Tiwai Peninsula

preliminary report - contaminated site

Old carbon disposal area, NZAS landfil
Photo credit: New Zealand's Aluminium Smelther (NZAS)

Murihiku Regeneration

March 2021

Tiwai Point – contaminated site
Report in response to ES Briefing Note

Summary

The New Zealand Aluminium Smelter (NZAS) site on Tiwai Peninsula has been identified by the Ministry for the Environment as a highly contaminated Hazardous Activities and Industries List (HAIL) site[1].

Industries listed as a HAIL site are those that are likely to cause land contamination resulting from hazardous substance use, storage or disposal. The activities at Tiwai Smelter meet all three criteria: the use, storage and disposal of a range of hazardous substances.

The purpose of this report is to explore the range of potential contaminants located at Tiwai Point, that are the direct result of Tiwai Aluminium Smelter activities. This report has been based around information provided by Environment Southland's Briefing Note (February 2021) and information gleaned from various news articles, reports, and newsletters. Information is focused on contaminants that have the potential to infiltrate soils, groundwater, and pollute the ocean. Air-borne pollutants are not covered.

Current understanding of the range and extent of soil and water contamination of Tiwai Point is limited. However, the aim of this report is to get an initial understanding of the potential range of contaminants located in the landfill, within onsite storage facilities, in the soil, and in underlying gravels and groundwater.

Understanding Tiwai as a contaminated site is urgent, irrespective of how long the smelter continues to operate. Many of the contaminants are persistent in the environment and will remain hazardous for generations to come if not mitigated in some way. The future of Tiwai Point as a geological feature is also uncertain. Tiwai Point is low-lying and sea level rise due to global warming is a very real threat. In addition, the peninsula is largely made up of gravel deposits, which are easily eroded. A further risk is the location of the peninsula in a known tsunami risk zone.

Media focus has largely been on landfilled dross and the precarious storage of Spend Cell Lining (SCL). However, Tiwai Point contains a cocktail of contaminants that would be catastrophic for the coastal environment if current containment were breached. Long-term, the hazardous substances and contaminants located at Tiwai Point cannot remain.

[1] https://www.mfe.govt.nz/land/hazardous-activities-and-industries-list-hail

Contents

1. Background and context

1.1 File Note

In February 2021 Environment Southland released a File Note regarding 'Environmental and Compliance Risks at the Tiwai Aluminium Smelter related to site closure'. The following is the summary of environmental implications provided by Environment Southland (ES).

Environmental implications of closure and associated risks:

1. The NZAS site is a highly contaminated HAIL site. It is desirable to avoid dispersion of these contaminants around the site or to other locations. Any unconsented discharge of contaminated soils within or outside the site may constitute a breach of the RMA or proposed Southland Water and Land Plan.

2. At this stage Environment Southland does not have access to the company's Closure Plan. Depending on the nature of that plan one or more consents may be required with Environment Southland or Invercargill City Council.

    - Decommissioning of the plant will likely trigger the need for a consent with the Invercargill City Council under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health and a detailed site investigation will be required.

    - The NZAS landfill will not have capacity for demolition waste from the whole of site, nor is it consented for it. NZAS may require consent with Environment Southland to landfill demolition waste and contaminated soils on/off site as per rules 45 or 46 of the proposed Southland Water and Land Plan.

3. The implications of climate change and associated sea level rise and potential coastal erosion and inundation needs to be a factor when considering the long-term legacy of site closure. The area is very low lying and subject to strong tidal and wave action from Foveaux straight, while the geology is almost exclusively unconsolidated sand and gravels.

The importance of geology and understanding future predicted sea level rise are highlighted in the sections below. The loose gravel geology combined with sea level rise means that contaminants that remain on the peninsula post smelter closure will inevitably reach the coastal environment in the decades to come.

1.2 Geology

The subsurface geology of the Tiwai GMZ is relatively well defined from the large number of drillholes which have been installed for the NZAS smelter. From the available data the subsurface geology appears relatively consistent across much of the Tiwai Peninsula. Most bore logs show a layer of relatively clean, well sorted, quartz gravels (pea gravels) extending to a depth of approximately 5 metres below sea level. These gravels form a large shallow freshwater lens (Environment Southland[2]). A diagrammatic cross-section showing the geology of the Tiwai Peninsula is shown in Figure 1.

[2] https://maps.es.govt.nz/apps/groundwater/zones/Tiwai.pdf

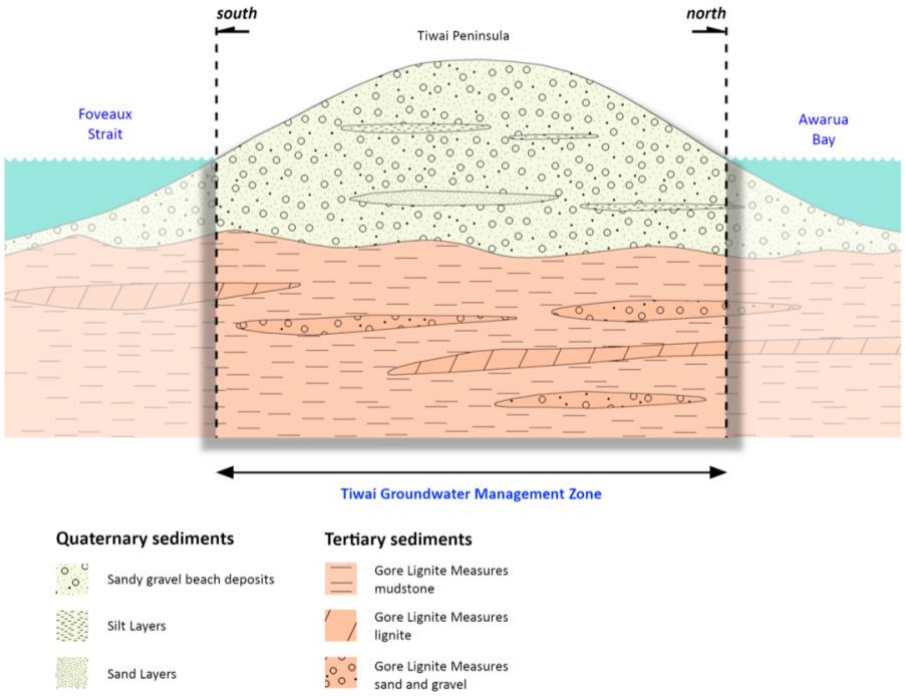

Figure 1: Cross-section of the Tiwai Peninsula showing geology. Sand and sand/gravel deposits extend to a depth of 20-25 metres. Source: Environment Southland.

Sand and sand/gravel deposits host a shallow unconfined aquifer system that effectively forms a freshwater lens underlying the peninsula (Figure 2). Depth to groundwater ranges from 2-5 metres, increasing with elevation towards the middle of the peninsula. Within the deeper mudstone, there are lenses of sand and gravel that host limited confined groundwater resources.

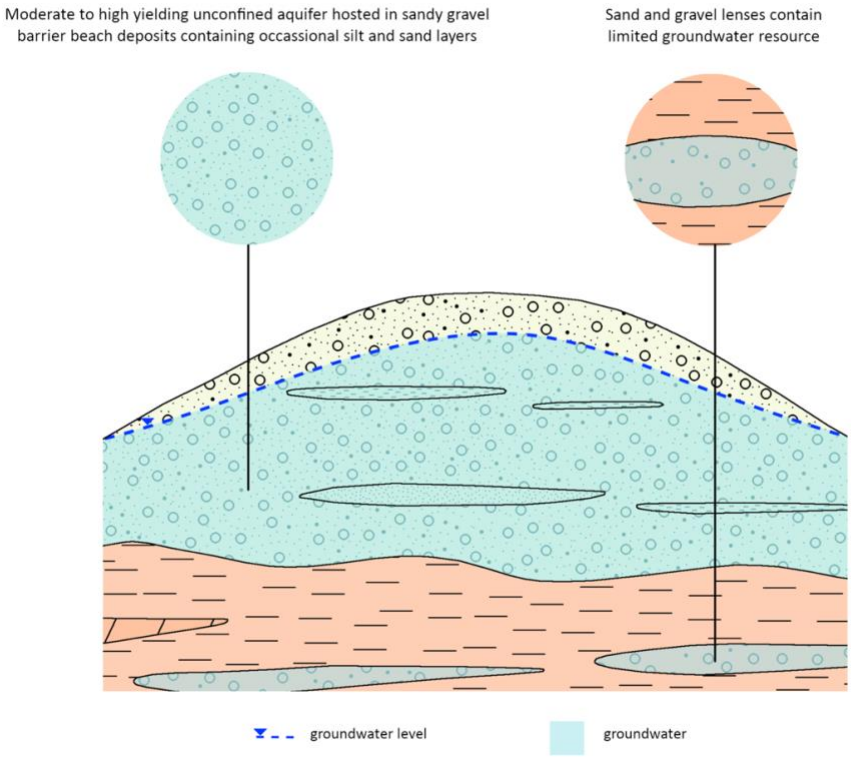

Figure 2: Cross-section of groundwater resources in the Tiwai Groundwater Management Zone. Source: Environment Southland.

Figures 1 and 2 highlight the connectivity between what happens on the land, with groundwater and neighbouring coastal waters. Contaminants from the land surface can quickly travel through the gravel substrate to underlying groundwater. The groundwater is shallow and highly connected to the surrounding coastline.

1.3 Sea level rise

Sea level rise is predicted to increase over the coming decades due to the effects of global warming. NIWA have published the following mean sea level rise scenarios for New Zealand to 2150 (Figure 3)[3].

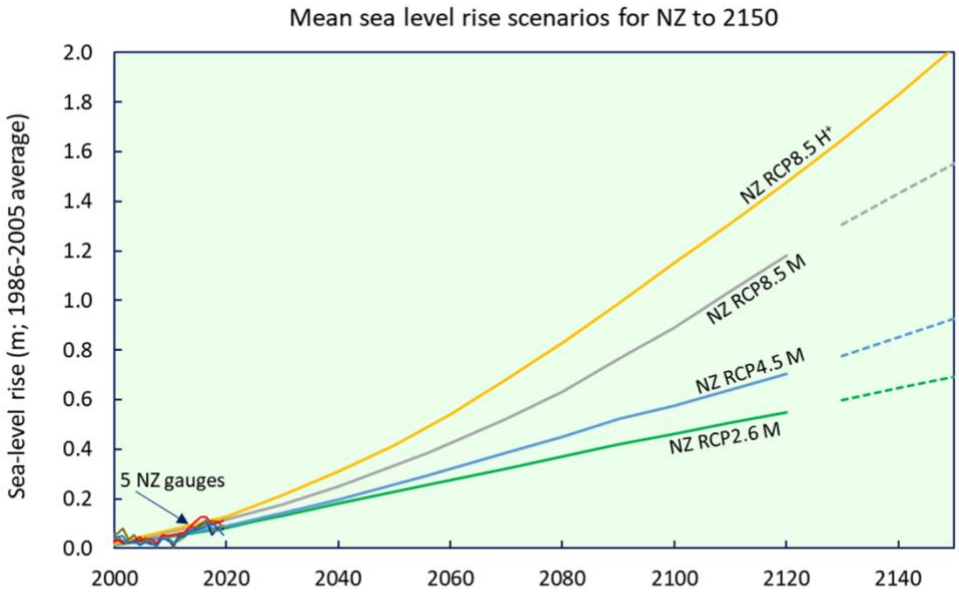

Figure: Four scenarios of New Zealand-wide sea-level rise projections recommended in the Ministry for the Environment's 2017 coastal guidance, based on the IPCC 5th Assessment Report, with the extensions to 2150 and the highest scenario, based on Kopp et al. (2014). Measurements up to 2019 are from: Auckland, Moturiki, Wellington, Lyttelton, Dunedin. Sea level height is relative to the average mean sea level over the recent period 1986-2005, which IPCC use as a zero baseline for projections.

Figure 3: Mean sea level rise modelled for New Zealand to 2150 by NIWA.

The following maps (Figure 4 and Figure 5) illustrate what sea level rise could look like for Tiwai and surrounds in terms of a changing shoreline[4]. Note that the modelling used is a 'bathtub filling' scenario and does not take into account accelerated coastal erosion, which would likely result in further changes to future coastlines.

Road access to the Tiwai Peninsula would become increasingly challenging as sea level rises. This is particularly noticeable when sea level rises 1.0 metres above the current high tide level. At this point the Tiwai smelter is likely to be located on an island, as part of a network of newly created islands.

[3] https://niwa.co.nz/natural-hazards/hazards/sea-levels-and-sea-level-rise
[4] https://coastal.climatecentral.org/map/15/168.3535/-46.4104/?theme=water_level&map_type=water_level_above_mhhw&basemap=hybrid&contiguous=true&elevation_model=best_available&refresh=true&water_level=1.0&water_unit=m

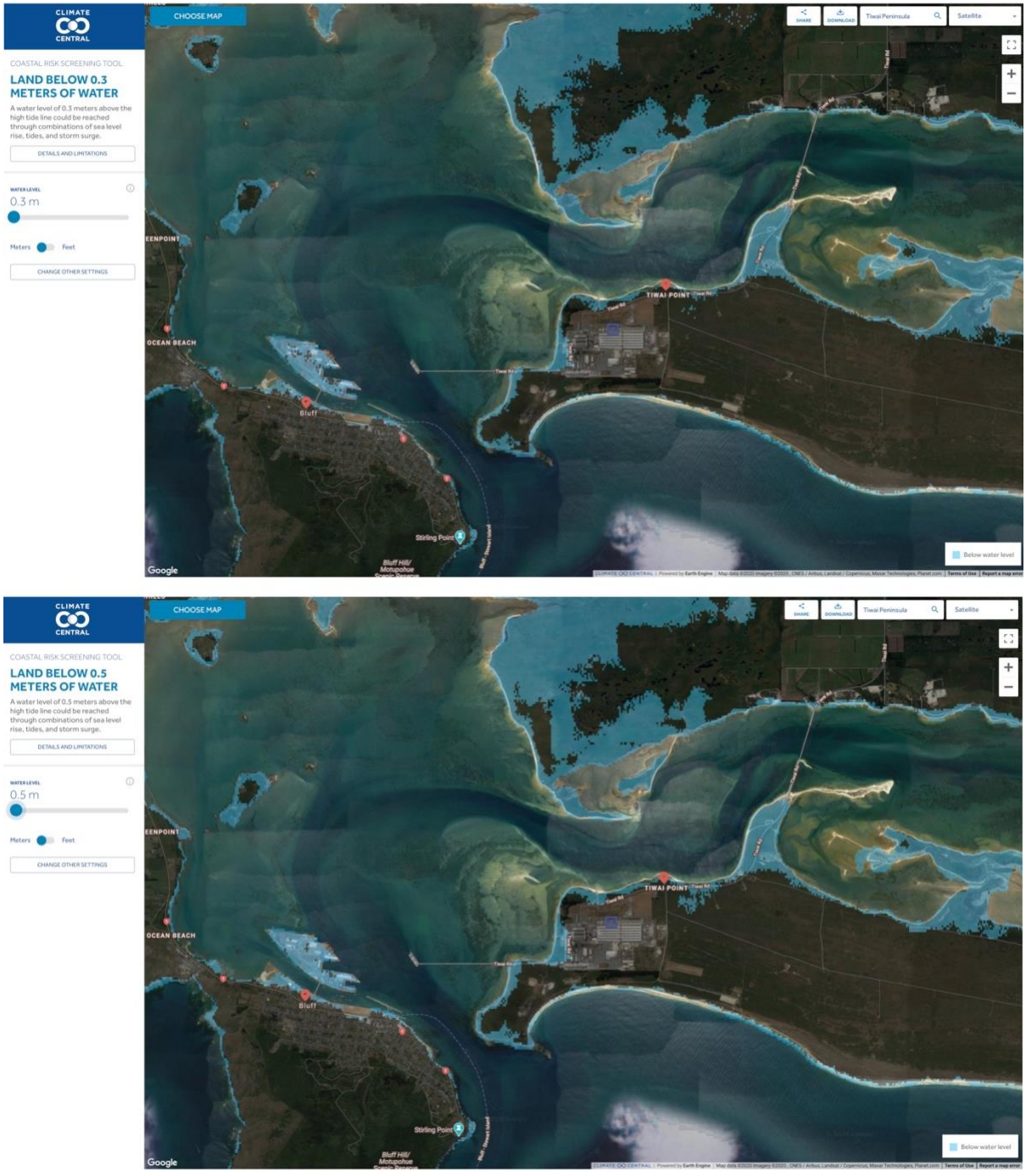

Figure 4: Changing coastline for Top: 0.3 metre sea level rise. Bottom: 0.5 metre sea level rise.

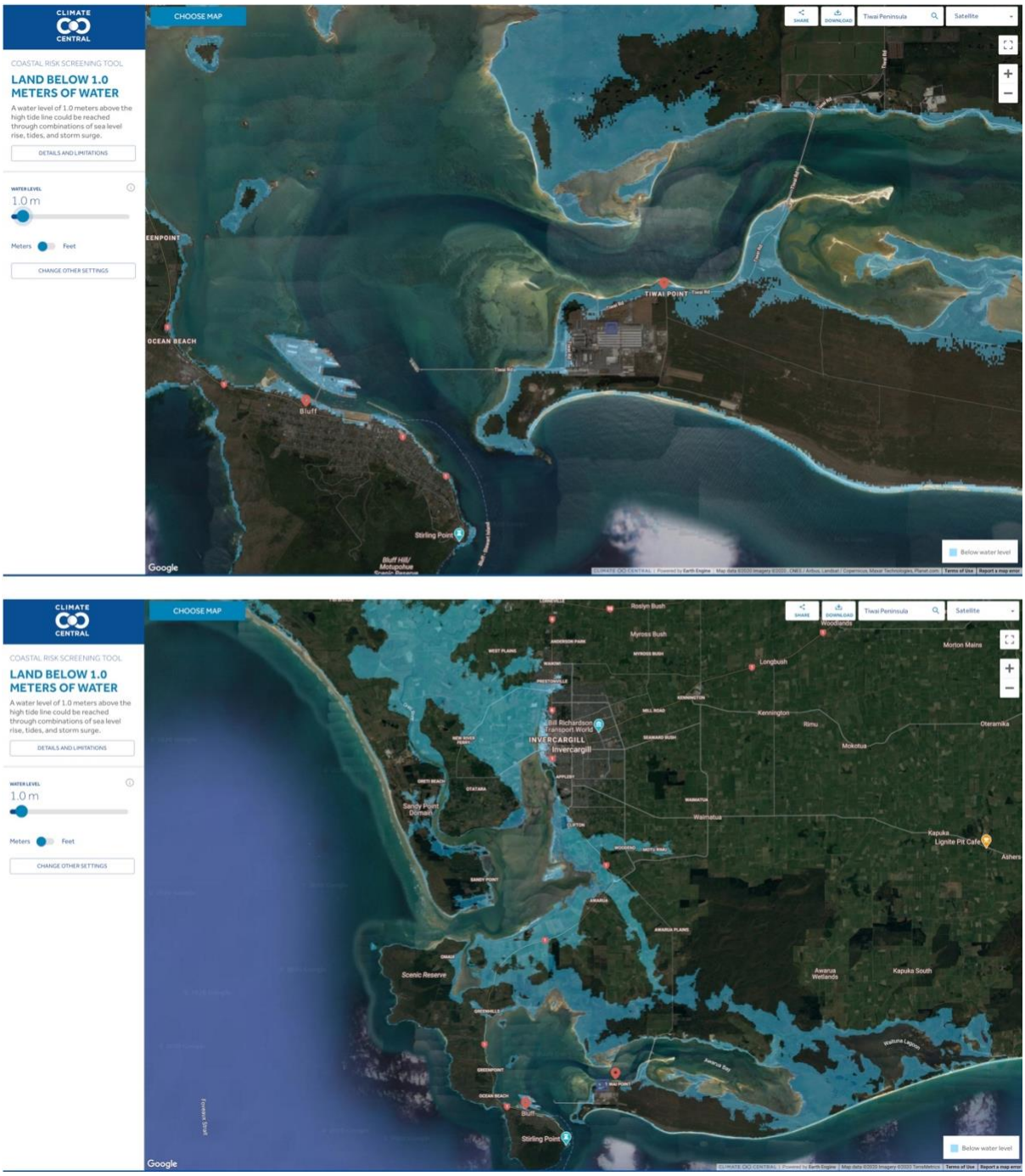

Figure 5: Changing coastline for 1 metre sea level rise. Top: Tiwai Peninsula. Bottom: Dramatic changes in coastline and accessibility for the greater area surrounding Invercargill. Many areas would effectively become islands.

