.1	1.65 - 5.3
Vanadium	g/m^3	N.D.	0.0049	0.002 - 0.022

N.D: Not analysed – only required biennially.


Bore A22
Fluoride
Fluoride g.m-3
0
1
2
3
4
5
6
7
8
9
10
11
12
May-07
Apr-08
May-09
May-10
May-11
Apr-12
Apr-13
Apr-14
Apr-15


Bore A22
Nitrogen Species
g.m-3
0
1
2
3
4
5
6
7
8
9
10
May-07
Apr-08
May-09
May-10
May-11
Apr-12
Apr-13
Apr-14
Apr-15
Total Nitrogen
Total Ammoniacal Nitrogen


Bore A22
Sulphate
Sulphate g.m-3
0
10
20
30
40
50
60
70
May-07
Apr-08
May-09
May-10
May-11
Apr-12
Apr-13
Apr-14
Apr-15

Landfill Groundwater Monitoring, Continued

Bore A23 monitoring results

The table below shows a summary of results from samples collected from bore A23 during 2014 and 2015. Bore A23 is located west of the landfill.

Analyte	Units	2014 Average	2015 Average	Range (since Commissioning)
Temperature	^0C	N.D.	11.3	9 - 12.5
pH		5.9	6.0	5.4 - 6.4
Conductivity	µS/cm	501	532	378 - 745
Alkalinity	g/m^3	31	30	31 - 60
Carbonaceous BOD5	g/m^3	1	<2	<1 - 5
Total Nitrogen	g/m^3	2.25	2.2	0.88 - 2.7
Total Ammoniacal Nitrogen	g/m^3	1.0	1.04	0.05 - 1.4
Fluoride	g/m^3	0.3	0.3	<0.1 - 0.36
Sulphate	g/m^3	1.1	1.25	0.25 - 30
Total Iron	g/m^3	4.7	5.3	2.6 - 13
Total Petroleum Hydrocarbons	g/m^3	N.D.	<1	<1 - 7.2
Total Kjeldahl Nitrogen	g/m^3	N.D.	2.2	1.1 - 2.3
Nitrate Nitrogen	g/m^3	N.D.	<0.02	<0.02 - 0.05
Nitrite Nitrogen	g/m^3	N.D.	<0.02	<0.02 - 0.019
Weak Acid Dissociable Cyanide	g/m^3	N.D.	<0.001	<0.001 - 0.1
Boron	g/m^3	N.D.	0.05	0.04 - 0.05
Manganese	g/m^3	N.D.	0.055	0.05 - 0.12
Nickel	g/m^3	N.D.	0.0032	<0.0005 - 0.0016
Potassium	g/m^3	N.D.	4	4 - 5
Vanadium	g/m^3	N.D.	0.010	0.013 - 0.021

N.D: Not analysed – only required biennially.

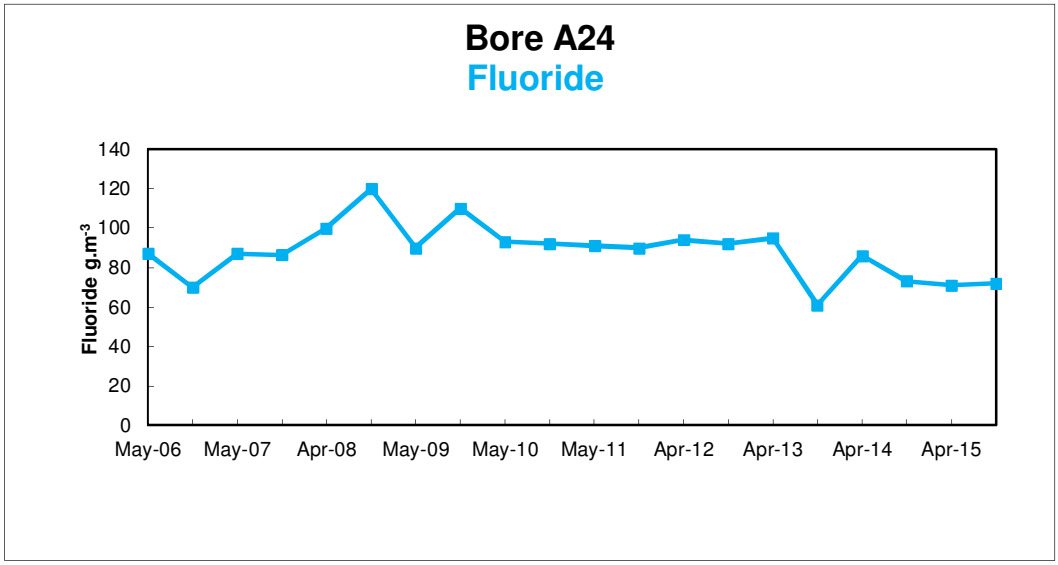
Landfill Groundwater Monitoring, Continued

