Nyrstar Hobart Triennial Public Environment Report 2022 – 2024

VERSION 3: SUBMITTED 10 APRIL 2025

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1. GENERAL MANAGER'S LETTER OF INTRODUCTION

It is my pleasure to present Nyrstar Hobart's Triennial Public Environmental Report. The contents of this report represent the environmental performance and work conducted at the site during the reporting period.

This Triennial Public Environment Report is a summary of Nyrstar Hobart's environmental activities for the period 1 January 2022 to 31 December 2024. It compares environmental performance against commitments and regulatory obligations, and reports on monitoring progress particularly in the areas of air, water, land and noise in the local community.

Our aim is to minimise the environmental impact of both our production processes and our products and to conduct our operations in compliance with all relevant environmental regulatory instruments. The environmental challenges posed by the site are not insignificant. Smelting operations over the past 108 years have resulted in contamination of soil and groundwater, accumulated waste stockpiles, and ecosystem impacts on the Derwent Estuary. However, Nyrstar Hobart acknowledges and accepts these challenges and has made significant and increasingly rapid progress in addressing these issues.

The reporting period saw a continued focus on reducing fugitive dust and consequently lead in air at the site. Many improvements were implemented during the reporting period, including the commissioning of a new baghouse in the Casting Department, further expanding the sprinkler system network, installation of new real-time dust monitors and ongoing infrastructure and housekeeping improvements across the site. Whilst the data indicates these improvements are having a positive impact, this will continue to be a significant focus for the site throughout the coming years.

A number of noise mitigation projects were implemented in the Roast Department in 2024 to reduce the risk of nuisance noise in the community. Works included installation of a new silencer on one of the primary steam vents, which achieved a significant reduction in intermittent steam venting noise from the Roast.

Works commenced on the New Cellhouse project, which involved the management of excavation spoil generated from the construction of a new major roadway. This process was well-managed, with minimal contaminated material required off-site disposal. The majority of the excavation spoil was re-used on the site, creating new laydown space.

In 2023, and again in 2024, the site achieved third-party verification of recycled content in finished market metal zinc. The Nyrstar Hobart zinc products contain a minimum of 20% recycled content. A Life Cycle Analysis for each of the zinc smelters in the Nyrstar Group was completed by an external consulting group in 2024. This analysis revealed that Nyrstar Hobart has the second lowest carbon emissions per tonne of market metal zinc in the group, achieved largely through the access to Tasmanian hydro-electricity. These credentials are becoming increasingly important to customers, and the end-users of the zinc produced at the Hobart smelter.

Over the past 3 years (the reporting period), eight instances of non-compliance with conditions in the site's environmental permit occurred. All were thoroughly investigated and actions to resolve the issues have been completed, or are still in progress.

Overall, 2022 - 2024 has presented some environmental management challenges, however the triennial period has also seen a number of key objectives of site environmental management plans completed, particularly in improved management of air emissions and waste. We will continue to focus on these, and other key areas of environmental management in 2025-2027.

If you have any comments regarding this review, please contact our Environment Principal, Kylie Veale on (03) 6278 4604.

Todd Milne

GENERAL MANAGER

2. NYRSTAR OPERATIONS OVERVIEW

2.1 Corporate Overview

Nyrstar is a global multi-metals business with market leading positions in zinc and lead, and growing positions in other base and precious metals, such as indium, copper, gold and silver. Nyrstar has seven smelters, and two mining operations located in Europe, the Americas and Australia and employ approximately 4,000 people.

In July 2019, Nyrstar's operational business became majority owned by Trafigura, one of the world's leading independent commodity trading companies.

2.1.1 Primary Products

Zinc

A global leader in zinc, Nyrstar is the world's second largest zinc smelting company based on production volumes. Nyrstar produces zinc in concentrate from its mining operations and a variety of refined market zinc products including special high grade zinc, zinc galvanising alloys, and zinc die-casting alloys as an outcome of its zinc smelting process. Zinc has diverse applications and uses, from construction and infrastructure, to transport, industrial machinery, communications, electronics and consumer products. This makes it an essential and highly sought-after resource.

