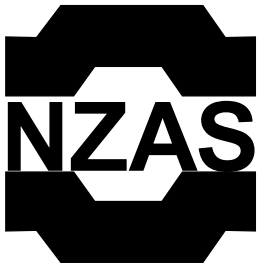

New Zealand Aluminium Smelters Limited

Interdepartmental

Committee

Report

2004

REPORT TO THE INTERDEPARTMENTAL COMMITTEE ON ENVIRONMENTAL EFFECTS OF THE TIWAI ALUMINIUM SMELTER FOR THE YEAR ENDING 31 DECEMBER 2004

MEETING AT TIWAI
27 April 2005 2.30pm

THE INFORMATION CONTAINED IN THIS REPORT IS CONFIDENTIAL TO THE MEMBERS OF THE INTERDEPARTMENTAL COMMITTEE

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Part I Liquid Discharges and Their Effects

Part J Landfill

Part K Groundwater

Summary

Main Stack

Main Stack discharges to air were within permit standards during 2004.

The moving average for gaseous fluoride from the Main Stack is increasing. Results show that emissions per tonne of aluminium produced have increased. During 2004, 52 cells were converted to high purity cells, resulting in a reduction in primary alumina available for dry scrubbing. This has caused in a slight reduction in the dry scrubbing efficiency.

The average total condensable hydrocarbons and the 16 USEPA polycyclic aromatic hydrocarbons levels measured in August 2004 decreased from the levels seen in 2003.

Potline Roof Louvres

Potline roof louvre discharges were within permit standards during 2004.

There was an increase in total particulate and particulate fluoride in the potline roof louvres during September. It may have been caused by roof replacement in the vicinity of the sampling manifold.

Dispersion

Wind speeds and direction were generally similar to 2003.

Monthly rainfall for 2004 was variable with the annual total of 1531mm being higher than usual. The five yearly running average is 1203mm.

Ambient Air

Ambient air gaseous and particulate fluoride concentrations during 2004 were at similar levels to those reported during 2003 and all within permit standards.

Atmospheric Deposition

All permit guidelines were met during 2004. In January some elevated concentrations for fluoride and reactive aluminium were seen. This was attributed to the very low rainfall recorded in January, which resulted in low dilution of the deposited material.

Vegetation

The fluoride concentrations of ungrazed grass close to the smelter were similar to the concentrations measured in 2003.

Fluoride in *Pinus radiata* needles were within permit guidelines during 2004.

The fluoride concentrations of grazed grass for all monitoring farms were within permit standards during 2004 and similar to previous years. Cattle bone and urine on GMF4 during 2004 were within the guidelines. Dental scores in cattle farmed on GMF4 were similar to those measured in 2003.

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 2004.

All permit standards were met for Treated Sewage discharges during 2004.

Groundwater monitoring results are similar to those reported in 2003.

The 2004 average free cyanide concentration measured in the treated effluent is similar to those measured during 2003, and is well below permit limits. Changes to the resource consent to extend the treated effluent discharge pipe 150 m further seaward and replace the diffuser were granted in October 2003. This work was completed early in 2004 and commissioned in mid February 2004.

Landfill

Monitoring of groundwater near the NZAS landfill during 2004 generally indicated similar results to 2003 except in Bore A24 and Bore T1A.
Bore A24 is located south-west of the MRP fines storage area and has shown an increase in a number of analyte concentrations during 2004.
Bore T1A is located south east of Haysom's DWP area and has shown an increase in analyte concentrations during 2004, it is thought that this is due to the influence of the leachate from the Haysom's DWP.

Environmental Management

Introduction

This report summarises NZAS' environmental performance during 2004. It includes some of the annual reports forwarded to Environment Southland each year with additional sections including discharges to air, dispersion conditions, liquid discharges etc. included to cover NZAS' discharges to, and effects on, the environment.

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

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

The NZAS systems for environmental management are certified as meeting the ISO 14001 requirements. In addition, NZAS' Laboratory has maintained accreditation to ISO 17025 "General Competence of Calibration and Testing Laboratories". The scope of the accreditation includes Quality Systems to ensure the accuracy of data.

Environmental Incidents

There was one environmental incident that was reported to Environment Southland in 2004.

On 1st September smoke discharges from the main stack exceeded 75% obscuration for a period of more than 30 minutes. A fire in the exit ducting of the fans from a carbon bake furnace was the cause of this incident.

Audit Programme

Auditing conducted by Environment Southland during 2004 included:

Audit Sample Type		Sites	Date	Issues
Ambient Air	1km Hut	1	February	None
		1	May	None
	No.6 Bore	1	August	None
	Bluff	1	November	None
Grazed Pasture		8	November	None
Atmospheric Deposition		2	February	None
		2	July	None
Drains	North	3	March	None
		3	September	1 fluoride outside agreed limits 1 suspended solid outside agreed limits, NZAS confirmed their result, ES reissued.
	South	3	March	1 fluoride outside agreed limits
		3	September	None
	West	3	March	1 conductivity reissued by ES
		3	September	1 conductivity outside agreed limits, NZAS confirmed result, ES reissued.
Cathode Effluent		1	March	None
		1	September	None

Discharges into Air

Introduction

Discharges into air from the smelter and wharf are covered by Air Discharge Permit Number 93566. The permit conditions were revised following NZAS' application to change or cancel some conditions, which was approved by the Southland Regional Council on 5 August 1998.

This Chapter covers:

- Main Stack Discharges,
- Potline roof louvre discharges,
- Fluoride discharges into air,
- Baghouse discharges,
- Main Stack plume opacity, and
- Sulphur contents of raw materials and fuels used in the aluminium smelting process.

Main Stack Discharges

Monitoring results

The following table shows the average main stack monitoring results for 2004. The averages are equivalent to the 12 month running average for the period ending December 2004.

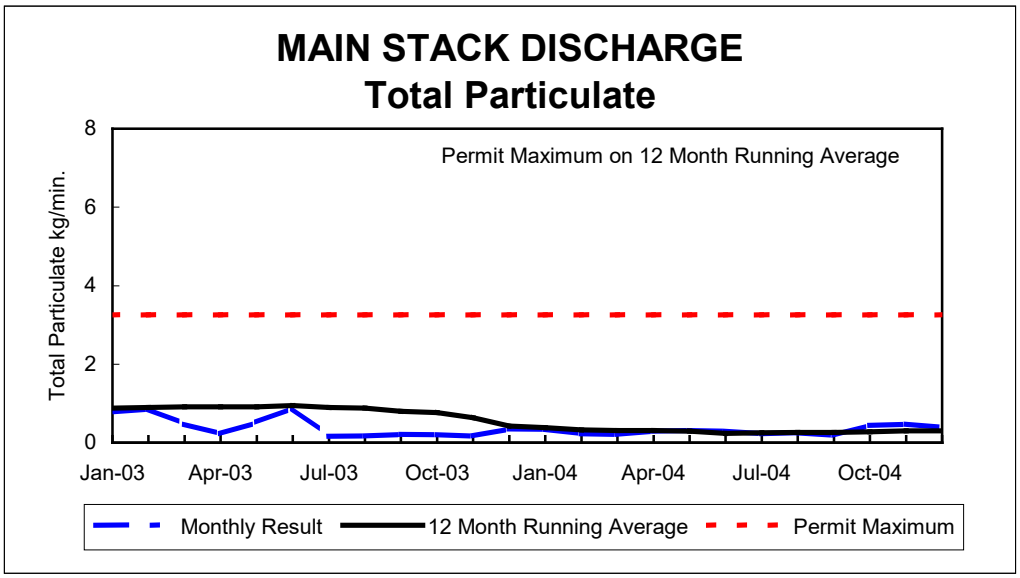
Parameter	Units	Running 12 month average		
		Standard	2004 Result	Maximum for any month
Gas flow rate	Sm^3/ min	-	65,500	-
Total particulate	kg/min	3.25	0.30	0.47
Gaseous fluoride	kg/min	0.65	0.23	0.29
Particulate fluoride	kg/min	1.94	0.01	0.01
Sulphur dioxide	kg/min	-	12.1	13.0
Total condensable hydrocarbons	kg/min	-	0.13	-
Polycyclic aromatic hydrocarbons	kg/min	-	0.03	-

Main Stack Discharges, Continued

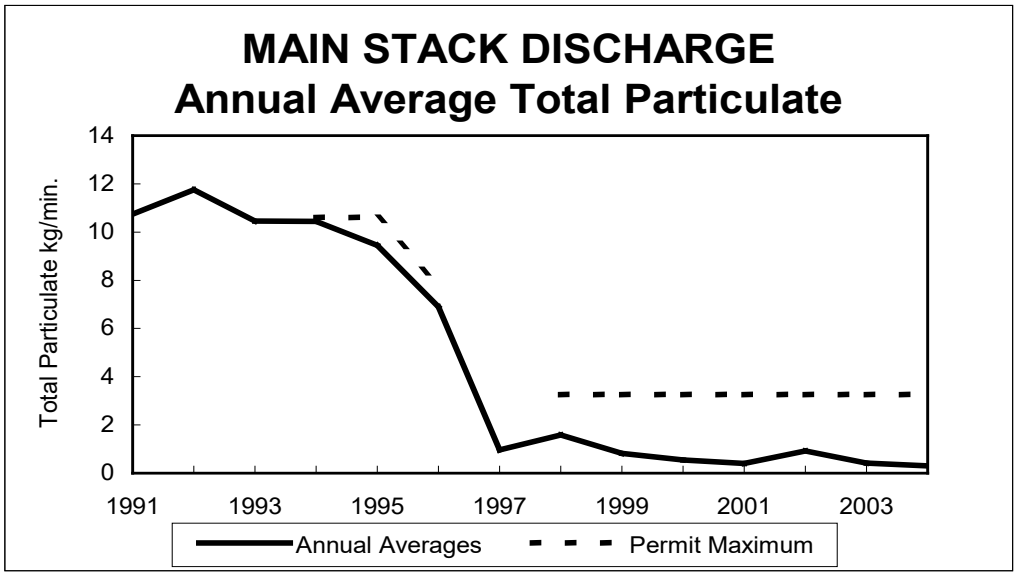
Total particulate

Standard: 12 month running average not to exceed 3.25 kg/min.

The following graph show both the average monthly and 12 monthly running average main stack total particulate discharge during 2003 and 2004.



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

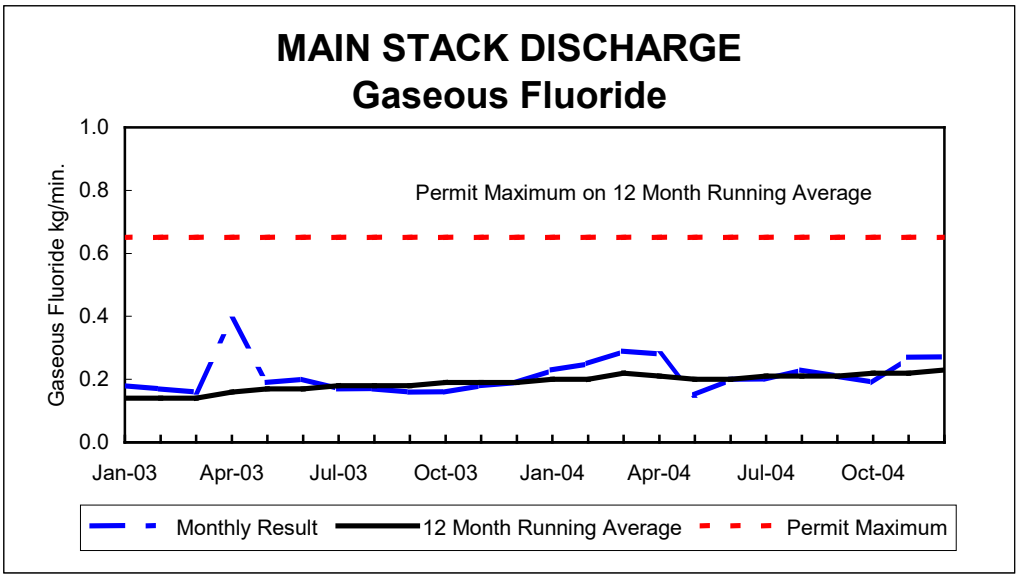


Main Stack Discharges, Continued

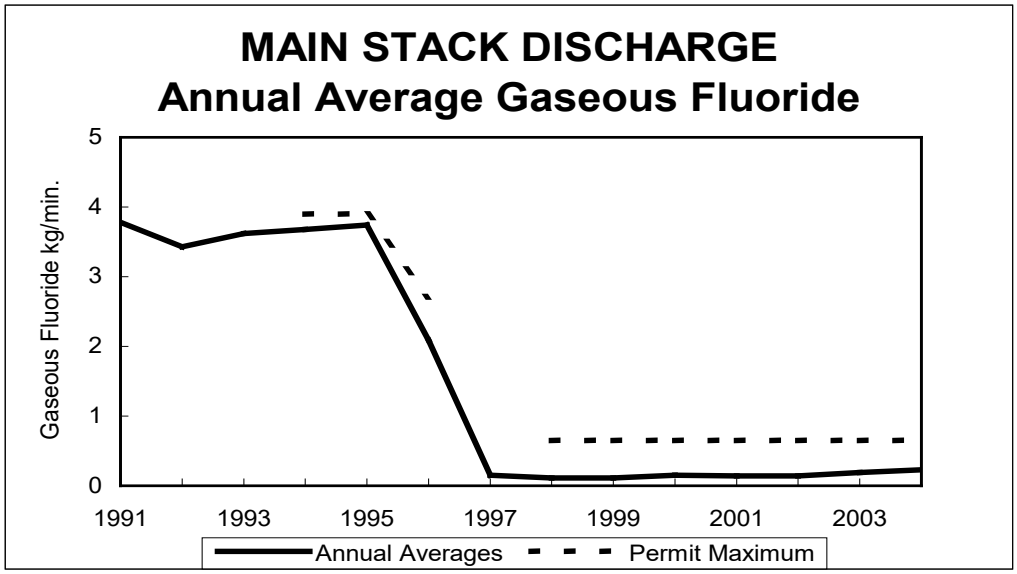
Gaseous fluoride

Standard: 12 month running average not to exceed 0.65 kg/min.

The following graph show both the average monthly and 12 monthly running average main stack gaseous fluoride discharge during 2003 and 2004.



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

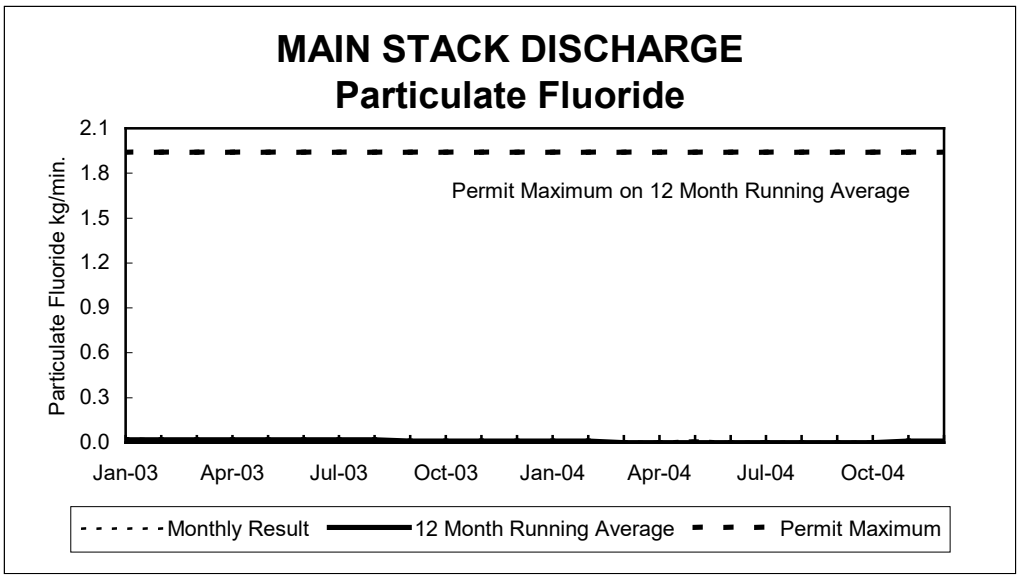


Main Stack Discharges, Continued

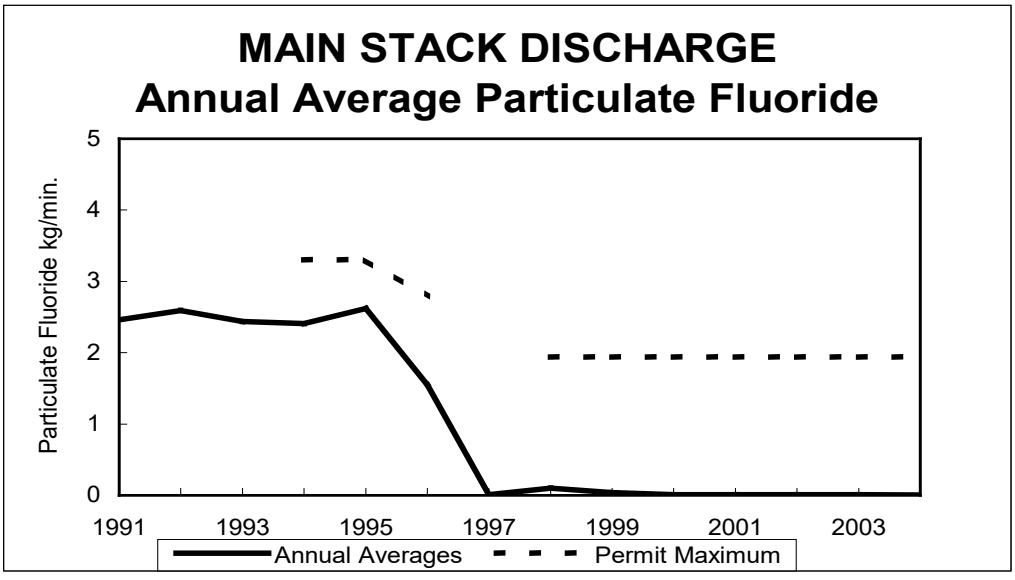
Particulate fluoride

Standard: 12 month running average not to exceed 1.94 kg/min.

The following graph shows both the average monthly, and the 12 monthly running average main stack particulate fluoride discharge during 2003 and 2004.



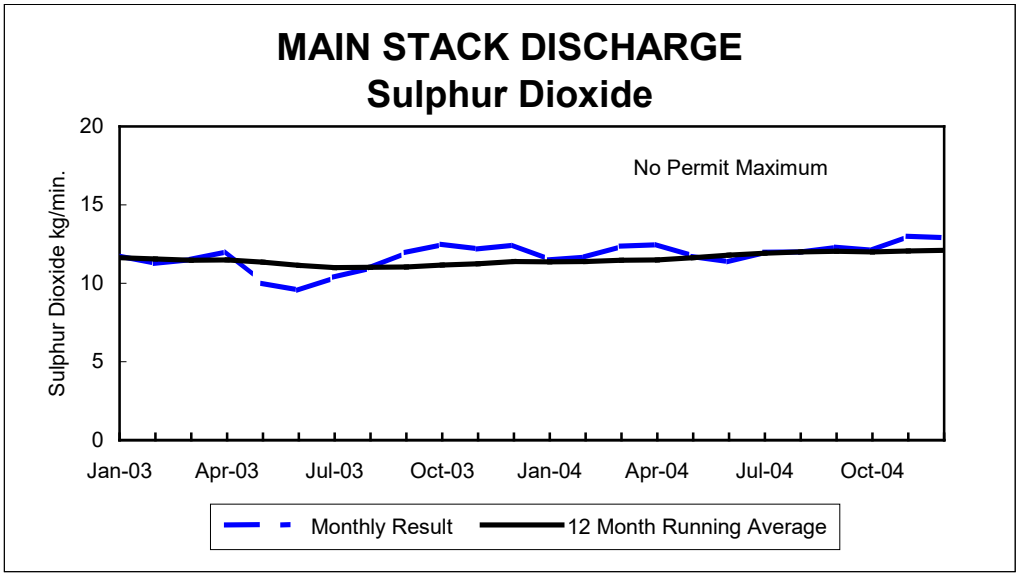
The following graph shows the annual average main stack particulate fluoride discharge.



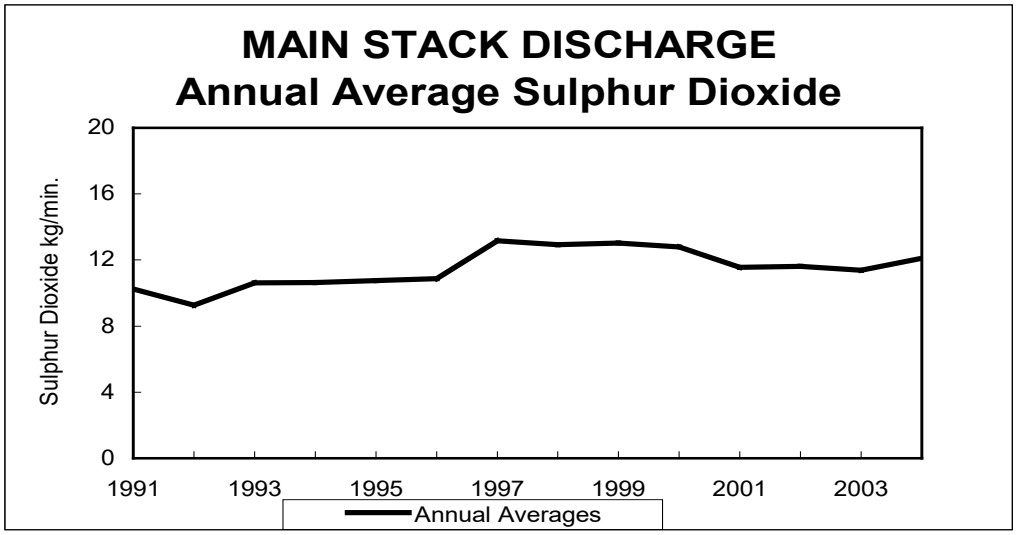
Main Stack Discharges, Continued

Sulphur Dioxide

The following graph shows both the average monthly and 12 monthly running average main stack sulphur dioxide discharge during 2003 and 2004.



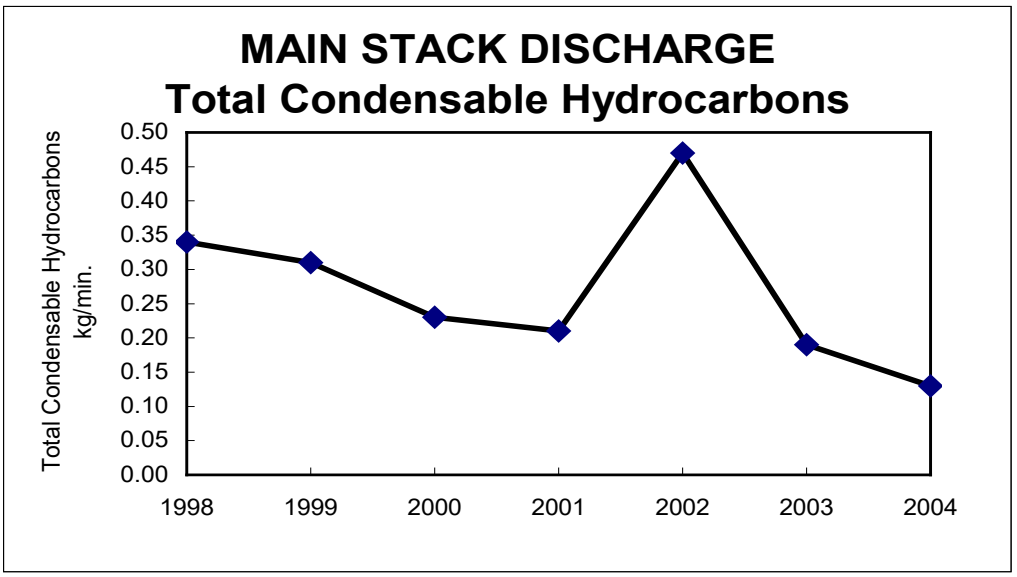
The following graph shows the annual average main stack sulphur dioxide discharge.



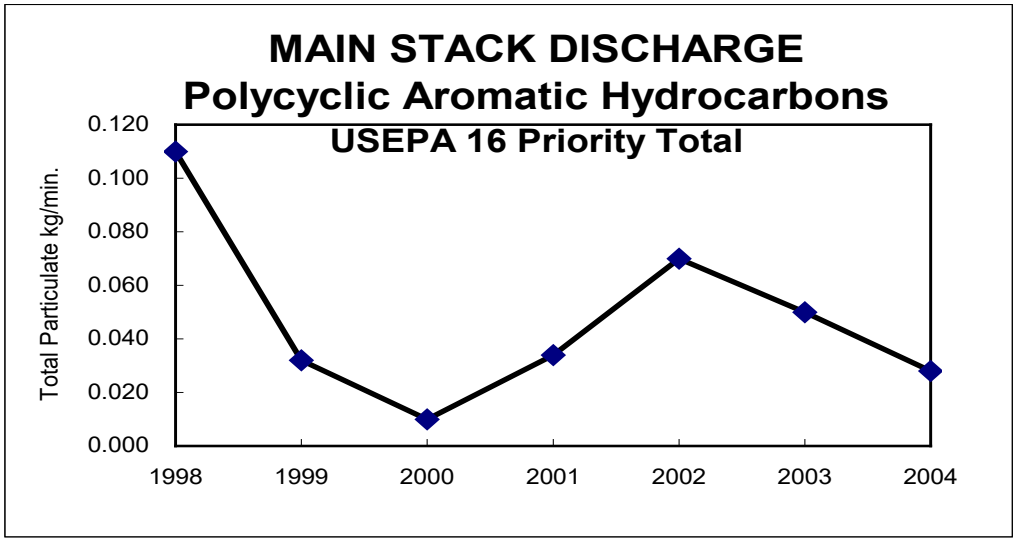
Main Stack Discharges, Continued

Total Condensable Hydrocarbons and Polycyclic Aromatic Hydrocarbons

The annual analysis for total condensable hydrocarbons and 16 USEPA priority PAH was carried out during August 2004. The following graph shows the annual Total Condensable hydrocarbons discharges.