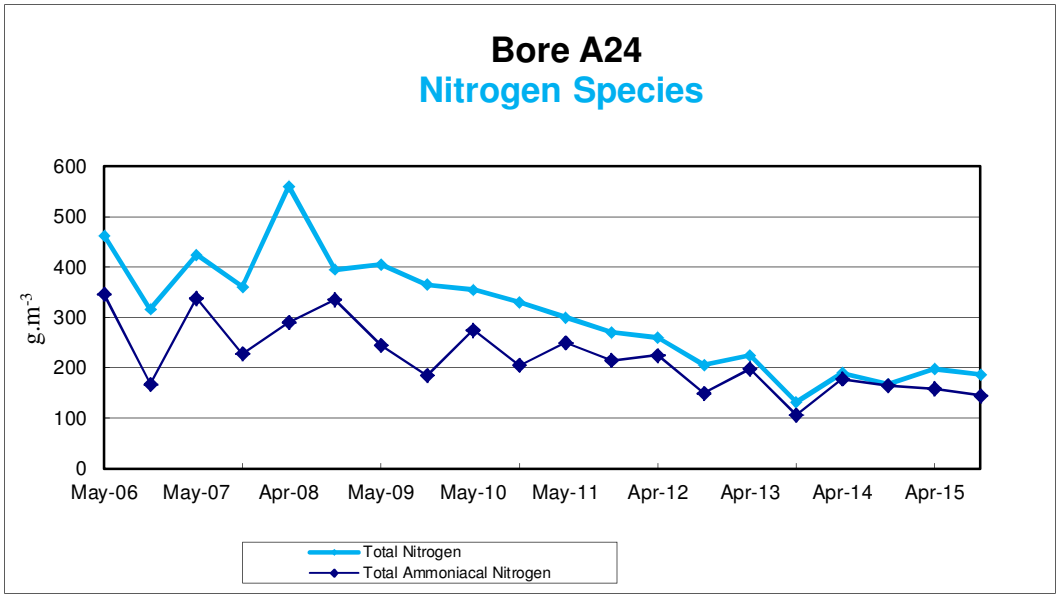
Bore A24 monitoring results

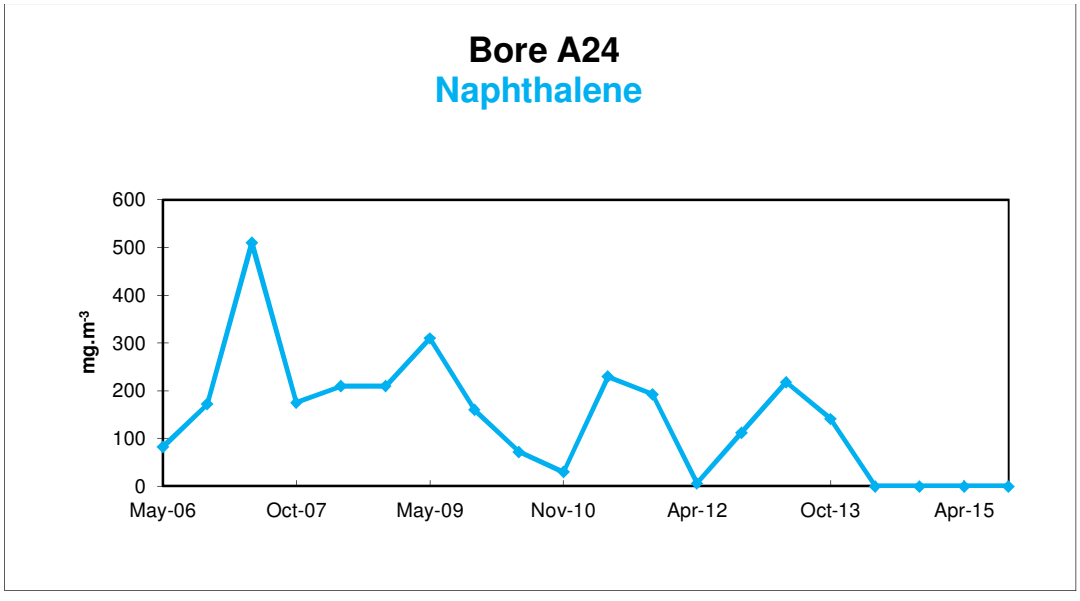
The table below shows a summary of results from samples collected from bore A24 during 2014 and 2015. Bore A24 is located east of the landfill.