As noted previously, the geology of the Tiwai peninsula is predominantly sand and gravel, meaning that it is at high risk of coastal erosion from sea level rise. Therefore, it is likely that the perimeter shoreline could be much reduced, particularly post large storm events.

1.4 Resource consents

NZAS holds 8 current consents with Environment Southland:

1. AUTH-203378 - Discharge to contaminants to air from the aluminium smelter.
2. AUTH-203373 - Discharge of water which may include contaminants to the coastal marine area (stormwater drain discharges).
3. AUTH-203375 - To occupy the coastal marine area with an outfall pipe.
4. AUTH-203379 - Discharge of treated effluent to the coastal marine area.
5. AUTH-203376 - Discharge of treated sewerage to land.
6. AUTH-202196 - To discharge contaminants onto or into land (landfill).
7. AUTH-202727 - To discharge stormwater and process water to land.
8. AUTH-202958 - To take and use groundwater.

Environment Southland monitors the local environment in relation to these consents only. The council relies on the monitoring results provided by NZAS in annual reports (not publicly available). Environment Southland produces Environmental Compliance Reports on an annual basis. Information from these reports specific to the Tiwai Smelter is provided in Appendix A. Tiwai Point is located with the Invercargill City Council boundary. Appendix B highlights sections of relevance from the 2019 ICC District Plan.

Current monitoring, planned additional monitoring/actions, and intended outcomes are given below for each resource consent held with Environment Southland.

1.4.1 Monitoring

1. AUTH-203378 - Discharge to contaminants to air from the aluminium smelter.

Current Monitoring:

- Assess reports supplied to Environment Southland as required by the resource consent against the conditions of the consent. These include, monthly emissions test results, quarterly reporting on ambient air quality monitoring, bi-annual monitoring of fluoride deposition, annual fluoride in un-grazed grass monitoring and monitoring of the meteorological conditions.
- Audit ambient air sampling and sample analysis and audit bi-annual fluoride deposition sampling and sample analysis by collecting duplicate samples and analysing at an independent laboratory. Undertaken once annually.

Planned Additional Monitoring or Actions:

- 1.1 - Review the application and other available documentation for information characterising the discharge. Take regard to particulate quality, considering contaminants additional to what is monitored as a requirement of the consent (contaminants other than fluoride). From the review consider what the implications are and whether additional monitoring would be beneficial.

Summary of planned action:

Review the application and other available documentation for information characterising the discharge. Take regard to particulate quality, considering contaminants additional to what is monitored as a requirement of the consent (contaminants other than fluoride).

Intended outcomes:

Monitoring of the discharge focuses on fluoride. A review of available reports may identify other risks of contamination by other contaminants not adequately covered during the application process and consenting process. From this review additional monitoring may be required.

2. AUTH-203373 - Discharge of water which may include contaminants to the coastal marine area (storm water drain discharges).

Current Monitoring:

- Assess results of weekly discharge monitoring (reported quarterly) against consent limits.
- Audit the sampling and analysis by collecting duplicate samples and analyse at an independent laboratory. Undertaken once annually.

Planned Additional Monitoring or Actions:

- 2.1 - Condition 13 of the consent requires the effects of the drain discharge to on aquatic life to be assessed in 2011. A previous compliance officer allowed the consent holder to skip this requirement. Request this survey be undertaken by 31 July 2021 to help understand the effects of the smelter on the biota of Bluff Harbour.

Summary of planned action:

Condition 13 of AUTH-203373 requires the effects of the discharge on aquatic life in Bluff Harbour to be assessed in 2011. A previous compliance officer allowed the consent holder to skip this requirement. Request this survey be undertaken by 31 July 2021.

Intended outcomes:

Characterise the effects on the environment from the ongoing discharge of contaminants from the coastal drains to Bluff Harbour.

3. AUTH-203375 - To occupy the coastal marine area with an outfall pipe.

Current Monitoring:

- No monitoring is undertaken by Environment Southland
- NZAS inspect and de-foul the outfall annually in conjunction with the coastal monitoring required by AUTH-203379.

Planned Additional Monitoring or Actions:

- No additional actions are proposed for this consent.

Intended outcomes:

NA

4. AUTH-203379 - Discharge of treated effluent (cathode pad leachate and cathode wash-down water) to the coastal marine area.

Current Monitoring:

- Assessment of discharge sample results undertaken on every discharge and reported quarterly. Assessment of receiving water sample results - monitored annually.
- Audit the sample collection and analysis of the discharge and the receiving water. Undertaken once annually.
- Site inspection and consent audit. Once annually, usually at the same time as sample auditing.

Planned Additional Monitoring or Actions:

- No additional actions are proposed for this consent.

Intended outcomes:

NA

5. AUTH-203376 - Discharge of treated sewerage to land.

Current Monitoring:

- Assess client reports against the conditions of the consent – discharge volume reporting, six monthly and two yearly groundwater sampling.

Planned Additional Monitoring or Actions:

- 5.1 - Site inspection and audit of all consent conditions including auditing sampling.
- 5.2 - Investigate/validate waste streams versus application.

Summary of planned action:

- Site inspection of the sewage discharge field (AUTH-203376) including auditing of the groundwater sampling required by the consent.
- Investigate and validate waste streams discharged to the sewage field.

Intended outcomes:

No scheduled site inspections have been completed in recent years. Assess compliance with the consent.

Is the discharge still consistent with the application?

6. AUTH-202196 - To discharge contaminants onto or into land (landfill).

Current Monitoring:

- Assess monitoring reports required by the consent – biannual groundwater sampling and reporting of additions to the landfill.

Planned Additional Monitoring or Actions:

- 6.1 - Undertake walk over inspection of the landfill.
- 6.2 - Undertake audit sampling of groundwater and broaden the suit of contaminants tested for to further understand the nature of the groundwater contamination
- 6.3 - Investigate if there are other bores that could be sampled in close proximity to the landfill and if there is request monitoring results from NZAS or undertake sampling.

Summary of planned action:

- Undertake walk over inspection of the landfill.
- Undertake audit sampling of groundwater and broaden suit of contaminants tested.
- Investigate if other bores exist close to the landfill and request monitoring results from NZAS or sample the bores.

Intended outcomes:

- To identify potential breaches of the consent and assess whether the landfill is consistent with the application.
- Further understand the groundwater quality in proximity to the landfill.

7. AUTH-202727 - To discharge stormwater and process water to land.

Current Monitoring:

- No monitoring required and no monitoring is undertaken.

Planned Additional Monitoring or Actions:

- 7.1 – Site visit and audit of stormwater sources. Determine whether the discharge is consistent with the application and whether further investigation is required.

Summary of planned action:

- Site visit and audit of storm water sources.
- Re-request recent cathode storage pad groundwater sample results.
- Inspect wash pad.
- Request any groundwater sample results associated with bore holes close to the wash pad.

Intended outcomes:

- Determine whether the discharge is consistent with the application and weather there is any unanticipated environmental effects.
- Understand if there is a potential for ongoing discharge from the spent cathode storage pad to land.
- Check for evidence of unconsented discharges to land.

8. AUTH-202958 - To take and use groundwater.

Current Monitoring:

- Assess abstraction records and reports required by consent Planned Additional Monitoring or Actions:
- No additional actions are proposed for this consent.

9. Other planned actions related to the Tiwai Aluminium Smelter.

- 9.1 - Re-request recent cathode pad groundwater sample results.
- 9.2 - Site inspection of wash pad – check for evidence of unconsented discharges to land.
- 9.3 - Request any groundwater sample results associated with the boreholes close to the wash pad.
- 9.4 - Ask for a plan for dealing with the refractory brick stockpile.
- 9.5 - Audit and validate all bore locations across the whole site
- 9.6 - Draft a summary of the known ground water quality across the site identifying gaps in knowledge.
- 9.7 - Collate and summarise information about the hydrology on the Tiwai peninsula identifying potential receiving environments for groundwater and soil contamination.
- 9.8 - Ask ICC for information on the types and locations of hazardous substances stored on site.
- 9.9 - Develop a formal relationship and schedule of meetings for sharing of information relating to the Tiwai Aluminium Smelter.
- 9.10 - Encourage NZAS to prepare and share a Closure Environmental Management Plan

1.5 Known and potential sites of soil or groundwater contamination

The Briefing Note provided by Environment Southland (ES) contains a map (Figure 1) showing eight known and potential sites of soil or groundwater contamination at Tiwai Point.

1. Landfill
2. Bulk fuel storage
3. Wash-down pad
4. 1991 oil spill
5. Refractory bricks
6. Transformer
7. Sewage dispersion field
8. Cathode pad – at risk from coastal erosion

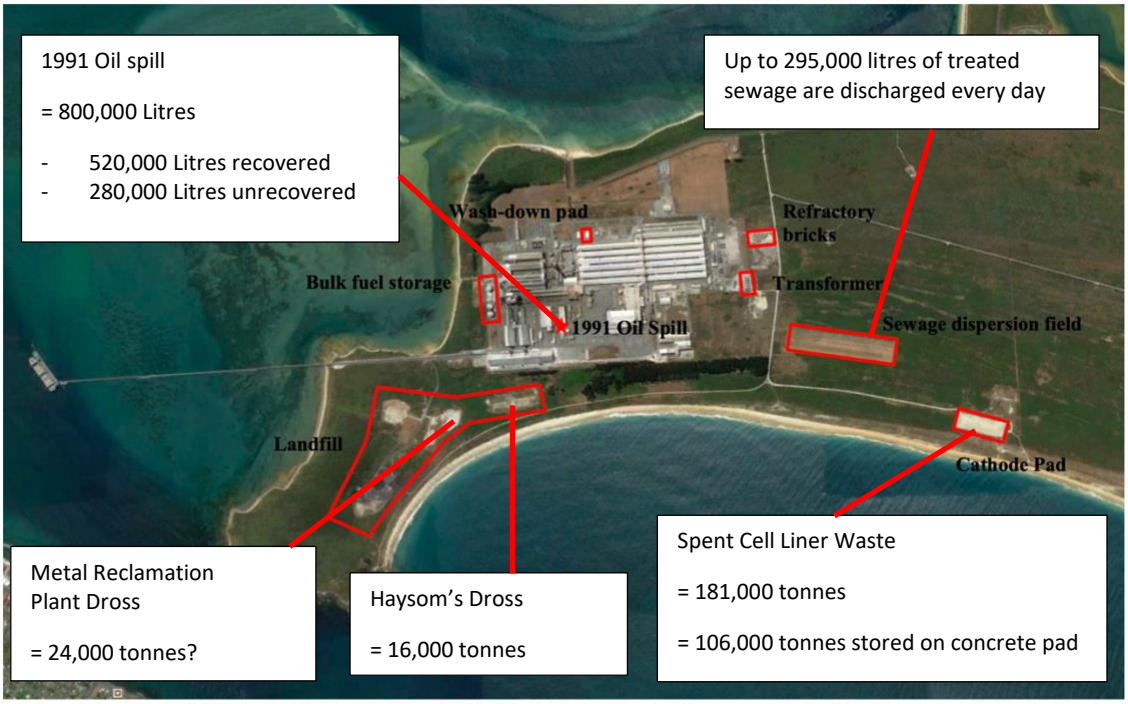

Figure 1: Aerial image of the Tiwai site (Google Earth, dated 13/01/2018?). Red areas show known and potential sites of soil or groundwater contamination.

Figure 6: Aerial map provided by ES showing known and potential sites of soil or groundwater contamination. Text boxes have been added to provide more summary information.

Each site, including their potential contaminants and key questions, are discussed in detail in separate sections below.

2. Landfill

Concern level = **high**

Key risks = discharge of contamination to groundwater and Foveaux Straight

Key future risk = coastal erosion of landfill site

Landfill waste:

1. General waste from smelter
2. Haysom's dross
3. Carbon fines
4. Asbestos
5. Hydrocarbon contaminated soils
6. Cleanfill

Operation of the NZAS landfill on the smelter's Tiwai Point property is covered by Discharge Permit No. 202196 issued by the Southland Regional Council (Environment Southland) on 8 December 2004. A detailed map of the landfill as it was in 2019 is provided in Figure 7.

As part of the resource consent process, NZAS provides an annual Environmental Monitoring Report to Environment Southland that covers consent monitoring and environmental effects of the Tiwai Smelter. These reports are only available via an Official Information Act (OIA) request. Radio NZ obtained the 2019 report and made it publicly available on their website[5].

Figure 7: Map of the Tiwai Landfill from the 2019 NZAS environmental monitoring report. Colour has been added by the author to group areas with similar contaminant types. Areas shaded dark red contain undisclosed material/contaminants. The area shaded yellow is the original landfill area.

[5] https://www.documentcloud.org/documents/20498631-2019-nzas-enviro-monitoring

Figure 2 highlights the extent of the landfill and the large areas of 'unspecified' contents. Note the large area used to dispose of 'carbon', when compared with that used to contain Haysom's Dross (16,000 tonnes).

Landfill characteristics

The landfill contains approximately 250 Olympic-size swimming pools of waste[6].

The landfill is not lined. Waste is buried, covered with soil and planted.

NZAS Landfill Management Plan

The general operation of the on-site landfill is outlined in the NZAS Landfill Management Plan.

According to the NZAS 2019 environmental monitoring report, the following material as deposited at the NZAS Landfill:

- General Waste - 1,492m^3
- Clean Waste - 698m^3
- Carbon Material - 3,499m^3

Additional details on the proposed operations during 2020 are included in the following sections:

- proposed operation for 2020,
- comments on operations for 2019, and
- 2019 groundwater monitoring results.

Proposed Operation for 2020

The operation of the General waste and Clean fill areas will continue with only one major change proposed for 2020 relating to the landfilling of bricks from the Carbon Bake Furnaces (CBF). The rest of the areas have capacity for many years of future land filling and do not require any structural changes within the next 12 months[7] (See Figure 7).

Environment Southland Briefing note

The Environment Southland Briefing note lists 6 types of Landfill waste:

1. General waste from smelter
2. Haysom's dross
3. Carbon fines
4. Asbestos
5. Hydrocarbon contaminated soils
6. Cleanfill

These are discussed separately in the following sections.

2.1 General waste from smelter

Unspecified and unknown.

Key questions:

[6] https://www.stuff.co.nz/national/300254887/report-details-consequences-of-landfill-of-toxic-waste-at-tiwai-point

[7] NZAS Annual Environmental Monitoring Report 2019. Report to Environment Southland on consent monitoring and environmental effects of the Tiwai Smelter for the year ending 31 December 2019.

What types of waste are classed as 'general'?

For example, does this include potential sources of contamination such as electrical appliances and general electrical waste, batteries, tyres?

2.2 Haysom's Dross

In the late 1980s Haysom Metal Industries set up a plant in Invercargill to remove aluminium from dross. The plan was to set up 24 hour processing to recover the aluminium from the dross and sell it back to the smelter.

However, complaints about noise from local community resulted in the Invercargill City Council (ICC) restricting plant operations to the hours between 6.00 am and 10.00pm. In December 1991 Haysom closed the plant, and in 1993 Haysom had gone into receivership.

It is estimated that Haysom had about 16,000 tonnes of dross stockpiled in Bluff. In 2003, a deal was struck to bury this dross in the landfill on Tiwai Point[8].

From: Environmental Compliance Monitoring Report 2006/2007[9] (see Appendix A)

"The monitoring bores downstream of the **Haysom's dross** and **NZAS MRP dross** landfill continued to show elevated levels of ***nitrogen, fluoride, vanadium and boron***. While these do not exceed any direct consent conditions, they do highlight concerns with the waste."

2.2.1 What is dross?

Aluminium dross refers to a by-product of an aluminium smelting or re-melting process. Residues from the aluminium smelting process that contain more than 45% metallic alluminium are called "skimmings". Residues with less than 45% metallic aluminium are called "dross". Dross from a primary smelter like Tiwai, is typically called 'white dross' and comprises 20-45% metallic aluminium and occurs as a fine white powder[10].

How is White Dross formed?

White dross is created by the skimming of furnaces during the aluminium smelting process. White dross can include oxide compounds not directly formed in the furnace, but which are introduced during the treatment process. It typically does not contain salt flux.

What is White Dross?

White dross comprises two major components:

- Aluminium metal - Al (m)
- Aluminium oxide – Al_2O_3

Smaller amounts of other components are also present, depending on

- conditions in the furnace
- conditions in the dross pan

[8] https://www.stuff.co.nz/southland-times/news/features/102663052/tiwai-2-return-of-the-dreaded-dross

[9] https://www.es.govt.nz/repository/libraries/id:26gi9ayo517q9stt81sd/hierarchy/environment/compliance/compliance-monitoring-reports/documents/Monitoring%20Reports/compliance-monitoring-report-2006_2007.pdf

[10] https://www.goredc.govt.nz/assets/documents/planning/Additional-information-from-applicant-scientific-report-and-interim-legal-opinion-3-August.pdf

- metal source
- alloys being processed

These other smaller components include:

- Aluminium nitride (AlN)
- Aluminium carbide (Al_4C_3)
- Cryolite (NA_3AlF_6)

Cryolite is often associated with molten metal coming from electrolysis cells, while Aluminium nitride and aluminium carbide are associated with thermite reactions occurring in the furnace or dross skim pan.

Dross - Chemical Analysis

Samples of dross from Tiwai were analysed by SpectraChem Analytical (issued 16/04/2014), commissioned by CMT Industries. They found the following components (mass %):

Aluminium oxide (Al_2O_3)	81.09%
Aluminium (Al)	46.3%
Fourine (F)	11.3%
Sodium (Na)	3.75%
Magnesium (Mg)	1.68%
Silicon (Si)	1.36%

The gives a picture of what 'building blocks' are present. However, this does not give an accurate picture of what *compounds* are present in the dross. For example:

- X-ray diffraction shows that Aluminium nitride (AlN) is present*.
- Aluminium oxide cannot be present at the level of 81 mass % as there are not enough 'building blocks' for this to happen (total analytes = 67.1% therefore maximum oxygen available is 100-67.1= 32.9%, but Al is present at 46.3% so the maximum allowable Al_2O_3 is 46.3+32.9 = 79.2%, to say nothing of the effect of Al diverted into non-oxide compounds.)

*Thermogravimetric analysis showed that there was a weight gain of about 6.1% between 550°C and 1400°C and was possibly not finished even at that temperature. That gain is due to the replacement of N in AlN by O, and it implies that there is at least 25% Aluminium nitride (AlN) in the original sample.

Key compounds are explained below.

Aluminium nitride (AlN)

The dross has a strong odour when freshly ground due to the Aluminium nitride content. AlN reacts with moisture in the air to produce Aluminium Hydroxide ($Al(OH)_3$) and Ammonia (NH_3) – which causes the smell.

$$AlN + 3H_2O \longrightarrow Al(OH)_3 + NH_3$$

It is the Aluminium nitride component of dross that is dangerous when it comes into contact with water. The resultant chemical reaction produces ammonia (NH_3), which is caustic (corrosive) and hazardous to human health.

Aluminium carbide (Al_4C_3)

Pale yellow to brown in colour. Will break down in water to produce Aluminium Hydroxide ($Al(OH)_3$) and Methane Gas (CH_4):

$$Al_4C_3 + 12\ H_2O \longrightarrow 4\ Al(OH)_3 + 3\ CH_4$$

Cryolite (NA_3AlF_6)

A mineral, also called sodium hexafluoroaluminate. Occurs as crystals that vary in colour from glassy and colourless to grey-black.

Is toxic due to fluoride ions being released in contact with water - and is used as an insecticide and pesticide. Health effects on people exposed to cryolite include: anemia, neurological problems, skin rashes, bone issues, and stomach and intestinal problems[11].*

Key questions:
What will happen to this dross in the long-term?

How and when will it be removed from Tiwai Point and where will it go?