The following graph shows the annual result for 16 Priority USEPA polycyclic hydrocarbons.



Main Stack Discharges, Continued

Comments

Discharges of total particulate, gaseous fluoride and particulate fluoride from the main stack were within the permit standards throughout 2004.

The moving average for gaseous fluoride from the Main stack is increasing. Results over the last two years show that our emissions have increased per tonne of aluminium produced. This could be attributed to an additional 52 cells using primary alumina feed stock. This reduces the amount of primary alumina available for scrubbing cell emissions in the dry scrubbers and increases the total amount of bagged AlF_3 additions due to the demand of the primary alumina fed cells.
The gaseous fluoride discharges are all well below permit standard, and predicted discharges in the Assessment of Effects on the Environment for the Permit.

The average Total condensable hydrocarbons and the 16 USEPA priority PAH levels measured in August 2004 decreased from the levels seen in 2003.

Potline Roof Louvre Discharges

Monitoring results

The table below shows the Potline roof louvre monitoring results for 2004. The permit standards are for 12 month running averages.

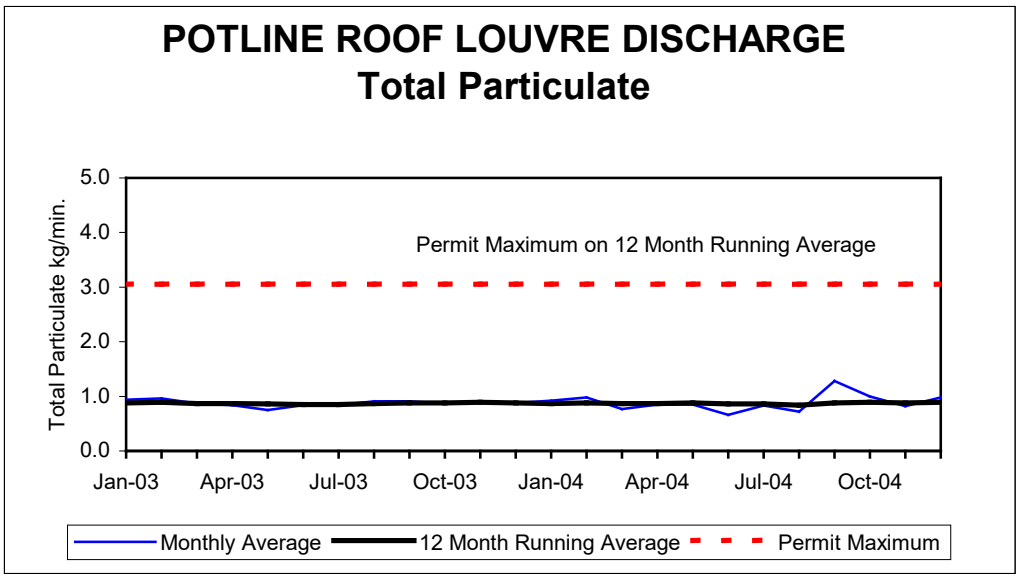
Parameter	Units	Running 12 month average		
		Standard	2004 Result	Maximum for any month
Total particulate	kg/min	3.05	0.89	1.28
Gaseous fluoride	kg/min	0.38	0.11	0.12
Particulate fluoride	kg/min	0.38	0.14	0.19
Sulphur dioxide	kg/min	-	0.33	0.39

Potline Roof Louvre Discharges, Continued

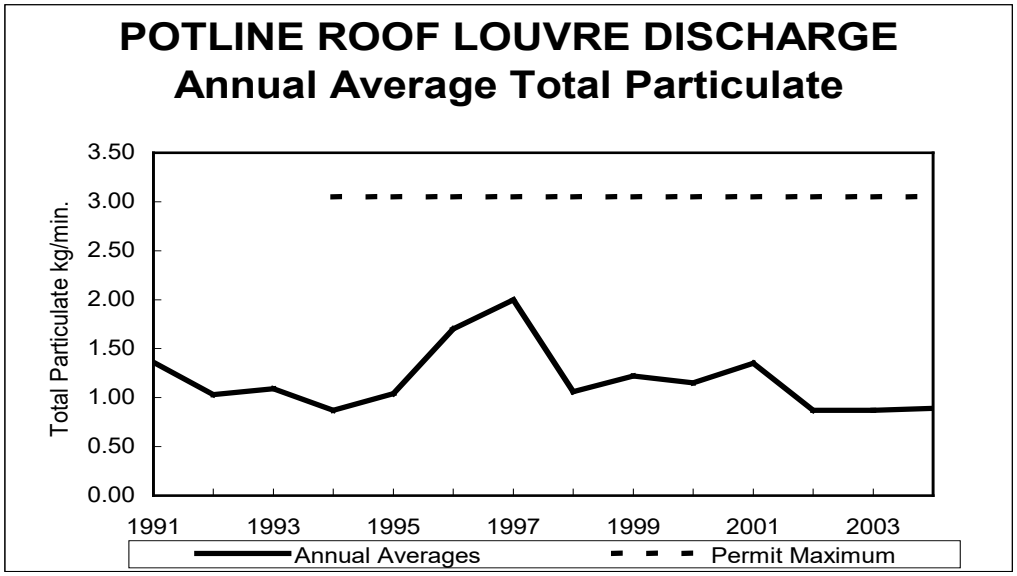
Total particulate

Standard: 12 month running average not to exceed 3.05 kg/min.

The following graph shows both the average monthly and 12 month running average Potline roof louvre total particulate discharge during 2003 and 2004.



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

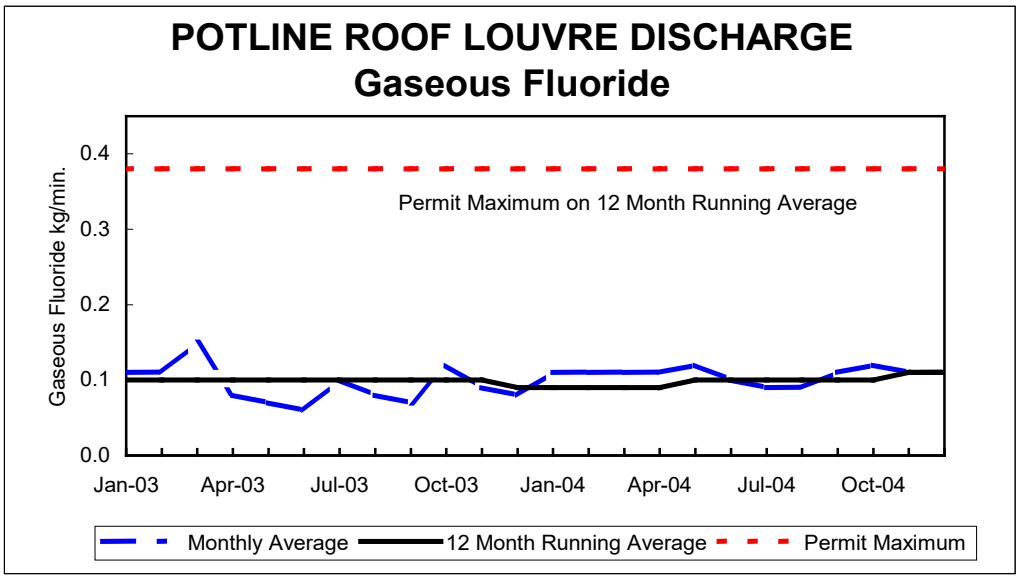


Potline Roof Louvre Discharges, Continued

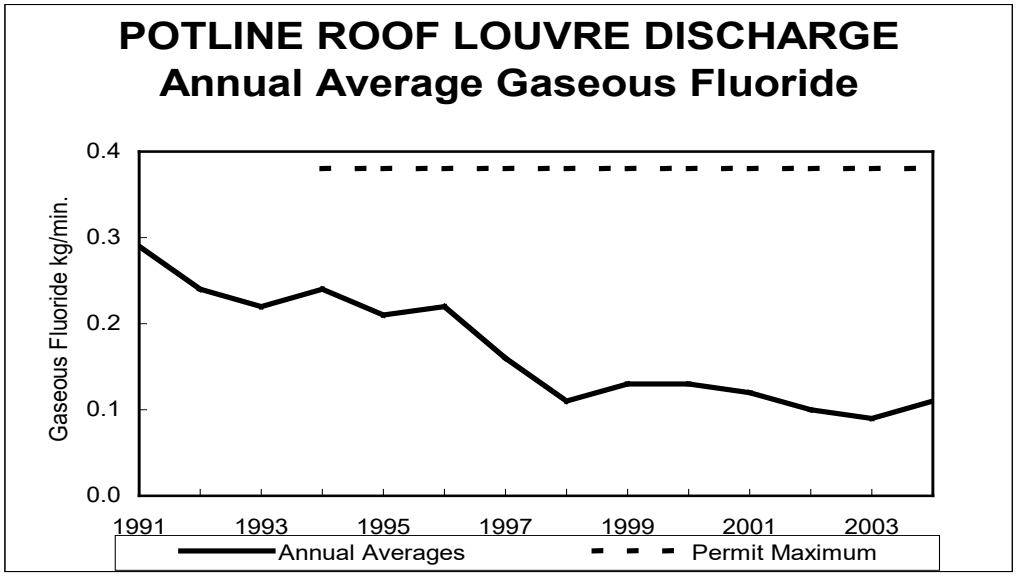
Gaseous fluoride

Standard: 12 month running average not to exceed 0.38 kg/min.

The following graph shows both the average monthly and 12 month running average Potline roof louvre gaseous fluoride discharge during 2003 and 2004.



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

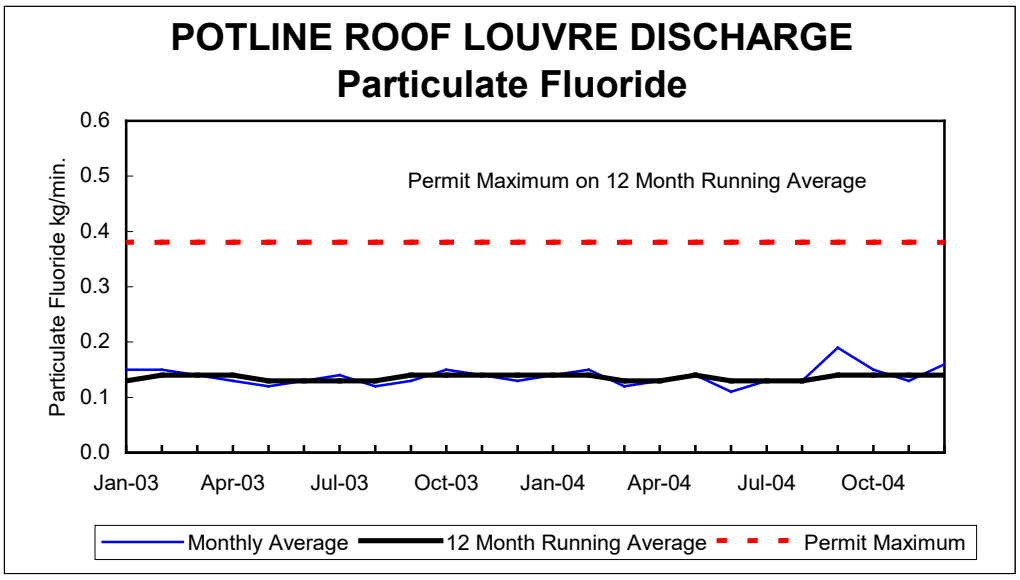


Potline Roof Louvre Discharges, Continued

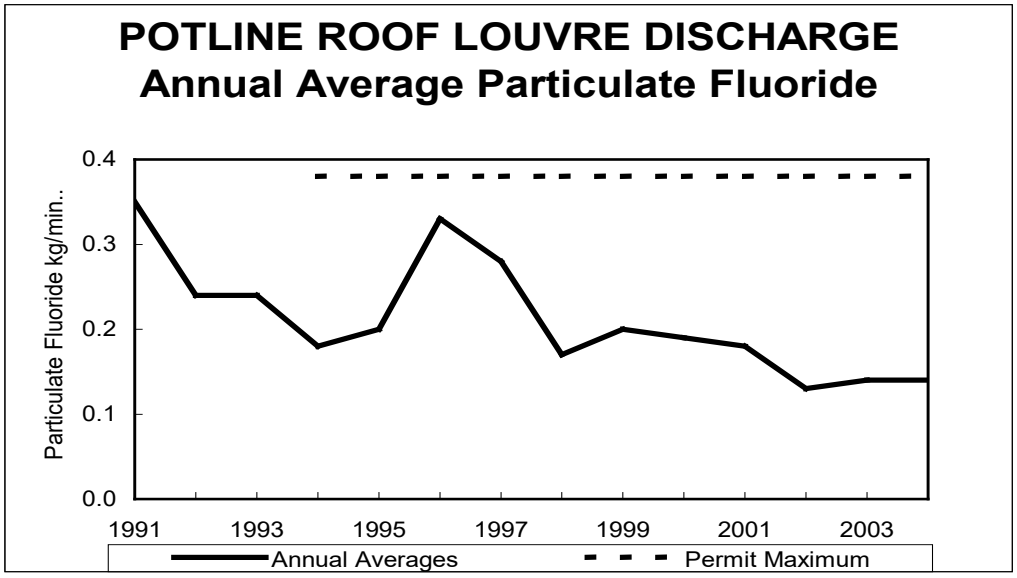
Particulate fluoride

Standard: 12 month running average not to exceed 0.38 kg/min.

The following graph shows both the average monthly and 12 month running Potline roof louvre particulate fluoride discharge during 2003 and 2004.



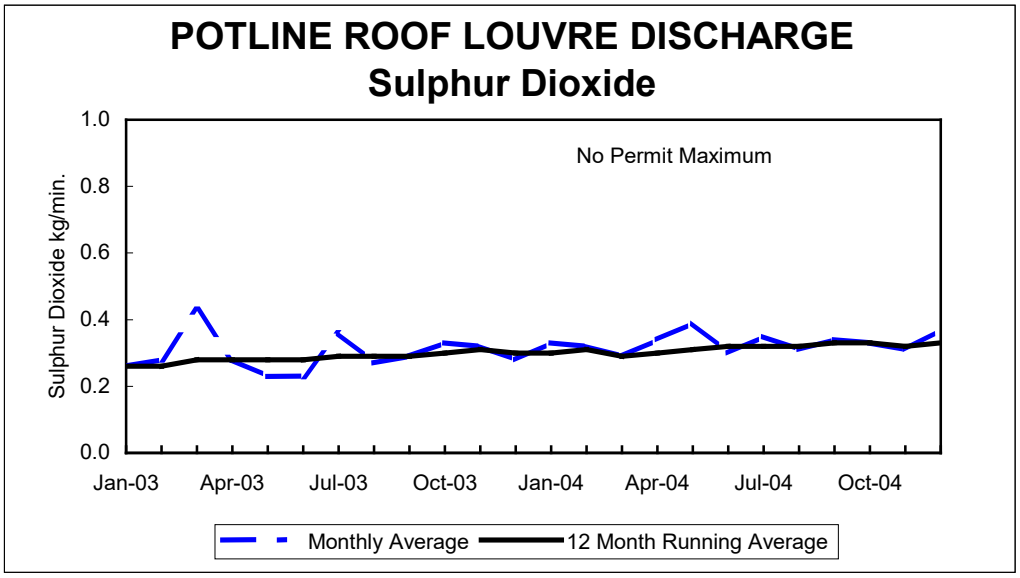
The following graph shows the annual average data for Potline roof louvre particulate fluoride discharge.



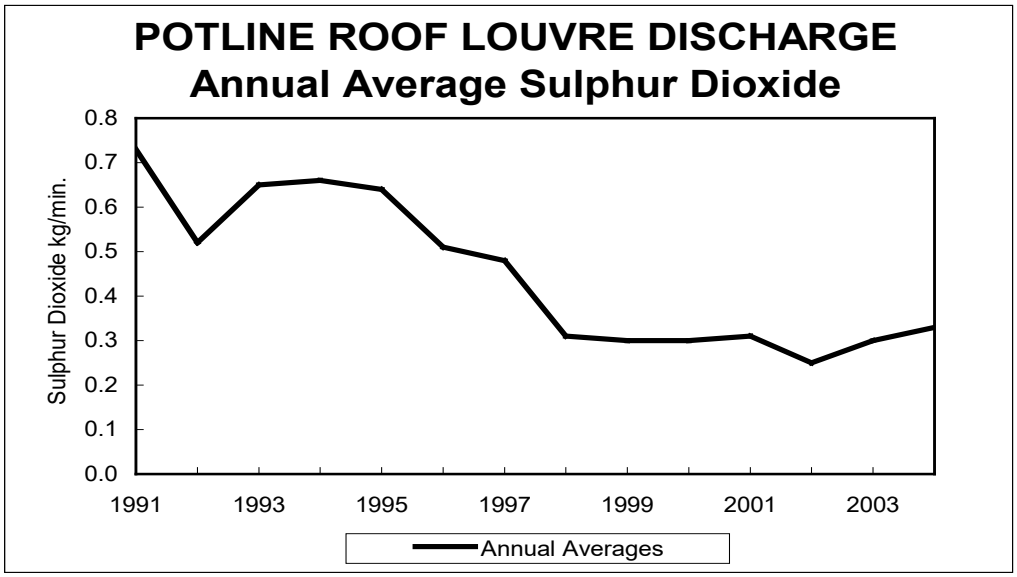
Potline Roof Louvre Discharges, Continued

Sulphur dioxide

The following graph shows both the average monthly and 12 month running Potline roof louvre sulphur dioxide discharge during 2003 and 2004.



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



Potline Roof Louvre Discharges, Continued

Comments

The discharges of total particulate, particulate fluoride and gaseous fluoride from the Potline roof louvres was within permit standards and similar to levels seen in previous years. Discharge of sulphur dioxide was within the range of results reported in past years.

The increase in total particulate and particulate fluoride during September 2004 may have been caused by roof replacement, causing a disturbance of accumulated particulate, being carried out in the vicinity of the sampling manifold.

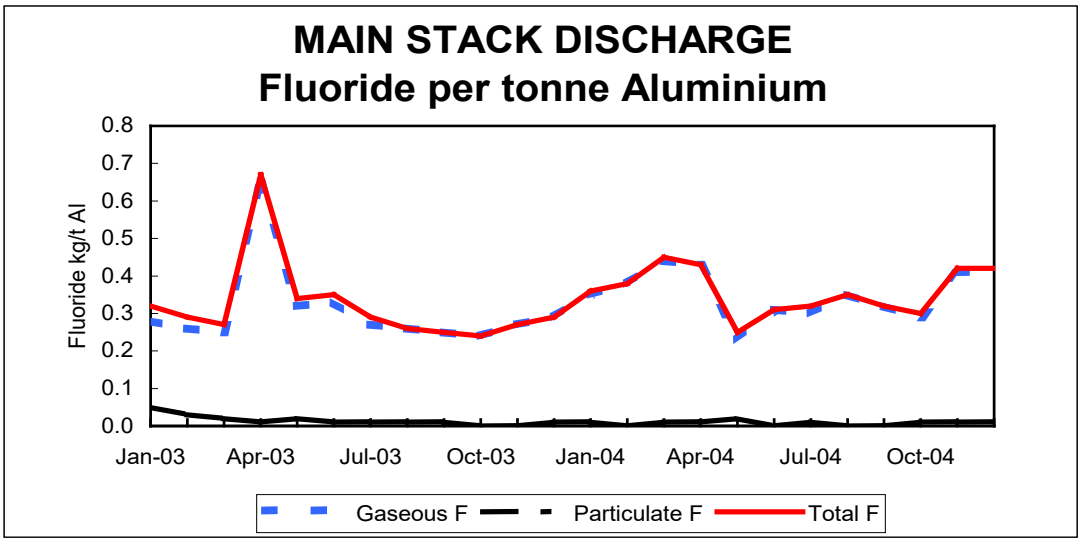
Fluoride Discharges

Performance data

The table below shows the fluoride discharges expressed as a ratio of hot aluminium metal production during 2004.

Parameter	Units	2004 Result	Maximum for any month
Main Stack			
• Gaseous fluoride	kg/t Al	0.35	0.44
• Particulate fluoride	kg/t Al	0.01	0.02
• Total fluoride	kg/t Al	0.36	0.45
Reduction Line Roof Louvres			
• Gaseous fluoride	kg/t Al	0.17	0.18
• Particulate fluoride	kg/t Al	0.21	0.29
• Total fluoride	kg/t Al	0.38	0.45
Plant			
• Gaseous fluoride	kg/t Al	0.52	0.61
• Particulate fluoride	kg/t Al	0.22	0.29
• Total fluoride	kg/t Al	0.74	0.83

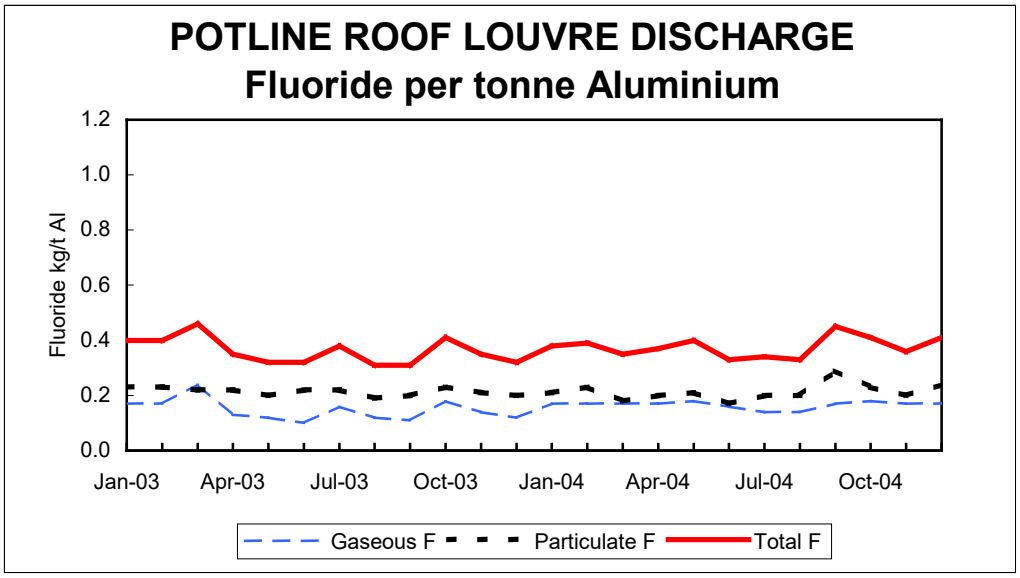
The following graph shows the monthly main stack fluoride per tonne aluminium discharge during 2003 and 2004.



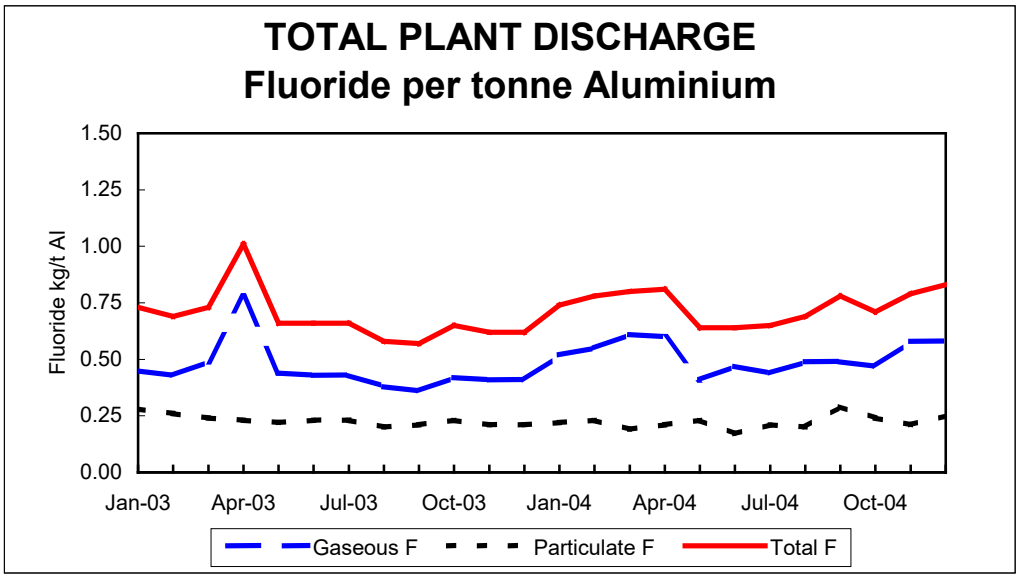
Fluoride Discharges, Continued

Performance data, Continued

The following graph shows the average monthly Potline roof louvre fluoride per tonne aluminium discharge during 2003 and 2004.



The following graph shows the average total plant fluoride per tonne aluminium during 2003 and 2004.



Comments

The annual fluoride discharge rate from the plant showed an increase during 2004.