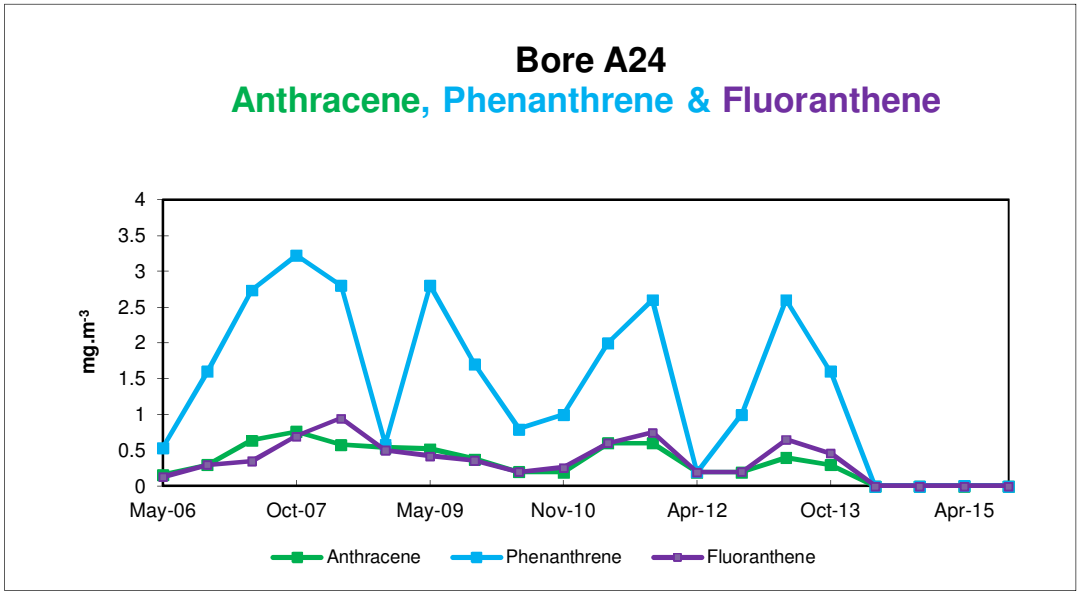
Analyte	Units	2014 Average	2015 Average	Range (since Commissioning)
Temperature	^0C	N.D.	11.2	9.4 - 12.8
pH		8.5	8.5	6.9 - 8.7
Conductivity	µS/cm	3715	3465	447 - 7290
Alkalinity	g/m^3	1425	1235	108 - 2600
Carbonaceous BOD5	g/m^3	20	27	2 - 120
Total Nitrogen	g/m^3	179	193	16.8 - 560
Total Ammoniacal Nitrogen	g/m^3	172	152	28.2 - 450
Fluoride	g/m^3	80	72	<0.1 - 120
Sulphate	g/m^3	35	79	0 - 312
Total Iron	g/m^3	25	26	8.2 - 60
Naphthalene	mg/m^3	0	0.15	0.06 - 510
Anthracene	mg/m^3	0.0005	0.00095	<0.3 - 1.2
Phenanthrene	mg/m^3	0.00275	0.0039	<0.3 - 4.9
Fluoranthene	mg/m^3	0.00065	0.00105	<0.3 - 1
Total Petroleum Hydrocarbons	g/m^3	N.D.	1.6	<1 - 18.6
Total Kjeldahl Nitrogen	g/m^3	179	192	63 - 560
Nitrate Nitrogen	g/m^3	N.D.	1	0.05 - 33
Nitrite Nitrogen	g/m^3	N.D.	1	0.01 - 1.3
Weak Acid Dissociable Cyanide	g/m^3	N.D.	0.013	<0.01 - 0.1
Boron	g/m^3	N.D.	8.2	4.1 - 17
Manganese	g/m^3	N.D.	0.117	0.084 - 0.22
Nickel	g/m^3	N.D.	0.03	0.004 - 0.05
Potassium	g/m^3	N.D.	43	11 - 79
Vanadium	g/m^3	N.D.	1	0.21 - 2.54

N.D: Not analysed – only required biennially.


Bore A24
Fluoride
Fluoride g.m-3
140
120
100
80
60
40
20
0
May-06
May-07
Apr-08
May-09
May-10
May-11
Apr-12
Apr-13
Apr-14
Apr-15


Bore A24
Nitrogen Species
g.m-3
600
500
400
300
200
100
0
May-06
May-07
Apr-08
May-09
May-10
May-11
Apr-12
Apr-13
Apr-14
Apr-15
Total Nitrogen
Total Ammoniacal Nitrogen


Bore A24
Naphthalene
mg.m-3
600
500
400
300
200
100
0
May-06
Oct-07
May-09
Nov-10
Apr-12
Oct-13
Apr-15


Bore A24
Anthracene, Phenanthrene & Fluoranthene
mg.m-3
4
3.5
3
2.5
2
1.5
1
0.5
0
May-06
Oct-07
May-09
Nov-10
Apr-12
Oct-13
Apr-15
Anthracene
Phenanthrene
Fluoranthene

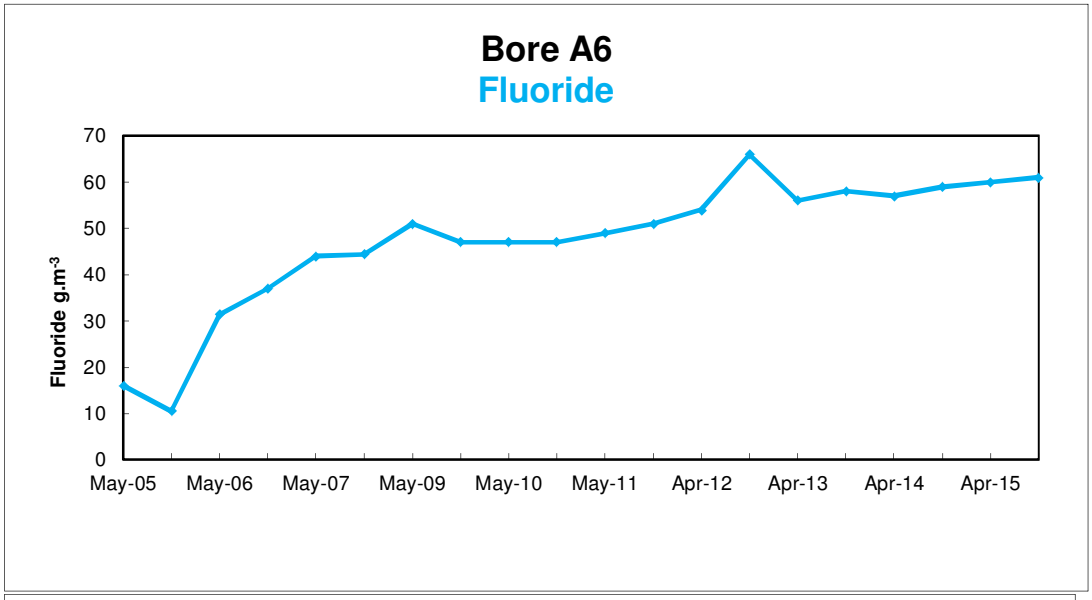
Landfill Groundwater Monitoring, Continued