Lead

Nyrstar has a market leading position in lead, producing a number of refined products for market. This includes lead concentrate and refined market lead (99.97% and 99.99%), as well as lead-antimony alloys, copperised-lead alloys, calcium lead alloys and calcium tin-lead alloys. Lead's primary usage is for the production of batteries. More than 80% of world production goes into the manufacture of lead acid batteries which play an important part in the starter mechanism for automobiles. Lead is also used in a wide variety of products found in and around our homes including paint, ceramics, pipes and plumbing materials, solders, gasoline and batteries. Other end uses for lead include underwater cable sheathing, glassware, solder and roof sheeting.

Indium

Indium is a minor component in zinc sulphide ores. It is a rare, silver, metallic element. The production of indium at Nyrstar Auby's indium recovery plant is 100% carbon dioxide free. Global demand for indium has increased substantially in recent years. It is considered a technology-critical element. Indium is most notably used in the semiconductor industry, in low-melting-point metal alloys such as solders, in soft-metal high-vacuum seals, and in the production of transparent conductive coatings of indium tin oxide on glass, such as flat panel television and video displays.

Copper

Nyrstar produces concentrated copper by-products. Copper is predominantly used in building construction. Other significant end-use markets include electrical and electronic products, transportation equipment, consumer products and industrial machinery and equipment.

Gold

Gold is produced in concentrate from our mining operations. Nyrstar also recovers gold in the lead refining process.

Silver

Silver is produced in concentrate from our mining operations. Nyrstar also recovers silver from the lead refining process as a silver doré and as a by-product from the zinc refining process into various leach products.

Sulphuric Acid

Sulphuric acid is a vital commodity in any modern national economy. It is a key substance in the chemical industry. It is most commonly used in the production of fertiliser, but is also important in mineral processing, oil refining, wastewater processing, and chemical synthesis.

It has a wide range of end applications including domestic acidic drain cleaners, as an electrolyte in lead-acid batteries, in dehydrating a compound, and in various cleaning agents. The chemical is also an essential ingredient in the production of fibres, paint, rubber, plastics, steel and medicines.

2.1.2 Nyrstar's Strategy

Nyrstar's management strategy is aimed at positioning the business for a sustainable future as a leading global multi-metals processing business. Through its deep market insight and unique processing capabilities, Nyrstar aims to generate superior returns by extracting the maximum value inherent in the mineral resources and by-products it processes.

Accordingly, Nyrstar has developed a coordinated approach to redeveloping and operating its asset portfolio to optimise the concentrate feed into its smelters, maximise minor and precious metal extraction, and enhance the margins of its end-product mix.

To realise its strategy, management has determined the following strategic priorities

- Maintain Nyrstar's strong safety performance by improving visible safety leadership
- Optimise the zinc smelters to deliver their full potential, underpinned by operational stability
- Ramp up the Port Pirie Redevelopment to deliver the guided earnings uplift
- Optimise the North American zinc mines to deliver their full potential

2.2 Nyrstar Hobart Smelter

Nyrstar Hobart (NH) is a large scale zinc smelter located on the western bank of the Derwent Estuary in Hobart, Tasmania (Figure 2.1). The Hobart site has operated for 108 years, celebrating its centenary in 2017. The site is one of the world's largest and most efficient zinc producers, with a production capacity of up to 280,000 tonnes of marketable metal. The facility uses the Roast, Leach, Electrowinning (RLE) process for zinc production and is closely integrated with the Nyrstar Port Pirie multi-metals smelter, which processes a number of Hobart's leach by-products.

The Hobart smelter is focused on high value added products for export to growing markets in Asia. The site has been significantly upgraded and modernised over the last 40 years, with improvements such as:

- The modernisation of gas purification and acid plants in the roasting facility;
- The modernisation of the leaching and purification processes;
- The introduction of mechanised zinc stripping in electrolysis and;
- The automation of the casting plant.

These major capital works and operational improvements have increased the plant's annual operating capacity from approximately 170,000 tonnes of zinc in 1977 to approximately 260,000 tonnes today. Hobart's key products are special high grade zinc, die cast alloys (branded 'EZDA') and continuous galvanising grade alloys. The site also produces by-products of cadmium, copper sulphate, paragoethite, lead sulphate leach concentrate and sulphuric acid.

NH owns approximately 120 ha of land on the western shore and 100 ha on the eastern shore of the Derwent Estuary, maintaining substantial buffer zones between the site and surrounding residential community.

The smelter is partially surrounded by a range of land uses, including General Residential, General Industrial, Utilities, Recreation, Open Space, Port and Marine, and Landscape Conservation. The NH operational site is shown in Figure 2.1, with the Planning Scheme information for NH and surrounding areas shown in Figure 2.2.