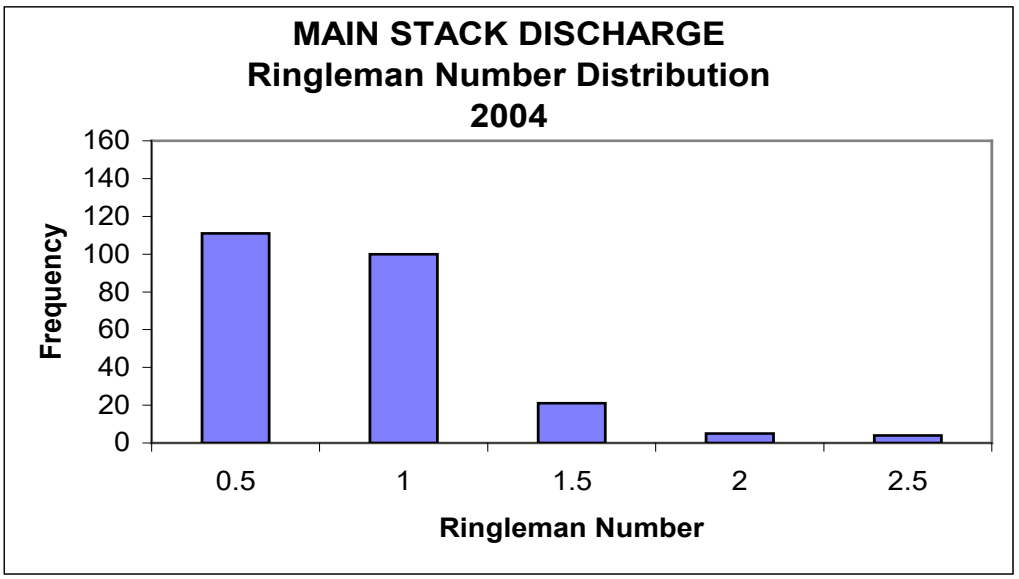
Baghouse Discharges

The regular inspection of baghouse discharges continued during 2004.

The regular inspections were in addition to the on-going operational surveillance of this equipment. Monthly inspections across the dust collectors inspected, reported emissions (using the six-point observation scale) to be mainly between 0 and 1, with a maximum of a 3. A score of 1 means "barely discernible emissions", whereas a score of 3 equates to "continuous but light emissions".

Main Stack Plume Opacity

Main Stack plume opacity is determined by visual observations using the standard Ringleman chart. The following graph summarises the observations recorded during 2004.



There was a reasonable decrease in the number of Ringleman number observations that were greater than one during 2004.

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 2004.

Material	Units	Permit Maximum	2004 Annual Average	2004 Maximum	2004 Minimum
Petroleum Coke	%	3.0	2.64	2.82	2.29
Pitch	%	1.0	0.45	0.46	0.44
Heavy Fuel Oil	%	3.5	1.97	2.38	1.57

Comments

All shipments of raw materials and fuels during the 2004 met permit standards for sulphur content.

The average sulphur content of the petroleum coke was at similar levels to 2003. Heavy fuel oil sulphur content has shown an increase and pitch is at similar levels to 2003.

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

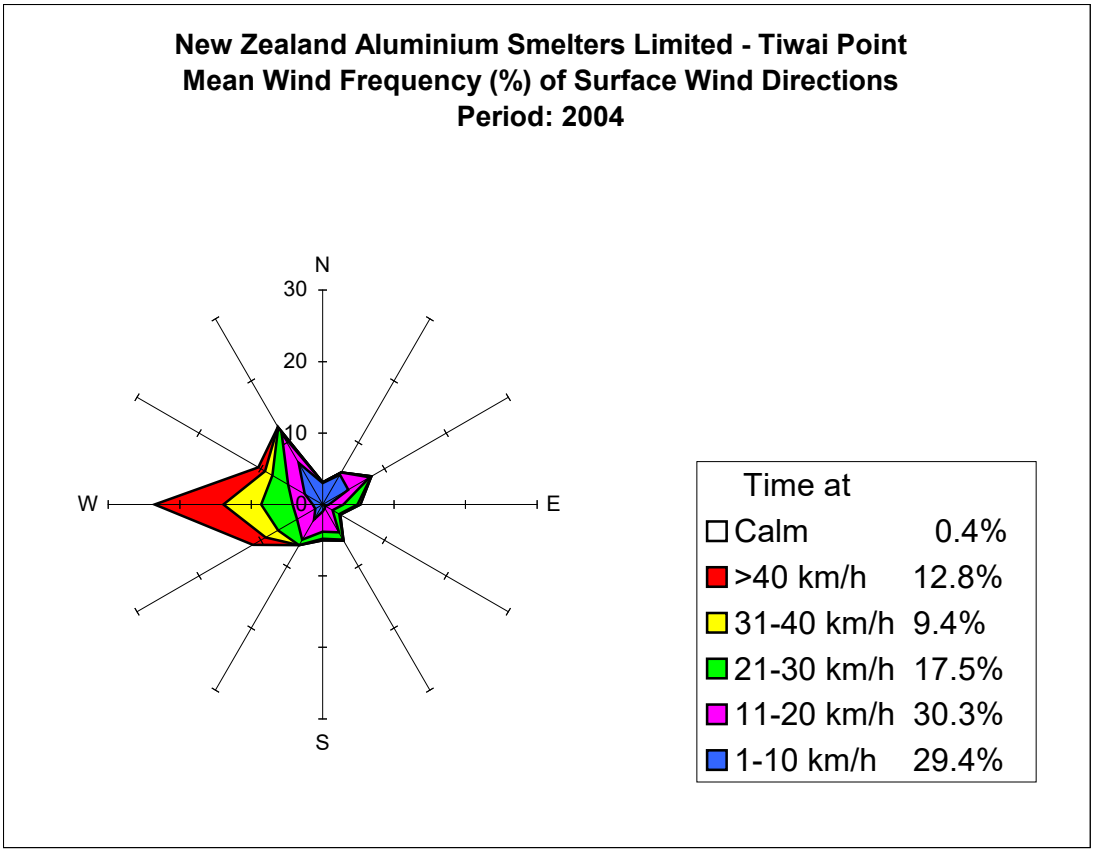
- the distribution of wind strength,
- the distribution of wind direction, and
- rainfall.

Meteorological Conditions

The mean wind frequency diagram on the following page shows that the 2004 wind pattern was dominated by westerly, north-westerly and south-easterly winds. Dispersion conditions are similar to previous years.

The following table shows the predominant winds and total rainfall recorded for each month during 2004.

Month	Predominant Wind Direction	Rainfall (mm)
January	West and East	72
February	West	124
March	West	124
April	West	200
May	West, and north-west	114
June	West, and north-west	144
July	North-west and north-east	55
August	West, north-west and north-east	200
September	West, south-west and north-west	111
October	West and south-east	67
November	West, north-west and south-east	95
December	West, south-west and south-east	225



Please note – the presentation of the wind-rose has changed from the 2003 report. Wind speed is now shown in km/h, it was previously shown in knots.

Ambient Air

Introduction

This chapter covers the monitoring for gaseous and particulate fluorides in ambient air at six monitoring sites. At all sites, except the 1km Hut site, sampling is by a method based on up to a one-month sampling period. The 1km Hut site is sampled on a weekly basis.

Permit Standards

The standards for ambient air gaseous fluoride covered by the air discharge permit are:

- 24 hour average 2.0 $\mu g/m^3$
- 7 day average 1.0 $\mu g/m^3$
- One month average 0.5 $\mu g/m^3$

The 24-hour average is not to be exceeded on more than eight days in any twelve consecutive months.

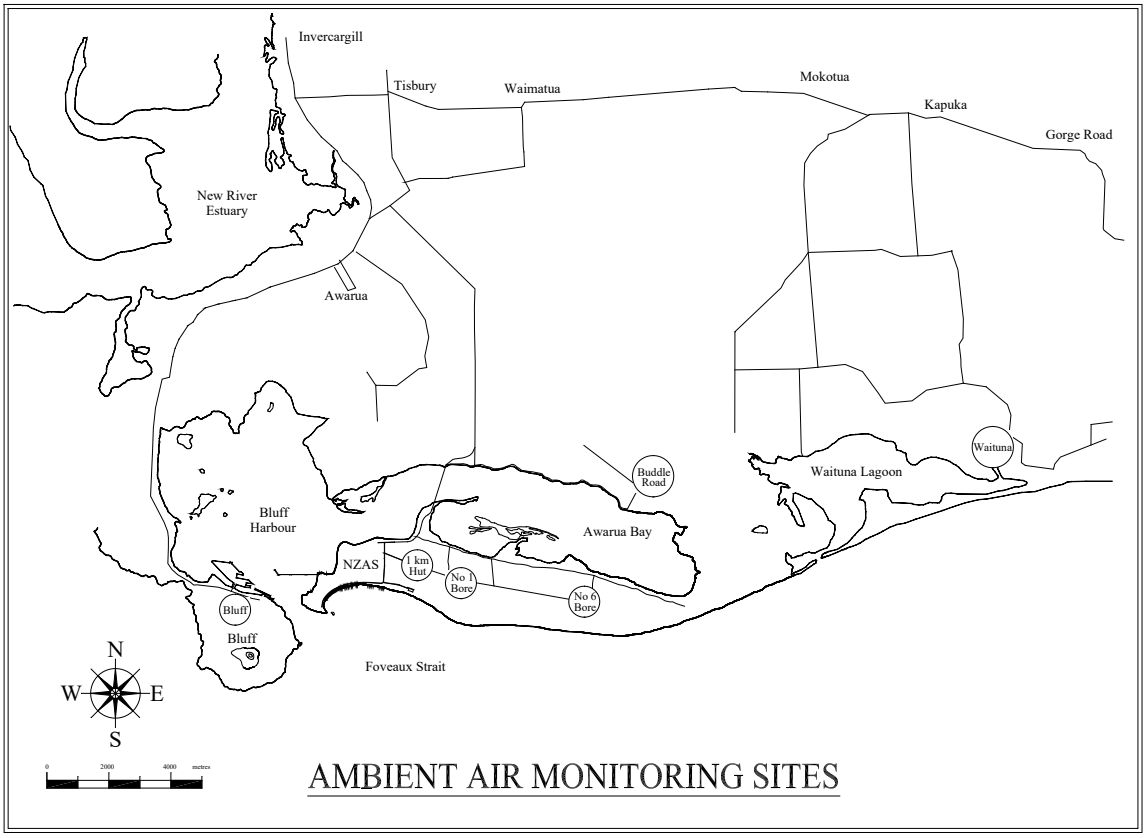
The standards apply to measurements on land off Tiwai Peninsula and on Tiwai Peninsula east of Comalco New Zealand Ltd's freehold land.

At sites other than 1km Hut, if two consecutive monthly results exceed 0.3 micrograms per cubic metre gaseous fluoride, then the monitoring shall revert to a seven-day sampling period. Sampling on a longer time basis may be resumed when two consecutive seven-day results are each less than 0.3 micrograms per cubic metre.

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

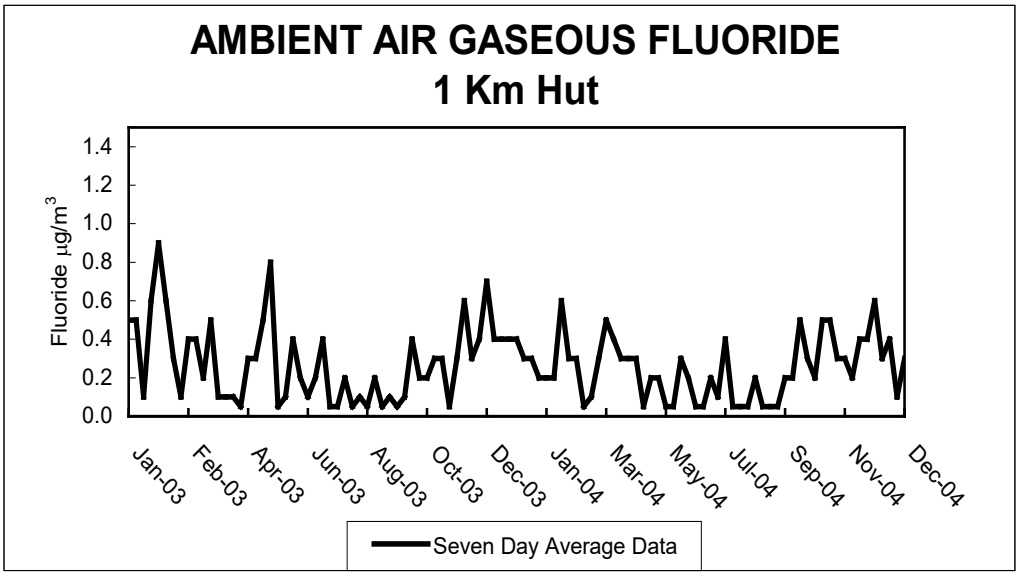
Monitoring results

The following table summarises the monitoring results during 2003 and 2004. The sampling frequency for ambient air fluoride at this site is seven days.

Parameter	Units	Standard	2003	2004
Gaseous Fluoride Concentration		-		
• Max 7 day average	$\mu g/m^3$	-	0.90	0.60
• Max monthly average	$\mu g/m^3$	-	0.50	0.40
• Annual average	$\mu g/m^3$	-	0.30	0.26
Particulate fluoride concentration		-		
• Max 7 day average	$\mu g/m^3$	-	0.30	0.30
• Max monthly average	$\mu g/m^3$	-	0.20	0.10
• Annual average	$\mu g/m^3$	-	< 0.1	< 0.1

Gaseous fluoride

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

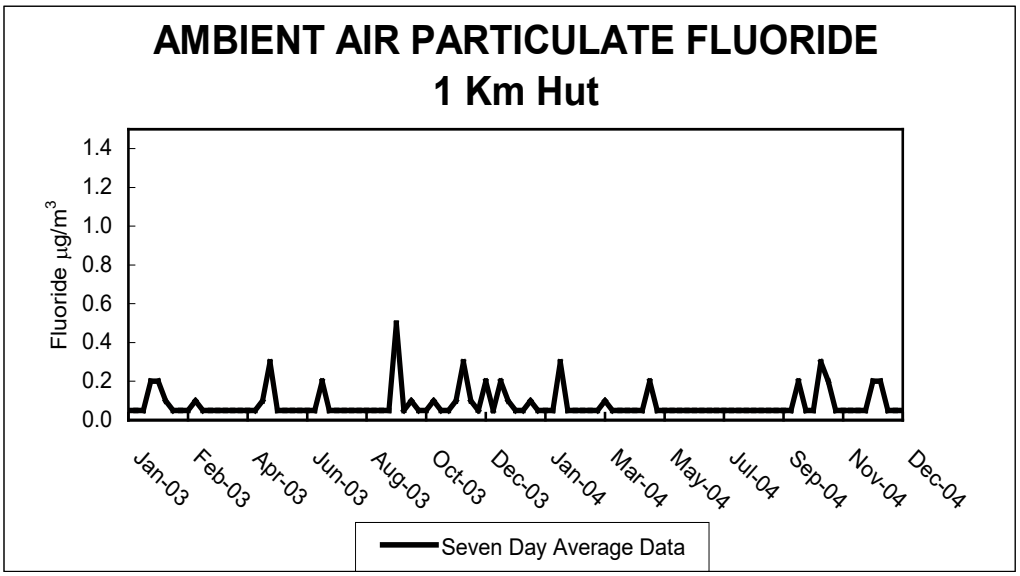


Note: Concentrations less than 0.1 $\mu g/m^3$ are plotted as 0.05 $\mu g/m^3$

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 less than 0.1 µg/m^3 are plotted as 0.05 µg/m^3

Comments

The fluoride levels have decreased a little to those reported in 2003.

Ambient Air at Other Sites on Tiwai Peninsula

Monitoring results

The following table summarises the monitoring results during 2003 and 2004 for the two other sites located on Tiwai Peninsula.

Site	Parameter	Units	Standard	2003	2004
No. 1 Bore	Gaseous Fluoride Concentration				
	• Max 7 day average	$\mu g/m^3$	1.0	N.D.	N.D.
	• Max monthly average	$\mu g/m^3$	0.5	< 0.1	< 0.1
	• Annual average	$\mu g/m^3$		< 0.1	< 0.1
	Particulate Fluoride concentration				
	• Max 7 day average	$\mu g/m^3$		N.D.	N.D.
	• Max monthly average	$\mu g/m^3$		< 0.1	< 0.1
	• Annual average	$\mu g/m^3$		< 0.1	< 0.1
No. 6 Bore	Gaseous Fluoride Concentration				
	• Max 7 day average	$\mu g/m^3$	1.0	N.D.	N.D.
	• Max monthly average	$\mu g/m^3$	0.5	< 0.1	< 0.1
	• Annual average	$\mu g/m^3$		< 0.1	< 0.1
	Particulate Fluoride concentration				
	• Max 7 day average	$\mu g/m^3$		N.D.	N.D.
	• Max monthly average	$\mu g/m^3$		< 0.1	< 0.1
	• Annual average	$\mu g/m^3$		< 0.1	< 0.1

N.D: Not Done

Comments

Gaseous and particulate fluoride concentrations were below the detection limit of the Australian standard (AS 3580.1991) method at these sites and thus within the permit standards throughout 2004.

Ambient Air at Sites off Tiwai Peninsula

Monitoring results

The following table summarises the monitoring results during 2003 and 2004 for the three ambient air-monitoring sites located off Tiwai Peninsula.

Site	Parameter	Units	Standard	2003	2004
Buddle Road	Gaseous Fluoride Concentration				
	• Max 7 day average	$\mu g/m^3$	1.0	N.D.	N.D.
	• Max monthly average	$\mu g/m^3$	0.5	< 0.1	< 0.1
	• Annual average	$\mu g/m^3$		< 0.1	< 0.1
	Particulate Fluoride concentration				
	• Max 7 day average	$\mu g/m^3$		N.D.	N.D.
	• Max monthly average	$\mu g/m^3$		< 0.1	< 0.1
	• Annual average	$\mu g/m^3$		< 0.1	< 0.1
Waituna	Gaseous Fluoride Concentration				
	• Max 7 day average	$\mu g/m^3$	1.0	N.D.	N.D.
	• Max monthly average	$\mu g/m^3$	0.5	< 0.1	< 0.1
	• Annual averge	$\mu g/m^3$		< 0.1	< 0.1
	Particulate Fluoride concentration				
	• Max 7 day average	$\mu g/m^3$		N.D.	N.D.
	• Max monthly average	$\mu g/m^3$		< 0.1	< 0.1
	• Annual average	$\mu g/m^3$		< 0.1	< 0.1
Bluff	Gaseous Fluoride Concentration				
	• Max 7 day average	$\mu g/m^3$	1.0	N.D.	N.D.
	• Max monthly average	$\mu g/m^3$	0.5	< 0.1	< 0.1
	• Annual averge	$\mu g/m^3$		< 0.1	< 0.1
	Particulate fluoride concentration				
	• Max 7 day average	$\mu g/m^3$		N.D.	N.D.
	• Max monthly average	$\mu g/m^3$		< 0.1	< 0.1
	• Annual average	$\mu g/m^3$		< 0.1	< 0.1

N.D: Not Done.

Comments

Gaseous and particulate fluoride concentrations were below the detection limit of the Australian standard (AS 3580.1991) method at these sites and thus within the permit standards throughout 2004.

Atmospheric Deposition

Introduction

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

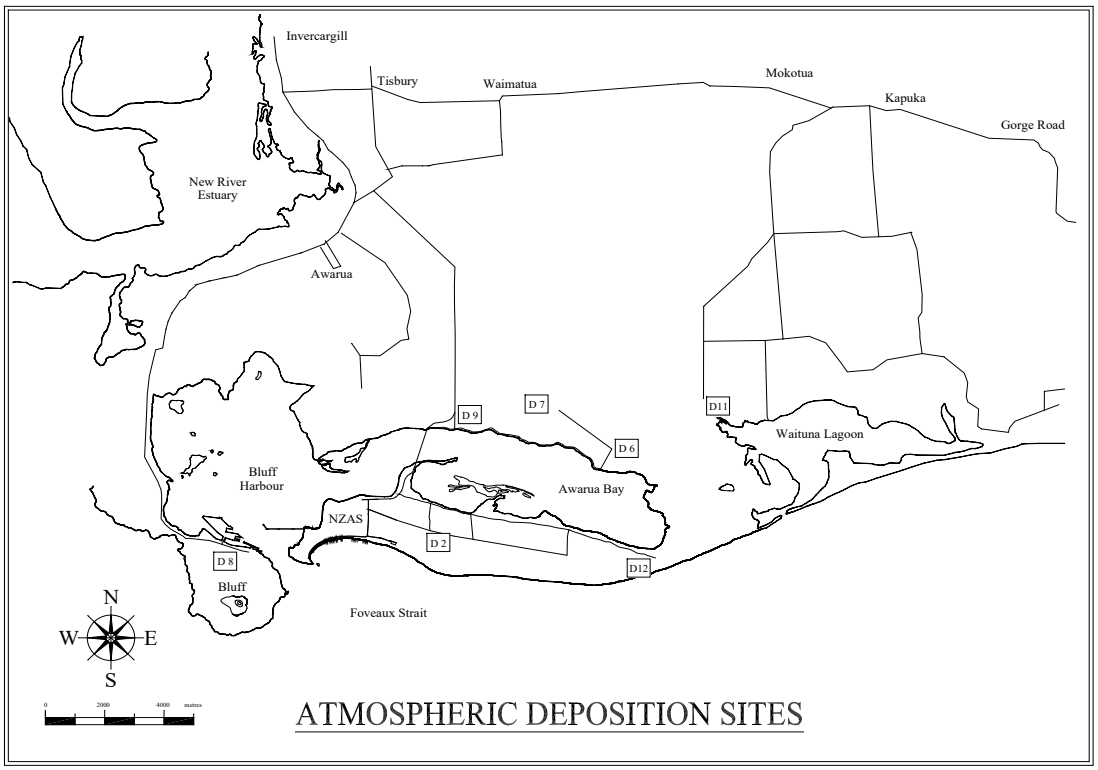
Permit Guidelines

The guidelines for atmospheric deposition apply to sites off Tiwai Peninsula and are shown in the table below.

Parameter	Unit	Guideline
Fluoride:	$g.m^{-3}$	0.9
Reactive Aluminium		
• Aesthetic highest desirable	$g.m^{-3}$	0.05
• Aesthetic excessive	$g.m^{-3}$	0.20

Site Locations

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



Atmospheric Deposition Monitoring Results

Fluoride Deposition

The fluoride atmospheric deposition during 2004 is summarised in the following table.

Site	Units	2004 average	Maximum for any month	Minimum for any month
D2. No.1 Bore[1]	$g.m^{-3}$	0.21	0.53	0.11
D12 TEF2[1]	$g.m^{-3}$	0.07	0.19	<0.05
D6 Buddle Road	$g.m^{-3}$	0.06	0.14	<0.05
D7 Gibson's Farm	$g.m^{-3}$	0.06	0.11	<0.05
D8 Bluff	$g.m^{-3}$	<0.05	<0.05	<0.05
D9 Awarua Bay Road	$g.m^{-3}$	<0.05	0.06	<0.05
D11 Marshall Road	$g.m^{-3}$	<0.05	0.08	<0.05

Note 1: Site located on Tiwai Peninsula and excluded from permit guideline.

Reactive Aluminium Deposition

The reactive aluminium atmospheric deposition during 2004 is summarised in the following table.

Site	Units	2004 average	Maximum for any month	Minimum for any month
D2. No.1 Bore[1]	$g.m^{-3}$	0.05	0.17	<0.03
D12 TEF2[1]	$g.m^{-3}$	<0.03	0.04	<0.03
D6 Buddle Road	$g.m^{-3}$	<0.03	0.04	<0.03
D7 Gibson's Farm	$g.m^{-3}$	<0.03	0.03	<0.03
D8 Bluff	$g.m^{-3}$	<0.03	<0.03	<0.03
D9 Awarua Bay Road	$g.m^{-3}$	<0.03	<0.03	<0.03
D11 Marshall Road	$g.m^{-3}$	<0.03	<0.03	<0.03

Note 1: Site located on Tiwai Peninsula and excluded from permit guideline.

Atmospheric Deposition Monitoring Results, Continued

Comments

All permit guidelines were met during 2004. Fluoride and reactive aluminium deposition during 2004 were within the normal range of results since the commissioning of the main stack dry scrubbing system in 1997.

The highest fluoride and reactive aluminium concentrations measured at most sites during 2004 were determined in January. The site most affected in January was No. 1 Bore, which had the highest results seen since March 2001. These higher than normal concentrations were most likely due to the lower than average rainfall and strong westerly winds influencing the dispersion along Tiwai Peninsula during this month. This would have resulted in low dilution of material deposited on the deposition gauge collection surface. The rainfall for January 2004 was 72mm compared to a long term average of 107mm.

No results were reported in February 2004 for Site 12 – TEF 2 due to vandalism.

Fluoride in Ungrazed Grass

Introduction

This chapter covers the monitoring of fluoride in ungrazed grasses at 24 monitoring sites located at Bluff, Green Hills, Awarua Plains, Waituna Wetlands and Tiwai Peninsula.