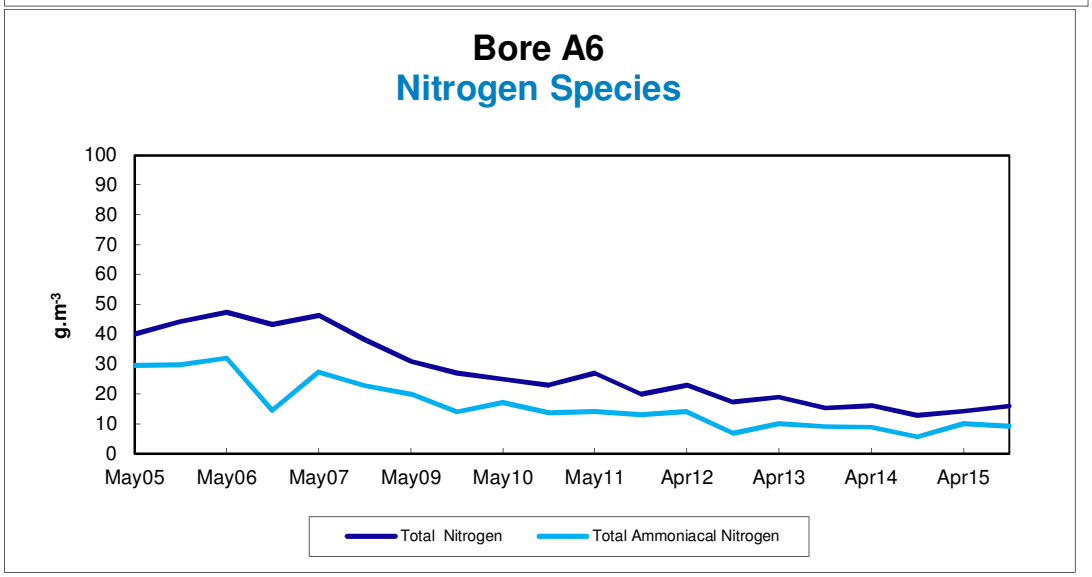
Bore A6 monitoring results

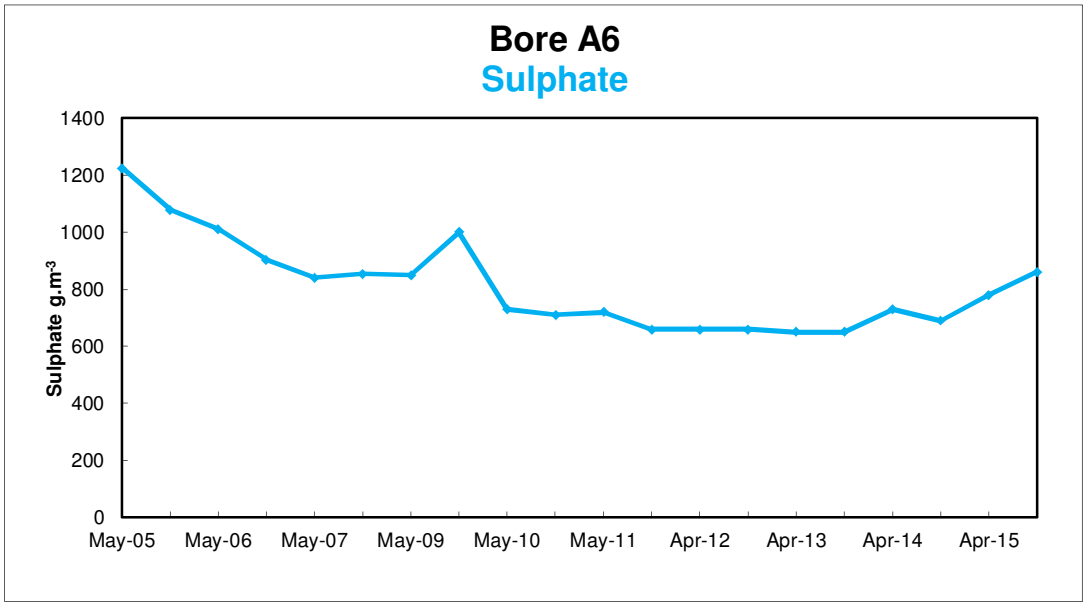
The table below shows a summary of results from samples collected from bore A6 during 2014 and 2015. Bore A6 is located south east of the landfill.