1.2.2 Taha Asia Pacific Ltd

In January 2012 Taha Asia Pacific Ltd (subsidiary of Taha International Corp, Bahrain http://www.tahacorp.com) began processing aluminium dross to remove trace aluminium. After extraction, the remaining product (ouvea premix) was to be further processed into mineral fertilizer by Taha Fertilizer Industries[12].

Taha used dross that had been stored in the landfill at Tiwai Point[13].

In August 2016 Taha Asia Pacific Ltd went into liquidation. Of concern was the fate of thousands of tonnes of ouvea premix. At the time it was thought that about 35,000 tonnes of ouvea premix were stored in three buildings in Southland, one at the old Mataura paper mill which runs beside the Mataura River, one in Liddell St in Invercargill and perhaps one near Bond St in Invercargill. About 10,000 tonnes was stored in the Mataura Paper Mill site[14].

Ouvea premix is a Class 6 Poisonous Substance[15].

- HSNO* Class 6.3A – skin irritant
- HSNO Class 6.4A – eye irritant
- HSNO Class 9.1C – aquatic ecotoxicant

"This substance may cause serious harm to living organisms if swallowed or inhaled. It can also cause serious harm to the health of aquatic systems if it enters a waterway." – page 12 Taha Land Use Application to ICC[6].

HSNO = Hazardous Substances and New Organisms Act

[11] http://fluoridedetective.com/fluoride-facts/cryolite/
[12] https://www.eco-business.com/news/aluminium-dross-recycled-into-fertilizer-in-new-zealand/
[13] https://www.recyclingtoday.com/article/e-crane-worldwide-700-series/
[14] https://www.stuff.co.nz/national/82822903/taha-company-collapse-sparks-concerns-about-hazardous-materials
[15] https://icc.govt.nz/wp-content/uploads/2014/10/Taha-Land-Use-application.pdf

Ouvea Premix composition[6]

Component Name	CAS* no.	Concentration %
Aluminium oxide - Al_2O_3	1344-28-1	25-50%
Aluminium nitride - AlN	24304-00-5	25-40%
Magnesium Aluminate – $MgAl_2O_4$	12068-51-8	5-30%
Cryolite – Na_3AlF_6	15096-52-3	2-4%
Aluminium - Al	7429-90-5	2-4%
Sodium aluminate – $NaAl_{11}O_{17}$	1302-42-7	2-5%
Potassium Fluoride - KF	7789-23-3	<1%
Potassium Chloride - KCl	7447-40-7	<1%
Fluorite – CaF_2	7789-75-5	<1%
Quartz – SiO_2	14808-60-7	<1%

*CAS number = a unique numerical identifier assigned by the Chemical Abstracts Service (CAS) to every chemical substance described in the open scientific literature. This system avoids confusion with the use of synonyms.

In the TAHA Environmental Management Plan[6] it states that their storage sites for Ouvea Premix were:

- 127 Kana Street, Mataura (2,000 tonnes), 116-130 Kana Street Mataura (5,000 tonnes)
- 76-89 Annan Street, Invercargill (4,650 tonnes)
- 139-143 Liddel Street, Invercargill (1,500 tonnes)

The fate of Ouvea Premix in Southland is ongoing.

Key questions:

Where will the Ouvea Premix be moved to?

If moved to the Tiwai Landfill – this can only be a short-term storage solution due to the predicted effects of sea level rise.

Where will the Ouvea Premix be stored long-term?

1.3 MRP Dross

MRP = Metal Reclamation Plant Dross

An article by Recycling International (October 2011) states that there was about 40,000 tonnes-plus of alumiunium dross stored in landfills at Tiwai[16]. If 16,000 tonnes is Haysom's Dross, that leaves about 24,000 tonnes of 'other' dross.

Key question: How much is in the landfill? And, is it different to the Haysom's dross?

[16] https://recyclinginternational.com/ferrous-metals/dross-recycling-plant-on-stream-in-new-zealand/8973/

Where will this dross be moved to long-term?

1.4 Carbon fines

Aluminium processing produces large quantities of carbon dust or 'fines'.

Carbon dust is a by-product of anode manufacturing process usually generated during crushing of anode butts and cleaning of bath material during shot blasting process. It is super fine black powder.

The carbon dust represents a main challenge to get rid of because of its environmental side effects such as air pollution due to its fineness, and the possible leaching to the groundwater. In addition, the carbon dust is usually dumped in landfills. The handling and transportation of the dust are also problematic.

A possible use for carbon fines is to incorporate them into cement[17].

Key question:

How much carbon dust is dumped in the landfill and how will this be contained, especially if disturbed while other landfill material is being removed?

2.5 Asbestos

Asbestos is the generic name given to *fibrous* forms of a number of naturally occurring silicate minerals. These fibres are very strong and are highly resistant to heat, fire, chemicals and wear. Asbestos is a proven human carcinogen, and all forms of asbestos can cause cancer. The main way people are exposed to asbestos is by breathing in air that contains asbestos fibres.[18].

Types of Asbestos Containing Products (ACP) likely used at the Tiwai Smelter (for insulating purposes in high-temperature processes)[19]:

- Textiles (insulation tape and cloth, valve packing)
- Fibre-cement (cladding, roofing, pipes, tanks)
- Insulation board (wall linings and panels)
- Millboards, paper, card (general insulation, gaskets)
- Plaster boards and coatings (spray-on coatings)
- Loose or encapsulated asbestos (gaskets)
- Bitumen products, surface coatings (paints, caulks, mastics)

What is the exotoxicity of asbestos?

The main environmental concern with asbestos stored at the Tiwai landfill is it's proximity to groundwater and coastal ecosystems. Studies have shown that the siphoning ability of shellfish can be compromised by exposure to asbestos fibres. Shell growth was also significantly reduced.[20] Another study suggests that positively charged asbestos fibres attach to planktonic cells, inhibiting their swimming capacity, and thus removing them from the water column. Plankton form the base

[17] Irshidat, M.R., and Al-Nuaimi, N. 2020. Industrial Waste Utilisation of Carbon Dust in Sustainable Cementitious Composites Production. *Materials* 2020, 13, 3295; doi: 10.3390/ma13153295
[18] https://www.health.govt.nz/your-health/healthy-living/environmental-health/hazardous-substances/asbestos/what-asbestos
[19] https://www.mfe.govt.nz/sites/default/files/media/Hazards/inventory-of-nz-imports-and-exports-of-asbestos-containing-products.pdf
[20] http://www.inchem.org/documents/ehc/ehc/ehc203.htm#PartNumber:8

of the aquatic food chain. If they are compromised in terms of numbers and availability, then the whole aquatic food chain is impacted [12].

Key Questions:

What is the effect of asbestos fibres on aquatic biota?

How much asbestos is estimated to be in the landfill?

Is there any monitoring of coastal/benthic depositions of asbestos around the Tiwai Peninsula?

What happens if the landfill is breached (e.g. tsunami) and large quantities of asbestos get washed into the coastal environment?

How will this asbestos be removed from Tiwai and where will it go?

2.6 Hydrocarbon contaminated soils

Hydrocarbons are a very diverse group of organic compounds that contain hydrogen and carbon. The predominant use of hydrocarbons is as a combustible fuel source. For example, crude oil is processed to form hydrocarbons in the form of petroleum products[21].

Hydrocarbon spills in the form of petroleum products both on land and in water, have been a problem since discovery of oil as a fuel source. They can have devastating effects on all living things they come into contact with. Oil spills and oil waste discharged into the sea from refineries, factories or shipping contain poisonous compounds that constitutes potential danger to plants and animals. The poisons can pass through the food web of an area and may eventually be eaten by humans[22].

Environmental contamination by hydrocarbons and petroleum products are particularly problematic due to their persistent nature and tendency to spread into ground and surface waters[13].

Key Questions:

What are the known forms of hydrocarbons in the Tiwai landfill and in what estimated quantities?

How has the contaminated soil been dumped? E.g. is it contained?

How will the groundwater and coastline be protected from the effects of the hydrocarbons? Will the soil be removed?

What bioremediation options are being considered?

Note: bioremediation options for hydrocarbon contaminated soils are described in “Biological Remediation of Hydrocarbon and Heavy Metals Contaminated Soil” by O. Peter Abioye [13].

[21] https://en.wikipedia.org/wiki/Hydrocarbon

[22] https://www.intechopen.com/books/soil-contamination/biological-remediation-of-hydrocarbon-and-heavy-metals-contaminated-soil

3. Bulk Fuel Storage

NZAS stores large quantities of heavy fuel oil, pitch and petroleum coke (see map below).

Figure 1: Aerial image of the Tiwai site (Google Earth, dated 13/01/2018?). Red areas show known and potential sites of soil or groundwater contamination.

3.1 Heavy Fuel Oil

Heavy fuel oil (HFO) is also known as residual fuel oil, and has a tar-like consistency. It is a remnant product from the distillation and 'cracking' of petroleum. It is not a 'clean' fuel, and is contaminated with several different compounds such as aromatics, sulfur and nitrogen. There is high risk of environmental contamination if HFO is leaked or spilt. It's tar-like consistency means it is especially damaging to birdlife.

Due to its very high viscosity and elevated density, HFO released into the environment is a greater threat to flora and fauna compared to distillate or other residual fuels. In 2009, the Arctic Council identified the spill of oil in the Arctic as the greatest threat to the local marine environment. Being the remnant of the distillation and cracking processes, HFO is characterized by an elevated overall toxicity compared to all other fuels. Its viscosity prevents breakdown into the environment, a property exacerbated by the cold temperatures resulting in the formation of tar-lumps, and an increase in volume through emulsification. Its density, tendency to persist and emulsify can result in HFO polluting both the water column and seabed[23].

Key questions:

Are the soils/gravels surrounding the storage area contaminated?

What is the plan to remove these soils/gravels from the site?

[23] https://en.wikipedia.org/wiki/Heavy_fuel_oil

3.2 Pitch and petroleum coke

Calcined petroleum-pet coke (CPC) and coal tar pitch (CTP) are the two main ingredients of the carbon anodes that provide the electrolytic chemical reaction during aluminium smelting. To produce one tonne of primary aluminium, a smelter needs about 425 kg of carbon anode which is produced by mixing 80% of CPC and 20% of CTP[24].

Calcined anode grade pet coke is produced from low/medium sulphur green pet coke (GPC) ("green"- unprocessed), which is a by-product of refining low sulphur medium and heavy crude oil, while coal tar pitch is derived after distillation from coal[19].

During the aluminium production process, an electric current passes through carbon anodes. New anodes are manufactured using petroleum coke, liquid pitch and recycled carbon material (NZAS).

Estimating volumes

Tiwai Smelter produces around 360,000 tonnes of aluminium per year.

If one tonne aluminium needs 425 kg of carbon anode

= 340 kg of calcined petroleum-pet coke (CPC)

= 85 kg of coal tar pitch (CTP)

Therefore in one year, 360,000 tonnes of aluminium needs 153,000 tonnes of carbon anode

= 122,400 tonnes of calcined petroleum-pet coke (CPC)

= 30,600 tonnes of coal tar pitch (CTP)

Currently, there is no known commercially viable substitute for calcined petroleum coke in the fabrication and utilisation of anodes for aluminium smelters. It boasts a superior combination of electrical conductivity and resistance to chemical and physical degradation in the smelting pot, which contains lower levels of contaminants (i.e. ash)[19].

Key questions:

Are the soils/gravels surrounding the storage area contaminated?

What is the plan to remove these soils/gravels from the site?

4. Washdown Pad

There is a wash-down site north of the main plant. This is used for vehicles and wash down of the cell linings. The cell lining wash-down water is transported to the cathode treatment plant. Other wash-down water is discharged to land (AUTH-202727).

Key Questions:

What potential contaminants are associated with the washdown pad?

How will this be removed/remediated once the Smelter has closed?

[24] https://aluminiuminsider.com/why-are-anode-production-costs-rising/

5. 1991 Oil Spill

Concern level = **moderate**

In 1991, approximately 800,000 Litres of diesel was spilled, initially contaminating 4.5 hectares. 120 recovery wells were installed and about 520,000 Litres of diesel were recovered from groundwater. The rest was left for bioremediation (?) and monitored.

Report from 2006 (A603025) indicates a much reduced halo of contamination around the original spill site with residual contamination [25]. However, this does not mean that the diesel has 'disappeared'.

5.1 What happens to diesel in groundwater?

Breakdown of diesel compounds releases volatile, dissolved, and highly carcinogenic polyaromatic hydrocarbons (PAHs) to the water, soil and above-surface environment. Due to its 'lighter than water' character, diesel may be transported in ground and surface waters over long distances, resulting in even greater environmental damage[26].

It is generally accepted that diesel flows in the direction of groundwater flow, but at a slower speed due to its viscosity (unlike gasoline which may flow faster than water). Diesel fuel may contain 500 individual compounds that tend to be more dense, much less volatile, less water soluble and less mobile than gasoline (USEPA 1996[27]).

Key question:

What is meant by bioremediation? Just left for 'nature' to break it down? (bioremediation of diesel contaminated sites is potentially a complex process)

The diesel has not just 'disappeared'. Do we have a good understanding of how it has broken down and where it's constituents may have ended up? E.g. in the coastal environment?

What is the current understanding in regard to hydrodynamics in the surrounding coastal system? This will help understand where contaminants such as diesel may be accumulating (they don't just disappear).

[25] From: ES Tiwai Briefing Note 18 February 2021.

[26] https://scholarworks.umt.edu/cgi/viewcontent.cgi?article=10043&context=etd

[27] United States Environmental Protection Agency. ***Introducing...How To Effectively Recover Free Product At Leaking Underground Storage Tank Sites, A Guide For State Regulators.*** EPA/510/F-96/005, September, 1996: 3+

6. Refractory Bricks

Carbon bake refractory bricks have been at various times temporarily stored to the east of the main plant and may have leached contaminants to the soil or groundwater.

The following has been taken from the 'Tiwai Pointer' newsletter: April-June 2014. In this example over 12,500 tonnes were temporarily stored and removed by truck.

Now you see, now you don't!

Rubble pile near the East Gate

Cleared area

Work is progressing on Freight Haulage's new yard

If you've driven past the East Gate lately, you will have noticed that the massive pile of bricks has disappeared. The rubble was made up of bricks from the latest carbon bake rebuild completed in February 2013, crushed concrete light posts, crushed fluewall tops, other refractory material etc.

Where did it go? Well, all 461 truckloads (over 12,500 tonnes) have been taken to Freight Haulage where it is being used to build up a new container hard stand and metal yard. The new area is approximately 2 hectares in size with rail siding and Freight Haulage hopes to have it completed by the end of the year.

Well done to the following teams:

- Procurement - for securing the disposal contract with the Richardson Group
- Environmental - for sampling and analysing material to determine suitability for disposal
- Carbon Refractory team - for managing removal logistics
- Freight Haulage and Southern Transport – for safely transporting the rubble to the new site

This highlights the volumes of bricks that have been stored in the open without lining separating them from sediments below.

Key questions:

What contaminants have leached from the bricks over the years to underlying sediments and groundwater?

Does the area used to temporarily store bricks pose a long-term environmental problem?

How would this be remediated?

7. Historic Transformer Sites

The historic power transformer sites are a high risk of PCB (polychlorinated biphenyl) contamination. Globally, old power transformers are a major source of PCBs. PCBs are a toxic environmentally persistent contaminant.

The following has been taken from the 'Tiwai Pointer' newsletter: January-March 2014.

New transformer for NZAS

Preparation work is well underway for the arrival of the new transformer with the concrete pad poured and fire walls installed

A significant capital project is underway, the replacement of the T01 Reduction Line Transformer (a standby transformer).

The new 220/33 kV 230 MVA transformer is currently being manufactured in Korea by Hyosung and is expected to be delivered at the end of May, with commissioning to take place in June/July. The concrete foundation pad was poured in late January, with installation of the fire walls and infrastructure now underway.

Each Reduction Line is serviced by its own transformer, Line 1 (T11), Line 2 (T21), Line 3 (T31) and Line 4 (T41). Once commissioned, the T01 replacement standby transformer can be used in place of any of the line transformers.

NZAS commenced operations in 1971. As part of that original plant installation three Toshiba transformers were purchased. Over the last ten years, three of the original transformers (Line 1, Line 2 and the standby) reached end of life. Since that time NZAS has been undertaking a replacement programme.

The total cost of the standby transformer replacement project will be approximately $8 million.

The original transformers installed at Tiwai have reached the end of their 'life', however the risk of PCB contamination still remains.

Polychlorinated biphenyls were once widely used as dielectric and coolant fluids in electrical apparatus. However, they are highly toxic in the environment and are classified as a 'persistent organic pollutant'[28]. Persistent organic* pollutants are very stable and don't break down through chemical, biological or photolytic processes. They remain in the environment for long periods of time.

This means they are able to bioaccumulate within a foodchain, and are particularly harmful to human health. Persistent organic pollutants tend to bioaccumulate in fatty tissues and usually enter the body via food sources. These chemicals accumulate in organisms high in the food chain, and can even be found in whales in remote areas like Antarctica[29].

*organic in this context refers to compounds containing carbon (organic chemistry).

Polychlorinated biphenyls are particularly problematic in water as they enter the food chain and can bioaccumulate in shellfish and fish. In the ocean, concentrations will be greater in shellfish than in the plankton on which they feed, and even greater in animals at the top of the food chain such as large predatory fish or mammals (seals, dolphins, whales, and people)[30].

[28] https://en.wikipedia.org/wiki/Polychlorinated_biphenyl
[29] https://en.wikipedia.org/wiki/Persistent_organic_pollutant
[30] https://www.greenfacts.org/en/pcbs/l-2/2-biomagnification.htm#1

Key questions:

What is the extent of PCB contamination at the historic power transformer sites?

How will these areas be remediated to ensure PCBs do not enter the coastal ecosystem?

8. Sewage Dispersion Field

Concern level = moderate

Key risks = Sewage on site is discharged by a sub-surface dispersion field east of the plant (AUTH-203376)

Key future risk = coastal erosion of site

Approximately 1,000 full-time employees and contractors work at the Smelter[31]. Tiwai Smelter is not connected to municipal sewage services, so must process and manage its own waste.

Tiwai has a permit limit of 295 m^3 treated sewage per day, with a limit of 8 kg per day of total suspended solids.

1m^3 = 1,000 litres. Therefore, up to 295,000 litres of treated sewage are potentially discharged every day to the dispersion field. Treated sewage is irrigated under an area of 6 hectares of DOC land (see below)[32].

[31] https://www.nzas.co.nz
[32] http://www.ecogent.co.nz/project/tiwai-point/

Ecogent supplied design services and subsurface drip irrigation for the Tiwai Point Aluminium Smelter. Refinery wastewater is irrigated under 6 hectares of Department of Conservations lands which to this day it remains the largest industrial SDI installation in NZ. More details coming soon...

The system used was designed by Ecogent – Environmental Engineering Solutions.

Ecogent is an Auckland-based company that develops commercial waste-water treatment plants for commercial operations that don't have access to municipal sewers[33].

Tiwai undertakes groundwater monitoring upstream and downstream of the dispersion field approximately every six months (NZAS Environmental Monitoring Report 2019[34]).

Results for 2018 and 2019 groundwater monitoring are given below[29]:

[33] http://www.ecogent.co.nz/about-us/
[34] https://www.documentcloud.org/documents/20498631-2019-nzas-enviro-monitoring

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.

Parameter	Units	2018 Average	2019 Average	Previous Range (post commission)
North Bore (Upstream)				
Faecal coliforms	MPN/100 ml	Absent	Absent	< 2
Total phosphorus	g/m^3	0.73	0.35	0.046 - 1.07
Total ammoniacal-N	g/m^3	<0.01	0.0105	< 0.01 - 0.03
Nitrate-N	g/m^3	0.04	0.12	< 0.01 - 0.21
Total Nitrogen	g/m^3	0.29	0.31	0.02 - 0.46
pH		7.8	8.0	7.4 - 8.1
Conductivity	µS/cm	370	357	305 - 399
Chlorinated Aliphatic HC	g/m^3	B.L.	N.D.	B.L.
South Bore (Downstream)				
Faecal coliforms	MPN/100 ml	Absent	Absent	< 2 - 65
Total phosphorus	g/m^3	0.25	0.11	< 0.01 - 0.42
Total ammoniacal-N	g/m^3	<0.01	<0.01	< 0.01 - 0.02
Nitrate-N	g/m^3	0.31	0.19	< 0.01 - 0.61
Total Nitrogen	g/m^3	0.93	0.57	0.05 - 1.17
pH		7.8	7.6	6.8 - 7.9
Conductivity	µS/cm	419	386	227 - 503
Chlorinated Aliphatic HC	g/m^3	B.L.	N.D.	B.L.