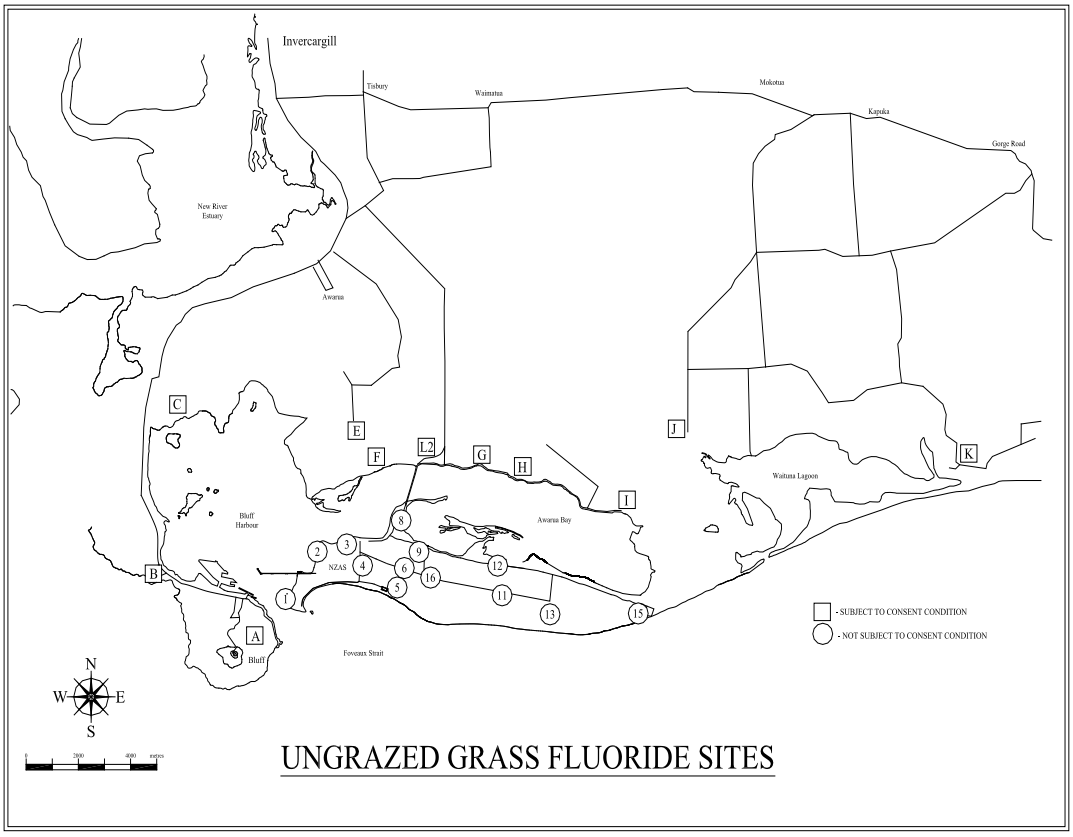
Permit Guidelines

The guidelines for fluoride in ungrazed grasses (on an unwashed, dry weight basis) on land off Tiwai Peninsula are detailed below. These guidelines came into effect in April 1994.

- Monthly sample shall not exceed 80 mg/kg more than once in any 12 consecutive months.
- Running average of any two consecutive months shall not exceed 60 mg/kg.
- Running average of any 12 consecutive months shall not exceed 40 mg/kg.

Site Locations

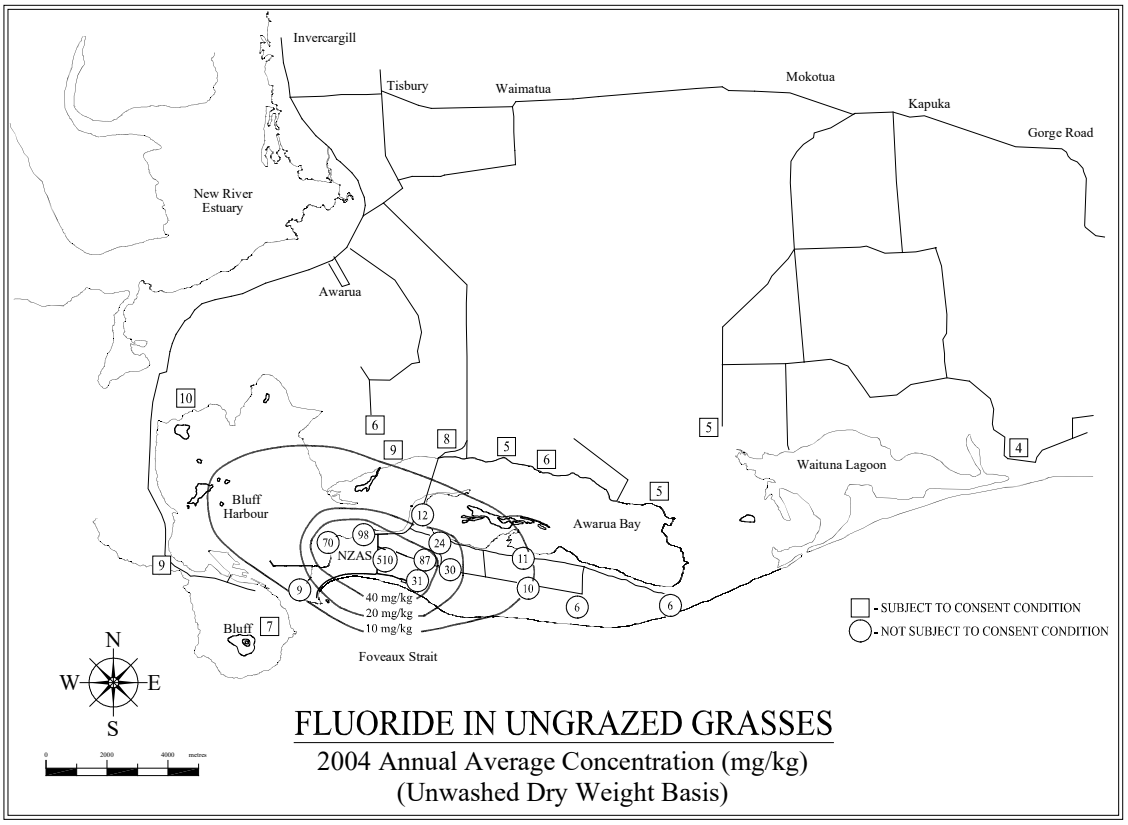
The ungrazed grass monitoring sites are shown on the following map.



Ungrazed Grass Monitoring Results

Annual average fluoride concentrations

The 2004 average ungrazed grass fluoride concentrations are shown in the following map.



Ungrazed Grass Monitoring Results, Continued

Monthly maximum concentration

The following table shows the maximum monthly fluoride concentrations for sites off Tiwai Peninsula during 2004.

Sites off Tiwai Penninsula	Permit Guideline not to be exceeded more than once in any 12 month consecutive months. mgF/kg	Maximum Monthly Result During 2004 mgF/kg
Ungrazed Grass Site A	80	16
Ungrazed Grass Site B	80	24
Ungrazed Grass Site C	80	20
Ungrazed Grass Site E	80	12
Ungrazed Grass Site F	80	19
Ungrazed Grass Site G	80	11
Ungrazed Grass Site H	80	9
Ungrazed Grass Site I	80	9
Ungrazed Grass Site J	80	7
Ungrazed Grass Site K	80	9
Ungrazed Grass Site L and L2	80	11

The monthly fluoride concentration in ungrazed grass was within the permit guideline for all sites during 2004.

Ungrazed Grass Monitoring Results, Continued

Two month average concentration

The following table shows the maximum two-month running average fluoride concentrations for sites off Tiwai Peninsula during 2004.

Sites off Tiwai Penninsula	Permit Guideline mgF/kg	Maximum Two Month Running Average During 2004 mgF/kg
Ungrazed Grass Site A	60	12
Ungrazed Grass Site B	60	20
Ungrazed Grass Site C	60	17
Ungrazed Grass Site E	60	8
Ungrazed Grass Site F	60	17
Ungrazed Grass Site G	60	10
Ungrazed Grass Site H	60	9
Ungrazed Grass Site I	60	8
Ungrazed Grass Site J	60	7
Ungrazed Grass Site K	60	6
Ungrazed Grass Site L and L2	60	10

The two month running average fluoride concentration in ungrazed grass was within the permit guideline for all sites during 2004.

Ungrazed Grass Monitoring Results, Continued

Running 12 month average concentration

The following table shows the maximum 12 month running average fluoride concentrations for sites off Tiwai Peninsula during 2004.

Sites off Tiwai Penninsula	Permit Guideline mgF/kg	Maximum Twelve Month Running Average During 2004 mgF/kg
Ungrazed Grass Site A	40	7
Ungrazed Grass Site B	40	9
Ungrazed Grass Site C	40	10
Ungrazed Grass Site E	40	6
Ungrazed Grass Site F	40	10
Ungrazed Grass Site G	40	6
Ungrazed Grass Site H	40	7
Ungrazed Grass Site I	40	6
Ungrazed Grass Site J	40	6
Ungrazed Grass Site K	40	6
Ungrazed Grass Site L and L2	40	11

The 12 month running average fluoride concentration in ungrazed grass was within the permit guideline for all sites during 2004.

Ungrazed Grass Monitoring Results, Continued

Comments

The 2004 annual average fluoride concentrations in ungrazed grass sites off Tiwai Peninsula were similar to the annual average fluoride concentration levels in 2003.

Sites on Tiwai Peninsula and close to the smelter are also similar to the annual average fluoride concentrations levels in 2003.

The maximum monthly concentrations for all sites, except A and B were all less than or similar to 2003 levels. The maximum concentration for A occurred in October 2004 and B occurred in September 2004. These anomalies are unlikely to be linked to smelter emissions as either, nearby sites were not effected, or dispersion conditions were not in the general direction of these sites during the month of the increase.

Fluoride in *Pinus radiata*

Introduction

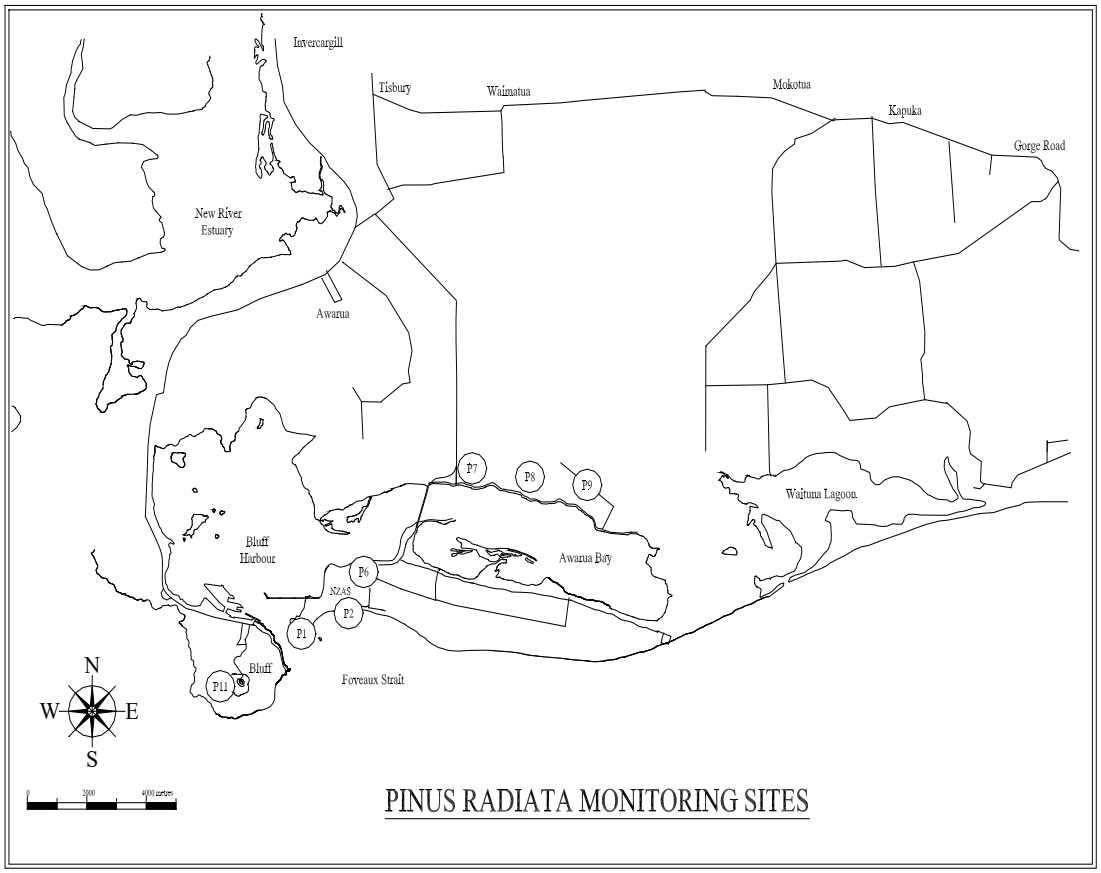
This chapter covers the monitoring of fluoride in *Pinus radiata* at 7 monitoring sites located at Bluff, Awarua Plains, Waituna and Tiwai Peninsula.

Permit Guidelines

Pine needles between one and two years are sampled quarterly. The guideline for fluoride in washed *Pinus radiata* needles on land off Tiwai Peninsula is 75 mg/kg.

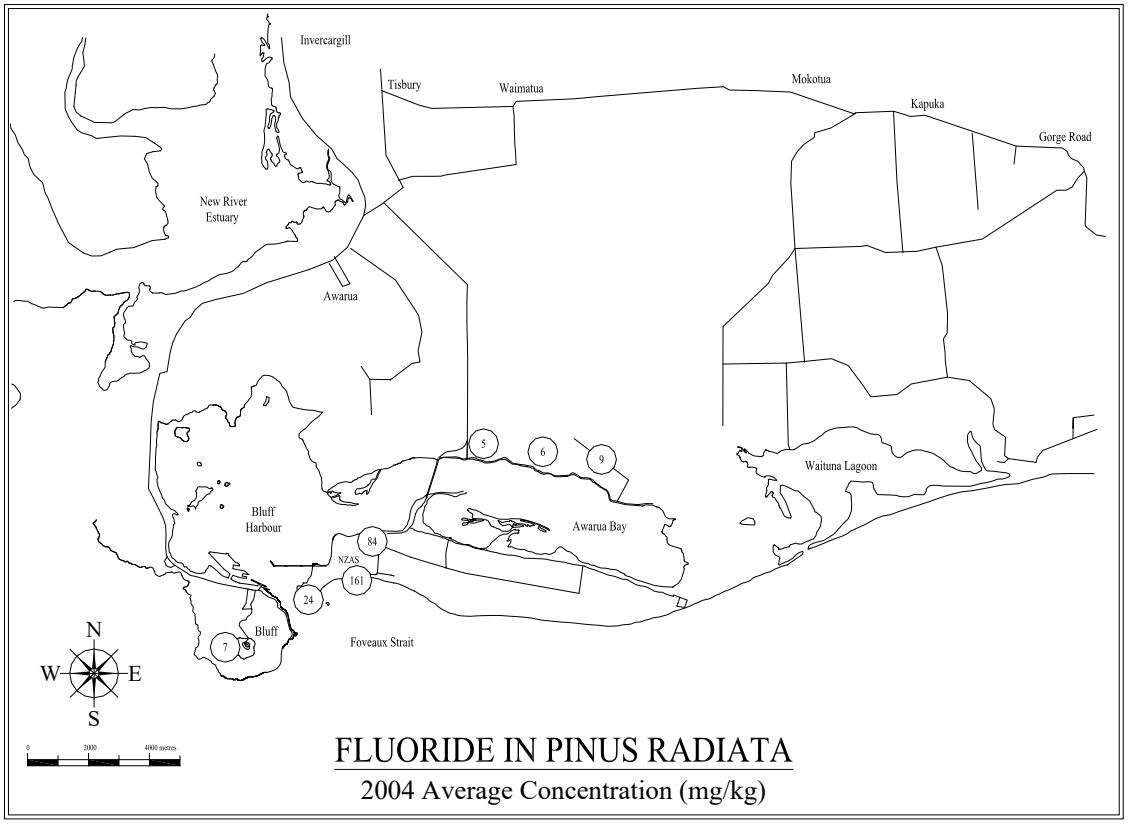
Site Locations

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



Pinus radiata Monitoring Results

The 2004 annual average fluoride concentrations of pine needle samples collected from the monitoring sites are shown in the following map.



Comments

Fluoride concentrations in *Pinus radiata* needles were within the permit guideline during 2004. The permit guideline only applies to sites off Tiwai Peninsula.

Fluoride concentrations of pine needles at all sites off Tiwai Peninsula and close to the smelter were similar to previously recorded average levels.

Site 6 and Site 7 have notably lower average concentrations of fluoride than in 2003.

The Health of Farm Livestock

Grazing Monitor Project

Summary

The fluoride concentrations of grazed pasture on all grazing monitor farms were within permit standard during 2004.

Cattle urine and bone fluoride concentrations on GMF4 were within permit guidelines during 2004.

Dental scores in cattle teeth farmed on GMF4 were similar to those measured in 2003.

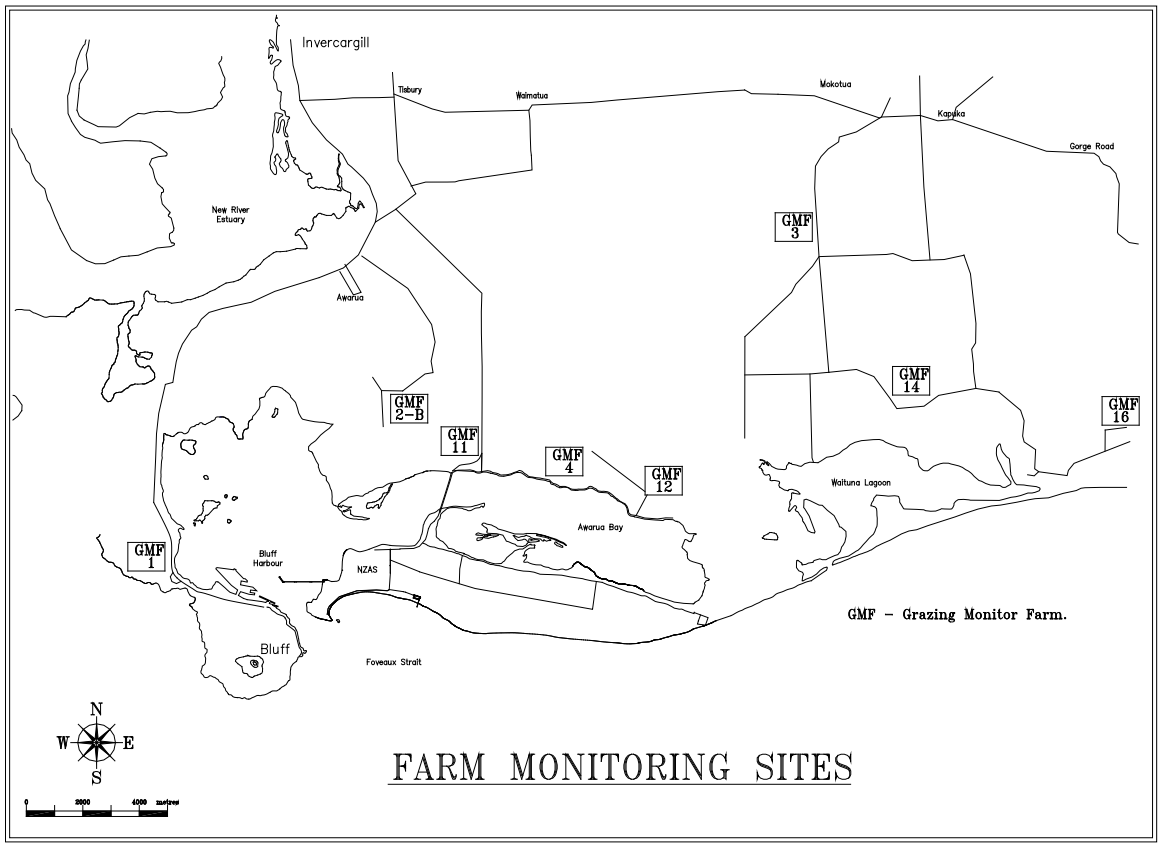
Introduction

Air Discharge and Coastal Permit Number 93566 requires NZAS to report on the health of farm livestock annually. The permit conditions were revised following NZAS' application to change or cancel some conditions which was approved by the Southland Regional Council on 5 August 1998.

The Grazing Monitor Project was established in 1969 prior to the smelter being commissioned. The project has continued since then with modifications as part of NZAS' Environmental Monitoring Program.

Site Locations

The following map shows the location of the farms included in the Grazing Monitor Project.



Monitoring the Health of Farm Livestock

The health of farm livestock is monitored by:

- measuring the fluoride concentration of cattle urine,
- measuring the fluoride concentration of cattle tailbone, and
- assessing the dental condition of cattle.

Urinary Fluoride

The urinary fluoride concentrations are corrected to a specific gravity of 1.030.

Bone Fluoride

The bone samples collected for measuring fluoride concentrations are from tail bone biopsies. The tailbone fluoride concentrations are converted to a metacarpal/metatarsal bone fluoride concentration using the method developed by J. Suttie.

Fluoride (F) in dry fat free metacarpal/metatarsal bone = F in ashed tailbone * 0.5.

Dental Condition

The tooth scoring system follows the method of J. Suttie. As most effects on teeth occur prior to eruption, when the teeth are forming, the tooth scores are given in relation to the year during which the tooth was formed. There is over 1 year between formation and eruption so the dental condition cannot be assessed until 1 to 2 years after any effects have occurred.

The inspection results from past years are combined to provide a table summarising the dental condition of the cattle permanent incisor teeth for the years when the teeth are forming.

Permit Standards

The Air Discharge and Coastal Permit contains a number of standards. A standard is defined in the permit as a limit which is not to be breached.

The standards for fluoride in grazed pasture (on an unwashed, dry weight basis) on land off Tiwai Peninsula are:

- monthly sample shall not exceed 80 mg/kg more than once in any 12 consecutive months,
- the average of any two consecutive months samples shall not exceed 60 mg/kg,
- running averages of monthly samples for a period of twelve months shall not exceed 40 mg/kg.

Permit Guidelines

The Air Discharge and Coastal Permit also contains a number of guidelines. A guideline is defined in the permit as a level which is set on best current knowledge, the exceeding of which requires further investigation or other action.

The guidelines for animal health monitoring are:

- urinary fluoride in dairy and beef cattle should not exceed 10 mg/L corrected to S.G. 1.030,
- bone fluoride concentrations as measured in metacarpal/metatarsal bones are:

    - 1605 mg/kg for two year olds,
    - 2379 mg/kg for four year olds, and
    - 2794 mg/kg for six year olds.

Grazing Monitor Farm No.1

The following information is contained in this section:

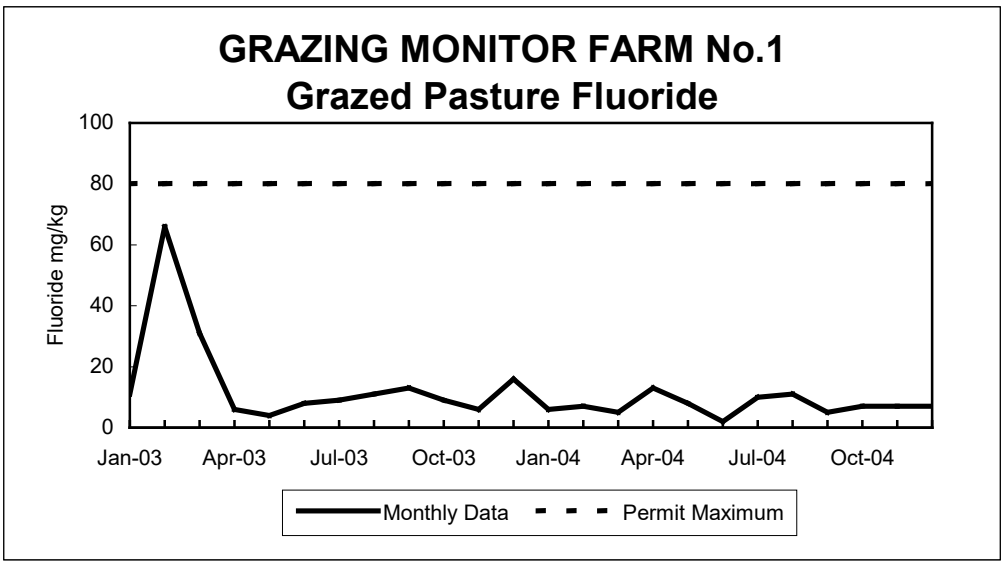
- fluoride in grazed pasture, and
- comments on the monitoring.

Fluoride in grazed pasture

The following table shows the grazed pasture monitoring results for 2004.

	Units	Standard	2004
Monthly sample maximum	mg/kg	80	13
Two monthly average maximum	mg/kg	60	11
Twelve monthly running average maximum	mg/kg	40	15
Annual average	mg/kg		7

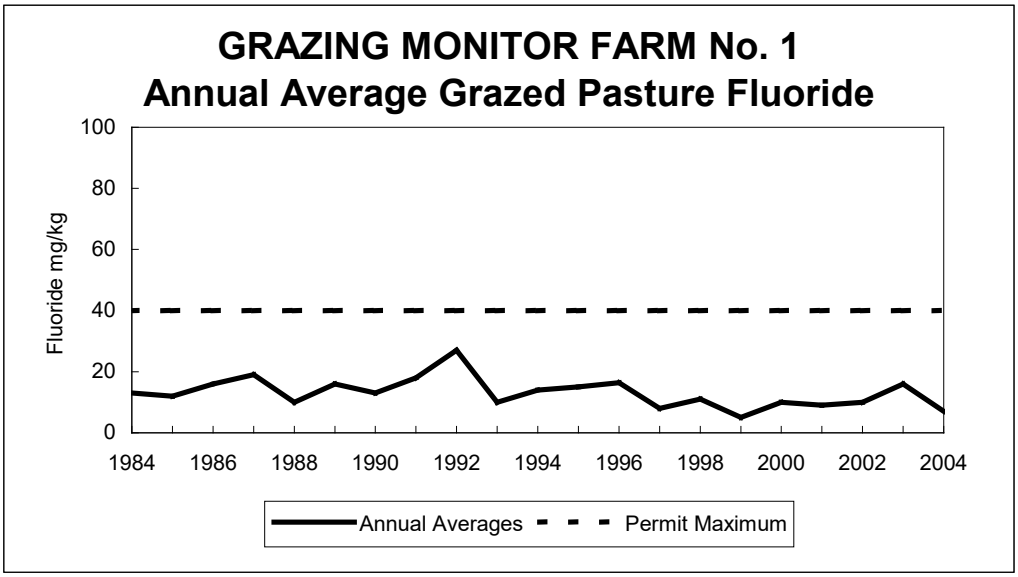
The following graph shows the results of monthly fluoride monitoring of grazed pasture during 2003 and 2004.