Analyte	Units	2014 Average	2015 Average	Range (since Commissioning)
Temperature	^0C	N.D.	12.6	10.3 - 13.5
pH		6.9	6.8	5.8 - 7.6
Conductivity	µS/cm	2720	2948	158 - 5689
Alkalinity	g/m^3	530	530	280 - 943
Carbonaceous BOD5	g/m^3	2	2	1 - 6
Total Nitrogen	g/m^3	14	15	9.7 - 47.4
Total Ammoniacal Nitrogen	g/m^3	7	10	0.15 - 34.7
Fluoride	g/m^3	58	61	2 - 104
Sulphate	g/m^3	710	820	480 - 2050
Total Iron	g/m^3	23	21	4.2 - 40
Naphthalene	mg/m^3	<0.1	<0.1	<0.1 - 5
Anthracene	mg/m^3	<0.1	<0.1	0.00001 - 1.34
Phenanthrene	mg/m^3	<0.1	<0.1	<0.05 - 0.2
Fluoranthene	mg/m^3	<0.1	<0.1	<0.01 - 0.2
Total Petroleum Hydrocarbons	g/m^3	N.D.	<1	<1 - 9.2
Total Kjeldahl Nitrogen	g/m^3	14	15	11.4 - 48
Nitrate Nitrogen	g/m^3	N.D.	0.10	0.001 - 14
Nitrite Nitrogen	g/m^3	N.D.	0.10	0.004 - 0.218
Weak Acid Dissociable Cyanide	g/m^3	N.D.	0.0046	0.0018 - 0.1
Boron	g/m^3	N.D.	0.64	0.64 - 2.54
Manganese	g/m^3	N.D.	1.34	0.22 - 1.85
Nickel	g/m^3	N.D.	0.005	0.0041 - 0.022
Potassium	g/m^3	N.D.	14	11.1 - 37
Vanadium	g/m^3	N.D.	0.10	0.05 - 0.4

N.D: Not analysed – only required biennially.


Bore A6
Fluoride
Fluoride g.m-3
70
60
50
40
30
20
10
0
May-05
May-06
May-07
May-09
May-10
May-11
Apr-12
Apr-13
Apr-14
Apr-15


Bore A6
Nitrogen Species
g.m-3
100
90
80
70
60
50
40
30
20
10
0
May05
May06
May07
May09
May10
May11
Apr12
Apr13
Apr14
Apr15
Total Nitrogen
Total Ammoniacal Nitrogen


Bore A6
Sulphate
Sulphate g.m-3
1400
1200
1000
800
600
400
200
0
May-05
May-06
May-07
May-09
May-10
May-11
Apr-12
Apr-13
Apr-14
Apr-15

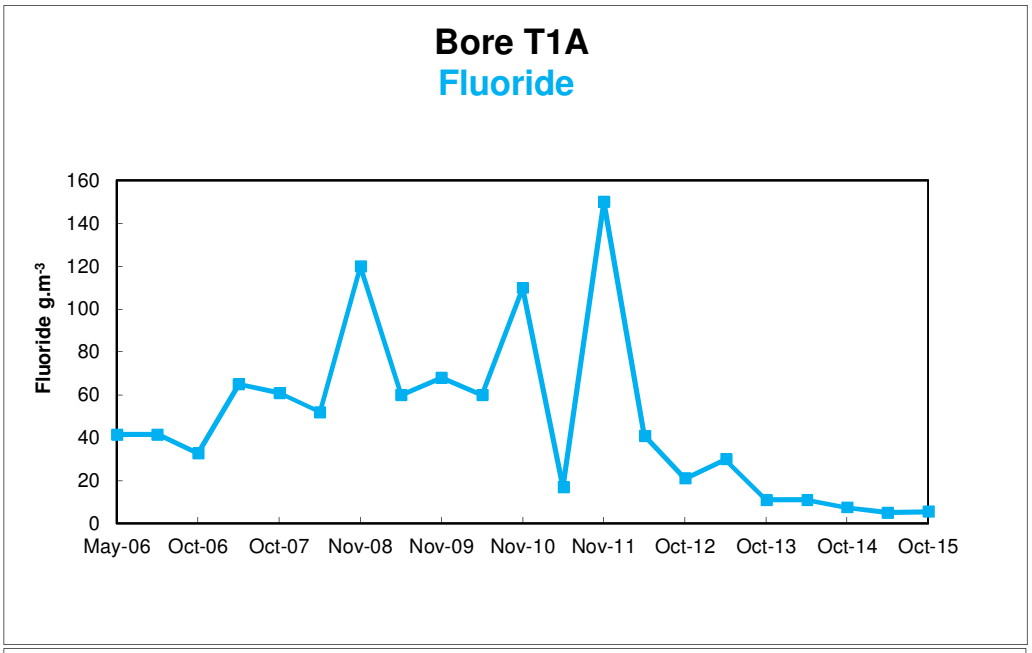
Landfill Groundwater Monitoring, Continued