Chlorinated Aliphatic Hydrocarbons only determined biennially.
ND - not done
BL - below detection limit

Comments

The discharges of treated sewage onto land during 2019 were similar to previously seen. Phosphorus levels in both Bores and the Nitrogen level in the South Bore have decreased significantly indicating that the field is recovering from fires that occurred the area in previous years.

9. Spent Cell Lining (SCL) or Spent Pot Lining (SPL)

Concern level = **high**

Key risks = discharge of contamination to Foveaux Straight and possible leaks to groundwater

Key future risk = coastal erosion of site

Toxic waste:

- Leachate is high in fluoride and cyanide, this is treated and discharged to coastal marine area (AUTH-203379).

SCL is the "most significant solid waste" to come from smelting, according to the aluminium industry's global body, the International Aluminium Institute.

The following information has been taken from: World Aluminium: Sustainable Spent Pot Lining Management Guidance, February 2020[35]. Note that Rio Tinto Aluminium is listed as one of the contributing organisations to this document.

Background

SPL is a solid waste generated during the production of primary aluminium. 25 kg of SCL is generated per tonne of aluminium produced.

Primary aluminium is produced via an electrolytic process called the Hall-Héroult process where the aluminium and oxygen in the alumina feedstock is separated by passing a large electric current through a molten bath mixture of cryolite, alumina and aluminium fluoride.

This process occurs within carbon-lined steel pots (Figure 1) to produce molten aluminium metal.

The lining of the pot is typically made of two layers - an insulating refractory lining and an interior carbon lining. Over time, the cell lining wears and can form cracks that reduce its ability to hold the liquid metal in the cell. When the lining of the pot comes to the end of its life, typically after 4-7 years, it is classified as spent pot lining (SPL).

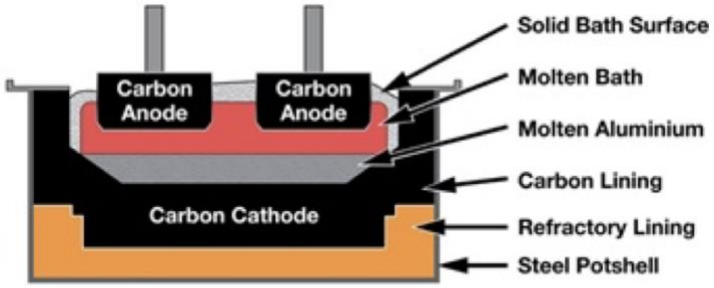

Figure 1: Cross section of aluminium pot (Regain 2019)

SPL is typically a mix of all cell lining materials; however, there is a shift in breaking the lining into the two separate cuts: the first cut (carbon lining), and the second cut (refractory lining). Although the

[35] https://www.world-aluminium.org/media/filer_public/2020/02/28/final_spl_guidance_-_25_feb_2020.pdf

exact composition of each cell lining can differ, typically SPL is composed of approximately 55% of the first cut carbon fraction and 45% of the refractory second cut[8].

Summary of SPL Terminology

SPL (Mixed): An unsorted (or unspecified) combination of the first and second cut SPL.

First Cut SPL: Carbon-rich component of SPL - mainly the upper portion of material from the bottom block and side walls of the pot. It typically consists of a relatively homogeneous and very hard mix of materials including carbon, fluorine and a small amount of cyanide.

Second Cut SPL: Refractory component of SPL – mainly the lower portion of material from the bottom block. It is typically less homogeneous than the first cut and contains lower levels of cyanide and fluorine. Aluminium, silica and sometimes iron are also present.

Properties – why it is a problem

When SPL is extracted from the pot, it is often grey-brown in colour and can vary in size from large blocks to fine dust. During the aluminium production process, chemical compounds can infiltrate and form inside the pot lining resulting in variable and complex chemical compositions.

SPL typically contains aluminium metal, sodium metal, carbon, fluorides, carbides, nitrides, silica and cyanides in both the first cut and second cut. The presence of these chemical compounds gives SPL certain characteristics or properties. Research also shows that the presence of species also changes over time. Both the first cut and second cut of SPL contain hazardous compounds.

SPL's classification as a hazardous waste primarily arises from its fluoride and cyanide content and the potential for these compounds to leach and impact the environment and human health. It can also be reactive with water to produce explosive gases. SPL is corrosive, it exhibits a high pH due to the presence of alkali metals and oxides.

Developing waste management plans

A SPL WMP should incorporate the waste management hierarchy in the following order of preference:

- Avoidance – minimising waste generated through the optimisation of processes;
- Segregation – separating wastes to increase reuse or recycling;
- Reuse – using SPL as a resource;
- Recycling – making SPL suitable for use in other processes;
- Energy recovery – conversion of waste materials into useable heat, electricity or fuel; and
- Appropriate disposal – with minimum impact on the environment and human health.

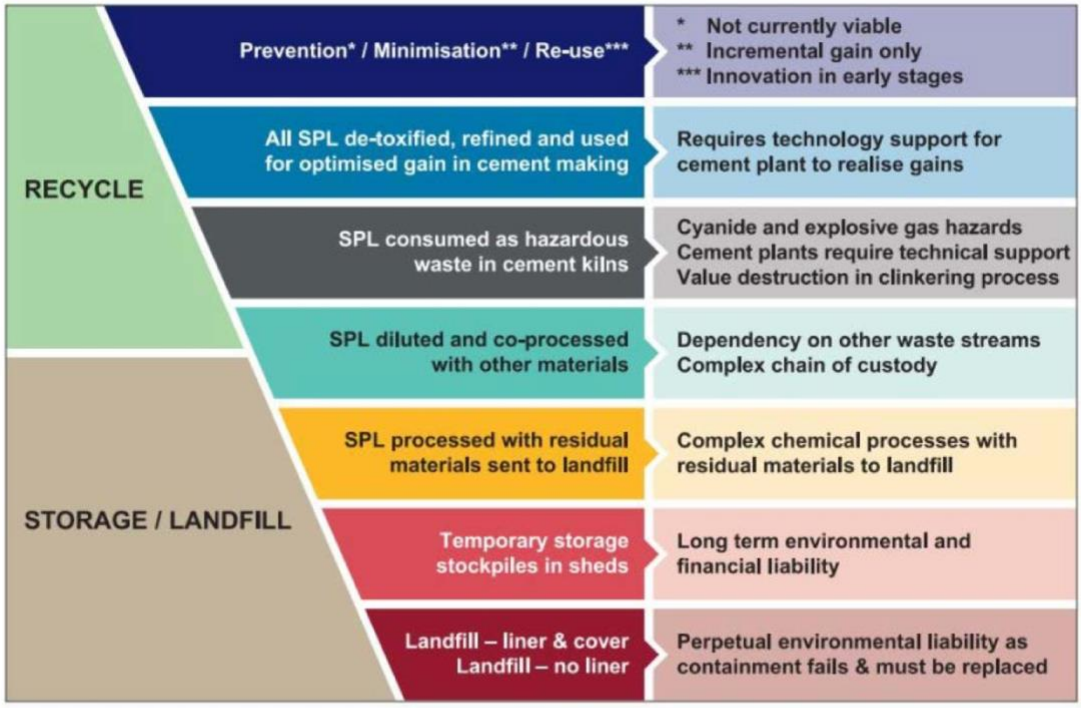

Figure 6: SPL disposal and waste management hierarchy
(Aluminium International Today, 2018)

Sustainable SPL management should include:

- A documented SPL management plan that focuses on protecting human health and the environment from impacts associated with generation, storage, handling, treatment, transportation and disposal of SPL;
- A risk assessment for each stage of the SPL management plan to identify all potential environmental, social, economic, health and safety risks;
- Documented plans for management and monitoring to mitigate key risks;
- A SPL management plan that considers the waste minimisation hierarchy;
- A structured, and systematic, process to assess key environmental, social and economic
- factors associated with specific management options;
- Consideration of specific SPL management issues that are individual to the site and situation (e.g. region, regulatory regime, SPL composition, local opportunities).

Environmental Management

The main issue related to SPL management and the environment is the potential for leaching of hazardous chemical compounds including fluoride and cyanide. There are also environmental risks related to SPL's water-reactivity and the potential for accumulation of flammable gases (hydrogen, methane, ammonia and phosphine).

Flourides

Fluorides are present in both cuts of SPL with typical ranges of between 5-20 wt%. Fluoride tends to be concentrated in the bottom carbon block at the contact point with the molten fluoride salt. There are several factors that can affect fluoride concentration in SPL including: alumina quality, lining quality and age of the steel pot.

The main environmental management concerns around fluoride relate to its potential for leaching and contamination of groundwater or the surrounding environment.

Cyanides

Concentrations of total cyanide in SPL can vary significantly. Cyanide is usually present in both cuts of SPL and there can be variability in cyanide concentrations within the pot. Higher concentrations of cyanide are often found at the side wall where the carbon fraction is exposed to air that can penetrate the lining though the space around collector bars. Total cyanide may vary significantly within a single pot as a result of several factors including alumina quality, the age of the pot or de-lining process.

The main environmental management concerns around cyanide relate to its toxicity, potential for leaching and contamination of groundwater and surrounding environment.

Alkalinity

SPL has a high pH due to the presence of alkali metals and oxides that have penetrated the lining materials or have been formed from chemical reactions. There are several environmental considerations with regards to the alkaline nature of SPL that should be managed.

The main environmental concern is related to the reaction of water with various species in SPL. Sodium oxide (formed from sodium reacting with water) will form sodium hydroxide in the runoff water which makes it highly caustic and thus corrosive.

Storage of SPL should consider water contact with SPL and systems to divert or collect water should be in place to ensure leaching and groundwater contamination risks are minimised.

Even small amounts of rainwater can react with nitrides in the SPL to produce ammonia. If the ammonia becomes concentrated in areas where workers or communities are present, systems should be in place to manage the related risks.

Carbides in the SPL can also react to form hydrogen which has risks related explosions in a confined space. Other gases such as ethylene can also be released but require similar management to hydrogen. Overall, the gas formation potential of SPL from its alkalinity requires storage areas that are well ventilated.

- SPL should be stored away from water, acids, bases and intense heat.
- SPL is highly reactive with water.

SPL as a hazardous waste

Spent Pot Lining is classified as a hazardous waste in a number of jurisdictions. In most cases, this classification means that SPL is subject to further treatment prior to storage or disposal. The treatment standards mostly relate to the destruction of cyanides and recovery of fluorides from the SPL to minimize risks associated with leaching and groundwater contamination. The hazardous waste categorisation and subsequent management protocols only apply once the waste has left the generation site in some instances.

Transport

The classification of SPL as a hazardous waste in many jurisdictions means that its transportation outside of the smelter site is typically highly regulated. When transportation of SPL is being planned, the major risks associated with the movement of hazardous material should be considered as part of a risk assessment. Spillage risks are high during loading, transportation and unloading processes and off-site transportation issues will require consideration as part of the transportation plan:

- Appropriate packaging including a leakproof container
- Labelling of container and transport vehicle
- Handling equipment
- Transportation vehicle specifications
- Transporter technical competence
- Licencing and permits
- Emergency precautions and procedures

The classification of SPL as a hazardous waste also makes it subject specific to The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The Basel Convention was adopted in 1989 by the Conference of Plenipotentiaries in Basel, Switzerland, after the discovery that toxic wastes were being dumped in developing countries. The main objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. The Convention was ratified in 1992 when 20 countries acceded to the Convention. As of 2018, 186 countries and the European Union are parties of the convention.

SPL is subject to the rules of the Basel Convention (Amber Control Procedure) based on the A4050 Basel entry – Waste that contains inorganic cyanide. In cases where the cyanides have been destroyed then SPL is assigned to AB120 due to the inorganic fluorine compound content.

The transport of SPL across borders is highly regulated in most jurisdictions. Each shipment of SPL should adhere to all local, national and international laws and as part of any SPL management plan, procedures should be in place to ensure the following issues are considered:

- Licensing & authorised status for all parties (importer/exporter/authorised trader)
- Valid written contracts & financial guarantees for each SPL shipment
- Notification procedures including notification of competent authorities
- Tracking procedures & movement documents
- Acknowledgement of receipt procedures
- Objections by competent authorities including classification/interpretation differences between parties

9.1 SPL stored at Tiwai Point

Approximately 106,000 tonnes of SPL is stored on a concrete pad close to the coastline. In the past, this concrete pad has cracked, causing “severe” pollution of groundwater with cyanide. The issues associated with the rapidly eroding beach nearby[36] and the longer-term effects of sea-level rise and storm surges mean that this location will not be suitable for storage of SPL in the near future[37].

Key questions:

Given that SPL cannot remain at Tiwai Point – how will it be removed and where will it go?

How will it be processed in the future?

[36] https://www.rnz.co.nz/news/national/436877/smelter-stockpiles-100-000-tonnes-of-hazardous-waste-near-beach

[37] https://www.rnz.co.nz/news/national/437867/another-75-000-tonnes-of-toxic-waste-revealed-to-be-stored-near-beach-at-tiwai-point

10. Other sources of contamination

Environmental monitoring reports provided to ES by NZAS are not publicly available. However, we can get an idea of the types of waste potentially deposited into the landfill and surrounds by looking at the activities undertaken. Some examples are given below.

Felt Bags
In the 2002/2003 ES Environmental Compliance report the following was noted:

> There had been a gradual increase in the particulate discharge from the main stack. Following examination of the issue it was determined that the felt bags in the dry scrubbers were losing their effectiveness. A programme to replace the 13,000 bags was initiated, and is due for completion in the current calendar year.

It can be assumed that these 13,000 felt bags were disposed of in the NZAS landfill. What contaminants do these bags contain? What risk do they pose to the environment should the landfill be breached?

Tiwai Wharf
The 2007/2008 ES Environmental Compliance report commented on a cleanup programme based at the Tiwai Wharf. It seems that in years gone by the wharf was used as a dumping ground for a range of potentially hazardous items. A total of 10 tonnes of rubbish were removed from the seabed around the wharf area.

> In 2004 a **Wharf Seabed Monitoring programme** was undertaken in Bluff Harbour to assess sediment levels near the end of the NZAS wharf to determine the impacts, if any, of the activities undertaken on the wharf. The study was conducted by the Cawthron Institute and found that the concentration of contaminants in the sediments were below guideline values. During the survey a quantity of debris associated with wharf activity was noted. Some items, such as a toilet bowl, caused some thought about how they came to be there. Approval was sought, and granted by Environment Southland, to remove a lot of this debris from the seabed.
>
> To minimise the impact on biodiversity in the area, a number of items were left on site as the local marine life had begun to colonise the area. Items with less than 50% of the surface area exposed were left in place.
>
> Phase 1 of this programme proved very successful, with items such as bottles, crockery, electrical cable, batteries, boots, transistor radios, tyres, toilets and steel structures removed. A grand total of **10 tonnes** was removed from around the wharf area.

It is assumed that these items were disposed of in the NZAS landfill? What will become of hazardous items such as electrical waste and batteries?

Cumulative effects of spills
Spills of substances such as hydraulic oil and heavy fuel have occurred many times over the years. Spills seem to be viewed as 'one-off' events that are reported on in the context of the calendar year in which they occur. However, many 'one-off' events have potential cumulative effects.

The following table contains spillage information gleaned from the ES Environmental Compliance reports since the 1999/2000 reporting year. Do we have an understanding of the cumulative effects of multiple 'small' spills?

Year	Landfill		Groundwater		stormwater/ocean		other	
	type	Volume/mass	type	volume	type	Volume/mass	type	volume
1999-00	putrescible material	?	Hydraulic oil spill	350 litres (lost to gravels under plant – reached g/w ?)				
2001-02							Sewage treatment plant - spillage	?
2002-03	Felt bags from dry scrubbers	13,000			Carbon fines	?		
	Pea gravels contaminated with hydraulic oil	?						
2003-04	Haysom's dross	16,000 tonnes						
2005-06	Contaminated soil (from oil spill) removed to 'bioremediation' area of landfill	?	The monitoring bores downstream of the Haysom's dross and NZAS MRP dross landfill continued to show elevated levels of nitrogen, fluoride, vanadium and boron.		Coke (from supply vessel)	?		
					Coastal permit granted to discharge up to 140 m^3/day of treated effluent to Foveaux Strait Coastal permits to discharge stormwater, drainage water from	Up to 140 m^3 per day		

Year	Landfill		Groundwater		stormwater/ocean		other	
	type	Volume/mass	type	volume	type	Volume/mass	type	volume
					perched water tables, cooling water and miscellaneous washing, flushing and irrigation water to coastal water via, the north, west and south drains			
2007-08	rubbish removed from the Tiwai Wharf seabed	10 tonnes removed – amount remaining - unknown				10 tonnes removed – amount remaining - unknown		
					Alumina to wharf and sea	1-2 tonnes		
					Heavy fuel to Bluff Harbour	4 litres		
2008-09					Hydraulic oil at wharf	10 litres		
					Hydraulic oil entered south drain – but removed	10-15 litres		
2011-12					Heavy fuel oil at wharf	5 litres spilt, but only 1 litre reached the water		
2012-13					Hydraulic fuel oil at wharf	5 litres		

Year	Landfill		Groundwater		stormwater/ocean		other	
	type	Volume/mass	type	volume	type	Volume/mass	type	volume
2019-20			Effluent spill (may have reached groundwater?)	?			Two exceedances of the discharge volume limit for sewage to land	?

11. Conclusion

This report has provided an initial desk-top study of the potential range of contaminants that exist at Tiwai Point. The landfill site is a key concern as it is unlined and contains a cocktail of contaminants of unquantified toxicity and volume. Coastal erosion of the shoreline near the SPL storage pad is also of key concern, and has received much media attention lately.

However, this report highlights that there are many potential sources of highly hazardous substances at the NZAS site. Apart from Dross and SPL, Tiwai Point and surrounds are at risk of contamination from:

- Carbon fines
- Asbestos
- Hydrocarbon contaminated soil
- Diesel
- Heavy Fuel Oil
- Pitch and petroleum coke
- Contaminants from the washdown pad
- Leachate from refractory bricks
- PCBs from historic transformer sites
- A range of contaminants that have been landfilled as 'general waste'

There are still many unknowns as to the extent of contamination associated with the buildings and infrastructure located on-site. It is proposed that once the infrastructure is no longer in use, that it be removed from site and disposed of elsewhere. It is not an option for it to be buried in the current NZAS landfill, which is at risk of coastal erosion and sea level rise. Future generations must be considered.

In the Briefing Note provided by Environment Southland, the monitoring actions proposed are specific to the consents held by NZAS. However, it can be argued that this information is not enough to protect the local environment long-term. We need to move beyond monitoring the present to planning for the future.

The toxicity of Tiwai Point as a site cannot be overstated. The effects of the known cocktail of contaminants reaching the coastal environment will be potentially devasting for generations to come. Detailed information is required about exactly what we are dealing with at Tiwai in terms of hazardous substances. What have we got and how will it be removed and mitigated?

Further investigation must be done in terms of removal of contaminants from Tiwai and what is to be done with the waste. It is proposed that this be the subject of a follow-up report.

Appendix A - ES Environmental Compliance Monitoring Reports

1999/2000

{first compliance monitoring report available electronically – earlier reports are hard copy only}

The smelter continues to have a strong environmental focus. This focus was unfortunately blemished by two incidents at the end of the financial year. The annual Inter-Departmental Committee (IDC) meeting, which examines the NZAS monitoring results and issues, found nothing of concern from the 1999 year. The IDC reports are available on request and cover all monitoring and audit requirements for the January to December 1999 year.

Table 13 - An example of the data supplied by NZAS.