Grazing Monitor Farm No.1, Continued

Fluoride in grazed pasture, continued

The following graph shows the annual average fluoride concentration in grazed pasture.



Comments

The fluoride in grazed pasture was within the permit standards. The 2004 average grazed pasture fluoride concentration of 7mg/kg was a decrease on the 2003 average.

Grazing Monitor Farm No. 2

Introduction

The following information is contained in this section:

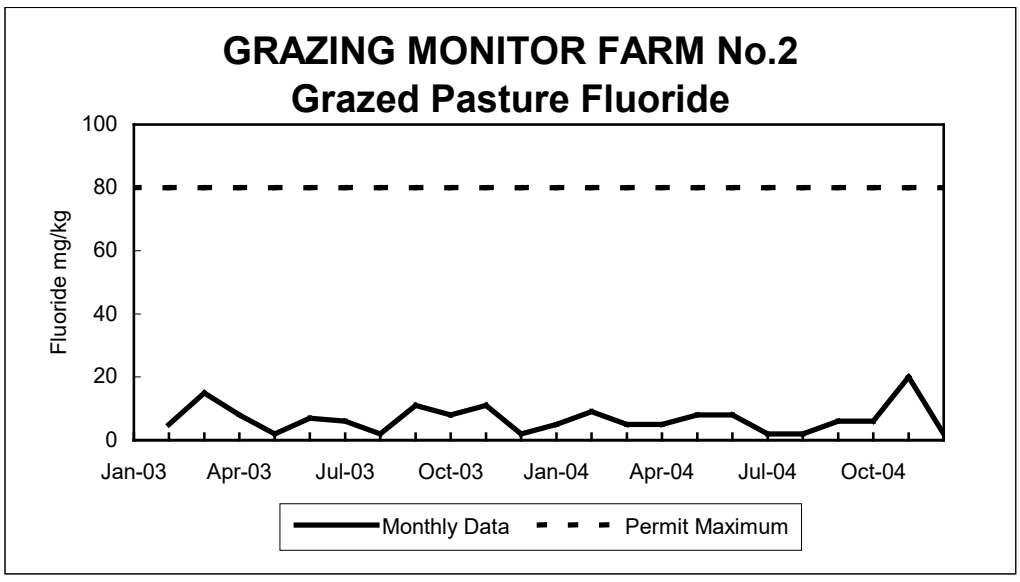
- fluoride in grazed pasture, and
- comments on the monitoring.

Fluoride in grazed pasture

The following table shows the grazed pasture monitoring results for 2004.

	Units	Standard	2004
Monthly sample maximum	mg/kg	80	20
Two monthly average maximum	mg/kg	60	13
Twelve monthly running average maximum	mg/kg	40	7
Annual average	mg/kg		7

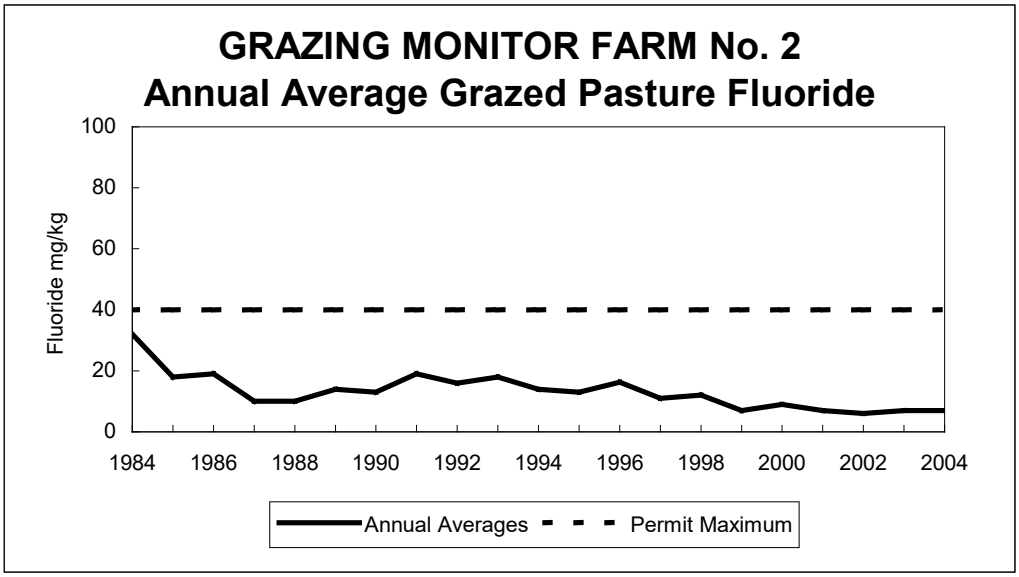
The following graph shows the results of monthly fluoride monitoring of grazed pasture during 2003 and 2004.



Grazing Monitor Farm No. 2, Continued

Fluoride in grazed pasture, continued

The following graph shows the annual average fluoride concentration in grazed pasture.



Comments

The fluoride in grazed pasture was within the permit standards. The 2004 average grazed pasture fluoride concentration of 7 mg/kg was similar to the average fluoride concentration measured during 2003. There was no sample data for January 2003 as the paddock had recently been ploughed.

Grazing Monitor Farm No. 3

Introduction

The following information is contained in this section:

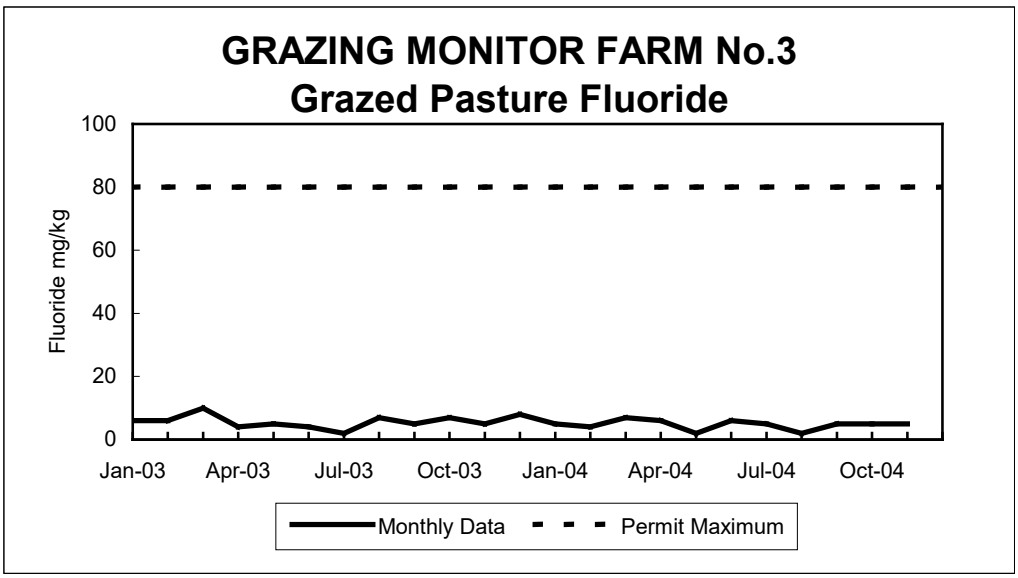
- fluoride in grazed pasture, and
- comments on the monitoring.

Fluoride in grazed pasture

The following table shows the grazed pasture monitoring results for 2004.

	Units	Standard	2004
Monthly sample maximum	mg/kg	80	7
Two monthly average maximum	mg/kg	60	7
Twelve monthly running average maximum	mg/kg	40	6
Annual average	mg/kg		5

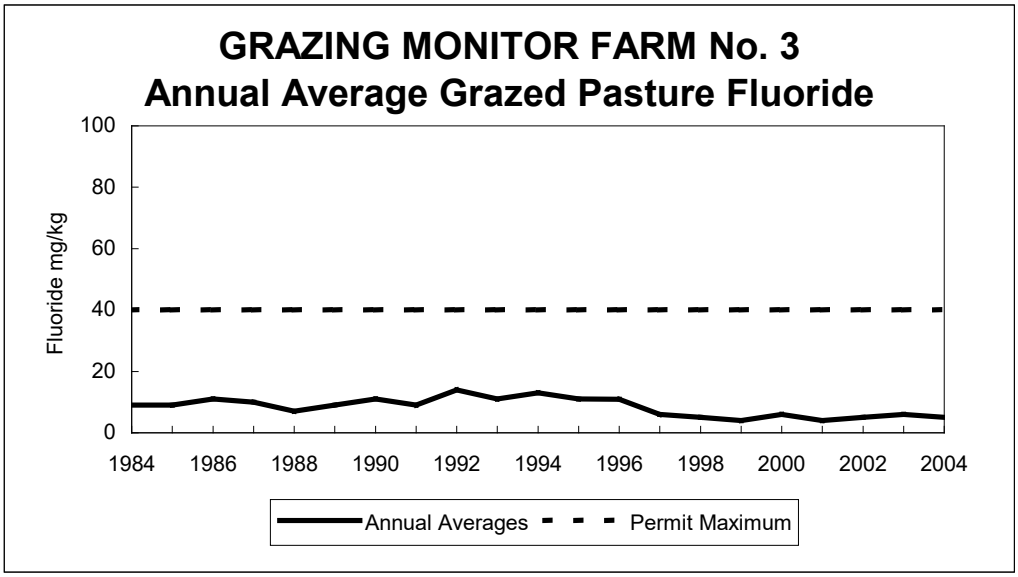
The following graph shows the results of monthly fluoride monitoring of grazed pasture during 2003 and 2004.



Grazing Monitor Farm No. 3, Continued

Fluoride in grazed pasture, continued

The following graph shows the annual average fluoride concentration in grazed pasture.



Comments

The fluoride in grazed pasture was within the permit standards. The 2004 annual average grazed pasture fluoride concentration of 5 mg/kg was similar to the concentration measured during previous years. There was no sample data for December 2004 as fertilizer had been applied within 20 days of sampling.

Grazing Monitor Farm No. 4

Introduction

The following information is contained in this section:

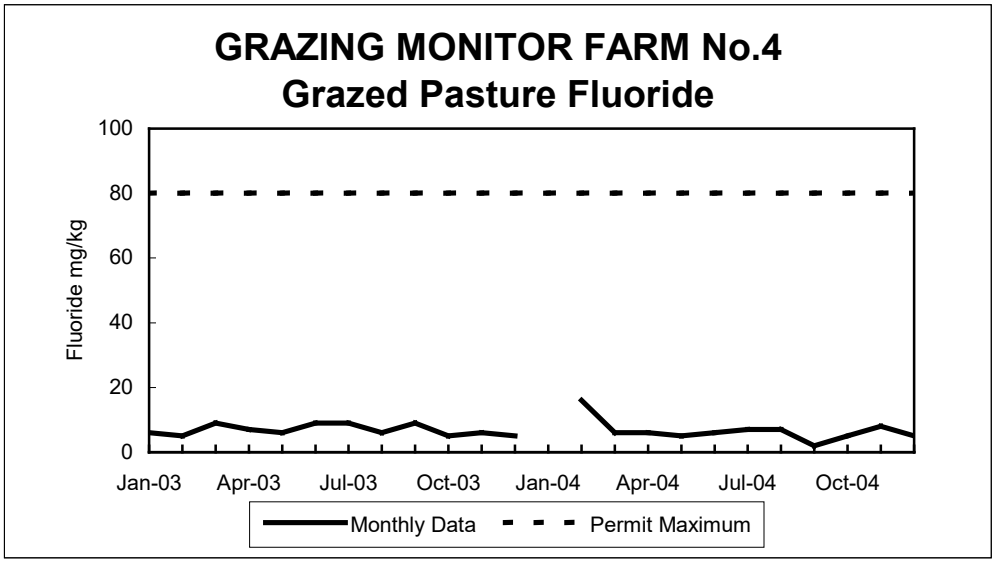
- fluoride in grazed pasture,
- cattle urinary fluoride,
- cattle bone fluoride,
- cattle dental condition, and
- comments on the monitoring.

Fluoride in grazed pasture

The following table shows the grazed pasture monitoring results for 2004.

	Units	Standard	2004
Monthly sample maximum	mg/kg	80	16
Two monthly average maximum	mg/kg	60	11
Twelve monthly running average maximum	mg/kg	40	8
Annual average	mg/kg		7

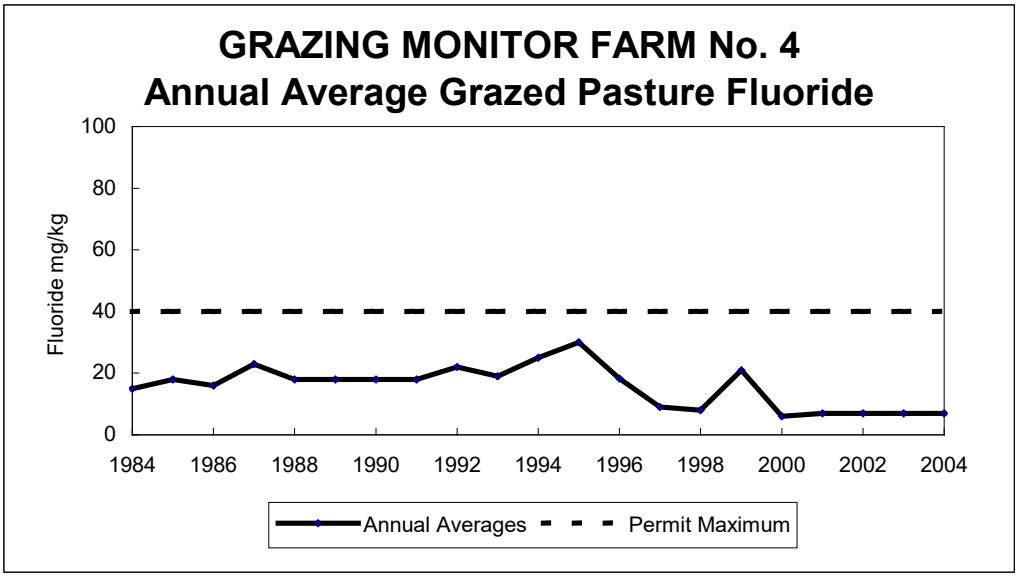
The following graph shows the results of monthly fluoride monitoring of grazed pasture during 2003 and 2004.



Grazing Monitor Farm No. 4, Continued

Fluoride in grazed pasture, continued

The following graph shows the annual average fluoride concentration in grazed pasture.



Cattle urinary fluoride

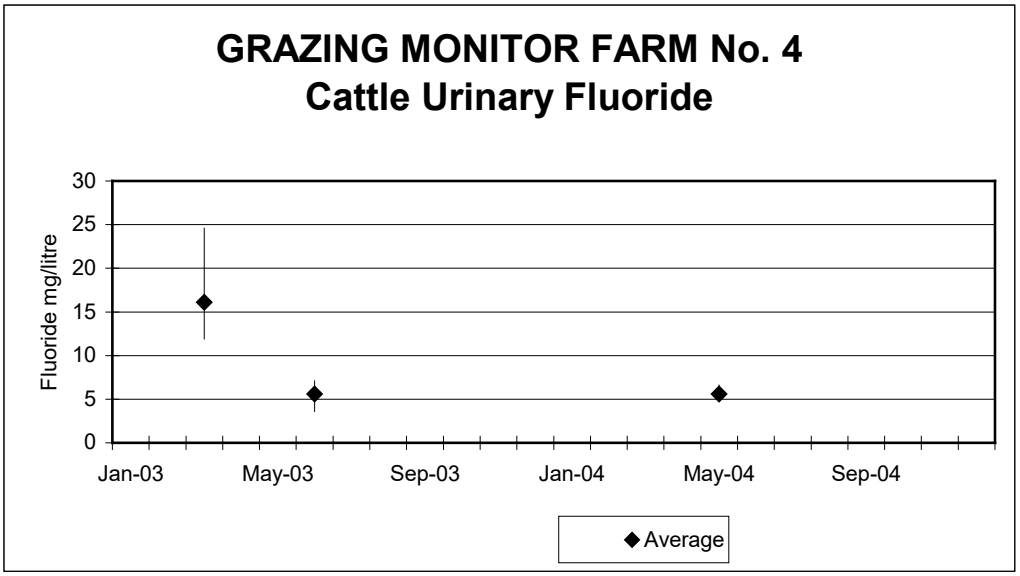
The following table summarises the results of cattle urinary fluoride monitoring during 2004.

	Units	Guideline	2004
Average fluoride concentration	mg/L	-	5.6
Maximum fluoride concentration	mg/L	10	6.6
Minimum fluoride concentration	mg/L	-	4.8
No. of samples	mg/L	-	4

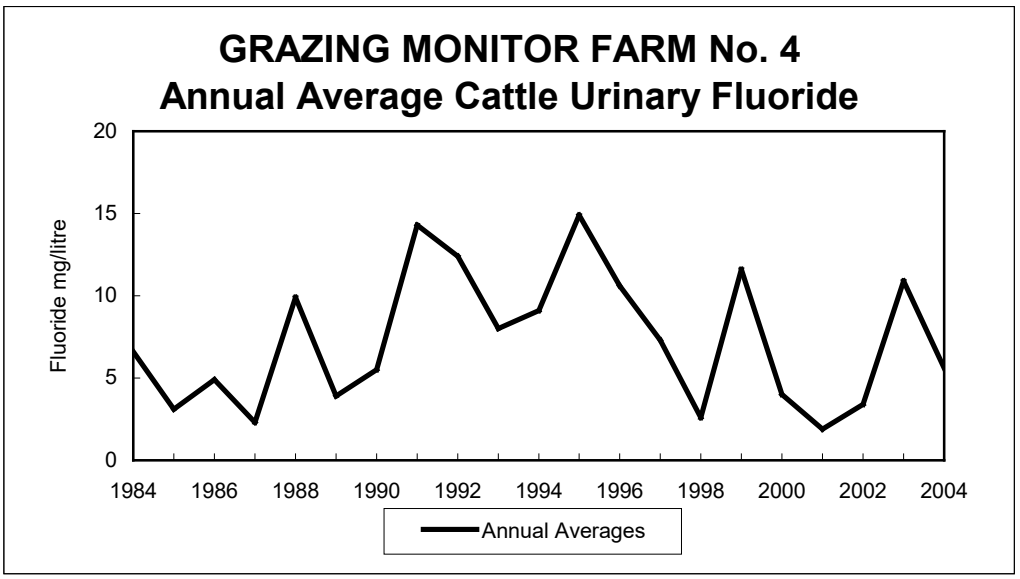
Grazing Monitor Farm No. 4, Continued

Cattle urinary fluoride, continued

The following graph shows the results of urinary fluoride monitoring of cattle during 2003 and 2004. The horizontal bars show the average concentration of the samples and the vertical bars show the range of concentrations.



The following graph shows the annual average fluoride concentration in cattle urine.



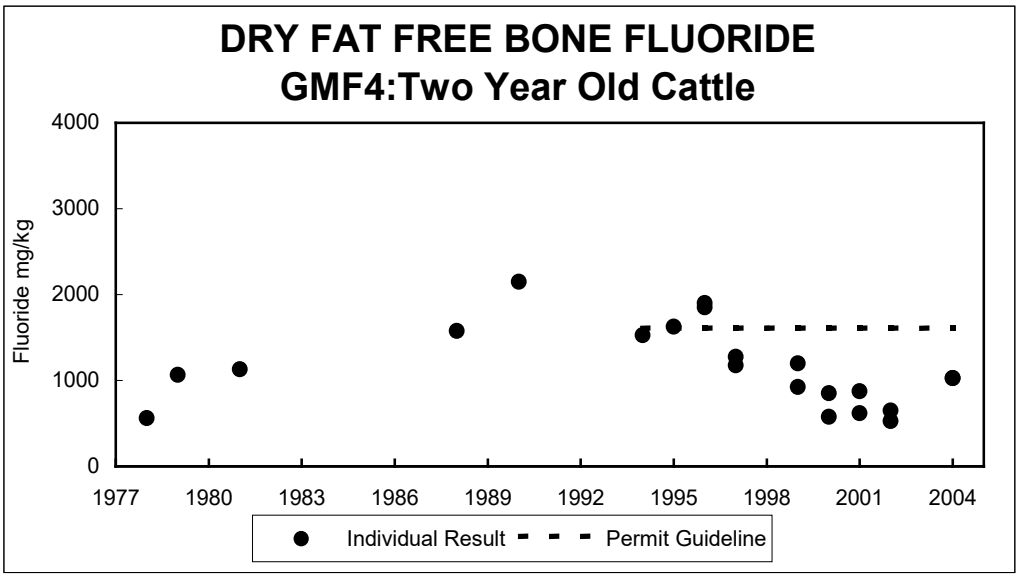
Grazing Monitor Farm No. 4, Continued

Cattle bone fluoride

The following table shows the results of bone fluoride monitoring during 2004.

Identification	Age	Units	Guideline	2004
54	2	mg/kg	1605	1025
319	2	mg/kg	1605	1025
37	4	mg/kg	2379	1125
79	6	mg/kg	2794	950

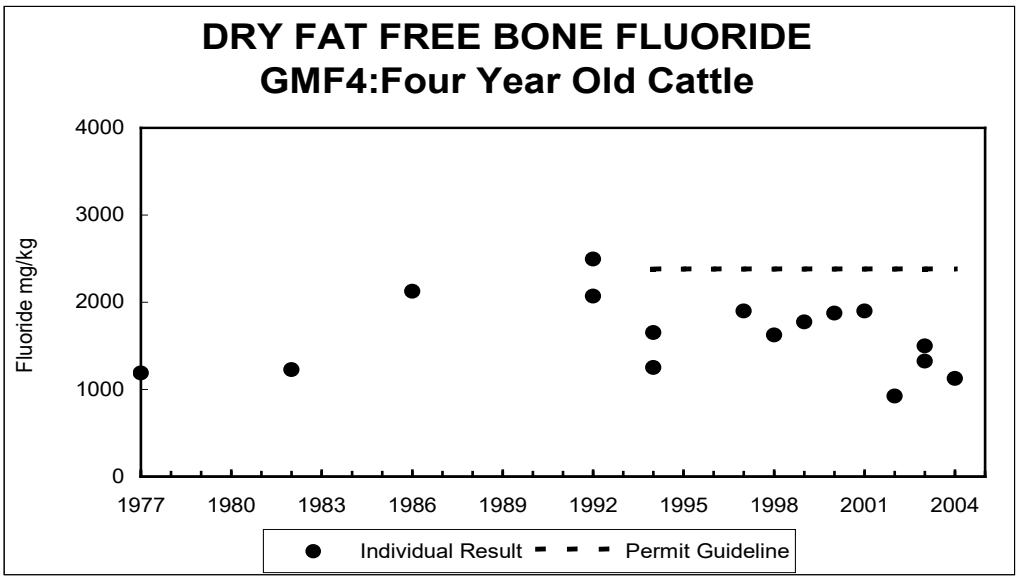
The following graph shows the bone fluoride concentration of individual biopsies collected from two year old cattle since the project began.



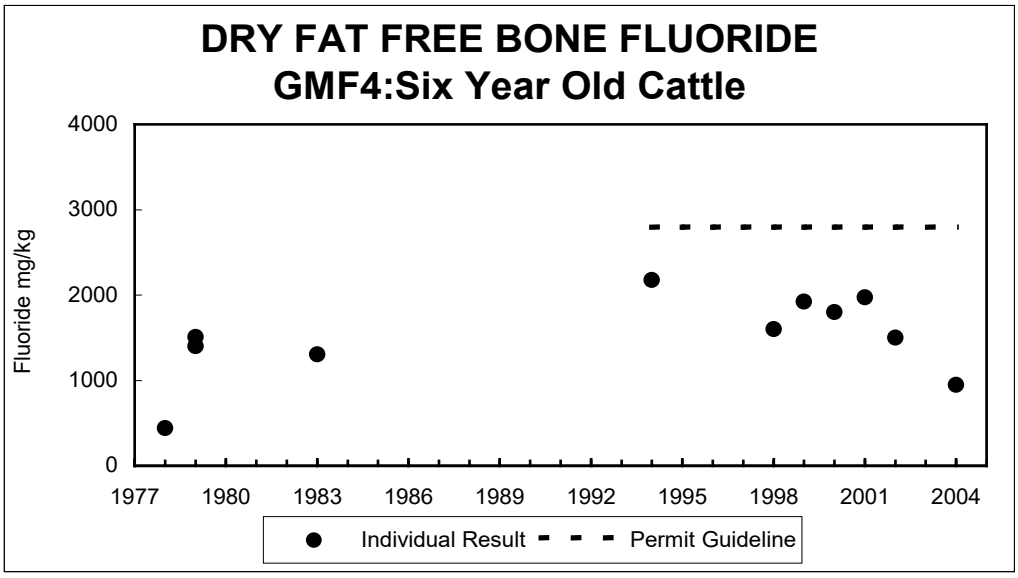
Grazing Monitor Farm No. 4, Continued

Cattle bone fluoride, continued

The following graph shows the bone fluoride concentration of individual biopsies collected from four year old cattle since the project began.