Figure 2-1 Nyrstar Hobart operational site location

Hobart city is built around the Derwent Estuary on a coastal plain, with the majority of the population within a 10 km radius of the CBD. The climate is cool and temperate. The dominant wind direction is north-westerly, though airflows are strongly modified by the complex hill and mountain topography surrounding the city. The regional geology is dominated by Permian to Triassic sedimentary rock intruded by Jurassic dolerite. Hobart experiences variable rainfall over a large catchment, with the majority of potable water sourced from highland catchments that yield high quality water. NH operates within the management catchment of Glenorchy City Council.

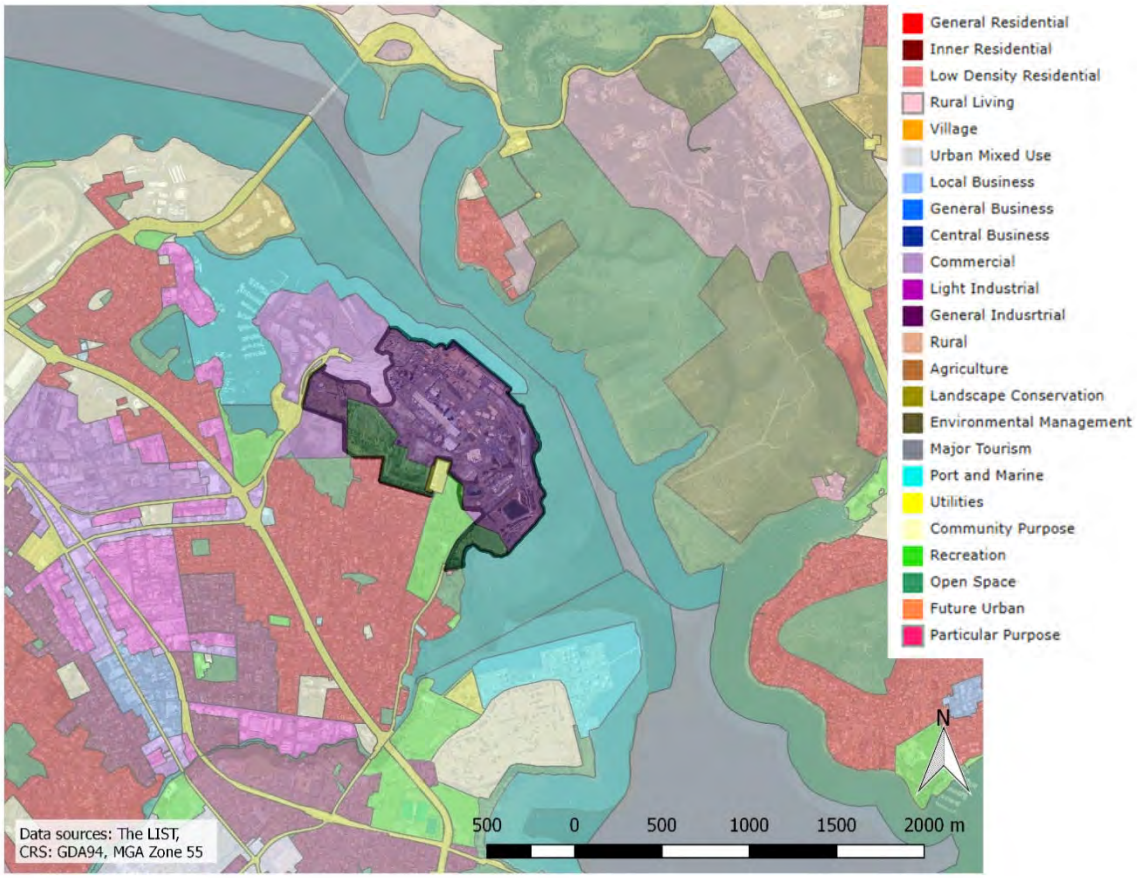


Figure 2-2 Land Use (as per the Tasmanian Planning Scheme) for NH and surrounding areas

2.3 Production

Annual production rates for zinc and other major NH products for the period 1 January 2019 to 31 December 2024 are shown below.