Site	Samples	Units	Standard	Apr-00	May-00	June-00
GMF1	Monthly Sample	mg/kg	80	9	4	7
	Two month average	mg/kg	60	8	7	6
	Twelve month average	mg/kg	40	9	8	9
GMF11	Monthly Sample	mg/kg	80	6	9	8
	Two month average	mg/kg	60	6	8	9
	Twelve month average	mg/kg	40	9	9	9
GMF3	Monthly Sample	mg/kg	80	6	8	6
	Two month average	mg/kg	60	6	7	7
	Twelve month average	mg/kg	40	5	5	5
GMF16	Monthly Sample	mg/kg	80	10	4	6
	Two month average	mg/kg	60	9	7	5
	Twelve month average	mg/kg	40	4	4	4

Grazing Monitor Farm 1 (GMFI) is just north of Bluff, GMF11 closest to the smelter on the Tiwai Rd, GMF 3 furthest north towards Mokotua and GMF 16 west of the Waituna Lagoon. Possible effects are not discernible.

Monitoring

There have been unusual increases in fluoride in vegetation on the plant boundary. However, these increases are not occurring elsewhere. Further investigation is ongoing to determine the reasons for the increase.

The fluoride in Superphosphate swamps any smelter influence regardless of the distance from the smelter. Consequently considerable care is required to ensure that recent fertilizer applications are noted and excluded from long term averages.

Complaints

No complaints were received regarding smelter operations. There were four incidents about which smelter staff notified Environment Southland. These were:

- Minor treated sewage overflow where a small volume spilled onto the surrounding land.
- A contractor entered the smelter property with putrescible material* in his truck, and dumped this in the smelter landfill before undertaking the contracted work.
- An hydraulic oil spill when moving equipment in Metal Products.
- A significant hydraulic oil spill from the furnace tippers in Metal Products. The oil was lost to a pit under the furnace and approximately 350 litres was believed to have been lost through the unsealed concrete slab joints to the gravels under the plant.

*specifics unknown

Table 14 - New Zealand Aluminum Smelters– Key issues with Environment Southland

Issue	Score	Comments
Provision of data / results.	excellent	Reports were complete on time and require minimal follow-up. Any questions are responded to promptly.
Compliance with consent conditions.	very good	Continual compliance with all issues other than the incidents.
Responsiveness to issues - e.g. drought.	excellent	Continue to respond well to issues.
Keeping Environment Southland informed of intentions, changes etc.	excellent	The company continues to brief Environment Southland on intentions and check for additional requirements.

2001/2002

Monitoring

NZAS has an outstanding record of data being provided as required. Monthly, quarterly, annual and periodic reports are all delivered, the majority on time, but if they are behind schedule Environment Southland is informed well ahead of the due date. The majority of data now shows discharges at levels that are difficult to meaningfully graph with the relevant consent limit. Auditing of vegetation samples has been reduced to one type per year (grazed grass, ungrazed grass, pine needles) from the current of all three each year.

Complaints and Self-reported Incidents

NZAS reported two incidents during the year. Both were minor spills of material from sewage treatment systems. The second incident was traced to a mouse in the computer that controlled the pumps to the disposal field. The mouse (four legs, tail and whiskers) had left a deposit of its own in the computer causing a failure of the system. This was rapidly noted and corrected by manual control (and no doubt some rodent control).

Issues

In 1999, work commenced on the potline roof gas flow measurement, in accordance with condition D3.3, which requires the measurement and reporting to the Council at two yearly intervals. However, during the 1999 measurements, a number of technical difficulties were discovered. The technical difficulties have been resolved, but in resolution, indicated that previous monitoring work (undertaken in 1997) may have been incorrectly estimating the total gas flows.

There are two areas of significance. One was the increased reported flows as a consequence of using sensor extension cables on a number of measurements, and the second is a non-vertical vector in the air flow measurements.

The discovery that two sensor extension cables with the anemometer resulted in the velocity measurements being over-estimated by approximately 23% was unexpected, and has not previously been noted by either the manufacturer or supplier. It did raise the interesting issue that calibration of the equipment by bodies such as the Commenwealth Scientific and Industrial Research Organisation had only ever used the single cable, and the addition of cables to enable measurements at longer distances had always been assumed to have negligible effect.

NZAS has increased the height of the side louvres to improve working conditions for potline operators. The increased air flows through the opened louvres is believed to have changed the velocity profiles through the potline roof.

In the 1997 report, it was believed that the vertical component of gas flow was between 99 and 100% of total flow. However in 1999, after the side louvres had been raised, the vertical component was measured and found to be 83% of total flow. This required the installation of an anemometer, which would determine the vertical velocity only. Production and calibration of such an anemometer took some time.

The results of the 1999 measurements were that the total flow was 593,900 standard cubic metres per minute, with a 95% confidence interval of 3.6% of total flow. This was a substantial reduction on the 1997 measurement of 853,800 standard cubic metres per minute. As a consequence of the reduction in air flow out of the roof louvers, there is a step-wise reduction in contaminant mass discharged due to the reduced gas volume.

Average concentrations of contaminants were generally similar between the 1997 and 1999 measurements, with only the gaseous fluoride showing a small increase from 0.14 mg/m^3 to 0.19

mg/m^3. The result of the reduced airflows and reasonably similar contaminant concentrations was a 10% decrease in gaseous fluoride, 10% decrease in sulphur dioxide, 34% decrease in total particulate, and 27% decrease in particulate fluoride compared to the 1997 values. Both sets of calculations will be reported to the Committee to enable members to see the changes occurring as a result of the new measurements.

Irrespective of the method of calculation, the resultant discharges were all well below consent limits.

General

NZAS continues to be a strong environmental performer. The annual Inter-Departmental Committee (IDC) meeting is becoming notable for the fact that it now takes longer to travel to the smelter than to hold the meeting. The company has strongly linked health and safety with its environmental performance. This appears to have worked very well at this site with outstanding performance in both these areas.

Table 9 - New Zealand Aluminum Smelters– Key issues for Environment Southland

Issue	Score	Comments
Provision of data / results.	Excellent	Reports were complete on time and require minimal follow-up. Any questions are responded to promptly.
Compliance with consent conditions.	Excellent	Continual compliance with all issues.
Responsiveness to issues - e.g. drought.	Excellent	Continue to respond well to issues.
Keeping Environment Southland informed of intentions, changes etc.	Excellent	The company continues to brief Environment Southland on intentions and check for additional requirements.

2002/2003

{13,000 felt bags from dry scrubbers were replaced – dumped in landfill? – what contaminants do they contain?}

Monitoring
Monitoring the effect of the smelter on the atmosphere came to a sudden and unexpected halt during the year. The cause was the theft of an entire air monitoring set-up, including gas pumps, samplers and solar panels. Although this equipment has been replaced, there is a gap in the data records.

During the year, two of the monitoring sites have had to be changed as a result of changes in the use of the land. In both cases alternative sites were available in the vicinity of the original site, and approval to relocate the monitoring site was given by the Director of Environmental Management. The proximity of the alternate sites is such that there is not expected to be any difference in exposure, and consequently the data can be considered to be continuous.

Sampling of grazed grasses on the Grazing Monitor Farms is proscribed within 28 days of applying fertilizer. Products made from phosphate rock contain appreciable amounts of fluoride. In July 2002, GMF1 had a high result of 47 mg/kg. Fertilizer had been applied to this area in mid-June, just outside the 28 day limit, however the lack of rain over this period is likely to have caused the high result. The average fluoride over the year was only 10 mg/kg at GMF1.

Complaints and Self-reported Incidents

There were two self-reported incidents and one complaint recorded during the year. The major issue was the discharge of carbon fines from an open area to the stormwater system, and thence to the west drain. This had previously occurred in May 2002. The company responded promptly to the issue and provided a full report. This is set out on the next page, as it is a very good example of report we would like to receive from industries in the event of an issue.

The company also reported the loss of hydraulic oil to the pea gravels following a burst hose on an excavator working on site. The affected gravels were removed to the landfill site.

One complaint was received regarding smoke from the stack. The company reported that the smoke discharge roughly corresponded with changes in the Carbon Bake. On-site monitoring did not note significant increases in opacity of the discharge. It was thought that the complainant was precisely up-wind and consequently looking directly down the plume. This would make the discharge appear darker than normal.

Green Carbon Fines Report
The following is the report received from NZAS relating to the discharge of carbon fines to the West Drain.

Environmental Incident – West Drain Discharge 10 September 2002

> "Further to our telephone discussion on the 10th September, that morning a visible plume of fine black material suspended in storm-water was observed discharging from the West Drain into the sea. This is contrary to specified conditions in the West Drain Consent (Consent No. 94502, Section 3(c), Schedule A(d)). The Section states...."The natural colour and clarity of the water shall not be changed to a conspicuous extent".

The West Drain comprises mainly of stormwater from the carbon area of site. In the two hours from midday to 2.00 pm on the 10th September approximately 4 mm of rain was recorded at the NZAS meteorological station.

On the 9th and 10th September green carbon anodes were being broken apart on a hard tarmac area for recycling. Quantities of fine carbon material were produced which would normally have been removed with a mechanical sweeper at completion of this work. However, prior to completion of the anodes being broken up, the substantial rain event flushed this fine carbon material through the drainage system to sea via the West drain.

Water samples were obtained from three points in the West drain during the discharge. These samples were analysed for concentration of suspended solids.

Analysis results are:

West Drain Sample Location	Total Suspended Solids g/m^3
V notch @ weir	65
Oil Boom	56
Drain exit	74

The amount of suspended solids in the water is similar to samples obtained from the sumps in the carbon area and the West drain in May 2002, when a similar incident occurred (range 45–68 mg/m^3).

Two samples, (from the weir and the oil boom) were analysed for concentrations of the USEPA 16 Priority PAH's. This data provides an indication if the carbon material is from unbaked (green) anodes or from baked anodes. Analyses were:

Sample Location	Total USEPA 16 PAH mg/m^3
West drain - Weir	0.283
West drain - Oil Boom	0.167

The samples obtained in May 2002 were also analysed for PAH content. Analysis results were:

Sample Location	Total USEPA 16 PAH mg/m^3
Drain sump near SCL shed	0.444
Drain sump near green carbon anode stockpile	0.185
Drain sump near green carbon substation	0.234
Drain sump near green carbon HFO tank	0.148
West drain - exit	0.084

Baked anode material contains no quantifiable levels of PAH (<1.0 µg/g naphthalene and <0.2µg/g for the remaining USEPA 16 PAHs). Thus, the data obtained from the West drain water samples in May and September 2002 indicates that the carbon material originated from green anodes rather than baked anodes.

Corrective actions implemented due to this incident are:

- all reject green anode braking-up operations have been transferred to an undercover area, and
- only full green anodes are to be stored outside, and
- areas of spillage which cannot be accessed by a mechanical
- sweeper will be routinely manually swept.

These measures are intended to ensure that there will be minimal green carbon material that could be washed through the drainage system and into the sea via the West drain. Manual sweeping of areas where the mechanical sweeper cannot access will further reduce the amount of other carbon material available to enter the drainage system.

The relocation of green carbon anode braking-up operations to undercover completes corrective actions proposed after the last incident. Subsequent to the incident in May 2002 the proposed re-engineering work to reduce spillage and dust generated during carbon butts load-out has been completed.

If you require further information or wish to discuss further please contact me."

The Green Carbon area was inspected by the Inter-departmental Committee following its meeting. All members were impressed at the changes to the operation of this area, minimising any possible repeat incidents of this nature.

Issues

There had been a gradual increase in the particulate discharge from the main stack. Following examination of the issue it was determined that the felt bags in the dry scrubbers were losing their effectiveness. A programme to replace the 13,000 bags was initiated, and is due for completion in the current calendar year.

General

The overall impacts of the smelter on the environment continue to be well below consent limits. The NZAS lab is now accredited, and as a consequence some of the audit monitoring has been further reduced. The accrediting authority also monitors the laboratory practice and provides additional surety of results.

Table 2 – NZAS – Performance Summary

Issue	*Score*	*Comments*
Provision of data/results	Very good	A portion of data lost due to theft of equipment. Monitoring reports are always on time.
Compliance with consent conditions	Excellent	Results continue to be well below the consent limits.
Responsiveness to issues - e.g. drought	Excellent	Responded promptly and comprehensively to issues as noted above.
Keeping Environment Southland informed of intentions, changes etc	Excellent	Continue to have dialogue with Environment Southland on all pertinent issues.

2003/2004

{Haysom's Dross was landfilled}

Monitoring
The only new issue of note in the monitoring area was the landfilling of the Haysom's dross from Bluff and Gladstone at the smelter site. The dross was placed in a purpose-built site, covered over and revegetated. Bores have been installed to ensure that both up and downstream groundwater monitoring is able to be undertaken.

The normal monitoring continued through the year with no substantive issues. There was only one non-compliance highlighted below.

There were no issues raised at the annual Inter-departmental Committee meeting. The meeting concluded with an inspection of the Haysom's dross area. It was interesting to note that there was very little to see considering the volume of material which was deposited.

Complaints and Self-reported Incidents

The smelter self-reported one incident where the discharge out of the north drain resulted in the receiving environment being more than 0.1 pH unit different from the control. The receiving water was measured at a pH of 7.8 while the control had a pH of 8.1. The non-compliance was believed to be due to a combination of high outflow in the drain and minimal tidal movement at the time of sampling resulting in poor mixing off the drain.

Three complaints were received regarding alumina discharges during unloading. One of these was the result of a dust collector blocking with moist alumina resulting in an overflow. The other two were the result of on-ship actions with hatches being left open during wind events. The smelter is aware of the problems of unloading alumina from general carrying vessels (the dedicated alumina carrier can unload without opening hatches), and is continuing to work with the ships' crews to ensure open hatches are kept to the minimum required to unload.

We also received a number of communications from a person who was concerned that the plant was causing a temperature inversion, and that by turning off dry-scrubbers the inversion was being exacerbated. We were able to provide copies of the Inter-Departmental Committee report, information on inversion formation and an assurance that the plant was unable to turn the dry scrubbers off at night. This information appears to have satisfied the person's concerns.

Issues
The smelter operation has not raised any issues through the year. There is ongoing fine-tuning work being undertaken. Environment Southland is kept well informed of all issues which may have any change to the current environmental impact.

The smelter has developed cell start-up procedures which have minimised environmental effects. This has meant that when cells are turned off as a result of electricity supply issues, there is no measurable change in discharge parameters observed while the cells are re-started. This is a significant improvement, as there were measurable effects when cell start-up occurred after the first shutdown of cells.

The discharge pipe on the bed of the coastal marine area from the smelter was repaired this year following damage and/or burial by the sediments in Foveaux Strait. The pipe was re-tested and was discharging in the required area.

General

There is very little to add to the New Zealand Aluminium Smelters Limited section. The smelter operation continues with monitoring showing substantially lower discharges than allowed by the consents.

A large number of consents expire in 2006. Next year will require re-application for these consents, which is likely to provide some additional workload.

Table 4 – NZAS – Performance Summary

Issue	*Score*	*Comments*
Provision of data/results	Excellent	Data is provided on time on an monthly and annual basis
Compliance with consent conditions	Excellent	There was only one minor non-compliance with consent conditions detected through the year
Responsiveness to issues e.g. drought	Excellent	Responses to incidents or other issues are well thought through, implemented and reported
Keeping Environment Southland informed of intentions, changes etc	Excellent	Environment Southland is kept well informed of any issue which may impact on the environment

2004/2005

Monitoring

Landfill Monitoring Bores

The smelter operates a small consented landfill to the south-south west of the main smelter buildings. The impact of this operation is monitored by a series of eight monitoring bores, three upstream, two to the west and three downstream of the landfill. The most recent results indicate that the levels of contaminants are slightly variable, but generally remain within the ranges established since 1996.

The main difference in groundwater quality was detected in the bore downstream of the area where the Haysom's Metals dross was buried. New Zealand Aluminium Smelters entered into an agreement with a number of local agencies to bury the waste that has been stored following the closure of the Haysom's Metal Industries' plant. The material was classified as "non-hazardous" by Landcare Research on behalf of the Ministry for the Environment. A consent was granted in 2003 to bury the waste in the north-west corner of their existing landfill.

Based on the nature of the dross, together with the groundwater chemistry and hydrology modelling, it was predicted that the main analytes of concern were likely to be fluoride, ammoniacal nitrogen, vanadium and nickel, with the predicted concentrations not expected to exceed the ANZECC guidelines.

The recent analytical results found that the concentration of:

- metals in the groundwaters were less those predicted and not currently near the ANZECC guidelines;
- fluoride concentrations were close to those predicted and not considered an issue at this time;
- ammoniacal nitrogen concentrations were considerably higher than predicted but, when using the model in the original application, were still within the ANZECC guidelines.

The beach along the south coast is a very active, high energy coastline and predicted to have seepage dilutions well in excess of 1,000 times under assumed worse case conditions. Therefore, the current levels of contaminants do not appear to be an issue, but these will need to be continually monitored.

Grazing Monitor Farms (MGF)

New Zealand Aluminium Smelters is required to monitor a number of farming properties to determine fluoride impacts on pasture and animals. The grazed pasture is monitored monthly for fluoride, and a number of averages calculated from this data.

Table 4 - Fluoride monitoring results for grazed pasture on the grazing monitor farms for the 2004 year

	Limit mg/kg	GMF 1	GMF 2	GMF 3	GMF 4	GMF 11	GMF 12	GMF 14	GMF 16
Monthly maximum	80	13	20	7	16	23	9	14	13
Two monthly average	60	11	13	7	11	19	8	9	9
12- month running average maximum	40	15	7	6	8	10	7	6	6
Annual average		7	7	5	7	10	6	5	5

All farms have shown fluoride levels well below the consent requirements. A number of other parameters are also measured on GMF 4, including the fluoride content of cattle urine, and fat-free fluoride content of tail bones from the cattle. These parameters are becoming increasingly difficult to measure, as the farming operations are changing with stock being purchased, rather than born and raised, on the properties. Sampling showed that the fluoride content of the urine and bones were both within consent limits and similar to the previous year.

In addition to grazed pasture, ungrazed pasture and pine tree foliage is also monitored in the vicinity of the smelter. Each year, we split one of the sample groups and have these externally analysed as an audit on the smelter operation. There are no significant outstanding issues with split samples.

Complaints and Self-reported Incidents

There were no complaints received from the public regarding the smelter operation. The smelter itself reported four issues, two of these were minor discharges to air, and two were non-compliances with consent conditions.

The two non-compliances were a pH change in seawater, as a result of the discharge from the North drain, and an excessive discharge of dust from a dust collector.

During routine testing of Dust Collector No 6, in the West/East Reclaim, the concentration of particulates in the dust collector discharge exceeded the permit standard of 500 milligrams per cubic metre. Maintenance was initiated immediately, even before the result of the testing was available, as it was obvious from a visual inspection that the dust collector was not operating correctly.

Routine monthly inspections had not picked up any problems prior to this. During the maintenance three holed bags were replaced in the dust collector. This will have been the cause of the excessive particulate discharge. Notice of the violation was given as soon as result of testing was available. The result of the test was 860 milligrams per cubic metre of particulate being discharged.

Retesting of the dust collector was undertaken after maintenance was complete, and this showed that the repairs had been effective in restoring compliance with the consent conditions.

Issues

The only significant item is the increasing level of ammoniacal nitrogen in the groundwater downstream of the Haysoms dross dump. This was forecast through the modelling undertaken prior to the material being shifted from Bluff. There are no downstream users of the groundwater, with it

discharging into the adjacent Foveux Strait. The dilution available in the strait means that it is improbable that this discharge would result in a measurable change in the coastal water.

General
The smelter operation continues well, with monitoring showing substantially lower discharges than allowed by the consents.

A large number of consents expire in 2006. Next year will require re-application for these consents, which is likely to provide some additional workload.

Table 5 – NZAS – Performance Summary

Issue	Score	Comments
Provision of data/results	Excellent	Data is provided on time on a monthly and annual basis
Compliance with consent conditions	Excellent	There was only one minor non-compliance with consent conditions detected through the year
Responsiveness to issues e.g. drought	Excellent	Responses to incidents or other issues are well thought through, implemented and reported
Keeping Environment Southland informed of intentions, changes etc	Excellent	Environment Southland is kept well informed of any issue which may impact on the environment

2005/2006

Monitoring

The New Zealand Aluminium Smelters (NZAS) Limited plant is located on the Tiwai Peninsula. A number of monitoring programmes are undertaken to assess whether the plant is having an impact on the local environment. This year's monitoring highlighted few issues, confirming again the very high level of compliance maintained by the staff that operate the smelter.