The following graph shows the bone fluoride concentration of individual biopsies collected from six year old cattle since the project began.



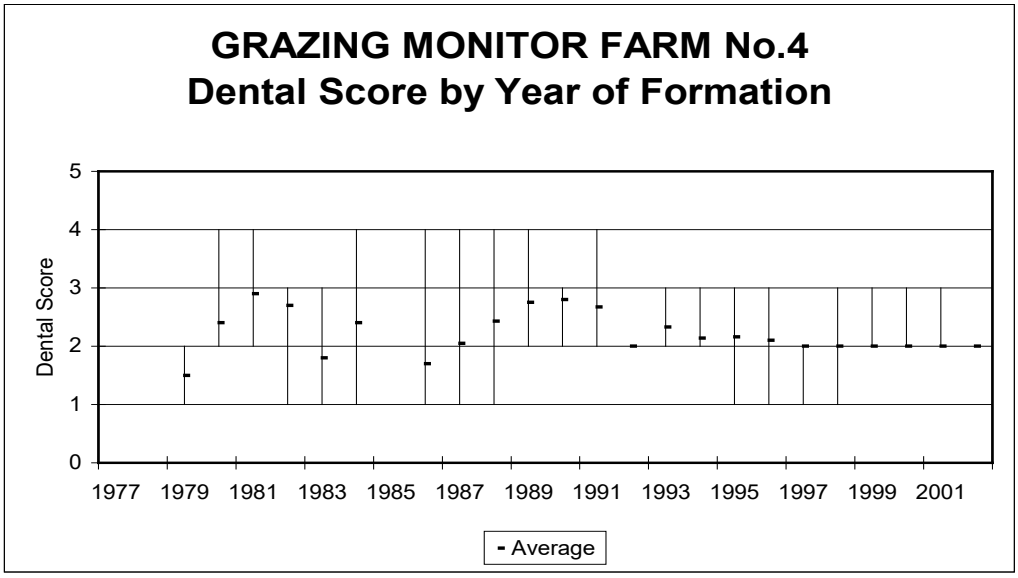
Grazing Monitor Farm No. 4, Continued

Cattle dental condition

The following table summarises combined results of the dental inspection of cattle.

Year of tooth formation	1998	1999	2000	2001	2002
Average tooth score	2	2	2	2	2
Maximum tooth score	2	3	3	3	2
Minimum tooth score	1	2	2	2	2
No. of cattle inspected	8	9	10	10	8

The following graph shows the average tooth score and range of tooth scores for the teeth of cattle formed since monitoring began.



Grazing Monitor Farm No. 4, Continued

Comments

The fluoride concentrations of cattle bone, cattle urine and grazed pasture on GMF4 were within the permit guidelines during 2004.

The 2004 annual average grazed pasture fluoride concentration of 7 mg/kg was the same as that determined during 2003.

There was no sample data for January 2004 as fertilizer had been applied within 20 days of sampling.

The annual average urinary fluoride concentration measured during 2004 was 5.6 mg/L compared to an average 10.9 mg/L measured during 2003. The maximum individual urinary fluoride concentration measured during 2004 was 6.6 mg/L compared with a maximum of 24.6 mg/L measured during 2003.

The dental scores in cattle inspected during 2004 were similar to those inspected in 2003.

Grazing Monitor Farm No. 11

Introduction

The following information is contained in this section:

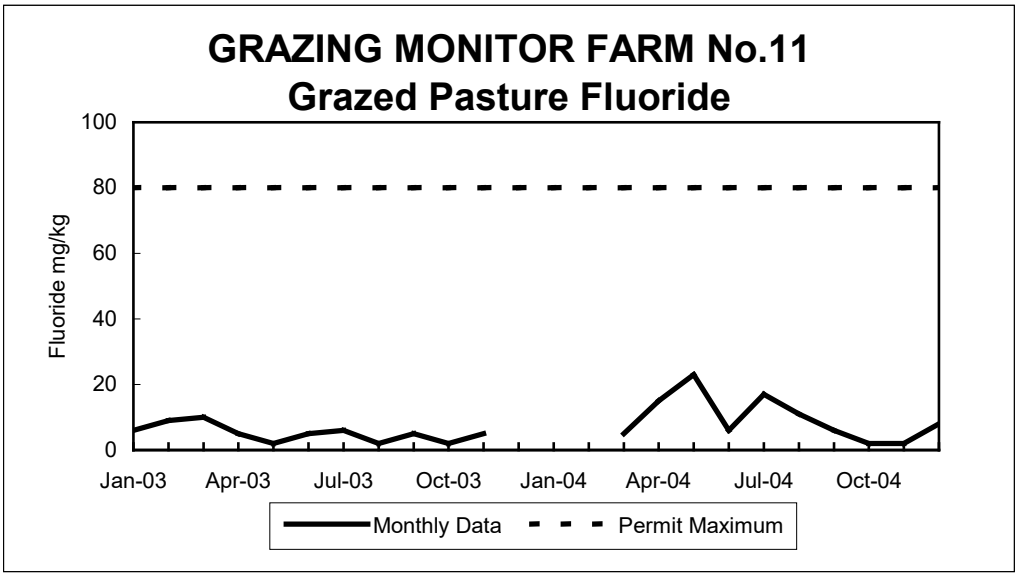
- fluoride in grazed pasture, and
- comments on the monitoring.

Fluoride in grazed pasture

The following table shows the grazed pasture monitoring results for 2004.

	Units	Standard	2004
Monthly sample maximum	mg/kg	80	23
Two monthly average maximum	mg/kg	60	19
Twelve monthly running average maximum	mg/kg	40	10
Annual average	mg/kg		10

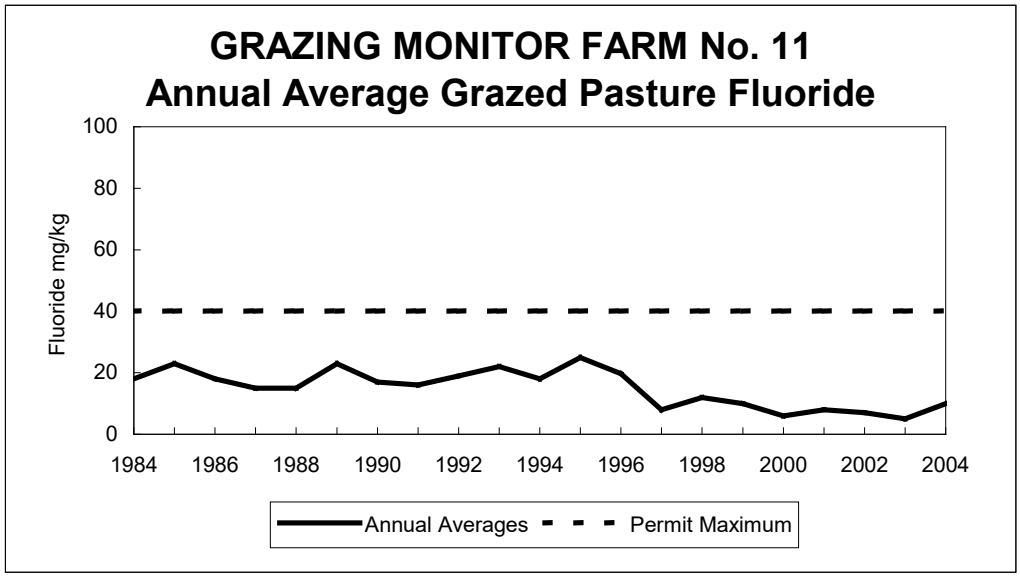
The following graph shows the results of monthly fluoride monitoring of grazed pasture during 2003 and 2004.



Grazing Monitor Farm No. 11, Continued

Fluoride in grazed pasture, continued

The following graph shows the annual average fluoride concentration in grazed pasture.



Comments

The fluoride in grazed pasture was within the permit standards. The 2004 average grazed pasture fluoride concentration of 10 mg/kg an increase on the average fluoride concentration measured during 2003. There is no data for December 2003, January and February 2004 as the paddock had been ploughed and sown in swedes.

Grazing Monitor Farm No. 12

Introduction

The following information is contained in this section:

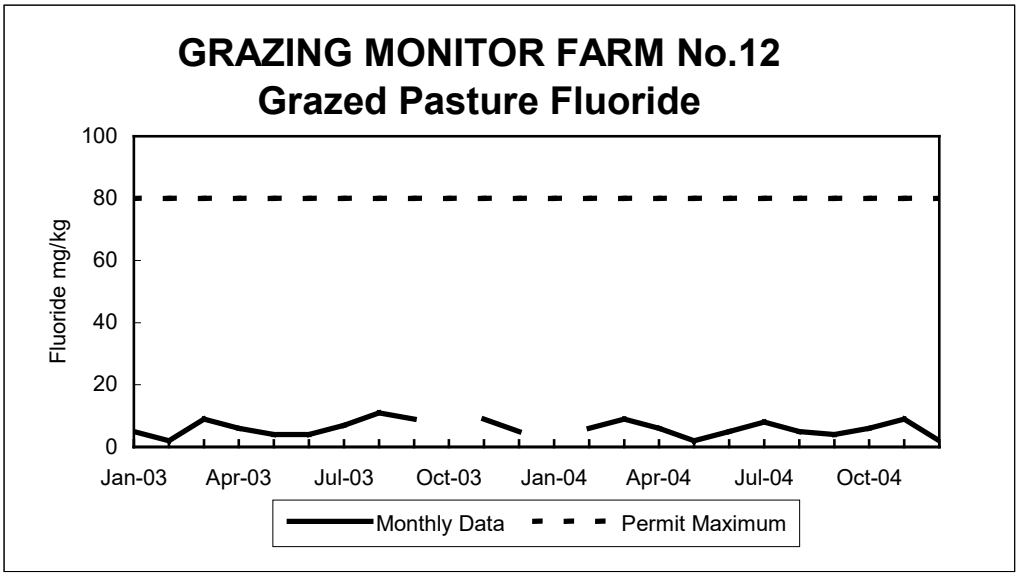
- fluoride in grazed pasture, and
- comments on the monitoring.

Fluoride in grazed pasture

The following table shows the maximum grazed pasture monitoring results for 2004.

	Units	Standard	2004
Monthly sample maximum	mg/kg	80	9
Two monthly average maximum	mg/kg	60	8
Twelve monthly running average maximum	mg/kg	40	7
Annual average	mg/kg		6

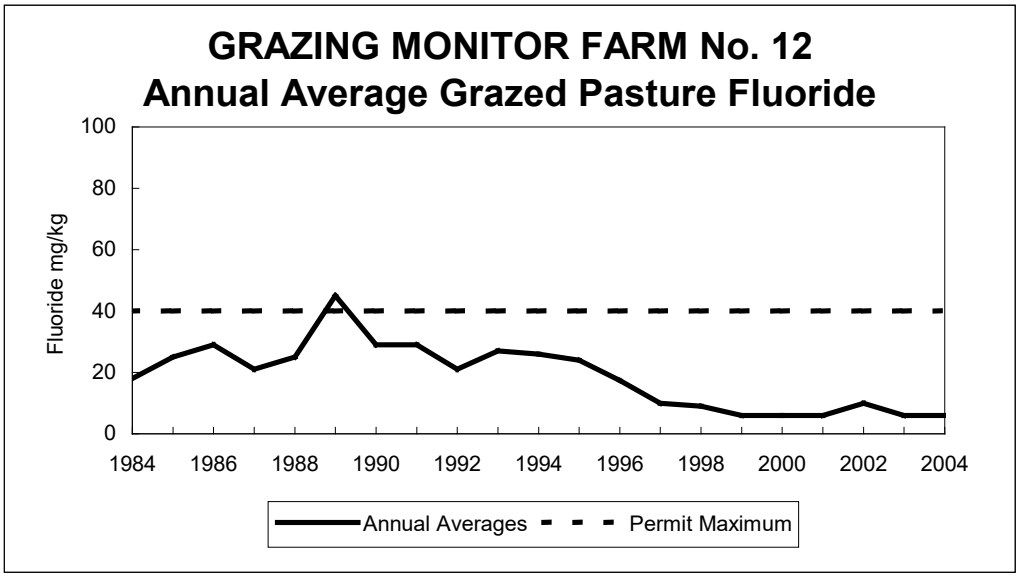
The following graph shows the results of monthly fluoride monitoring of grazed pasture during 2003 and 2004.



Grazing Monitor Farm No. 12, Continued

Fluoride in grazed pasture, continued

The following graph shows the annual average fluoride concentration in grazed pasture.



Comments

The fluoride in grazed pasture was within the permit standards. The 2004 annual average grazed pasture fluoride concentration of 6 mg/kg was the similar to the average concentration measured in 2003. There was no sample data for October 2003 and January 2004 as fertilizer had been applied within 20 days of sampling.

Grazing Monitor Farm No. 14

Introduction

The following information is contained in this section:

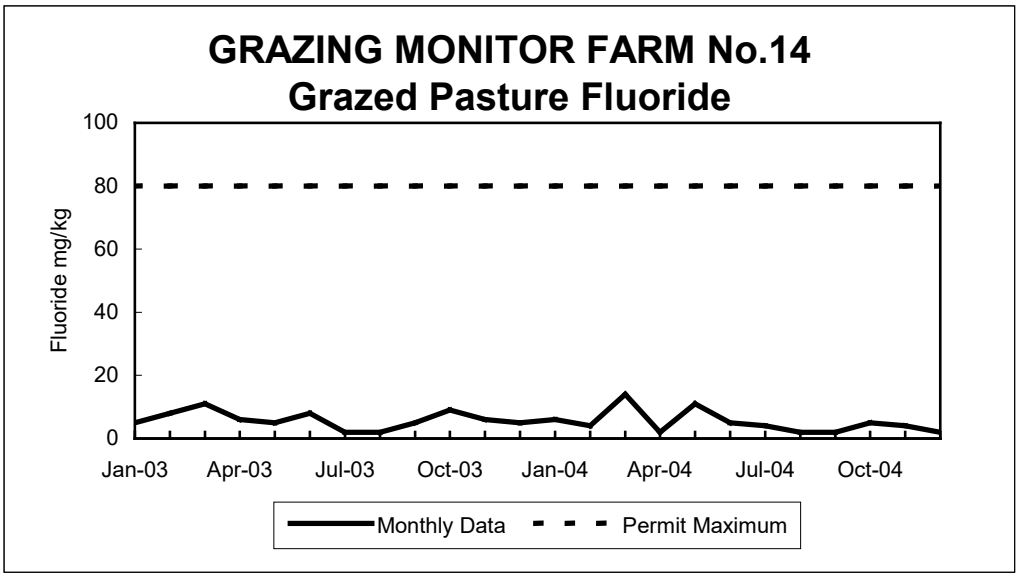
- fluoride in grazed pasture, and
- comments on the monitoring.

Fluoride in grazed pasture

The following table shows the grazed pasture monitoring results for 2004.

	Units	Standard	2004
Monthly sample maximum	mg/kg	80	14
Two monthly average maximum	mg/kg	60	9
Twelve monthly running average maximum	mg/kg	40	6
Annual average	mg/kg		5

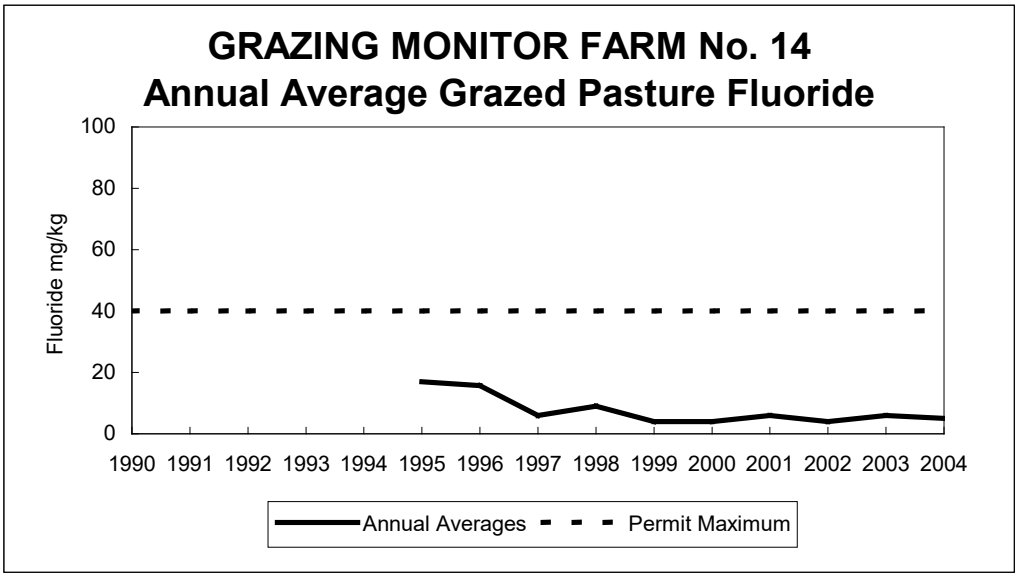
The following graph shows the results of monthly fluoride monitoring of grazed pasture during 2003 and 2004.



Grazing Monitor Farm No. 14, Continued

Fluoride in grazed pasture, continued

The following graph shows the annual average fluoride concentration in grazed pasture.



Comments

The fluoride concentration in grazed pasture was within the permit standards during 2004. The 2004 annual average grazed pasture fluoride concentration of 5 mg/kg was similar to the average concentration measured during 2003.

Grazing Monitor Farm No. 16

Introduction

The following information is contained in this section:

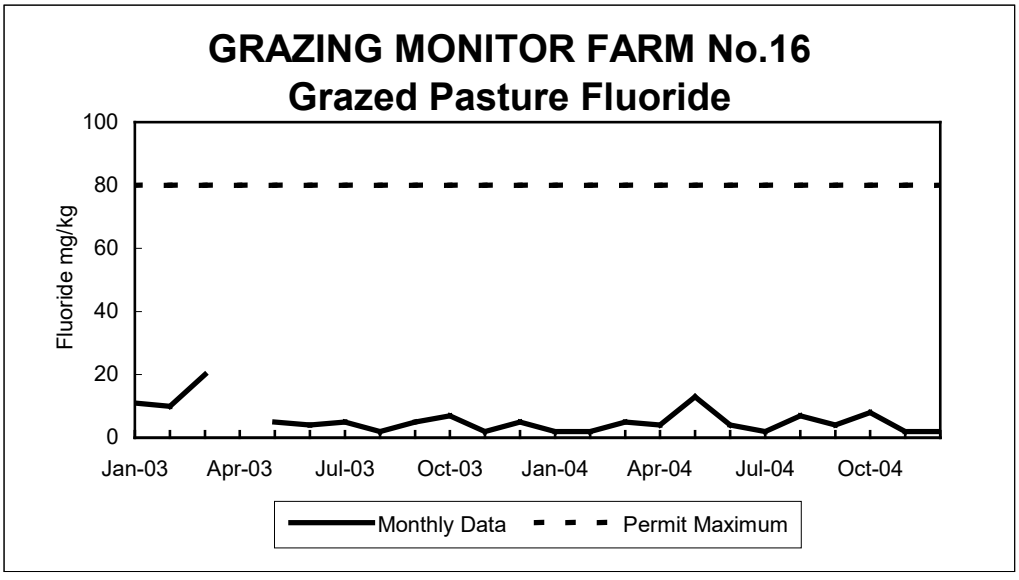
- fluoride in grazed pasture, and
- comments on the monitoring.

Fluoride in grazed pasture

The following table shows the grazed pasture monitoring results for 2004.

	Units	Standard	2004
Monthly sample maximum	mg/kg	80	13
Two monthly average maximum	mg/kg	60	9
Twelve monthly running average maximum	mg/kg	40	6
Annual average	mg/kg		5

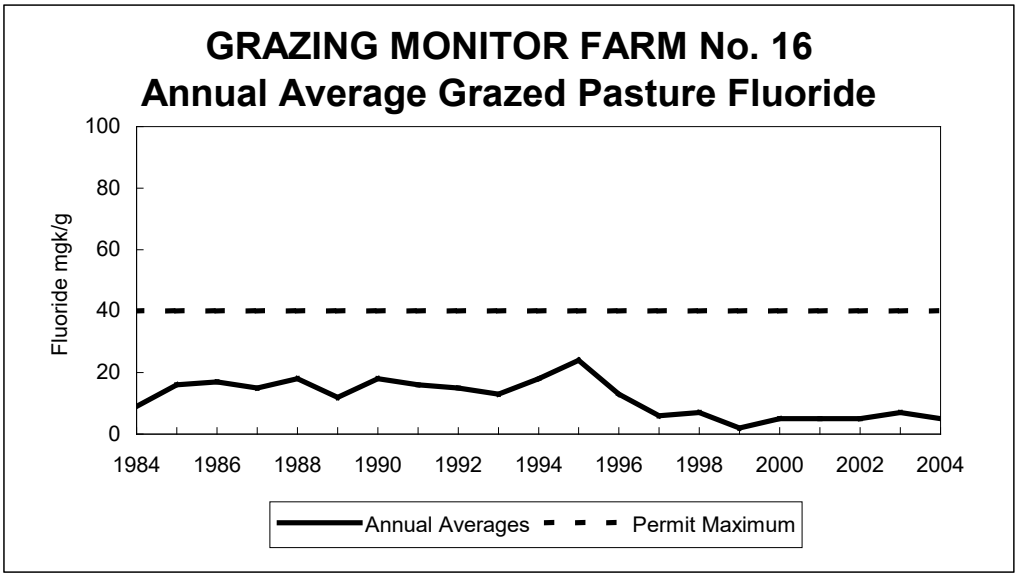
The following graph shows the results of monthly fluoride monitoring of grazed pasture during 2003 and 2004.



Grazing Monitor Farm No. 16

Fluoride in grazed pasture, continued

The following graph shows the annual average fluoride concentration in grazed pasture. Although GMF 16 was only included in the monitoring program in August 1994 an annual pasture graph has been produced including pre 1994 data from the neighbouring GMF 10 site. GMF10 was removed from the program in February 1998 as it is in the same ownership as GMF16 and pasture samples from the two farms during the years 1994 to 1998 indicated similar results.



Comments

The fluoride concentrations in grazed pasture were within the permit standards during 2004. The 2004 annual average grazed pasture fluoride concentration of 5 mg/kg was similar to the concentration measured in 2003. There was no sample data for April 2003 as fertilizer had been applied within 20 days of sampling.

Liquid Discharges and Their Effects

Introduction

Liquid discharges from the smelter are covered by six Coastal and Discharge Permits issued by the Southland Regional Council. These permits commenced in October 1996.

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.

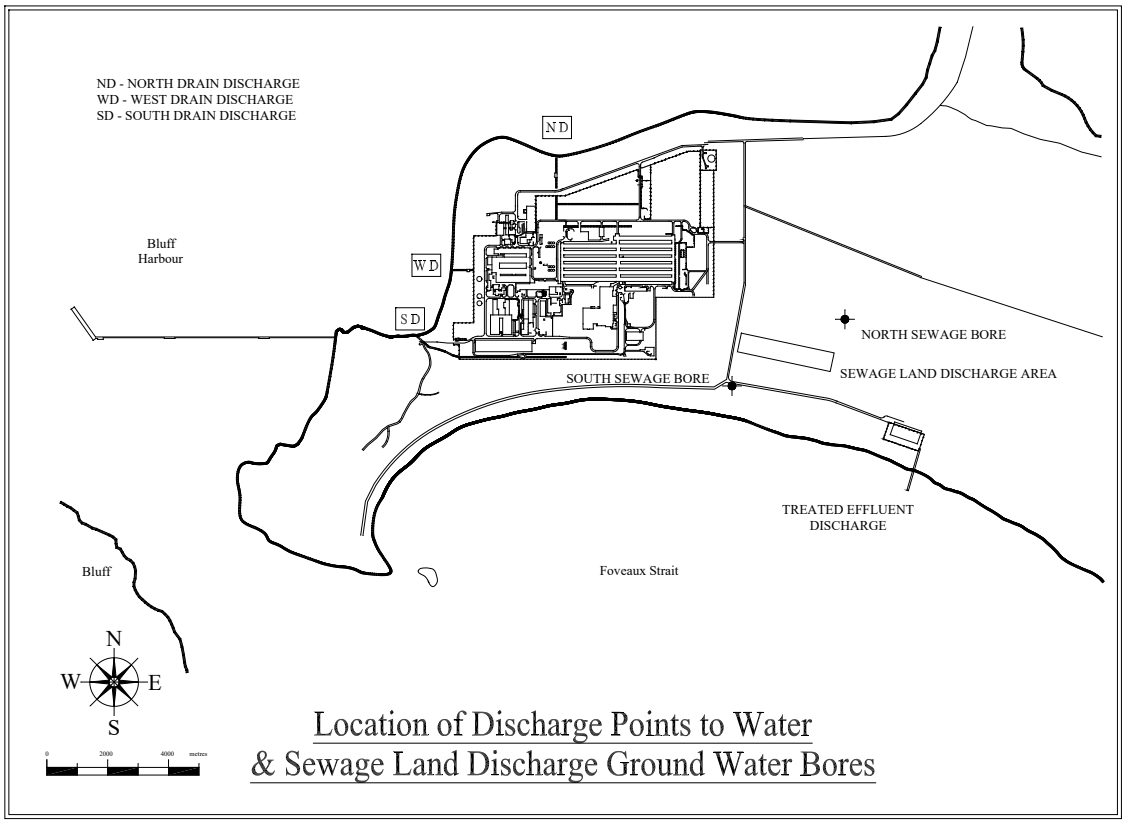
	Units	Limit
North, South, and West Drain		
• Quarterly average total suspended solids	g/m^3	30
Treated effluent		
• Maximum daily discharge	m^3/day	140
• Total suspended solids	g/m^3	100
• Free cyanide	g/m^3	20
Treated sewage		
• Maximum daily flow	m^3/day	295
• Biochemical oxygen demand	g/m^3	18
• Total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

The following permit limits apply to coastal water monitoring sites:

- the natural temperature shall not be changed by more than three degrees Celsius,
- the natural pH shall not be changed by more than 0.1 unit and at no time shall be less than 6.7 or greater than 8.5,
- there shall be no destruction of natural aquatic life by reason of a concentration of toxic substances nor shall the waters emit objectionable odours,
- the natural colour and clarity of the water shall not be changed to a conspicuous extent,
- the dissolved oxygen in solution in the waters shall not be reduced below 5 milligrams per litre,
- there shall be no production of any conspicuous oil or grease films,
- the fluoride concentration of coastal water relating to drain discharges shall not exceed 5.0 g/m^3, and
- the quarterly average fluoride concentration of coastal water relating to drain discharges shall not exceed 2.0 g/m^3.