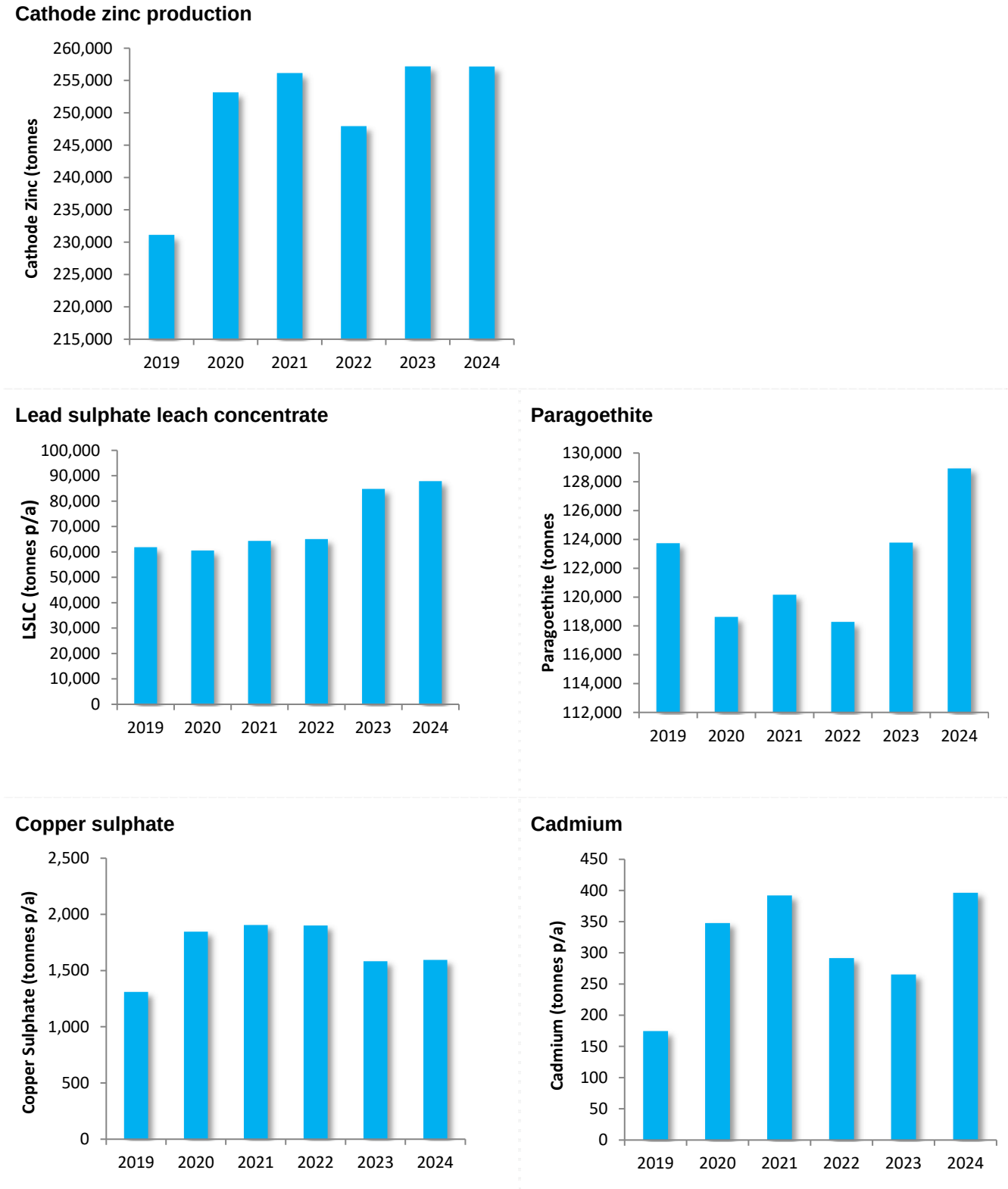


Figure 2-3 Product and by-product production 2019 –2024

2.4 Raw Materials

The major raw material used for site operations is zinc concentrate, made from the milling and beneficiation of mined zinc sulphide (sphalerite) ore. Concentrates arrive by ship and are unloaded at the NH wharf, on the eastern frontage of the smelter, then stockpiled in a closed concentrates shed prior to use. The concentrates shed is a purpose-built facility, constructed in 1997, to reduce dust emissions from stockpiling concentrates and other by-products.