This year, a vegetation health inspection was undertaken by Dr D Doley. The summary of his findings were:

> *The survey indicated that the general condition of the vegetation in the Tiwai Peninsula, Awarua, Waituna, Bluff, and Greenhills districts was satisfactory in April 2005. This condition was attributable to favourable growing conditions during the spring and summer of 2004-2005 and to the absence of severe storms during the previous year. Several species that are commonly injured by storm, particularly Pinus radiata were almost free from injury except for locations close to the ocean or the shore of Awarua Bay.*
>
> *There was no indication of visible injury of vegetation that could be attributed to emissions of sulphur dioxide from the smelter.*
>
> *Visible injury to vegetation that could be attributed to fluoride was limited to the western end of the Tiwai Peninsula. Similar patterns of injury distribution were observed in native flax Phormium tenax), sensitive native and exotic plant species and Pinus radiata. Visible injury was not detected east of the 1 km hut on the Tiwai Peninsula, and reliable indicators of injury were not observed at Tiwai Point*
>
> *There was no evidence of visible injury to vegetation in the Bluff township, the Greenhills area close to Bluff Harbour, Awarua Bay Awarua Plain or Waituna districts that could be attributed to fluoride emissions from the smelter.*

The ammonia and total nitrogen levels in groundwater downstream of the Haysom's dross storage area have continued to increase. It was predicted that the levels of ammonia would be elevated at this point due to the nature of the dross, the groundwater chemistry and hydrology of the area. However, the levels being detected are higher than expected.

NZAS is working with consultants to reassess the impacts of the dross storage. The actual monitoring data is being used to calibrate the original model to better predict what may happen.

Complaints and Self-reported Incidents

This year there were three self reported incidents and one complaint from a member of the public.

The three self reported incidents were:

- While unloading coke from a supply vessel a small amount of coke was blown into the Coastal Marine Area (CMA), which appeared to form a "slick" on the surface of the water. The source of the problem was quickly identified and the discharge ceased. The "slick" of coke was broken up by wave action;
- NZAS staff reported one exceedance in the volume of sewage discharged for a 24 hour period. Systems were checked and it was found that the most likely cause was an unusually large input of stormwater from a heavy shower of rain;
- There was a period when the level of particulate being discharged from the main stack was elevated. This remained compliant with the consent, but was found to be the result of a series of broken filter bags in the scrubbers. When one or more of these bags break, it

causes alumina to escape from the dry scrubber and discharge to air via the main stack. From its investigations, NZAS found that the broken bag detectors were faulty and now obsolete. A different type of detector was sourced, trialled, and is due to be installed.

On one occasion, a member of the public observed a "cloud of alumina" to be forming over a vessel at the Tiwai wharf during the unloading of raw material. When contacted, NZAS staff were aware that the wind had strengthened and shifted, causing turbulence in the hold of the vessel which, in turn, had mobilised some of the alumina, causing the dust problem. To resolve this, one of the hatches on the vessel was closed and the problem ended.

Issues

Electricity constraints since the end of November 2005 have resulted in the plant operating with fewer cells than normal. Since that time, approximately 76 cells have been removed from the circuit. This reduction in operational cells causes less re-circulating alumina to be available to scrub emissions and this is likely to cause an increase in gaseous fluoride emissions. Since the cell shut has occurred, monitoring levels have remained below the permitted limits in the Air Discharge Permit.

Restrictions on electricity availability were partially lifted in May 2006. This meant that cells have been progressively restarted at a rate of approximately 5-6 per week since the later part of May.

General

In 2006, six of NZAS's resource consents were due to expire. Applications were submitted and consents granted for the following:

- permits for the discharge of water and contaminants to land in circumstances where those contaminants may enter water at three locations, namely, land adjacent to the north, west and south drains;
- coastal permits to discharge stormwater, drainage water from perched water tables, cooling water and miscellaneous washing, flushing and irrigation water to coastal water via, the north, west and south drains;
- coastal permit to:
    - occupy the foreshore and seabed in Foveaux Strait for the treated effluent pipe and diffuser;
    - disturb the foreshore and seabed in order to maintain and change the effluent pipe and diffuser; and
    - discharge up to 140 m^3/day of treated effluent to Foveaux Strait;
- permit for the discharge of treated sewage onto and into land, including in circumstances where it may enter water;
- coastal permit to:
    - disturb the foreshore and seabed in Awarua Bay in order to remove a disused sewage pipe;
    - discharge contaminants (including any debris discharged in the operation of demolishing and removing) to coastal water that may be associated with the removal operation; and
    - temporarily occupy the coastal marine area so as to provide for navigational safety during the operation. The occupation of the coastal marine area by the pipe is currently authorised by consent number 96102;
- discharge permit to discharge contaminants to the air from an aluminium smelter and related activities.

NZAS performance summary

Issue	Score	Comments
Provision of data/results	Excellent	Data is provided on time at monthly, quarterly and annual intervals
Compliance with consent conditions	Excellent	There were no significant non-compliance issues.
Responsiveness to issues e.g. drought	Excellent	Responses to incidents or other issues are well thought through, implemented and reported
Keeping ES informed of intentions, changes, etc	Excellent	NZAS staff are very pro-active in communicating with Environment Southland when there is potential for smelter operations to possibly impact on the environment.

Key question – what data is collected and what are the results?

2006/2007

Monitoring

New Zealand Aluminium Smelters has a number of current discharge consents and coastal permits:

- discharge and coastal permit for discharges from the north, south and west drains;
- discharge permit for treated sewage to land;
- coastal permit for the discharge of treated effluent;
- air discharge consent from an aluminium smelter and related activities;
- discharge contaminants to land at the smelter's landfill site.

All consents were monitored throughout the year, with full compliance achieved.

Key question: What does this mean in terms of parameters? What environmental effects were monitored?

One of the contaminants extensively monitored as a part of the consent monitoring programme, is the level of fluoride discharged via the main stack. This is measured at several different points from the main stack, on several environmental receptors that include:

- grazed pastures on a series of monitoring farms;
- ungrazed grasses at Bluff, Greenhills, the Awarua Plains and on the Tiwai Peninsula;
- pine needles at various sites around Awarua Bay; and
- specialized pump equipment measuring general atmospheric deposition at several sites in the Awarua area.

All monitoring lacks specificity as the fluoride measured is not site specific, but it provides a good indication of environmental impacts.

The environmental receptors provide cummulative information about the fluoride and are based on the ability of the vegetation to take up the fluoride, while the atmospheric deposition measurement utilises specialised pumps to filter fixed volumes of air and assess the fluoride levels on a monthly basis.

All monitoring results continued to be well within consent limits. This was demonstrated in the annual summary of the atmospheric deposition monitoring results.

Table 2 – Fluoride Deposition 2006

Site	*Units*	*Guideline*	*2006 Average*	*Maximum for any one month*	*Minimum for any one month*
Buddle Road	g/m^3	0.9	0.07	0.14	<0.05
Gibson's Farm	g/m^3	0.9	0.05	0.09	<0.05
Bluff	g/m^3	0.9	<0.05	0.09	<0.05
Awarua Bay Road	g/m^3	0.9	0.05	0.09	<0.05
Marshall Road	g/m^3	0.9	<0.05	0.05	<0.05

Complaints and Self-reported Incidents

NZAS reported two incidents in 2006:

- on 19 June 2006, the level of dust being emitted from one of the unloaders exceeded the Environment Southland-NZAS code of practice for the discharge to air at the NZAS wharf, as reported by a staff member. The affected line was isolated and the problem was found to be linked to a series of broken bags, designed to retain any fugitive dust from escaping to the atmosphere. The bags were replaced and the unloader line returned to service;
- in September 2006, NZAS reported an oil spill from a pin hole leak in a heavy fuel oil pipe. The oil was contained by the permanent oil traps and temporary booms that were installed once the spill was discovered. No oil residue was found to have entered Bluff Harbour. The contaminated soil was removed and transferred to a bioremediation area and the waste oil was removed for recycling/processing.

Both incidents were responded to in a prompt and effective manner, minimising the impact to the environment.

Issues

The monitoring bores downstream of the Haysom's dross and NZAS MRP dross landfill continued to show elevated levels of nitrogen, fluoride, vanadium and boron. While these do not exceed any direct consent conditions, they do highlight concerns with the waste. NZAS is investigating the possible recycling of the MRP dross. The MRP dross still contains a percentage of aluminium that can be recovered from the by-product.

NZAS performance summary

Issue	Score	Comments
Provision of data/results	Excellent	Data is provided on time at monthly, quarterly and annual intervals
Compliance with consent conditions	Excellent	There were no significant non-compliance issues.
Responsiveness to issues e.g. drought	Excellent	Responses to incidents or other issues are well thought through, implemented and reported
Keeping ES informed of intentions, changes, etc	Excellent	NZAS staff are very pro-active in communicating with Environment Southland when there is potential for smelter operations to possibly impact on the environment.

2007/2008

{wharf dumping ground cleaned up – 10 tonnes removed}

Monitoring

New Zealand Aluminium Smelters (NZAS) currently holds the following resource discharge consents that require monitoring:

- discharge and coastal permit for discharges from the north, south and west drains;
- discharge permit for treated sewage to land;
- coastal permit for the discharge of treated effluent;
- air discharge consent from an aluminium smelter and related activities;
- discharge contaminants to land at the smelter's landfill site.

A wide range of monitoring is undertaken to measure the environmental impact that the smelter is having on the environment. This includes monitoring of:

- the air being discharged from the main stack;
- the air being discharged from the main smelting buildings;
- the ambient air quality at several sites in the Awarua and Bluff areas;
- the vegetation and pine needle quality, with respect to fallout from the air;
- water quality in Awarua Bay and Foveaux Strait;
- groundwater quality;
- gaseous emissions.

All of this routine monitoring is conducted routinely by NZAS as a part of its various resource consent requirements, with regular audits being conducted by Environment Southland to confirm the validity of the results. This year, all monitoring was fully compliant with the respective resource consents.

For a number of years NZAS has been able to build up a very strong and well established compliance record. As a result, Environment Southland considered rationalising some of this monitoring. However, NZAS believes that the current monitoring regime is necessary to provide it with information to assure the public that NZAS continues to perform and have a limited impact on the surrounding environs in the Awarua/Bluff area.

Complaints and Self-reported Incidents

No incidents were reported from the public, however NZAS was very active in self-reporting minor events. The reporting of these events is to be commended. The alerts received by Environment Southland resulted in no significant environmental impact. The alerts received included:

- spillage of approximately 1-2 tonnes of alumina onto the wharf, to sea and onto an adjacent work boat. All attempts were made to remedy the situation and clean up the vessel. Impact was assessed as minor;
- short period of black smoke was being discharged to the air during the commissioning of a new furnace. The burners were turned off for repair and commissioning recommenced. Impact was assessed as minor;
- a faulty thermocouple caused the carbon bake furnace fan to trip out, causing the bake furnaces to vent directly to air for four hours. Impact was assessed as minor;
- a suspected sewage leak was reported when it was discovered an underground pipe was failing to hold pressure. Further investigation found no problem with the pipe and no loss of sewage to land. No impact;
- spillage of four litres of heavy fuel oil to Bluff Harbour on an outgoing tide. This was caused by oil being retained in an elbow of the pipe after bunkering. The heavy fuel oil was lost to

sea when the lines were disconnected. The oil was unable to be contained. The incident was fully investigated, the cause identified and appropriate remedial action has been put in place to eliminate a repeat of this type of incident.

Issues

No issues at the time this report was prepared.

General

In 2004 a **Wharf Seabed Monitoring programme** was undertaken in Bluff Harbour to assess sediment levels near the end of the NZAS wharf to determine the impacts, if any, of the activities undertaken on the wharf. The study was conducted by the Cawthron Institute and found that the concentration of contaminants in the sediments were below guideline values. During the survey a quantity of debris associated with wharf activity was noted. Some items, such as a toilet bowl, caused some thought about how they came to be there. Approval was sought, and granted by Environment Southland, to remove a lot of this debris from the seabed.

To minimise the impact on biodiversity in the area, a number of items were left on site as the local marine life had begun to colonise the area. Items with less than 50% of the surface area exposed were left in place.

Phase 1 of this programme proved very successful, with items such as bottles, crockery, electrical cable, batteries, boots, transistor radios, tyres, toilets and steel structures removed. A grand total of **10 tonnes** was removed from around the wharf area. NZAS is to be commended for embarking on a project of this nature.

The plant is currently investigating the installation of a SO meter, to meet a condition within its air discharge permit. Progress towards achieving this will be reported in next year's publication.

Performance summary

Issue	Score	Comments
Provision of data/results	Excellent	Data is provided on time at monthly, quarterly and annual intervals
Compliance with consent conditions	Excellent	There were no significant non-compliance issues, some minor events were reported by NZAS staff.
Responsiveness to issues e.g. drought	Excellent	Responses to incidents or other issues are well thought through, implemented and reported back to Council
Keeping ES informed of intentions, changes, etc	Excellent	NZAS staff are very pro-active in communicating with Environment Southland when there is potential for smelter operations to possibly impact on the environment.

2008/2009

New Zealand Aluminium Smelter (NZAS) runs four pot-lines that produce some of the world's best aluminium. Due to the loss of a transformer in September 2008, pot-line one was shut down. The shut down of pot-line one decreased NZAS's ability to remove fluoride from the gas emissions going out the main stack. This was because the reduction in alumina used at the plant meant that less alumina could be put through the dry scrubbers to bind and remove the fluoride from the discharge to the air. The alumina, used to make aluminium, first goes through the dry scrubbers to bind the gaseous fluoride before being used in the pot-lines. The innovations, changes and improvements that NZAS implemented to meet the fluoride emission standards deserves commendation. Pot-line number one was brought back on line in May 2009.

Monitoring

New Zealand Aluminium Smelters (NZAS) currently holds the following resource consents that require monitoring:

- discharge and coastal permit for discharges from the north, south and west drains;
- discharge permit for treated sewage to land;
- coastal permit for the discharge of treated effluent;
- air discharge consent from an aluminium smelter and related activities;
- discharge contaminants to land at the smelter's landfill site.

A wide range of monitoring is undertaken to measure the environmental impact that the smelter is having on the environment. This includes monitoring of:

- the air being discharged from the main stack;
- the air being discharged from the main smelting buildings;
- the ambient air quality at several sites in the Awarua and Bluff areas;
- the vegetation and pine needle quality, with respect to fallout from the air;
- water quality in Awarua Bay and Foveaux Strait;
- groundwater quality;
- gaseous emissions.

The above monitoring is required under the different consents held by NZAS. The routine monitoring is conducted by NZAS, with regular audits conducted by Environment Southland to ensure the validity of the results. This year, with the exception of two dust collection results, all monitoring results were fully compliant with the respective resource consents.

One set of dust collection results in October 2008 was found to exceed the consent limit. This was investigated by NZAS and the cause was found to be a series of holes in some of the dust collector bags. These were replaced and the dust emissions brought back under consent limit within one month of testing, as required by the consent.

A second set of dust collection results in November 2008 was also found to exceed the consent limit. This was, again, investigated by NZAS and the cause was again found to be associated with the dust collector bags, but this time it appeared that the bags were not up to industry standard. A new batch of bags was ordered and replaced the suspect bags. The dust emissions were brought back under consent limit within one month of testing, as required by the consent.

Complaints and Self-reported Incidents

One incident was reported by the public. This incident involved dust from the ships at the Tiwai Wharf being blown into the waters of Bluff Harbour. Dust was confirmed to be present around the

ships, however the situation did not exceed any of the NZAS consent conditions. As the result of the incident NZAS has made improvements regarding the unloading of ships at the wharf.

NZAS was very active in self reporting minor events and the reporting of these events is to be commended. The alerts received by Environment Southland resulted in no significant environmental impact. The alerts received included:

- 10 litres of hydraulic oil was spilled on to the Tiwai Wharf. This was caused by a ruptured hydraulic hose. The oil was contained and removed by the use of specialised absorbent material. The incident was fully investigated and appropriate remedial action taken. Impact was assessed as minor;
- 10-15 litres of hydraulic oil entered the south drain. The oil was contained then removed from the drain. Follow up monitoring at costal sites confirmed that no oil or grease was observed in Awarua Bay or Bluff Harbour. Impact was assessed as minor. The incident was fully investigated and the cause was found to be an "O" ring on the hydraulic oil line that was damaged during installation. This resulted in 150 litres of hydraulic oil mixing with the cooling water, however the majority of the leak was contained in the cooling towers. Preventative measures have been put in place to eliminate a repeat of this type of incident.

General

As a measure of its commitment to environmental management the New Zealand Aluminium Smelter has achieved ISO 14001 certification. This is an international certification that is externally audited annually, which demonstrates that the company has the systems in place to actively manage environmental issues at its plants and promotes the principle of continual improvement within the company.

Performance summary

Issue	Score	Comments
Provision of data/results	Excellent	Data is provided on time at monthly, quarterly and annual intervals
Compliance with consent conditions	Very Good	There were no significant non-compliance issues, some minor events were reported by NZAS staff.
Responsiveness to issues e.g. drought	Excellent	Responses to incidents or other issues are well thought through, implemented and reported back to Council
Keeping ES informed of intentions, changes, etc	Excellent	NZAS staff are very pro-active in communicating with Environment Southland when there is potential for smelter operations to possibly impact on the environment.

ISO 14001 Certification – information from Wikipedia

https://en.wikipedia.org/wiki/ISO_14000

ISO 14001 defines criteria for an Environmental Management System (EMS). It does not state requirements for environmental performance but rather maps out a framework that a company or organization can follow to set up an effective EMS. It can be used by any organization that wants to improve resource efficiency, reduce waste, and reduce costs. Using ISO 14001 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved. ISO 14001 can also be integrated with other management functions and assists companies in meeting their environmental and economic goals.

ISO 14001, like other ISO 14000 standards, is voluntary, with its main aim to assist companies in continually improving their environmental performance and complying with any applicable legislation. The organization sets its own targets and performance measures, and the standard highlights what an organization needs to do to meet those goals, and to monitor and measure the situation. The standard does not focus on measures and goals of environmental performance, but of the organization. The standard can be applied to a variety of levels in the business, from the organizational level down to the product and service level.

Benefits

ISO 14001 was developed primarily to assist companies with a framework for better management control, which can result in reducing their environmental impact. In addition to improvements in performance, organizations can reap a number of economic benefits, including higher conformance with legislative and regulatory requirements by adopting the ISO standard.

By minimizing the risk of regulatory and environmental liability fines and improving an organization's efficiency, benefits can include a reduction in waste, consumption of resources, and operating costs.

Secondly, as an internationally recognized standard, businesses operating in multiple locations across the globe can leverage their conformance to ISO 14001, eliminating the need for multiple registrations or certifications.

Thirdly, there has been a push in the last decade by consumers for companies to adopt better internal controls, making the incorporation of ISO 14001 a smart approach for the long-term viability of businesses. This can provide them with a competitive advantage against companies that do not adopt the standard. This in turn can have a positive impact on a company's asset value. It can lead to improved public perceptions of the business, placing them in a better position to operate in the international marketplace.

The use of ISO 14001 can demonstrate an innovative and forward-thinking approach to customers and prospective employees. It can increase a business's access to new customers and business partners. In some markets it can potentially reduce public liability insurance costs. It can also serve to reduce trade barriers between registered businesses. There is growing interest in including certification to ISO 14001 in tenders for public-private partnerships for infrastructure renewal.

2009/2010

New Zealand Aluminium Smelter (NZAS) is located on the Tiwai Peninsular and runs four pot-lines that produce some of the world's purest aluminium. During May 2009 the process of bringing cells into production on line one was commenced (line one was shut down in September 2008 due to the loss of a transformer). NZAS developed and preformed the world's first "live blast starting" of a cell on the line. A live cell blast starting involves restarting a cell that is on the line, while power is still running through the line. Normal procedure for bringing a cell back into production was to shut the whole line down so that a cell could then be connected back up. Live cell restarts mean that cells can gradually be brought back onto lines as needed and line stoppages are not required each time. This allows for much more effective production and management of discharges. This process was completed in May 2010, when all cells on line one were operational.