Site Locations

The locations of the liquid discharge and their effects 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 is sampled once each discharge.

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 where:

- coastal water monitoring sites are chosen to monitor the effects of discharges on coastal waters and
- 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 bore north of the disposal area, upstream, and one bore south of the disposal area, downstream.

Monitoring is carried out at about six monthly intervals.

North Drain Discharges

Introduction

Discharges from the North Drain are covered by Coastal Permit 94501 which commenced on 8 October 1996.

Discharge monitoring results

The following table summarises the North Drain discharge monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Total suspended solids				
• Annual average	g/m^3	-	9.8	7.8
• Maximum quarterly average	g/m^3	30	11.2	10.5
• No. of times quarterly average > 30 g/m^3		0	0	0

Coastal water monitoring results

The following table summarises the North Drain weekly coastal water monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Fluoride				
• Annual average	g/m^3	-	1.4	1.4
• Maximum quarterly average	g/m^3	2.0	1.5	1.5
• No. of times quarterly average > 2.0 g/m^3		0	0	0
• Maximum individual sample	g/m^3	5.0	3.5	3.5
• No. of times individual sample > 5.0 g/m^3		0	0	0
pH				
• Maximum difference		0.1	0.3	0.1
• No. of times > 0.1		0	1	0
Visible oil				
• No. of times observed		0	0	0

The following table summarises the North Drain annual coastal water monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Difference in temperature	^{o} C	3.0	0.1	0.2
Minimum dissolved oxygen concentration	mg/litre	5.0	7.8	9.5

Comments

Discharges from the North Drain were all within permit limits during 2004.

South Drain Discharges

Introduction

Discharges from the South Drain are covered by Coastal Permit 94503 which commenced on 8 October 1996.

Discharge monitoring results

The following table summarises the South Drain discharge monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Total suspended solids				
• Annual average	g/m^3	-	2.4	3.8
• Maximum quarterly average	g/m^3	30	3.6	5.3
• No. of times quarterly average > 30 g/m^3		0	0	0

Coastal water monitoring results

The following table summarises the South Drain weekly coastal water monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Fluoride				
• Annual average	g/m^3	-	1.3	1.3
• Maximum quarterly average	g/m^3	2.0	1.3	1.3
• No. of times quarterly average > 2.0 g/m^3		0	0	0
• Maximum individual sample	g/m^3	5.0	1.4	1.6
• No. of times individual sample > 5.0 g/m^3		0	0	0
pH				
• Maximum difference		0.1	0.1	0.1
• No. of times > 0.1		0	0	0
Visible oil				
• No. of times observed		0	0	0

The following table summarises the South Drain annual coastal water monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Difference in temperature	^{o} C	3.0	0.4	0.2
Minimum dissolved oxygen concentration	mg/litre	5.0	9.4	9.6

Comments

Discharges from the South Drain were within permit limits during 2004.

West Drain Discharges

Introduction

Discharges from the West Drain are covered by Coastal Permit 94502 which commenced on 8 October 1996.

Discharge monitoring results

The following table summarises the West Drain discharge monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Total suspended solids				
• Annual average	g/m^3	-	10.6	9.1
• Maximum quarterly average	g/m^3	30	17.8	11.9
• No. of times quarterly average > 30 g/m^3		0	0	0

Coastal water monitoring results

The following table summarises the West Drain weekly coastal water monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Fluoride				
• Annual average	g/m^3	-	1.3	1.3
• Maximum quarterly average	g/m^3	2.0	1.3	1.3
• No. of times quarterly average > 2.0 g/m^3		0	0	0
• Maximum individual sample	g/m^3	5.0	1.4	1.4
• No. of times individual sample > 5.0 g/m^3		0	0	0
pH				
• Maximum difference		0.1	0.1	0
• No. of times > 0.1		0	0	0
Visible oil				
• No. of times observed		0	0	0

The following table summarises the West Drain annual coastal water monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Difference in temperature	^{o} C	3.0	0.1	0.1
Minimum dissolved oxygen concentration	mg/litre	5.0	8.0	9.6

Comments

Discharges from the West Drain were all within permit limits during 2004.

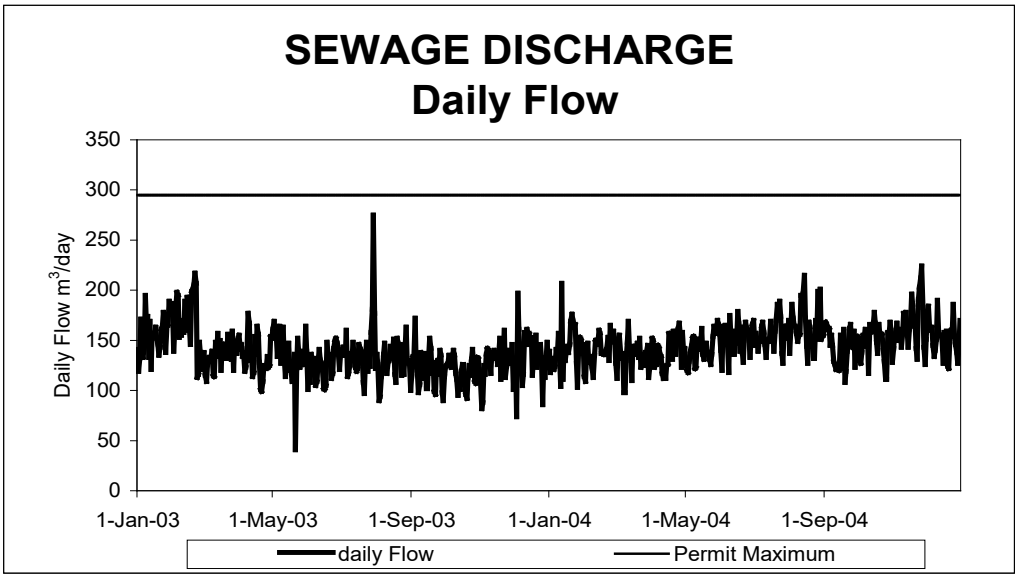
Treated Sewage Discharges

Introduction

Discharges of treated sewage onto land are covered by Discharge Permit Number 96122, which was granted on 16 October 1996.

Discharge monitoring results

The following graph shows the daily sewage discharge flow during 2003 and 2004. The permit limit for daily flow is 295 m^3/day.

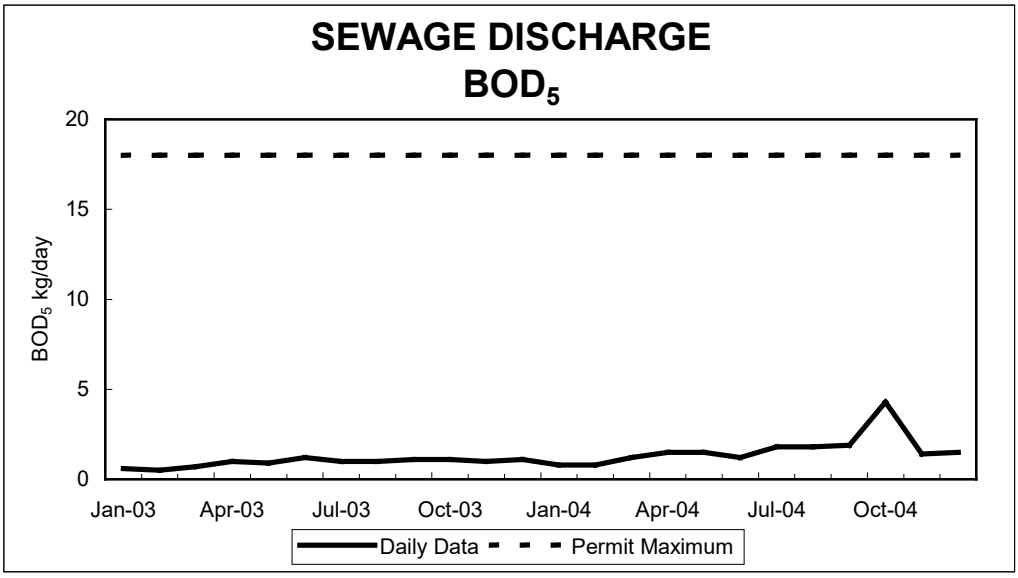


The following graph shows the annual average daily sewage discharge flow.

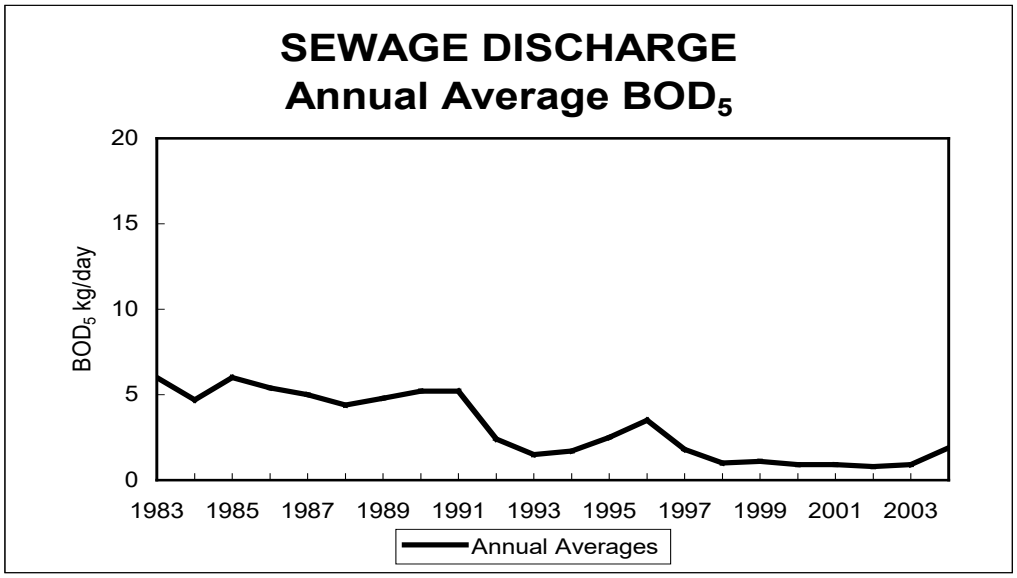
Treated Sewage Discharges, Continued

Discharge monitoring results, continued

The following graph shows the monthly biochemical oxygen demand (BOD_5) discharge from the sewage treatment plant during 2003 and 2004. The permit limit for BOD_5 is 18kg/day.



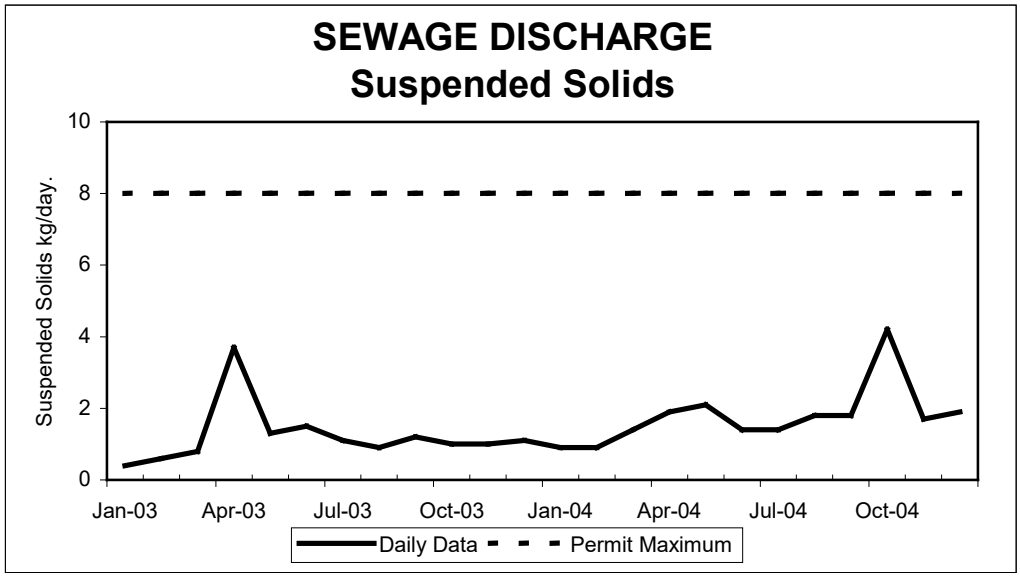
The following graph shows the annual average BOD_5 discharge from the sewage treatment plant.



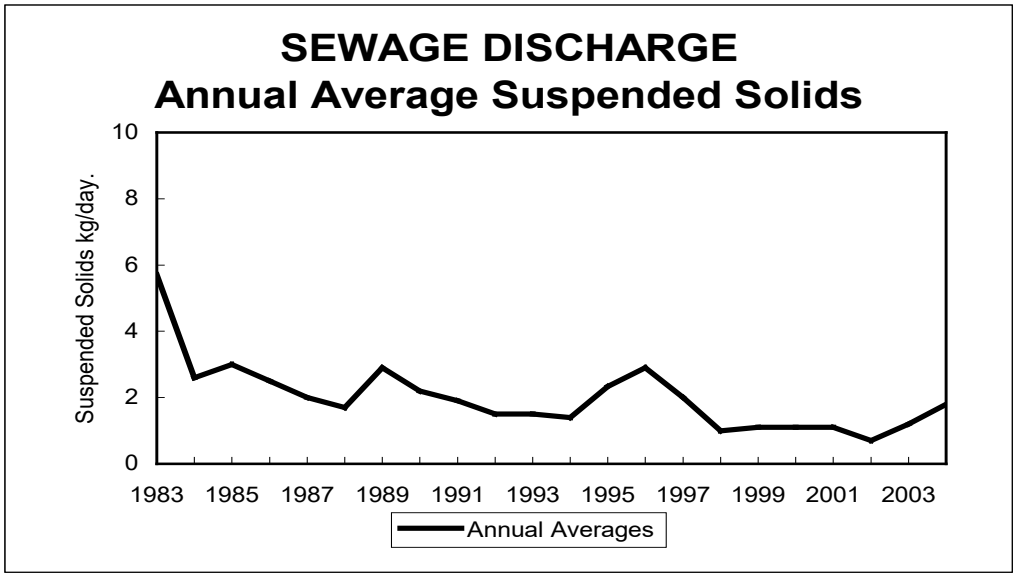
Treated Sewage Discharges, Continued

Discharge monitoring results, continued.

The following graph shows the monthly suspended solids discharge from the sewage treatment plant during 2003 and 2004. 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 map on page I.2.

Parameter	Units	2003 Average	2004 Average	Previous Range (post commission)
North Bore (Upstream)				
Faecal coliforms	MPN/100 ml	Absent	Absent	< 2
Total phosphorus	g/m^3	0.07	0.05	0.05 - 0.15
Total ammoniacal-N	g/m^3	0.01	0.01	0.01 - 0.03
Nitrate-N	g/m^3	0.001	0.002	< 0.01 - 0.06
Total Nitrogen	g/m^3	0.05	0.11	0.02 - 0.2
pH		7.8	7.7	7.5 - 8.1
Conductivity	µS/cm	329	327	309 - 333
Chlorinated Aliphatic HC	g/m^3	N.D.	N.D.	B.L.
South Bore (Downstream)				
Faecal coliforms	MPN/100 ml	Absent	Absent	< 2 - 23
Total phosphorus	g/m^3	0.00	<0.01	< 0.01 - 0.04
Total ammoniacal-N	g/m^3	<0.01	<0.01	0.01 - 0.02
Nitrate-N	g/m^3	0.017	0.039	< 0.01 - 0.35
Total Nitrogen	g/m^3	0.13	0.30	0.05 - 0.62
pH		7.8	7.9	7.2 - 7.9
Conductivity	µS/cm	400	423	232 - 421
Chlorinated Aliphatic HC	g/m^3	N.D.	N.D.	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 2004 were within permit limits.

Groundwater monitoring results are similar to those previously reported.

Treated Effluent Discharges

Introduction

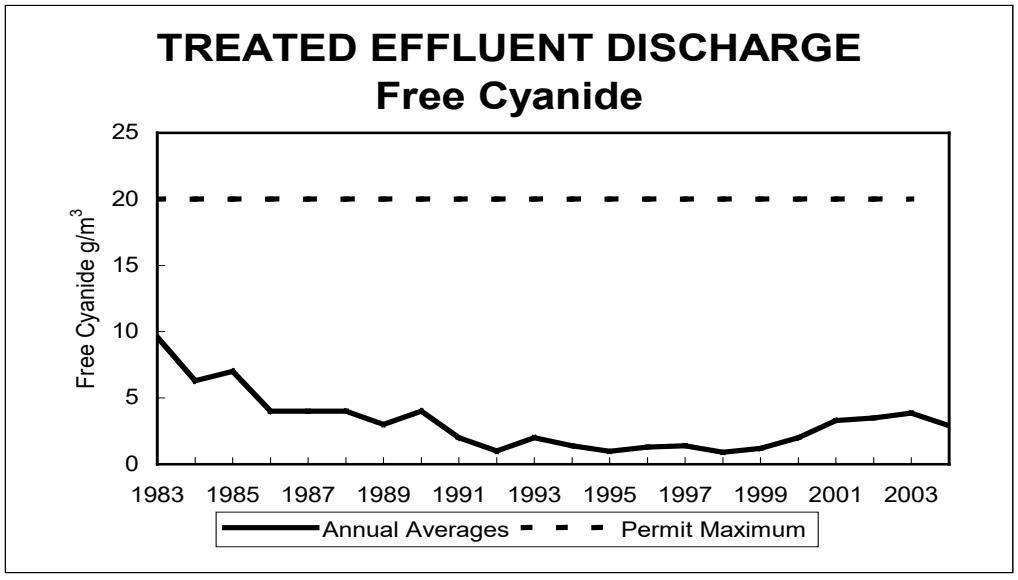
Discharges of treated effluent into Foveaux Strait are covered by Coastal Permit Number 94488 which commenced on 11 October 1996.

Discharge monitoring results

The following table summarises the results of treated effluent discharge monitoring during 2003 and shows a comparison with the 2004 results.

Parameter	Units	Limits	2003 Result	2004 Result
Maximum daily discharge	m^3/day	140	80	80
Suspended Solids				
Maximum Concentration			55.6	86
Average Concentration	g/m^3	100	13.3	11.4
No.> 100 g/m^3		0	0	0
Free Cyanide				
Maximum Concentration	g/m^3	20	11.8	10.4
Average Concentration			3.9	2.9
No.> 20 g/m^3		0	0	0

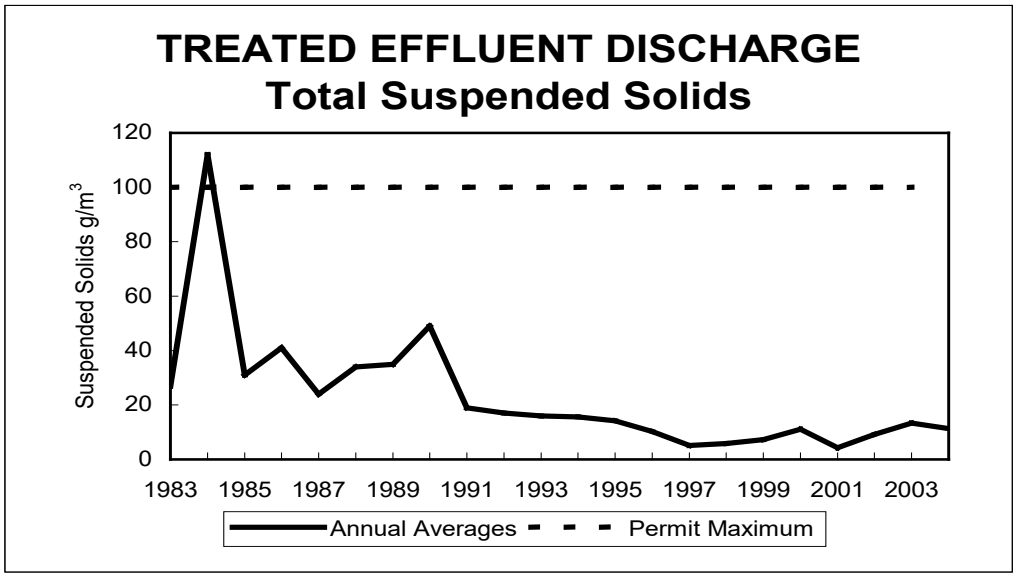
The following graph shows the annual average free cyanide concentration of treated effluent discharged.



Treated Effluent Discharges, Continued

Discharge monitoring results, continued

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



Coastal water monitoring results

The following table summarises the treated effluent annual coastal water monitoring results during 2004 and shows a comparison with 2003 results.

Parameter	Units	Limit	2003 Result	2004 Result
Change to temperature	^{o}C	3.0	0.1	0.0
Change to pH		0.1	0.0	0.0
Dissolved oxygen	mg/L	>= 5.0	7.8	9.0
No of times visible oil observed		0	0	0

Comments

All discharges of treated effluent were within permit limits during 2004.

Changes to the resource consent to extend the discharge pipe a further 150m seawards and replace the diffuser were granted in October 2003. This work was completed early in 2004 and commissioned in mid February 2004.

Treated Effluent Discharges, Continued

Coastal water monitoring results, continued

The new Cathode Outfall Discharge Structure including the diffuser was inspected on 27 May 2004. It was found that the structure was sitting on the bottom with the concrete base partly buried in the seabed. There was very slight weedy growth starting to form all over. The pipe and anchor blocks were all intact and well secured being partly buried in the seabed as well. The vent holes in the top of the discharge pipe were inspected and found to be in place and unobstructed. There was no evidence of any obstructions or breaks in the discharge pipe.

Landfill Operations

Introduction

Operation of the landfill on the smelter's Tiwai Point property is covered by Discharge Permit No. 94460 issued by the Southland Regional Council on 30 October 1995. A new permit was issued, Number 202196, on 8 December 2003.

This report covers:

- proposed operation at the landfill for the next twelve months,
- comments on operations for 2004,
- the amount and type of materials deposited at the landfill, and
- groundwater monitoring.

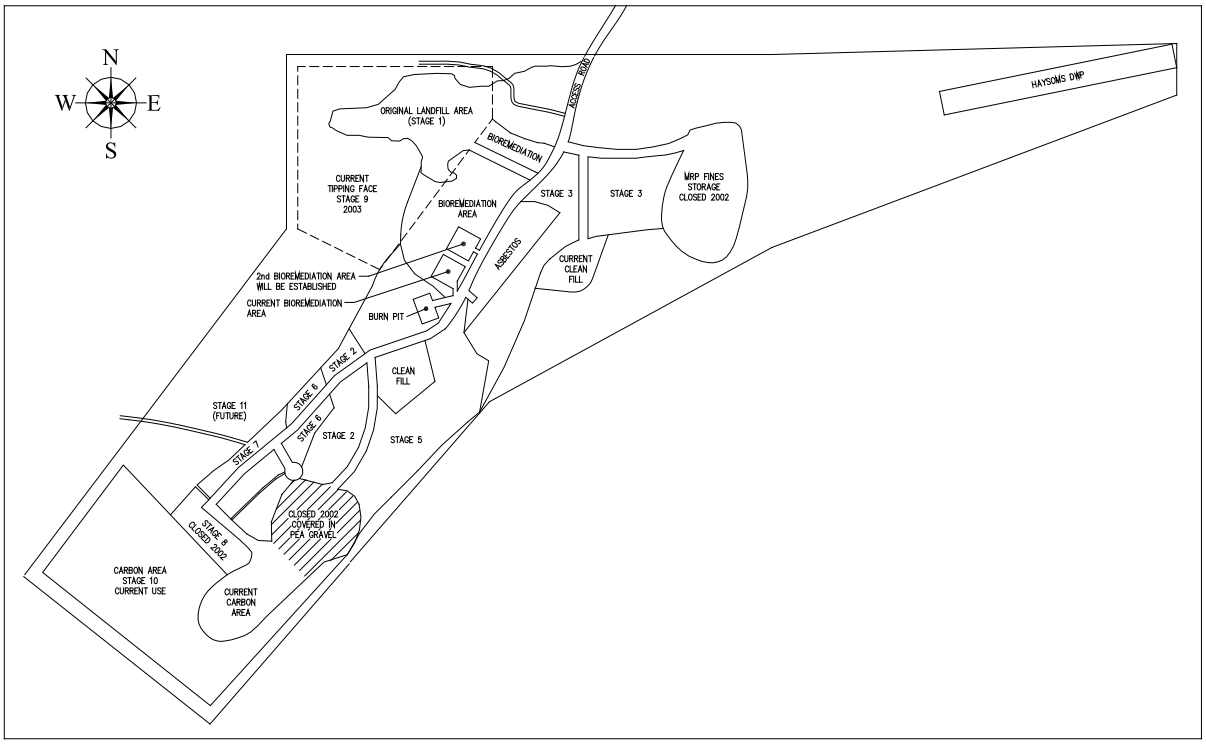
Proposed Operation For 2005

Introduction

The proposed operation of the landfill for 2005 is outlined in the NZAS Landfill Management Plan. Additional details on the proposed operations during 2005 are included in the following sections.