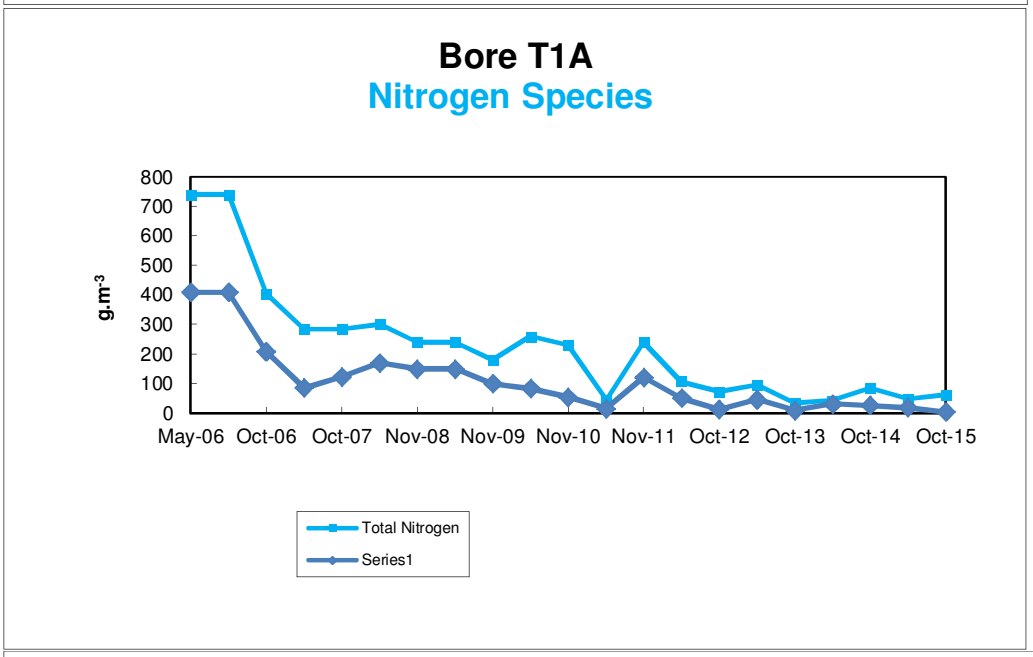
Bore T1A monitoring results

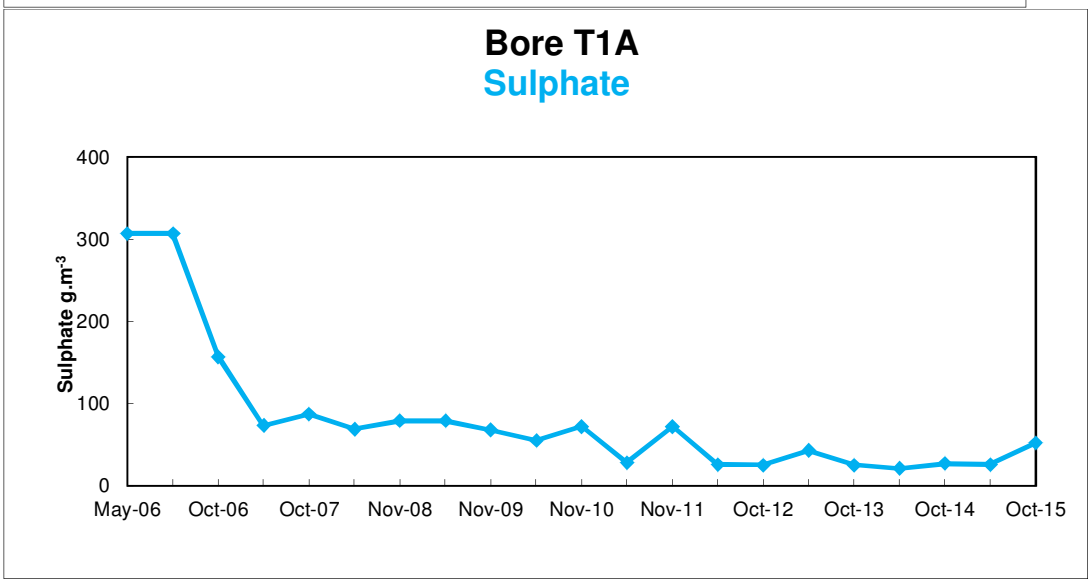
The table below shows a summary of results from samples collected from bore T1A in 2014 and 2015. Bore T1A is located east of the Haysoms DWP area.

Analyte	Units	2014 Average	2015 Average	Range (since Commissioning)
pH	-	7.8	7.3	6.8 - 9.6
Alkalinity	g/m^3	235	198	107 - 2110
Temperature	^0C	N.D.	12.4	10.6 - 13.7
Conductivity	µS/cm	1123	1125	473 - 8930
Carbonaceous BOD_5	g/m^3	<2	<2	<1 - 10
Fluoride	g/m^3	9	5	<0.1 - 210
Sulphate	g/m^3	24	39	17.4 - 338
Total Iron	g/m^3	0.08	0.06	0.01 - 15.3
Boron	g/m^3	N.D.	2.1	0.05 - 12.6
Manganese	g/m^3	N.D.	0.17	0.0006 - 0.253
Potassium	g/m^3	N.D.	25	2.44 - 69.1
Vanadium	g/m^3	N.D.	0.04	<0.01 - 0.34
Nickel	g/m^3	N.D.	<0.01	<0.0005 - 0.044
Ammoniacal-Nitrogen	g/m^3	29	10.6	<0.01 - 580
Total Nitrogen	g/m^3	64	55	1.5 - 783
Total Kjeldahl Nitrogen	g/m^3	27	11	0.4 - 630
Nitrate Nitrogen	g/m^3	N.D.	28	1.25 - 229
Nitrite Nitrogen	g/m^3	N.D.	0.0	0.003 - 20.8
Total Petroleum Hydrocarbons	g/m^3	N.D.	<1	<1
Weak Acid Dissociable Cyanide	g/m^3	N.D.	0.00	<0.001 - 0.325

N.D: Not analysed – only required biennially.