NH experiences some variability in the yearly total of roasted zinc concentrates, with this variability primarily driven by plant maintenance requirements, and plant performance (Figure 2.4). During 2022 – 2024, the majority of concentrates were sourced from Glencore MIM (Mt Isa Mine) in northwest Queensland, Min Metals Group (MMG) Rosebery mine in the west coast region of Tasmania, and Perilya Broken Hill mine. The proportion of feed concentrates from each of the mines for the reporting period is shown in Figure 2.5.

2.5 Secondary Materials

Another significant source of feed material to the site are zinc oxides, and recycled zinc concentrates produced from zinc mine tailings. The majority of the zinc oxide is sourced from the Nyrstar Port Pirie smelter. This material is processed at NH on an ongoing basis with an average volume of 60,776 tonnes processed per annum over the reporting period. These secondary materials make up in excess of 20% of NH's feed book.

In 2023, NH published a Self-Declared Environmental Claim, in accordance with ISO 14021:2016 *Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling*), declaring that NH zinc products conatin a minimum of 20% recycled content. This claim was verified by an external auditing body in 2023, and again in 2024 (Figure 2-6). NH will continue to track recycled content of their zinc products on an ongoing basis, seeking third-party verification on an annual basis.

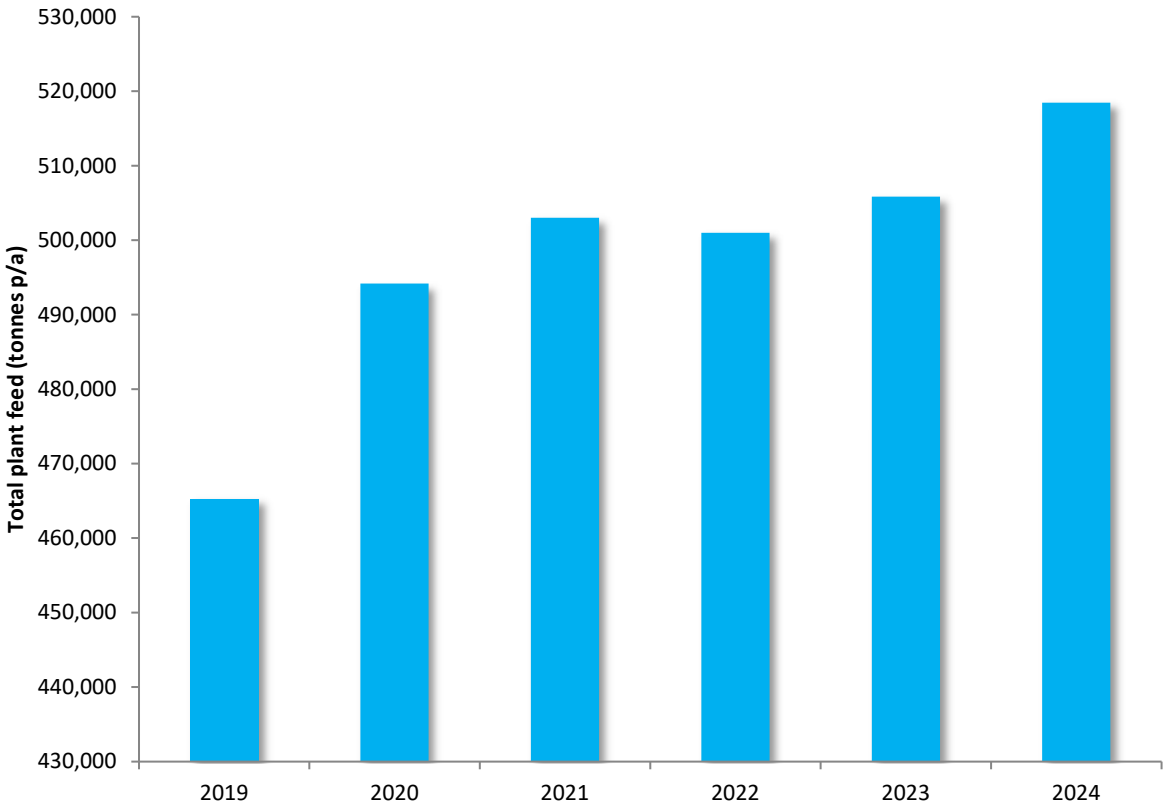


Figure 2-4 Total plant feed

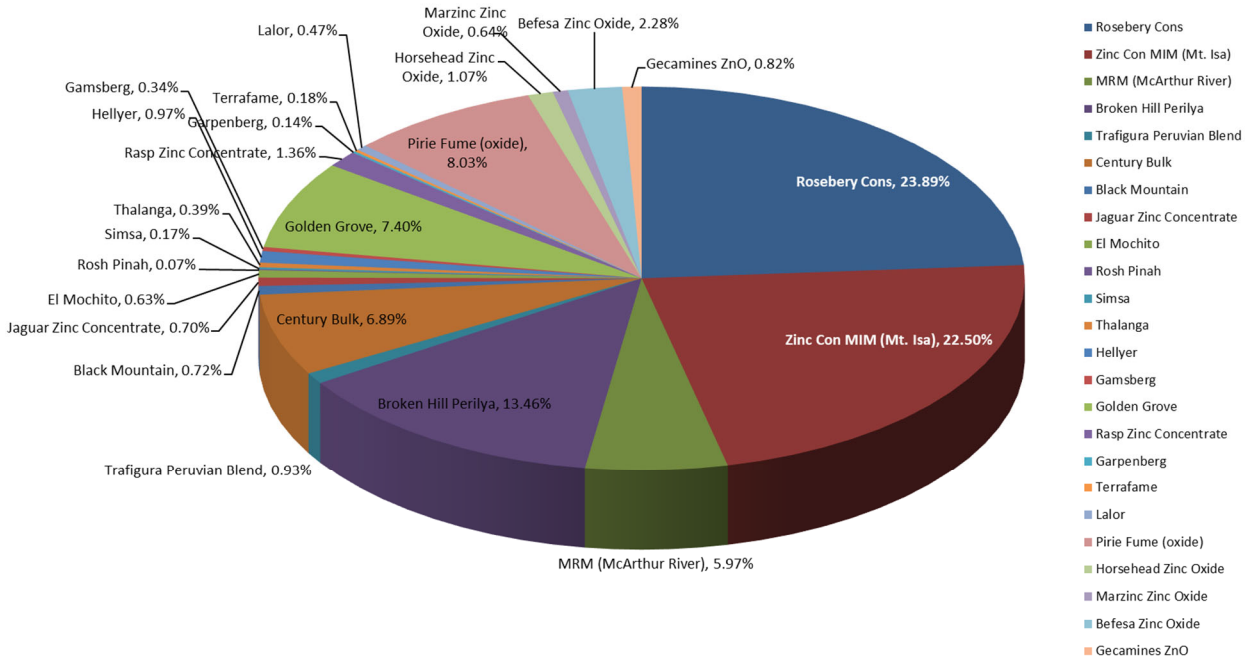


Figure 2-5 Proportion of feed materials by source 2022 – 2024