Landfill areas being developed or extended

The following map shows the current landfill disposal and storage areas.



Proposed Operation For 2005, Continued

Landfill areas being developed or extended, continued

There was continued use of the general waste tip face (stage 9). Its use will continue through 2005 in a southerly direction along the boundary of the landfill area.

The stage 10 carbon dust tipping area was opened in 2002 and will continue operation through 2005. Access to stage 10 is through part of the old tipping area with the dormant part now covered in pea gravel.

All tipping faces are marked with sleepers and signage and limited to 15 metres wide.

Special Work in 2005

Recovery of Aluminium from Dross (MRP)
Trials are planned to recover aluminium from the dross dumped in previous years. Talks are progressing with interested parties to determine their ability to use this by-product in their process. If this work is unsuccessful, the area will be capped.

Dumping of Drain Sediment
Approximately 100 tonnes of sediment from Reduction Line drains will be disposed of in settling ponds developed in the stage 2 area.

Recovery of Carbon
Trials are to be undertaken to recover carbon material for other industries as an alternative fuel.

Comments on Operations for 2004

Reopening of MRP (dross) area
Reopening of the MRP (dross) area did not go ahead. This was due to the redesign of the dust collection bins in Metal Products. The new bins allowed the by-product to be put into containers and shipped with dross material to Sims & Westerns in Australia who recover the aluminium and further process the other by-products.

New 4WD Tracks for Bore Water Monitoring
During 2004 work began on two new 4WD tracks to allow for easier and safer access to the landfill monitoring sites. The first of these tracks begins 10 metres north of the landfill wash down area and heads in the direction of bore A20 and when completed will end at bore A21. This track has about 30 metres to be completed. The second track begins 30 meters south of the end of the sealed landfill road and heads towards bore A23. This track requires about another 200 metres before completion. It is planned to have the tracks completed by December 2005.

Amount and Type of Materials Deposited

Introduction

Each year the smelter surveys the amount and type of material deposited at the Tiwai Point Landfill. The survey is usually conducted over a period of about four weeks during early summer.

Survey procedure

The survey took place over a period of 31 days from 13th December 2004 to 12th January 2005.

- Each truck load of waste was weighed before and after deposition at the landfill to obtain an accurate weight
- The contents and source of each truckload is recorded
- The amount of waste measured during the survey is used to estimate the annual deposition.
- Annual estimates are corrected to account for any special events that may occur during the annual survey.

Survey Results

The following table shows the various types of wastes observed in the NZAS landfill waste stream and their estimates for their annual generation rates over the past three survey periods.

Estimated Tonnes of Waste to the NZAS Landfill By Material			
Material	**2002/03**	**2003/04**	**2004/05**
Alumina	0	0	20
Bricks/Refractory	182	163	137
Carbon Material	3469	3221	2620
Concrete	0	20	0
Drain Sediment	500	0	100
Dust collector bags	26	22	10
Furnace Elements	5	16	0
Furnace slag	144	94	234
Grass	3	0	0
MMMF	0	0	3.6
Non- classifiable Waste	527	339	244.8
Paper/Cardboard	159	105	118
Plastic	142	71	74
Reject Bath	63	65	146
Rubber	14	20	2
Sand	19	0	50
Steel and other Metals	4	52	39.3
Textiles	5	2	22.7
Timber	101	159	85
Total	**4844**	**4348**	**3906**

Amount and Type of Materials Deposited, Continued

Survey Comments

Total waste to the landfill has decreased over the last four years with an expected decrease of 440 tonnes during 2005. There have been fluctuations in amounts of some types of materials. Some of this may be due to survey anomalies. (i.e: waste not generated evenly over a year.)

However there has been a genuine reduction in carbon dust and timber this year with recycling being implemented. NZAS is carrying out ongoing work to identify end users for process waste, namely carbon material and to reduce the amount of general waste to landfill.

During the survey period there was a quantity of alumina and sand deposited at the Landfill. While this contaminated alumina material went to Landfill, in the future the product will be recycled into the process. The sand was the result of a sand blasting campaign over the time of the survey. It is expected that the sand blasting activities will continue during 2005.

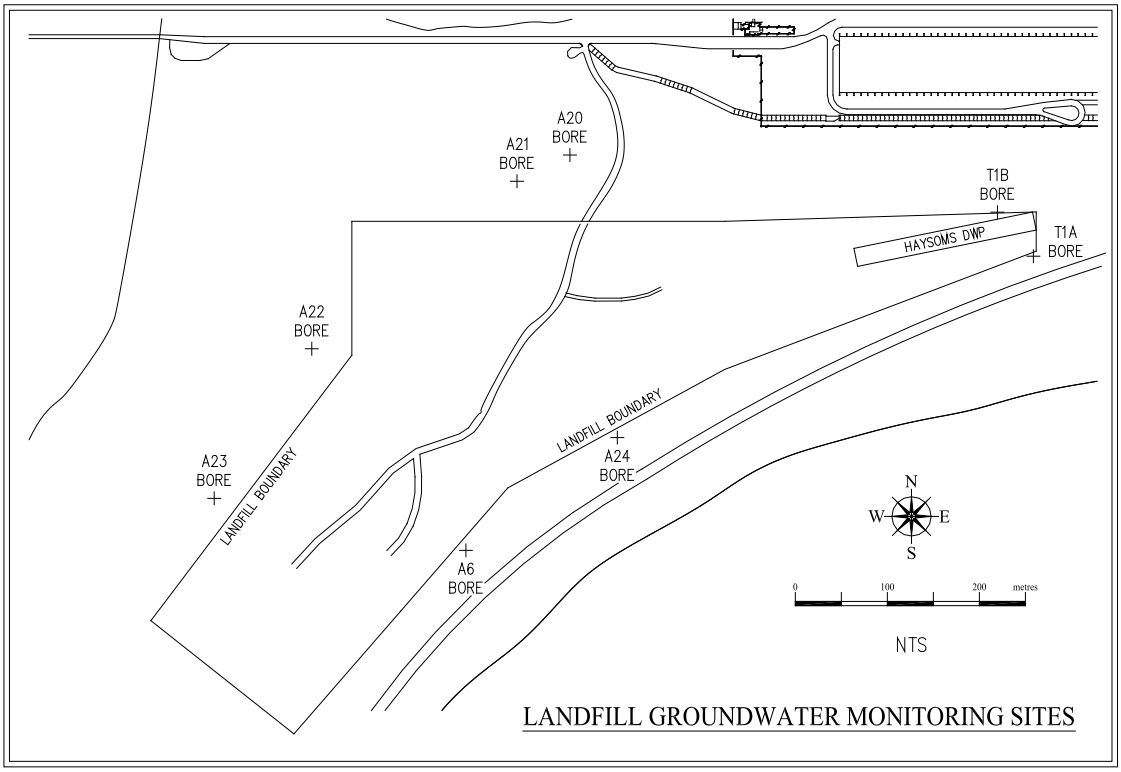
Methodology for the collection of gross survey data is consistent with the past four years. During the processing of the data this year, some figures were referenced to other landfill tracking records and adjustments made.

In the 2005 report it is proposed to use the previous 12 months data for process waste and limit the survey to general waste data. This will improve the level of confidence attached to the data.

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 2003 and 2004. Bore A20 is located north of the landfill (upstream).

Analyte	Units	2003 Average	2004 Average	Range (since Commissioning)
Temperature	^{0}C	10	9.7	7.5 - 13.4
pH		6.3	6	5.4 - 7.2
Conductivity	µS/cm	848	824	644 - 912
Alkalinity	g/m^3	33.5	26	8 - 146
Carbonaceous BOD5	g/m^3	2	<1	<1 - 6
Total Nitrogen	g/m^3	0.3	0.3	0.1 - 1.3
Total Ammoniacal Nitrogen	g/m^3	0.05	0.06	0.02 - 0.16
Fluoride	g/m^3	0.1	0.06	0.03 - 0.28
Sulphate	g/m^3	33	35	27 - 47
Total Iron	g/m^3	6.91	11.87	0.72 - 16.5
Total Petroleum Hydrocarbons	g/m^3	<1	N.D.	<1 - 11.6
Total Kjeldahl Nitrogen	g/m^3	0.3	0.2	0.3 - 0.5
Nitrate Nitrogen	g/m^3	<0.002	N.D.	<0.002 - 14
Nitrite Nitrogen	g/m^3	<0.002	N.D.	<0.002 - 0.014
Weak Acid Dissociable Cyanide	g/m^3	<0.001	N.D.	<0.001 - 0.1
Boron	g/m^3	0.041	N.D.	0.038 - 0.067
Manganese	g/m^3	0.195	N.D.	0.115 - 0.394
Nickel	g/m^3	0.0035	N.D.	0.002 - 0.01
Potassium	g/m^3	3.82	N.D.	3.3 - 4.1
Vanadium	g/m^3	0.002	N.D.	<0.001 - 0.003

N.D: Not analysed – only required biennially.

Landfill Groundwater Monitoring, Continued

Bore A21 monitoring results

The table below shows a summary of results from samples collected from bore A21 during 2003 and 2004. Bore A21 is located north of the landfill (upstream).

Analyte	Units	2003 Average	2004 Average	Range (since Commissioning)
Temperature	^{0}C	9.8	8.7	6.5 - 13.7
pH		6.0	5.65	5.1 - 6.3
Conductivity	µS/cm	1079	1125	683 - 1723
Alkalinity	g/m^3	23	15.5	9 - 160
Carbonaceous BOD5	g/m^3	<1	<1	<1 - 16
Total Nitrogen	g/m^3	1.2	1.1	0.7 - 8
Total Ammoniacal Nitrogen	g/m^3	0.47	0.36	0.1 - 4.6
Fluoride	g/m^3	0.56	0.59	0.19 - 0.83
Sulphate	g/m^3	61	73	29 - 101
Total Iron	g/m^3	17.6	12.8	2.2 - 94.6
Naphthalene	mg/m^3	<0.1	<0.1	<0.1 - 0.1
Anthracene	mg/m^3	<0.02	<0.02	<0.02 - 0.03
Phenanthrene	mg/m^3	0.008	<0.005	<0.005 - 0.02
Fluoranthene	mg/m^3	<0.02	<0.02	<0.02 - 0.015
Total Petroleum Hydrocarbons	g/m^3	<1	N.D.	<1 - 7.3
Total Kjeldahl Nitrogen	g/m^3	1.15	1.1	0.8 - 6.5
Nitrate Nitrogen	g/m^3	0.01	N.D.	0.01 - 29
Nitrite Nitrogen	g/m^3	0.013	N.D.	<0.002 - 0.028
Weak Acid Dissociable Cyanide	g/m^3	0.001	N.D.	<0.001 - 0.1
Boron	g/m^3	0.109	N.D.	0.077 - 0.154
Manganese	g/m^3	0.126	N.D.	0.1 - 0.473
Nickel	g/m^3	0.004	N.D.	<0.0005 - 0.007
Potassium	g/m^3	7	N.D.	5 - 11
Vanadium	g/m^3	0.01	N.D.	0.001 - 0.043

N.D: Not analysed – only required biennially.

Landfill Groundwater Monitoring, Continued

Bore T1B monitoring results

The table below shows a summary of results from samples collected from bore T1B during 2003 (before deposition of any Haysoms DWP) and 2004. Bore T1B is located on the north side (upstream) of the Haysoms DWP area.

Analyte	Units	2003 Average	2004 Average	Range
pH	-	7.8	7.8	7.4 - 7.8
Alkalinity	$g.m^{-3}$	148	133	144 - 150
Temperature	^{0}C	7.8	7.8	7.4 - 7.8
Conductivity	$\mu S.cm^{-1}$	526	535	394 - 649
Carbonaceous BOD_5	$g.m^{-3}$	1	<1	<1 - 2
Fluoride	$g.m^{-3}$	0.01	0.14	0.11 - 0.86
Sulphate	$g.m^{-3}$	20	16	18.2 - 20.2
Total Iron	$g.m^{-3}$	0.03	0.02	0.03 - 0.03
Boron	$g.m^{-3}$	0.044	N.D.	0.044 - 0.044
Manganese	$g.m^{-3}$	<0.01	N.D.	<0.01 - <0.01
Potassium	$g.m^{-3}$	2.7	N.D.	2.56 - 2.84
Vanadium	$g.m^{-3}$	<0.01	N.D.	<0.01 - <0.01
Nickel	$g.m^{-3}$	<0.01	N.D.	0.0006 - 0.0006
Ammoniacal-Nitrogen	$g.m^{-3}$	<0.01	<0.01	<0.01 - <0.01
Total Nitrogen	$g.m^{-3}$	2	2	1.9 - 2.4
Total Kjeldahl Nitrogen	$g.m^{-3}$	0.400	N.D.	0.3 - 0.4
Nitrate Nitrogen	$g.m^{-3}$	1.63	N.D.	1.52 - 1.74
Nitrite Nitrogen	$g.m^{-3}$	0.072	N.D.	0.067 - 0.077
Total Petroleum Hydrocarbons	$g.m^{-3}$	N.D.	N.D.	N.D.
Weak Acid Dissociable Cyanide	$g.m^{-3}$	<0.001	N.D.	<0.001 - <0.001

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 2003 and 2004. Bore A22 is located west of the landfill.

Analyte	Units	2003 Average	2004 Average	Range (since Commissioning)
Temperature	^{0}C	10.0	9.6	8.6 - 12.1
pH		4.8	5.7	4.2 - 7.3
Conductivity	µS/cm	581	519	354 - 1204
Alkalinity	g/m3	5	18	1 - 294
Carbonaceous BOD5	g/m3	2.0	0.5	<1 - 12
Total Nitrogen	g/m3	2.2	1.60	0.4 - 2.8
Total Ammoniacal Nitrogen	g/m3	0.11	0.34	0.05 - 0.47
Fluoride	g/m3	2.0	0.40	0.38 - 2.8
Sulphate	g/m3	19	9	9 - 44
Total Iron	g/m3	1.6	1.7	0.6 - 3.5
Total Petroleum Hydrocarbons	g/m3	<1	N.D.	<1 - 3.45
Total Kjeldahl Nitrogen	g/m3	2.1	2.2	0.9 - 2.3
Nitrate Nitrogen	g/m3	0.053	N.D.	<0.02 - 0.2
Nitrite Nitrogen	g/m3	0.004	N.D.	<0.002 - 0.042
Weak Acid Dissociable Cyanide	g/m3	<0.001	N.D.	<0.001 - 0.1
Boron	g/m3	0.052	N.D.	0.006 - 0.066
Manganese	g/m3	0.017	N.D.	0.005 - 0.394
Nickel	g/m3	0.001	N.D.	0.001 - 0.01
Potassium	g/m3	1.74	N.D.	1.7 - 4.1
Vanadium	g/m3	0.007	N.D.	0.002 - 0.022

N.D: Not analysed – only required biennially.

Landfill Groundwater Monitoring, Continued

Bore A23 monitoring results

The table below shows a summary of results from samples collected from bore A23 during 2003 and 2004. Bore A23 is located west of the landfill.

Analyte	Units	2003 Average	2004 Average	Range (since Commissioning)
Temperature	^{0}C	10.3	10.0	9 - 12.5
pH		6.3	6.1	5.4 - 6.4
Conductivity	µS/cm	498	511	378 - 745
Alkalinity	g/m3	34	35	31 - 60
Carbonaceous BOD5	g/m3	1.3	1	0.5 - 5
Total Nitrogen	g/m3	1.5	2.1	0.9 - 2.7
Total Ammoniacal Nitrogen	g/m3	1.0	1.2	0.05 - 1.4
Fluoride	g/m3	0.11	0.04	0.03 - 0.36
Sulphate	g/m3	1.1	0.3	0.3 - 30
Total Iron	g/m3	6.5	4.6	4.4 - 13
Total Petroleum Hydrocarbons	g/m3	<1	N.D.	<1 - 7.2
Total Kjeldahl Nitrogen	g/m3	1.5	2.0	1.1 - 2.3
Nitrate Nitrogen	g/m3	0.02	N.D.	<0.02 - 0.05
Nitrite Nitrogen	g/m3	0.003	N.D.	<0.02 - 0.019
Weak Acid Dissociable Cyanide	g/m3	0.0005	N.D.	<0.001 - 0.1
Boron	g/m3	0.046	N.D.	0.038 - 0.05
Manganese	g/m3	0.0497	N.D.	0.05 - 0.118
Nickel	g/m3	0.001	N.D.	<0.0005 - 0.002
Potassium	g/m3	4.67	N.D.	4 - 5
Vanadium	g/m3	0.014	N.D.	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 2003 and 2004. Bore A24 is located south east of the landfill.

Analyte	Units	2003 Average	2004 Average	Range (since Commissioning)
Temperature	^{0}C	10.5	10.2	9.4 - 12.8
pH		7.9	8.1	6.9 - 8.2
Conductivity	µS/cm	4190	5840	1400 - 5890
Alkalinity	g/m3	1161	1710	414 - 1640
Carbonaceous BOD5	g/m3	43	63.5	2 - 65
Total Nitrogen	g/m3	202	341.5	16.8 - 322
Total Ammoniacal Nitrogen	g/m3	166.5	233	28.2 - 256
Fluoride	g/m3	37	44	0.49 - 44
Sulphate	g/m3	100	68.5	5 - 312
Total Iron	g/m3	29	54.5	8.2 - 60
Naphthalene	mg/m3	84.9	203.5	0.06 - 268
Anthracene	mg/m3	<0.3	0.37	<0.3 - 0.59
Phenanthrene	mg/m3	0.485	1.23	<0.3 - 2.31
Fluoranthene	mg/m3	<0.3	<0.3	<0.3 - 0.24
Total Petroleum Hydrocarbons	g/m3	<1	N.D.	<1 - 18.6
Total Kjeldahl Nitrogen	g/m3	199	360	67 - 247
Nitrate Nitrogen	g/m3	0.81	N.D.	0.05 - 1.23
Nitrite Nitrogen	g/m3	0.01	N.D.	0.01 - 0.632
Weak Acid Dissociable Cyanide	g/m3	0.012	N.D.	0.005 - 0.1
Boron	g/m3	9.22	N.D.	4.08 - 9.22
Manganese	g/m3	0.197	N.D.	0.11 - 0.197
Nickel	g/m3	0.024	N.D.	0.004 - 0.024
Potassium	g/m3	60	N.D.	11.1 - 60
Vanadium	g/m3	1.4	N.D.	0.31 - 1.41

N.D: Not analysed – only required biennially.

Landfill Groundwater Monitoring, Continued

Bore A6 monitoring results

The table below shows a summary of results from samples collected from bore A6 during 2003 and 2004. Bore A6 is located south east of the landfill.

Analyte	Units	2003 Average	2004 Average	Range (since Commissioning)
Temperature	^{0}C	11.6	11.2	10.3 - 13.5
pH		7.3	7.2	6.1 - 7.6
Conductivity	µS/cm	3430	4265	158 - 5689
Alkalinity	g/m^3	643	710	478 - 943
Carbonaceous BOD5	g/m^3	2	2	1 - 6
Total Nitrogen	g/m^3	29	40	9.7 - 44
Total Ammoniacal Nitrogen	g/m^3	16.8	32	1.3 - 34.7
Fluoride	g/m^3	31	4	2 - 104
Sulphate	g/m^3	1045	1540	674 - 2050
Total Iron	g/m^3	16.6	25.5	9.9 - 29.8
Naphthalene	mg/m^3	0.150	0.088	<0.1 - 0.15
Anthracene	mg/m^3	0.490	0.615	0.05 - 1.34
Phenanthrene	mg/m^3	<0.05	<0.05	<0.05 - 0.08
Fluoranthene	mg/m^3	0.0250	0.015	<0.01 - 0.09
Total Petroleum Hydrocarbons	g/m^3	<1	N.D.	<1 - 9.2
Total Kjeldahl Nitrogen	g/m^3	26.1	35.2	14.2 - 35.2
Nitrate Nitrogen	g/m^3	3.43	N.D.	0 - 14
Nitrite Nitrogen	g/m^3	0.05	N.D.	0.004 - 0.17
Weak Acid Dissociable Cyanide	g/m^3	0.012	N.D.	0.012 - 0.1
Boron	g/m^3	1.06	N.D.	0.9 - 2.5
Manganese	g/m^3	0.72	N.D.	0.2 - 1.9
Nickel	g/m^3	0.01	N.D.	0.005 - 0.022
Potassium	g/m^3	24.4	N.D.	17.6 - 37
Vanadium	g/m^3	0.07	N.D.	0.05 - 0.22

N.D: Not analysed – only required biennially.

Landfill Groundwater Monitoring, Continued

Bore T1A monitoring results

The table below shows a summary of results from samples collected from bore T1A in 2003 (before any deposition of Haysoms DWP) and 2004. Bore T1A is located south east of the Haysoms DWP area.

Analyte	Units	2003 Average	2004 Average	Range
pH	-	7.8	8.2	7.5 - 7.9
Alkalinity	$g.m^{-3}$	120	370	108 - 122
Temperature	^{0}C	10.6	11.4	10.6 - 11
Conductivity	$\mu S.cm^{-1}$	480	2027	473 - 603
Carbonaceous BOD_5	$g.m^{-3}$	1	5	<1 - 1
Fluoride	$g.m^{-3}$	0.01	1.41	0.025 - 0.08
Sulphate	$g.m^{-3}$	18	90	17.4 - 20.5
Total Iron	$g.m^{-3}$	0.01	0.34	0.01 - 0.05
Boron	$g.m^{-3}$	0.051	N.D.	0.05 - 0.051
Manganese	$g.m^{-3}$	0.0010	N.D.	0.0006 - 0.0014
Potassium	$g.m^{-3}$	2.6	N.D.	2.44 - 2.68
Vanadium	$g.m^{-3}$	<0.01	N.D.	<0.01 - <0.01
Nickel	$g.m^{-3}$	<0.01	N.D.	<0.01 - <0.01
Ammoniacal-Nitrogen	$g.m^{-3}$	<0.01	59.5	<0.01 - <0.01
Total Nitrogen	$g.m^{-3}$	1.7	138.0	1.7 - 10.7
Total Kjeldahl Nitrogen	$g.m^{-3}$	0.4	N.D.	0.4 - 0.4
Nitrate Nitrogen	$g.m^{-3}$	1.26	N.D.	1.25 - 1.26
Nitrite Nitrogen	$g.m^{-3}$	0.005	N.D.	0.003 - 0.006
Total Petroleum Hydrocarbons	$g.m^{-3}$	N.D.	N.D.	N.D.
Weak Acid Dissociable Cyanide	$g.m^{-3}$	<0.001	N.D.	<0.001 - <0.001

N.D: Not analysed – only required biennially.

Landfill Groundwater Monitoring, Continued

Comments

Apart from Bore A24 and Bore T1A the groundwater monitoring data from the bores near the landfill do not indicate any significant trends in the general groundwater quality during 2004.

Bore A24 has showed an increasing trend in a number of analyte concentrations during 2004. Bore A24 is located approximately 200m southwest of the MRP fines area.

These increases over the past couple of years have been attributed to seepage from a bunded area created 4 – 5 years ago adjacent to the then active MRP storage area. Leachate from the storage of MRP fines and their rainwater runoff has collected in this area creating an enriched body of water. Overtime, ponding of water within this bunded area created a head of water and thus provides a mechanism for the movement of the enriched water into the groundwater. Flow of the groundwater is southeast towards the coast. In April/May 2004 the bund wall was removed and the ponding ceased. Survey analyte concentrations seem to have stablised since then. This was noted between the June survey (immediately after the bund was removed) and the October survey for 2004.

Bore T1A has shown an increase in analyte concentrations during 2004. Bore T1A is located south east of the Haysoms DWP area.

The increases have appeared since the deposition of the Haysom's Dross. It is expected that Bore T1A is beginning to show the influence of the leachate from the deposited Haysom's DWP.

Groundwater

Spent Cathode Pad Leachate

The monitoring included measuring the conductivity in the groundwater of three monitoring wells at six-monthly intervals, and a further six wells at 12 monthly intervals. The monitoring in 2004 indicated no leakage.

Spent Cell Lining Storage Shed

Monitoring of the membranes under the Spent Cell Lining storage shed continued during 2004. A pumping program to remove the water from the membrane, detected in quarter four 2001, was started in August 2002. Some of the ports into the membrane have been found to be dry at present, so pumping has been adjusted to focus on those areas of the membrane still containing liquid. All of the ports are still being checked monthly for liquid. The content of the liquid is being monitored quarterly. The elevated concentrations of cyanide and fluoride in the liquid obtained and analysed have continued to decrease but are still not back to pre 2001 concentrations. Monitoring of the groundwater around the shed shows that the concentrations of cyanide and fluoride in the groundwater have not changed significantly or have been affected by the increased volume of liquid detected in the shed membranes.