Bore T1A
Fluoride
Fluoride g.m-3
160
140
120
100
80
60
40
20
0
May-06
Oct-06
Oct-07
Nov-08
Nov-09
Nov-10
Nov-11
Oct-12
Oct-13
Oct-14
Oct-15


Bore T1A
Nitrogen Species
g.m-3
800
700
600
500
400
300
200
100
0
May-06
Oct-06
Oct-07
Nov-08
Nov-09
Nov-10
Nov-11
Oct-12
Oct-13
Oct-14
Oct-15
Total Nitrogen
Series1


Bore T1A
Sulphate
Sulphate g.m-3
400
300
200
100
0
May-06
Oct-06
Oct-07
Nov-08
Nov-09
Nov-10
Nov-11
Oct-12
Oct-13
Oct-14
Oct-15

Comments

The first survey for 2015 was carried out at the end of April and the second in October. The upstream bores (A20, A21 and A41) continue to show low levels of fluoride, total nitrogen and sulphate. The typical levels are fluoride 1-3gm^3, total nitrogen 1-4gm^3, sulphate 20-40gm^3 TPH and PAHS' >DL.

The bores to the west of the landfill (A22 and A23) also show low levels of analytes with a slight increasing trend for total nitrogen in bore A22.

The bore to the east of the landfill (A24) shows a consistent level of between 60-120gm^3 of fluoride, decreasing levels of total nitrogen over 10 years from 500gm3 to under 200gm3. The level of sulphate has also decreased over time to around 50gm3. PAHs have been found at variable levels over the past 10 years but have now remained stable at the DL since 2014.

The bore to the south east of the landfill (A6) has showed an overall decrease in total nitrogen and sulphate. Fluoride shows an increasing trend. Cyanide levels remain low, TPH and PAH's are at the detection limit.

The bore located to the east of Haysom's DWP area (T1A) shows decreasing levels of analytes.

Part L - Groundwater

Spent Cathode Pad Leachate

Monitoring of the groundwater during 2015 showed similar levels to 2014.

Spent Cell Lining Storage Shed

Monitoring of the membranes under the Spent Cell Lining storage shed continued during 2015. The concentration of fluoride and cyanide in the liquid between the membranes has not changed significantly.

Monitoring of the groundwater around the shed showed that the concentrations of cyanide and fluoride in the groundwater have not changed significantly.