Sustainability Assurance: AU/SS/240427

Recycled Content Verification Statement

This Statement is issued to

Nyrstar Hobart Pty Ltd

300 Risdon Road, Lutana, Tasmania 7009, Australia

for the product(s):
Continuous Galvanizing Grade (CGG) and Special High Grade (SHG) Zinc,
Zinc Die Casting Alloy 3 (EZDA 3), and
Zinc Die Casting Alloy 5 (EZDA 5).

The claimed recycled zinc (Zn) used for above mentioned product(s) has been verified by SGS as complying with the definition of recycled materials as Pre-consumer or Post-consumer in ISO 14021:2016.
The recycled content(s) of above-mentioned product(s) have been calculated according to ISO 14021:2016 and verified by SGS as

Continuous Galvanizing Grade (CGG) and Special High Grade (SHG) Zinc,
Zinc Die Casting Alloy 3 (EZDA 3), and
Zinc Die Casting Alloy 5 (EZDA 5): Minimum 20%,
based on the annual quantity of material used.

The verification does not address product quality or other legal compliance and is subject to continued satisfactory and consistent practices.

This statement is valid from **26 October 2024** until **25 October 2025** and remains valid subject to satisfactory surveillance audits.
Issue 2.

Authorised by
Sharn McAulley
General Manager

SGS Australia Pty Ltd
10/585 Blackburn Road, Notting Hill VIC 3168,
Australia
t (61-3) 9574 3200 - www.sgs.com

Figure 2-6 Nyrstar Hobart Recycled Content Verification Statement

2.6 Site Products and their Uses

NH produces a range of premium products, including value-added alloys. Zinc is alloyed with other metals such as aluminium and manganese to produce targeted products.