NZAS currently holds the following resource discharge consents that require monitoring:

- discharge and coastal permit for discharges from the north, south and west drains;
- discharge permit for treated sewage to land;
- coastal permit for the discharge of treated effluent;
- air discharge consent from an aluminium smelter and related activities;
- discharge contaminants to land at the smelter's landfill site.

A wide range of monitoring is undertaken to measure the environmental impact that the smelter is having on the environment. This includes monitoring of:

- the air being discharged from the main stack;
- the air being discharged from the main smelting buildings;
- the ambient air quality at several sites in the Awarua and Bluff areas;
- the vegetation and pine needle quality, with respect to fallout from the air;
- water quality in Awarua Bay and Foveaux Strait;
- groundwater quality;
- gaseous emissions.

In addition to the resource consents held by the company, the Regional Coastal Plan for Southland contains a section that allows the company to operate the Tiwai wharf.

Various monitoring is conducted routinely by NZAS, as required by its different resource consents. Environment Southland also regularly undertakes audit monitoring to confirm the validity of the results. This year all monitoring results were fully compliant with the respective resource consents.

In May 2010, the five yearly vegetation health assessment was undertaken. This assessment was unaffected by the October 2009 fire on the peninsula, as the fire did not destroy any of the routine monitoring sites. The report concluded that the general condition of vegetation on the Tiwai Peninsular and in the Awarua, Waituna, Bluff and Greenhill districts was satisfactory in May 2010. Therefore, the fluoride emissions were not believed to be adversely effecting vegetation in those areas.

Despite line one not being fully operational for the majority of the year, NZAS successfully kept all fluoride emissions below consented levels. It was encouraging to note that the fluoride emissions returned to pre-line one shut down levels by April 2010. The fluoride emissions then continued to decrease and June 2010 recorded the second lowest level ever achieved.

NZAS' commitment to complying with consent limits and having no environmental impact on the receiving environment is to be commended.

Complaints and self-reported incidents

No incidents were reported from the public, however NZAS was very active in self-reporting minor incidents. Two incident reports were received by Environment Southland, however none of the incidents received related directly to any of NZAS' consents, or resulted in a significant environmental impact.

The incidents reported were:

- 10 litres of heavy fuel oil (HFO) was released onto the Tiwai wharf during the changes being implemented to the delivery system in December 2009. Some of this HFO was also released into the sea. The impact was assessed as minor and resulted from planned improvements that have reduced the risk of a HFO leak occurring and discharging directly to the sea.
- During February 2010, approximately 60 m^3 of liquid pitch was lost into the coastal marine area off the Tiwai wharf. The spill was due to a blockage in the liquid pitch manifold, which was undetected prior to the discharge of the pitch from the ship starting. The impact was assessed as minor. Procedures have now been implemented to prevent a reoccurrence of this incident.

General

Every five years, NZAS hires contractors to conduct a survey of the wharf and surrounding seabed. The latest survey, undertaken in December 2009, showed that the concentrations of contaminants in sediment samples collected in Bluff Harbour are all well below guideline values indicative of adverse environmental effects. There was also no sediment accumulation or accretion evident at the markers installed in 2004 on either end of the NZAS wharf.

In October 2009 a fire, believed to be started by a contractor's tractor, destroyed or damaged 930 hectares of vegetation on the Tiwai Peninsular (which is approximately 2000 hectares in size). By May 2010, just 18 weeks later, flax, tussock and bracken had regenerated well in most areas, leaving very little evidence that a fire had occurred. One positive outcome of the fire has been better planned access for fire trucks for the peninsular, as well as a large firebreak at the eastern end. Another beneficial side effect of the fire was a reduction in the quantity of the gorse present in the areas of the peninsular that were affected by fire.

Performance summary

Issue	Score	Comments
Provision of data/results	Excellent	Data is provided on time at monthly, quarterly and annual and five yearly intervals
Compliance with consent conditions	Very Good	There were no significant non-compliance issues.
Responsiveness to issues e.g. drought	Excellent	Responses to incidents or other issues are well thought through, implemented and reported back to Council

Keeping ES informed of intentions, changes, etc	Excellent	NZAS staff are very pro-active in communicating with Environment Southland when there is potential for smelter operations to possibly impact on the environment.

Bouquet

The heavy fuel oil (HFO) pipeline which transports HFO from the ships at the wharf to the holding tanks on site used to run underneath the wharf for approximately 150 metres. This meant that the only way any checks or maintenance could be performed on this section of the pipe line was from a small boat. The HFO pipe is pressure tested using water before every HFO delivery to ensure there are no leaks at least at commencement of offloading. However, the NZAS health and safety procedures prevent the use of small boats around the vicinity of the wharf when ships are docked. Therefore inspections of the HFO pipeline under the wharf could not occur when HFO was actually flowing through this section of the pipeline, so there was always the chance of a leak going undetected.

In September 2008, NZAS undertook a project to remove 180 metres of old and redundant pipeline, as well as repositioning the pipeline currently running underneath the wharf to alongside the wharf. The purpose of this project was to:

- prevent HFO spills to the water occurring by allowing any leaks to be easily spotted;
- allow for ease of access to the pipeline;
- make maintenance work on the pipeline easier.

The actual installation of the HFO pipeline along the wharf started in August 2009 and was completed in December 2009. The whole of the pipeline is now visible to operators from the road and NZAS is now able to have patrols along the length of the pipeline during HFO deliveries. This allows for any potential leaks to be quickly detected.

2010/2011

New Zealand Aluminium Smelter Limited (NZAS) is one of New Zealand‟s largest exporters and is located on the Tiwai peninsula at Awarua, Invercargill. NZAS runs four pot-lines, of which the fourth pot-line produces some of the purest aluminium in the world. With the economy starting to recover from the global economic recession, and all the cells being back on line, NZAS was able to operate between 95 per cent to full production capacity for the 2010/11 period and produced 350 kilotonnes of aluminium.

Monitoring

NZAS holds the following resource discharge consents that require monitoring:

- discharge and coastal permit for discharges from the north, south and west drains;
- discharge permit for treated sewage to land;
- coastal permit for the discharge of treated effluent;
- air discharge consent from an aluminium smelter and related activities;
- discharge contaminants to land at the smelter's landfill site.

A wide range of monitoring is undertaken to measure the environmental impact that the smelter is having on the environment. This includes monitoring of:

- the air being discharged from the main stack;
- the air being discharged from the main smelting buildings;
- the ambient air quality at several sites in the Awarua and Bluff areas;
- the vegetation and pine needle quality, with respect to fallout from the air;
- water quality in Awarua Bay and Foveaux Strait;
- groundwater quality;
- gaseous emissions.

In addition to the resource consents held by the company, the Regional Coastal Plan for Southland contains a section that allows the company to operate the Tiwai wharf. The wharf is operated under an agreement between Environment Southland and NZAS. This agreement is currently in the process of being renewed. NZAS took over the wharf maintenance from South Port during the fourth quarter of 2010.

Various monitoring is conducted routinely by NZAS, as required by its different resource consents. Environment Southland also regularly undertakes audit monitoring to confirm the validity of the results. Overall, there was good agreement between the audit results for NZAS and Environment Southland. This year all monitoring results were fully compliant with the respective resource consents.

The only issue that arose was in October 2010, when results from the dust monitor reached the "action shall be taken" trigger level. However, these results were brought back to normal operating levels within a few days and the consented limits were not breached.

The gaseous fluoride levels are also now back to the low levels seen before the loss of a transformer in 2008.

Complaints and self-reported incidents

No incidents were self-reported by NZAS to Environment Southland between 1 July 2010 and 30 June 2011.

Environment Southland received one complaint from the public about smoke coming from NZAS in April 2011. However, it was confirmed that the source of the smoke was not NZAS, but a large fire in the Greenhills area.

General

NZAS has been working alongside Taha Asia Pacific Limited to set up the pilot plant on the NZAS site for the processing of aluminium dross. The plant is designed to remove the aluminium from the dross being produced at NZAS and from the dross currently in the NZAS landfill. Taha Asia Pacific Limited was granted an air discharge permit on 1 July 2011 for the processing of the aluminium dross. Work at the plant was expected to begin from 1 August 2011.

Performance summary

Issue	Score	Comments
Provision of data/results	Excellent	Data is provided on time at monthly, quarterly and annual and five yearly intervals
Compliance with consent conditions	Very Good	There were no significant non-compliance issues.
Responsiveness to issues e.g. drought	Excellent	Any issues or incidents are immediately responded to, thoroughly investigated and procedures implemented if necessary. All findings and results are reported back to Council
Keeping ES informed of intentions, changes, etc	Excellent	NZAS staff are very pro-active in communicating with Environment Southland when there is potential for smelter operations to possibly impact on the environment.

2011/2012

{change in reporting format]

Consents

NZ Aluminium Smelters Ltd holds seven discharge consents that require inspecting.

They include:

- discharge and coastal permit for discharges from the north, south and west drains;
- discharge permit for treated sewage to land;
- coastal permit for the discharge of treated effluent;
- air discharge consent from an aluminium smelter and related activities;
- discharge contaminants to land at the smelter's landfill site.

The New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai peninsular at Awarua, Invercargill and produces some of the purist aluminium in the world.

The compliance performance during the 2011/12 year was assessed against the current resource consents.

NZAS exceeded consent limits on two occasions, in July2011 and February 2012. NZAS immediately informed Environment Southland of the breaches and remedial action, or measures were put in place.

Complaints and self-reported Incidents

Environment Southland received a complaint from the public in May 2012 regarding dust emissions from ships unloading alumina at the Tiwai wharf. NZAS implemented a series of standard operating procedures.

NZAS self-reported an incident in June 2012. It was a spillage of approximately 5 litres of heavy fuel oil to the Tiwai wharf, of which approximately 1 litre reached the harbour waters. Much of the spilt oil was recovered by smelter staff. A thorough investigation into the cause of the incident was conducted by NZAS. The results were presented to Environment Southland and measures were put in place to prevent any repeat incidents.

Table 19 – New Zealand Aluminium Smelters – consent performance summary

Plant location	Consent compliance			
	Fully compliant	Partial non-compliance	Significant non-compliance	Additional information
Awarua				Fluoride in the coastal water adjoining the North Drain exceeded the consent limit in July 2011. A retest showed that the levels had dropped back to normal and preventative measures were put in place. One dust collector exceeded the consent limit in February 2012 due to damaged bags. Remedial action was taken and the results were brought back within consent limits within a few days.

Table 20 - New Zealand Aluminium Smelters – issues

Issue	Score
Provision of data/results	Excellent
Responsiveness to issues	Excellent
Keeping Environment Southland informed of intentions, changes, etc.	Excellent

2012/2013

Consents

NZ Aluminium Smelters Ltd holds seven discharge consents that require inspecting.

They include:

- discharge and coastal permit for discharges from the north, south and west drains;
- discharge permit for treated sewage to land;
- coastal permit for the discharge of treated effluent;
- air discharge consent from an aluminium smelter and related activities;
- discharge contaminants to land at the smelter's landfill site.

The New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai peninsular at Awarua, Invercargill and produces some of the purist aluminium in the world.

The compliance performance during the 2012/13 year was assessed against the current resource consents.

NZAS remained fully compliant with consent limits during the reporting period.

Table 11 - New Zealand Aluminium Smelters – liaison and reporting

Issue	Score
Provision of data/results	Excellent
Responsiveness to issues	Excellent
Keeping Environment Southland informed of intentions, changes, etc.	Excellent

Compliance and Self-reported Incidents

Environment Southland received two complaints from the public; one in September 2012 and one in March 2013. The September 2012 complaint related to dust emissions from a ship unloading at the Tiwai wharf and the March 2013 complaint related to excessive smoke discharging from chimney stacks. Environment Southland could not confirm either incident.

NZAS has measures in place to minimise any dust emissions.

NZAS self-reported an incident in March 2013. It was reported that a spillage of approximately five litres of hydraulic fuel oil to the Tiwai wharf reached the harbour waters. As much of the spilt oil as possible was recovered by smelter staff. Environment Southland provided education and training to prevent any repeat incidents.

2013/2014

{change in consent information – change in description and 'traffic light' reporting adopted]

Consents

NZ Aluminium Smelters Limited holds six discharge consents that require inspecting.

They include:

- discharge contaminants to land, including circumstances where they may enter coastal water;
- discharge treated sewage to land;
- discharge treated effluent into Foveaux Strait;
- discharge contaminants to air from the aluminium smelter and related activities;
- discharge Haysoms dross to the onsite landfill.

The New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai peninsular at Awarua, Invercargill and produces some of the purest aluminium in the world.

What we look at

NZAS has six consents to discharge. Compliance during 2013/14 was assessed against the current resource consents.

Consent Performance		
NZAS remained fully compliant with consent limits during the reporting period.	12/13	13/14

New Zealand Aluminium Smelters – liaison and reporting

Issue	Score
Provision of data/results	Excellent
Responsiveness to issues	Excellent
Keeping Environment Southland informed of intentions, changes, etc.	Excellent

Complaints and Self-reported Incidents		
Environment Southland received three self-reported incidents from NZAS during the 2013/14 year. These related to dust and smoke emissions due to equipment failures. Two complaints were also made by the public, one in October 2013 and the other in November 2013, relating to dust emissions from the Tiwai wharf. Environment Southland confirmed the presence of dust on only one of these occasions. NZAS was notified of the confirmed incident, however it was already aware of the issue and was in the process of taking corrective actions to rectify the situation. Actions employed by NZAS were appropriate and timely. NZAS has employed further measures to minimise any dust emissions.	12/13	13/14

Green box = "full compliance"

2014/2015

Consents

NZ Aluminium Smelters Limited holds six discharge consents that require inspecting.

They include:

- discharge contaminants to land, including circumstances where they may enter coastal water;
- discharge treated sewage to land;
- discharge treated effluent into Foveaux Strait;
- discharge contaminants to air from the aluminium smelter and related activities;
- discharge Haysoms dross to the onsite landfill.

The New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai peninsular at Awarua, Invercargill and produces some of the purest aluminium in the world.

What we look at

NZAS has six consents to discharge. Compliance during 2014/15 was assessed against the current resource consents.

Complaints and self-reported incidents

Environment Southland received one self-reported incident from NZAS during the 2014/15 year. These related to dust and smoke emissions due to bag house failure. Actions employed by NZAS were appropriate and timely. No complaints were received from the public for the period.

Complaints and self-reported incidents			
Environment Southland received one self-reported incident relating to smoke and dust emissions between 2014/2015.	12/13	13/14	14/15

Consent performance summary

NZAS remained fully compliant with consent limits during the reporting period.

Environment Southland granted an amendment to air discharge sampling in December 2014 to reduce sampling sites and test parameters. Granting of the amendment was based on exemplary compliance with all measured parameters.

Consent performance			
NZAS remained fully compliant with consent limits during the reporting period.	12/13	13/14	14/15

Green box = “full compliance”

2015/2016

Consents

NZ Aluminium Smelters Limited holds six discharge consents that require inspecting.

They include:

- discharge contaminants to land, including circumstances where they may enter coastal water;
- discharge treated sewage to land;
- discharge treated effluent into Foveaux Strait;
- discharge contaminants to air from the aluminium smelter and related activities;
- discharge Haysoms dross to the onsite landfill.

The New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai peninsular at Awarua, Invercargill and produces some of the purest aluminium in the world.

What we look at

NZAS has six consents to discharge. Compliance during 2015/16 was assessed against the current resource consents.

Complaints and self-reported incidents			
Environment Southland received three self-reported incidents from NZAS during the 2015/16 year. The first of these related to smoke emissions due to blockage of heavy fuel oil burners. The second complaint was initially received by NZAS from a member of the public, and related to dust emission from its landfill site due to excessive winds. The third incident related to alumina dust discharge during ship offloading. Actions taken by NZAS were appropriate and timely.	**13/14**	**14/15**	**15/16**

Consent performance			
NZAS remained fully compliant with consent limits during the reporting period. Environment Southland granted an amendment to air discharge sampling in December 2014 to reduce sampling sites and test parameters. Granting of the amendment was based on exemplary compliance with all measured parameters.	**13/14**	**15/15**	**15/16**

Green box = “full compliance”

2016/2017

{change in consent information}

Consents

NZ Aluminium Smelters Limited holds six discharge and water take consents that require inspecting, as follows:

- discharge contaminants to land where they may enter coastal water;
- discharge treated sewage to land;
- discharge treated effluent to the Coastal Marine Area (CMA);
- discharge of water including contaminants to the CMA;
- discharge of contaminants to air from the aluminium smelter and related activities;
- take and use groundwater for industrial supply.

New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai Peninsula at Awarua, and produces some of the purest aluminium in the world.

What do we look at?

NZAS holds eight resource consents, six of which have monitoring and inspection requirements. Compliance during the 2016/17 period was assessed against these resource consent conditions.

Complaints and self-reported incidents			
Two complaints were received: one relating to black dust blowing from the NZAS site and the other related to dust originating from a ship berthed at the port. Neither was confirmed by ES staff, however, NZAS staff responded immediately, and no further complaints were received on either occasion.	**14/15**	**15/16**	**16/17**

Consent performance			
NZAS remained compliant with consent limits during the 2016/17 period, with the following exceptions which were responded to appropriately. An exceedance of the alumina particulate emissions limit from a dust collector was reported by NZAS in March 2017. Re-tests of the dust collector discharge following replacement damaged filter bags, resulted in compliant levels and no further issues were reported. An exceedance of the TSS limit for cathode effluent was reported for samples collected in October 2016. This was responded to appropriately and	**14/15**	**15/16**	**16/17**

Consent performance			
preventative measures have been put in place to avoid future exceedances. NZAS continually provided notifications to ES during the 2016/17 period, regarding routine maintenance that may have resulted in concerns from members of the public.			

Green box = “full compliance”

2017/2018

Consents

NZ Aluminium Smelters Limited holds six discharge and water take consents that require inspecting, as follows:

- discharge contaminants to land where they may enter coastal water;
- discharge treated sewage to land;
- discharge treated effluent to the Coastal Marine Area (CMA);
- discharge of water including contaminants to the CMA;
- discharge of contaminants to air from the aluminium smelter and related activities;
- take and use groundwater for industrial supply.

New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai Peninsula at Awarua, and produces some of the purest aluminium in the world.

What do we look at?

NZAS holds nine resource consents, six of which have monitoring and inspection requirements. Compliance during the 2017/18 period was assessed against these resource consent conditions.

Complaints and self-reported incidents			
Five complaints were received during 2017/18: one regarding aluminium dross, one smoke complaint, one relating to carbon dust and two concerning alumina dust originating from the port. The Aluminium dross complaint was investigated by Environment Southland. It was found that NZAS were operating within the current resource consent conditions. The remaining incidents were not confirmed by Environment Southland staff and were referred to NZAS on all occasions. These were investigated and responded to appropriately by NZAS staff.	**15/16**	**16/17**	**17/18**

Consent performance			
NZAS remained compliant with consent limits during the 2017/18 period. Audit sampling of the effluent and stormwater discharges was also completed by ES with no issues. NZAS continually provided notifications to ES during the 2017/18 period, regarding routine maintenance that may have resulted in concerns from members of the public.	**15/16**	**16/17**	**17/18**

Green box = “full compliance”; Yellow box = “low risk non-compliance” category

2018/2019

{change in reporting layout}

New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai Peninsula at Awarua, and produces some of the purest aluminium in the world.

What do we look at?

NZAS holds nine resource consents, six of which have monitoring and inspection requirements. Compliance during the 2018/19 period was assessed against these resource consent conditions.

Consents

NZAS holds six discharge and water take consents that require inspecting, as follows:

- discharge contaminants to land where they may enter coastal water;
- discharge treated sewage to land;
- discharge treated effluent to the Coastal Marine Area (CMA);
- discharge of water including contaminants to the CMA;
- discharge of contaminants to air from the aluminium smelter and related activities;
- take and use groundwater for industrial supply.

Complaints and self-reported incidents	2016/17	2017/18	2018/19
Three complaints were received in the 2018/19 period. One incident was for a fire in the landfill which was responded to by Fire and Emergency New Zealand. Two incidents were for black smoke from the smelter. NZAS investigated the reported incident and traced it to one of the furnaces. Immediately on discovery the furnace was shut down.			