Part M - Greenhouse Gas Discharges

Calculated Carbon Dioxide and Perfluorocarbon Discharges

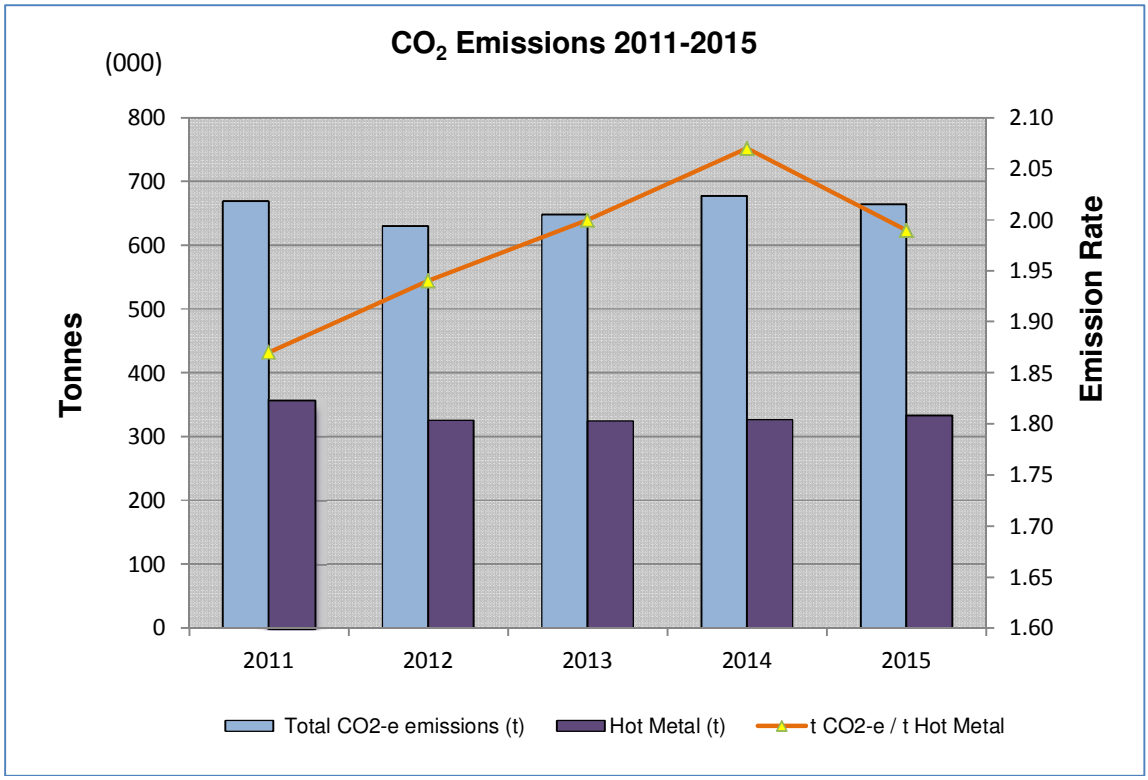
Introduction

Air Discharge Permit 203378 does not have a requirement to report calculated carbon dioxide and perfluorocarbon discharges from NZAS during each calendar year; however NZAS will continue to report this for general information purposes.

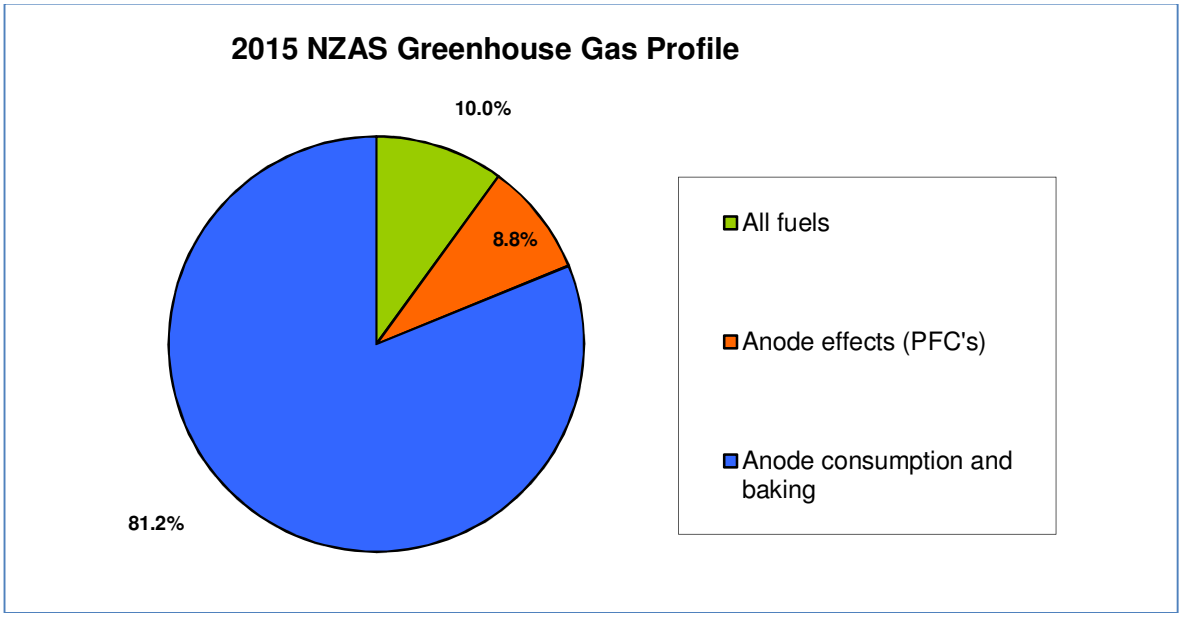
NZAS increased the metal production slightly in 2015 compared to 2014 by having more cells in circuit. Line 4 has not been operating since 2011.

Carbon Dioxide - 2015

The total calculated carbon dioxide equivalent (CO_2-e) discharge from NZAS during the year ending 31 December 2015 was 664119 tonnes. This was 2% less CO_2-e than last year and with metal production increased by 6196 tonnes. The emission rate in 2015 was 1.99 t CO_2-e / per tonne of aluminium produced, which is similar to the 2013 performance.



The total calculated CO_2 equivalents are emitted from carbon consumption (anodes), perfluorocarbons generation (PFCs) and fuel usage. The contribution from PFCs was up on last year due to process instabilities in the Reduction Lines. The percentage distribution is displayed below.



Anodes – 2015

81.2% of the total CO_2 emissions from the smelter are due to baking and consuming carbon anodes. Emission of greenhouse gases during the production of aluminium is unavoidable as the consumption of carbon anode blocks form part of the chemical process to produce aluminium. However emissions can be minimised by manufacturing high quality anodes and ensure that they are not burning when in contact with air in the cells (airburn). A moderate rate of airburn was observed during 2015, which kept the anode consumption at a higher than average level.

Perfluorocarbons – 2015

Perfluorocarbons (PFCs) contribute to climate change in the same way that CO_2 does. PFCs are gases emitted from the aluminium production process when conditions in the cells become unstable. Greater cell stability was observed in 2015 compared to 2014 which led to an improved performance of the total quantity of PFCs discharged. The percentage of PFC's emitted as CO_2 equivalent out of the total greenhouse gas emission was 9% during 2015 compared to 11% in 2014.

Fuel – 2015

Heavy fuel oil is the main fuel used on site and is used for baking the carbon anodes and heating of some casting furnaces. Calculated CO_2 equivalents from fuels were comparable to 2014 data. The greenhouse gas contribution from fuels is stable at about 10% of the total emissions.

End of Report for 2015