Zinc provides excellent corrosion resistance to iron and steel. It is also a relatively hard metal with a low melting point, making it suitable for die casting, but still soft enough to be formed, rolled, or extruded.

Zinc is found in materials in construction and infrastructure, transport and industrial machinery, and communications and electronics, to consumer products and human health applications.

The major uses for NH's zinc products are as follows:

- **Galvanising** – zinc's most important use is in protecting steel from corrosion. A thin layer of zinc protects the underlying steel, extending the life of motor vehicles, bridges, fences, buildings and a wide range of other products for many years. Zinc is also used as sacrificial anodes attached to ships' hulls, pipelines and underwater structures to prevent corrosion.
- **Die Casting** – one of the fastest growing uses of zinc is for the production of die-casting alloy – the shortest distance between raw material and finished product. Because of the quality of these zinc alloys, complex precision parts are mass-produced for products as diverse as bathroom fittings, zippers, automobile parts, vacuum cleaners, refrigerators, carburettors, and scale model vehicles and other toys.
- **Brass and Bronze** – a wide variety of brasses and bronzes are produced, which include zinc as an essential alloying ingredient. Modern uses include high purity zinc alloys used to purify water by removing chlorine, hydrogen sulphide, iron and other metals.
- **Chemicals** – in the form of various chemicals, zinc is essential in the manufacture of plastics, ceramics, medicinal products, paints, motor oil additives, soldering fluxes and many other items. Zinc is also used in the manufacture of a number of chemicals, most frequently zinc oxide, zinc sulphate and zinc chloride. These products are used in fertiliser, pharmaceuticals, paper, rubber, rayon, wood and other industries that require high quality zinc.

NH's other products include:

- **Sulphuric Acid** – NH recover sulphur in our production processes to produce a significant quantity of high purity sulphuric acid. Sulphuric acid is a vital commodity in any modern economy. In fact it is so widely used that its consumption rate – like steel production or electricity power – is a good barometer of a nation's prosperity. It is used either directly or indirectly in almost every industry. It is an essential ingredient in the production of fertilisers, fibres, paint, rubber, plastics, steel, detergent and medicines, and can even be found, perhaps surprisingly, in many beers and soft drinks. One of its more specialised uses is in the production of high strength fibres for use in bulletproof vests and yacht sails.
- **Cadmium** is a soft, bluish-white, ductile metallic element that occurs in association with zinc ores. Its main use is in the production of nickel cadmium batteries.

2.7 The Production Process

The production process at NH is shown in Figure 2-7.

The sequences of steps in the zinc production at NH are as follows:

- **Roasting** of zinc concentrate to calcine to make it more readily soluble for further purification. A by-product of this step is sulphuric acid.
- **Leaching** of the calcine in a five stage counter-current process, using the spent electrolyte from the electrolysis step. This produces an impure zinc sulphate solution and leaves a lead-silver product. Iron is also removed as paragoethite, which is normally further treated at Nyrstar's lead smelter at Port Pirie, South Australia.
- **Purification** of the zinc sulphate solution, removing metallic impurities by their displacement through the addition of zinc dust. Copper is recovered as a copper sulphate by-product, and cadmium metal is also recovered for sale.
- **Electrolysis** of the purified solution, whereby it is depleted of a portion of its zinc and regenerates sulphuric acid. This produces cathode zinc and spent electrolyte, which is recycled to the leaching stage.
- **Casting** of cathode zinc into slabs and blocks, and the production of alloys.