Consent performance summary	2016/17	2017/18	2018/19
NZAS remained compliant with consent limits during the 2018/19 period. Audit sampling of the effluent discharge, stormwater discharge and ambient air quality sampling was also completed by Environment Southland with no issues. NZAS continually provided notifications to Environment Southland regarding routine maintenance that may have resulted in concerns from members of the public during the 2018/19 period.			

Green box = “full compliance”; Yellow box = “low risk non-compliance” category

2019/2020

New Zealand Aluminium Smelters Limited (NZAS) is located on the Tiwai Peninsula at Awarua, and produces some of the purest aluminium in the world.

What do we look at?

Environment Southland investigates complaints and self-reported incidents and assesses compliance against the conditions listed in the resource consents.

New Zealand Aluminium Smelters Limited (NZAS) holds six discharge and water take consents that require inspecting. The consents are:

- the discharge of contaminants to land where they may enter coastal water;
- the discharge of treated sewage to land;
- the discharge of treated effluent to the Coastal Marine Area (CMA);
- the discharge of water including contaminants to the CMA;
- the discharge of contaminants to air from the aluminium smelter and related activities;
- to take and use groundwater for industrial supply.

Complaints and self-reported incidents	2017/18	2018/19	2019/20
An infringement was issued for an effluent spill to ground.			

Consent performance summary	2017/18	2018/19	2019/20
A number of breaches of consent discharge limits occurred in the 2019/20 period. The cyanide limit for the effluent discharge to Foveaux Strait was exceeded on one occasion by a margin of 10%. The limit for fluoride in the discharge to Bluff Harbour was exceeded on one occasion. Two exceedances of the discharge volume limit for sewage to land occurred. No issues were identified during the Environment Southland audit sampling of the stormwater discharge to Bluff Harbour and ambient air quality sampling. NZAS continually provided notifications to Environment Southland during the 2019/20 period.			

Green box = “full compliance”; Yellow box = “low risk non-compliance” category;

Red box = “significant non-compliance”

Appendix B - ICC District Plan 2019

https://icc.govt.nz/public-documents/invercargill-city-district-plan-2019/

Part One – Introduction and Interpretation

Definitions:

Aluminium Smelting

Means the casting and smelting of aluminium, together with those industrial and other ancillary activities providing equipment, product or other inputs to these processes, and includes:

1. Associated infrastructure, administration, training activities, tourist activities, staff facilities, medical treatment facilities, Caretaker Accommodation, wharves, stores, roading, parking and/or essential services
2. Stockpiles, facilities and structures for storage, loading and unloading
3. The disposal and/or treatment of waste material and effluent associated with the above
4. The storage and distribution of liquid or gaseous fuels associated with aluminium smelting
5. Earthworks
6. Activities associated with fire fighting and emergency services.

Contaminated Land

Means any land that has a hazardous substance in or on it that:

1. Has significant adverse effects on the environment; or
2. Is reasonably likely to have significant adverse effects on the environment; or
3. Is likely to pose an immediate or long term hazard to human health.

Landfill

Means a site used for the deposition of solid waste, including material that does not meet the definition of 'cleanfill', on to or into land. This excludes farm landfills and dead holes.

Part Two – Issues, Objectives and Policies

Hazardous Substances

The Hazardous Substances and New Organisms Act 1996 and the Resource Management Act 1991 complement each other. The Hazardous Substances and New Organisms Act 1996 provides the framework for developing technical standards for the use, storage, transportation, inspection, identification and regulation of hazardous substances. The Resource Management Act 1991 outlines responsibilities councils have to control the effects of the use or development of land, and to prevent or mitigate any adverse effects that may result from the use, storage, disposal or transportation of hazardous substances. The Resource Management Act 1991 is focused on site-specific controls on the use of land and on managing the risks to the local environment. It requires councils to take an effects-based approach to managing hazardous facilities.

The Invercargill City Council and Environment Southland also share functions under the Resource Management Act 1991 for the control of the use of land with the purpose of preventing or mitigating any adverse effects of the storage, use, transportation or disposal of hazardous

substances. Environment Southland controls the use of land to manage the effects of hazardous substances in the beds of lakes and rivers, and in the coastal marine area. The Council is responsible for managing the effects of hazardous substances on all other land.

Issues

The significant resource management issue for hazardous substances:

HAZ-I1 If not managed effectively the manufacture, storage, use, transportation and disposal of hazardous substances can have adverse effects on the environment and on public health and safety.

Objectives

HAZ-O1 Protection of the environment and human health and safety from the adverse effects of the manufacture, storage, use, transportation and disposal of hazardous substances.

HAZ-O2 Avoid creating new areas of contaminated land and further contamination of already contaminated land.

Policies

HAZ-P1 Environment:

Ensure that hazardous substances are manufactured, stored, used and disposed of in a manner that avoids, remedies or mitigates adverse effects on the environment.

Explanation:

If not manufactured, stored, used, transported or disposed of appropriately, hazardous substances can give rise to a range of adverse environmental effects. These effects can be reduced through appropriate manufacture, storage, use and disposal practices. Particular consideration should be given to the adoption of appropriate operating procedures and systems, staff training, defined transport routes, management plans, monitoring regimes and contingency plans. Particular consideration should also be given to the provision of containment systems or contingencies to control spillage or leakage, installation of appropriate signage and separation or buffers from sensitive natural environments, areas at significant risk of natural hazards and incompatible land use activities.

Natural Hazards

Sea level rise/storm surge has been identified as a natural hazard in respect of land adjoining the open sea coast, Bluff Harbour, the New River Estuary and tidal tributaries. The areas below three metres above mean sea level are most at risk from storm surge and sea level rise over the next 100 years or so. The areas below three metres above mean sea level adjoining the New River Estuary and the tidal tributaries have been mapped and are shown on the District Hazard Information Maps.

The District, like the rest of New Zealand, is susceptible to seismic activity. A major rupture of the south-west segment of the Alpine Fault is understood to have a 30% chance in the next 50 years. The District is also at risk of earthquakes in the Puysegur Subduction Zone to the south-west of the South Island. The best information available to the Council indicates that a Modified Mercalli VIII earthquake is the 475 year return period earthquake event2 allowing for the risk of amplified ground shaking due to the nature of the underlying soils. The lower lying areas of the Invercargill District have a high, or very high, susceptibility to liquefaction.

The lower lying areas have varying degrees of susceptibility to tsunami risk. A tsunami affecting these areas would most likely be generated by a seismic event anywhere around the Pacific Basin, or by an event originating in the Puysegur Subduction Zone.

Land use activities are subject to such phenomena as inundation, seismic activity, coastal erosion, and sea level rise/storm surge.

Generally, those areas of land below three metres above mean sea level are most at risk from sea level rise, are also affected or potentially affected by riverine inundation, liquefaction, storm surge, and tsunami.

NH-P7 Identification - Sea Level Rise:

To recognise areas below the five metre contour (AMSL) as having the potential to be affected by sea level rise, and to identify areas below the three metre contour (AMSL) as being most at risk from sea level rise.

Explanation:

Throughout New Zealand local authorities are being warned to plan proactively for sea level rise and its consequences, and these contours form the basis of the advice from central government.

Natural features and landscapes

Bluff Harbour, Awarua Bay, the New River Estuary, Oreti Beach and parts of the Oreti and Waihopai Rivers are within the coastal marine area, which for resource management purposes is administered by Environment Southland.

NFL-P2 Identification and Characterisation of Outstanding Natural Features and Landscapes:

To identify the following as Invercargill's outstanding features and landscapes, as delineated on the District Planning Maps:

1. Areas of Significant Indigenous Biodiversity within the Otatara Zone
2. Bluff Hill (Motupōhue)
3. Three Sisters/Ōmaui area
4. The Bluff Dune System
5. Awarua Wetlands
6. New River Estuary
7. Bluff Harbour/Awarua Bay
8. Sandy Point
9. Oreti Beach
10. Lake Murihiku.

Explanation:

These areas have been identified to be outstanding natural features and landscapes on the basis of an analysis using the criteria set out in NFL-P1.

NFL-P3 Protection for Outstanding Natural Features and Landscapes:

To provide for the protection of Invercargill's outstanding landscapes and natural features, from those activities that could adversely affect their intrinsic value and identity, which includes their associated vegetation and habitats.

Explanation:

The values and character of these areas which include their associated vegetation and habitats are also important in defining the character of the Invercargill City District.

Coastal Environment

Overview

The Invercargill City District contains about 165 kilometres of coastline around harbours, estuaries or tidal rivers and along the open coast. It is a highly dynamic entity. In a short period of time (geologically speaking) the District's coast has gone through much change. Change due to coastal processes is expected to continue, especially if sea level continues to rise as much as predicted.

The Invercargill City District has a significant area of wild and scenic coastline within its boundaries. These boundaries also nearly surround two large estuarine harbours.

The coastal environment is characterised in part by special qualities relating to landscape, landform, intrinsic values and heritage values and by regionally significant development in the Port of Bluff and the Aluminium Smelter at Tiwai Point.

Within the coastal environment, there is a diminishing degree of maritime influence as one moves inland from the sea coast. There is an area of coastal dominance that abuts the coastal marine area and is dominated by coastal processes. Moving inland, there is then an area of coastal influence. It may vary from a narrow strip to many metres in depth. The coastal hinterland area is still further inland but shows some geomorphological evidence of coastal processes.

The New Zealand Coastal Policy Statement 2010 (NZCPS 2010) requires preservation of the natural character of the coastal environment and its protection from inappropriate subdivision, use and development.

The natural character of the Invercargill coastal environment is analysed in Appendix 4 of the Regional Coastal Plan for Southland (2013).

Issues

The significant resource management issues for the coastal environment:

CE-I1 The natural character of much of the coastal environment is at risk from inappropriate subdivision, use and development.

CE-I2 There is a need to identify locations where subdivision, use and development are appropriate.

CE-I3 Public access to and along the coast is fragmented and in some places non-existent and this needs to be improved.

CE-I4 A range of activities, including sea ports and infrastructure, can have a functional need of coastal space.

CE-I5 The District's coastal water and ecosystems are degraded by discharges from land based activities.

Objectives

CE-O1 The natural character of the coastal environment is preserved and protected from inappropriate subdivision, use, and development.

CE-O2 Provision is made for those activities that have a functional need of locating within the coastal environment.

CE-O3 Provide for existing infrastructure and development within the coastal environment, including the Port of Bluff and Tiwai Smelter and recognise the functional need for some activities to locate within the coastal environment.

CE-O4 Residential development within the coastal environment is provided for at Bluff and Ōmaui.

CE-O5 Infrastructure, renewable energy projects and associated development are provided for in the coastal environment, recognising that such developments may have specific locational and technical constraints, while maintaining and enhancing public access and preserving natural character as far as practicable.

CE-O6 Manage adverse effects of land use and development on coastal water quality and ecosystems.

CE-P6 Functional, Technical or Operational Requirements:

1. To protect and provide for existing infrastructure, port and renewable energy projects that have a functional, technical or operational requirement to locate in the coastal environment.

2. To recognise and make provision for the functional, technical or operational requirements of infrastructure, port and renewable energy projects in determining appropriate locations and/or management in the coastal environment, and make appropriate provision for other facilities and activities that have located in the coastal environment for historical reasons.

Explanation:

The Port of Bluff and wharf facilities at Tiwai Point straddle the coastal marine area and the landward edges of the coastal environment and they have a functional need for such a location, as do mineral extraction activities. Infrastructure including roads, railways, and communication and power lines can also have a need to be located within the coastal environment in order to provide essential services.

Other activities, such as the Aluminium Smelter at Tiwai Point and the associated National Grid transmission lines, are located in the coastal environment for historic reasons and have invested heavily in their buildings, plant and equipment. Much of the District's sport and recreation activities require large areas of land located within the coastal environment. All these activities are important in enabling development and diversification to occur to meet the changing needs of the Invercargill City District and the Southland region. Many have a technical and/or operational requirement to be located within a coastal space. For others, it is not practicable to consider relocation.

Where new activities are being established, notwithstanding this policy, regard must be given to the suitability of any site and, together with any expansion of existing activities, the extent to which adverse effects can be avoided, remedied or mitigated, having regard to the provisions of the Resource Management Act 1991.

Water

An integrated approach to water quality and water quantity issues between Environment Southland and the Invercargill City Council has been adopted. Environment Southland is responsible for controlling the use of land for the purposes of maintaining and enhancing water quality and water quantity, as well as controlling discharges of contaminants into or on to land or water. The Invercargill City Council also plays a role in managing the District's water quality and water quantity through management of land use activities and its responsibility to control adverse environmental effects of inappropriate land use, subdivision and development. It is therefore within the Council's jurisdiction to include provisions in the District Plan for controlling the effects of land use on water quality and water quantity.

Smelter Zone

Overview

The Smelter Zone offers the opportunity for the aluminium smelter industry to operate, maintain and upgrade an Aluminium Smelter at Tiwai Point, along with associated industrial activities.

The Aluminium Smelter at Tiwai Point has been in operation since 1971. Employment, both directly at the smelter and in associated services, accounts for a significant proportion of Invercargill's economic critical mass. The presence of a large aquifer means that the Smelter is self-sufficient in terms of water supply, and waste water is treated on-site. Environmental effects of the Smelter operation are continuously monitored and independently reviewed.

The characteristics of aluminium smelting activities include high noise, light and glare levels, the opportunity to generate odour emissions, the storage and use of hazardous substances and frequent use and visitation by heavy vehicles and hazardous substance transporters.

The Smelter is sited at Tiwai Point within the coastal environment. It has a functional need for this site because of its reliance on Tiwai Wharf as part of its operations (for the import of raw materials) and its location within close proximity to port facilities at Bluff for export of product. Electricity supply and roading infrastructure have been constructed to meet the requirements of the smelting operation on this site.

At some stage, the Smelter may be considered by its owners to have completed its operational life, and the facility may be closed. In that event, maintenance and rehabilitation of the site could be a significant issue.

The Smelter Zone adjoins recognised areas of indigenous biodiversity. There are a number of archaeological sites of heritage value within the zone and more on the coastline adjoining the zone.

Issues

The significant resource management issues for the Smelter Zone:

SMELZ-I1 The Smelter has specific operational requirements which need to be protected.

SMELZ-I2 In the event that the Smelter ceased operations, a long-term resource management issue would be the maintenance and rehabilitation of the site.

Objectives

SMELZ-O1 Enabling a viable Aluminium Smelter to operate at Tiwai Point, which is internationally competitive and which forms the basis for a significant part of the economic critical mass of Invercargill.

SMELZ-O2 Provide for activities associated with the Aluminium Smelter to be undertaken within the Smelter Zone, while managing the environmental effects of those activities beyond the zone boundary.

Policies

SMELZ-P1 Smelter Zone:

To provide a Smelter Zone to enable the operation, maintenance and upgrade of the Aluminium Smelter at Tiwai Point.

Explanation:

The Smelter has a functional need for this site because of the need for a location adjacent to a port (for import of alumina) and within close proximity to port facilities at Bluff for export of product. Electricity supply and roading infrastructure have been constructed to meet the requirements of the smelting operation on this site.

SMELZ-P2 Noise:

To provide for the opportunity to generate levels of noise in keeping with the operation of the Aluminium Smelter, whilst also recognising that residential areas in Bluff are entitled to protection from unreasonable or excessive noise as part of their residential amenity.

Explanation:

The Tiwai Point Aluminium Smelter is sited on a peninsula surrounded on three sides by open sea or harbour. The nearest area likely to be affected by any significant noise is the town of Bluff, approximately two kilometres away to the west across the harbour. Privately owned farmland and isolated residences are located well over three kilometres north-west of the smelter.

SMELZ-P3 Odour:

To accept odour emissions associated with aluminium smelting activities whilst also ensuring the absence of nuisance from objectionable odour.

Explanation:

The isolated nature of the Aluminium Smelter site and its large size mean that odours associated with processes can be effectively contained on-site.

SMELZ-P4 Glare:

To accept that glare may be an effect from activities in the Smelter Zone while avoiding nuisance from glare beyond the site.

Explanation:

The Aluminium Smelter is characterised by very large buildings and structures which have the potential to create glare. Significant glare from large structures can affect transportation networks and could affect those with distant views of the Smelter.

SMELZ-P5 Lightspill:

To manage the effects of lightspill from the aluminium smelting activities and associated operations on nearby residential areas and transportation networks.

Explanation:

Floodlighting and security lighting are an essential feature of smelter operations which must continue 24 hours a day, seven days a week, but it is both possible and necessary to avoid nuisance to residential areas across the harbour. Lightspill can also cause a hazard to transportation networks, including to aircraft, vehicles, trains, cyclists and pedestrians.

SMELZ-P6 Wind, Site Coverage, Height of Structures, Landscaping, Planting and Screening, Weather Protection, Electrical Interference:

To acknowledge that these dimensions of amenity do not require regulatory controls in the Smelter Zone.

Explanation:

Because of the large and isolated nature of the site and the self-contained and extensive nature of the smelter operation, these dimensions of amenity are not relevant in the zone.

SMELZ-P7 On-site Servicing Capacity:

To acknowledge that the capacity to meet requirements for water supply, stormwater and foul water disposal on-site is important to the Smelter operation.

Explanation:

The fresh water requirements of the Smelter are met from the Tiwai aquifer. This aquifer and its use by the smelter are carefully monitored to guard against salt water intrusion. The waste water requirements of the smelter operation are met by on-site treatment facilities. While these operations are subject to consents from Environment Southland, they are important to the operation of the smelter and would be likely to be issues if other activities were considered in the area.

SMELZ-P8 Hazardous Substances:

To provide for the storage, use and transport of hazardous substances whilst having regard to the safety needs of the general public.

Explanation:

Hazardous substances are routinely used and stored, some in large quantities, in the normal course of the Smelter operation.

SMELZ-P9 Re-use and Rehabilitation:

In the event that activities are discontinued within the zone, to promote adaptive re- use of buildings, and if that does not occur encourage the rehabilitation of the site, including the removal of buildings.

Explanation:

The Smelter is located in the coastal environment, preservation of the natural character of which is a matter of national importance. If requirements change, adaptive re-use or replacement of existing buildings makes best use of the land resource and infrastructure. Derelict industrial properties and poorly maintained industrial land could significantly detract from the amenities of the neighbouring town.

SMELZ-P10 Demolition or Removal Activities:

To manage the adverse effects of demolition or removal activities on amenity values by ensuring the clean-up, screening and maintenance of sites.

Explanation:

Although normally temporary and localised, demolition activities can create a significant nuisance. There is an obligation to ensure that demolition materials are disposed of responsibly. There is also a need to ensure that the site is made safe, clean and tidy in a timely manner. For similar reasons, relocation of buildings needs to be properly managed.

SMELZ-P11 Connectivity:

To promote connectivity between the Smelter Zone, the seaport at Bluff and the Aluminium Smelter's own wharf at Tiwai, and the connections provided with the wider Invercargill City District via the roads servicing the site.

Explanation:

Safe, efficient and direct links between systems are a priority to enable the safe and efficient transport of goods and also to minimise any side effects or risk on the adjacent town.

Methods of Implementation

SMELZ-M1 Delineate the Smelter Zone on the District Planning Maps.

SMELZ-M2 Include Rules identifying activities that are appropriate within the Smelter Zone.

SMELZ-M3 Identify the anticipated amenity values in and around the Smelter Zone, where appropriate include environmental standards to protect and enhance them, and implement through enforcement under the Resource Management Act 1991, education, advocacy and collaboration with other territorial authorities.

SMELZ-M4 Include Rules addressing District Wide issues.

SMELZ-M5 Require applications for resource consent to include an analysis of the proposal on the defined amenity values of the Smelter Zone.

SMELZ-M6 Initiate environmental advocacy for:

1. Mitigation or avoidance of nuisance arising from glare and windflow effects
2. Promotion of well-maintained structures and land.

SMELZ-M7 Identify cross boundary issues, e.g. discharges.

SMELZ-M8 Consult with stakeholders who may be affected by the operation of the Smelter, for example land owners and occupiers, iwi, central government organisations, internal Council departments and local community and business groups.

SMELZ-M9 Recognise sectorial responses, such as hazardous substances standards and guidelines.