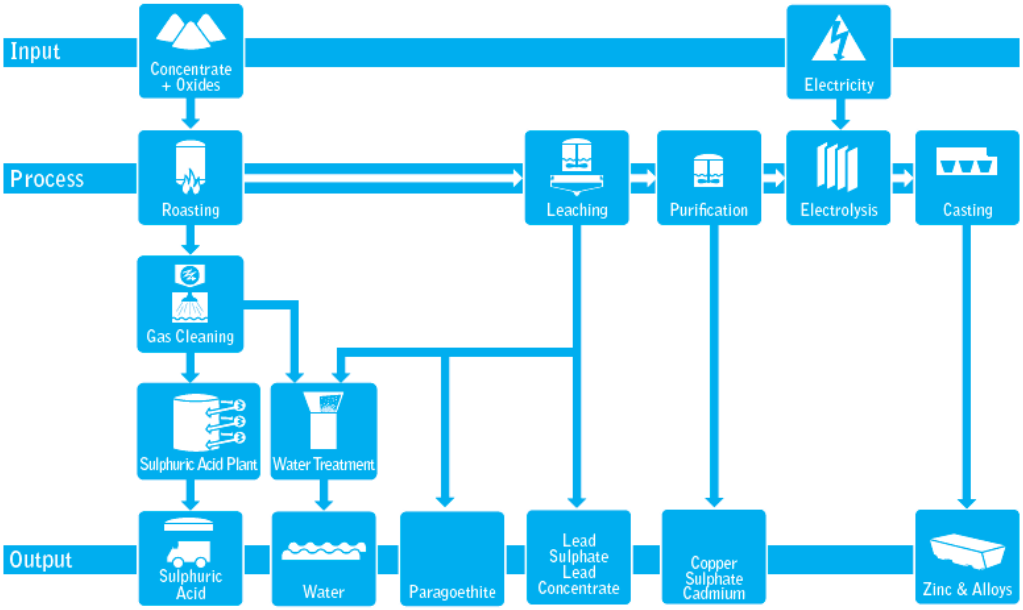


Figure 2-7 Production process

2.8 Environmental Procedural or Process Changes

NH implemented a number of process changes during the reporting period. These changes have been implemented, and managed in such a way that they have not resulted in a material difference to site emissions, nor is it considered that they have the potential to cause environmental harm.

- Commissioning of a new baghouse in the Casting Department – as part of the dross cooling and handling project, a second baghouse was installed on the dross plant in the Casting Department. The improvements to the dross plant have reduced the risk of fugitive dust emissions.
- Installation of on-line particulate monitors in the Paragoethite Dryer baghouse, the Anode Casting scrubber stack, and the Roaster baghouse. Data collected from the monitors is trended in real-time and enables ongoing assessment of particulate matter exiting the systems and improved early detection of any performance anomalies.
- Manufacturing of zinc-antimony alloy. In order to meet market requirements, NH manufactured a trial parcel of zinc-antimony alloy in 2023. The trial was completed successfully.
- New Cellhouse re-use of excavation spoil. Earthworks for the New Cellhouse project commenced in 2023. NH are re-using the excavation spoil on the site in order to level out areas to create additional laydown space. This has minimised the volume of soil requiring off-site disposal.
- Replacement of chlorine gas system with sodium hypochlorite. Chlorine has historically been used in the acid plant, to control the mercury content in the sulphuric acid. In 2023, chlorine was replaced with sodium hypochlorite, eliminating the risks associated with the storage and use of chlorine gas.
- Trial of sodium sulphide addition in the on-site effluent treatment plant. The purpose of the trial was to assess the potential of increasing the deportment of magnesium in effluent while otherwise maintaining effluent quality.
- Reduction in noise emissions from the Roasting plant. A number of noise mitigation projects were implemented in the Roast Department in 2024 to reduce the risk of nuisance noise in the community. Works included installation of a new silencer on one of the primary steam vents, installation of silencers on two of the steam vents associated with a steam turbine, and complete lagging and cladding of the start-up scrubber stack to reduce tonal noise caused by large volumes of air flowing through the stack.
- Adoption of re-usable containers for mercury filter cake handling, significantly reducing the volume of single-use high-density polyethylene containers used at the site for handing and transport of mercury filter cake.

3. ENVIRONMENTAL MANAGEMENT SYSTEM

3.1 Introduction and Overview

NH has integrated management of multiple systems into a one-business system covering the areas of Safety, Health, Environment and Quality (SHEQ). Specifically the SHEQ Management System has been developed to encompass:

- Strategic planning;
- Asset management;
- Environmental management;
- Occupational health and safety;
- Human resource management; and
- Quality management.

The objective of the management system is to share the responsibility for management of SHEQ at all levels in the organisation and to ensure that every individual is aware of and accountable for safety, health, environment and quality management issues in their area of influence.

NH has maintained accreditation for the international standards ISO 14001:2015 – Environmental Management Systems, ISO 9001:2015 – Quality Management System and has achieved accreditation again ISO 45001:2018 – Occupational Health and Safety Management System.

The site's Integrated Management System is internally evaluated against the above standards by applying specific audits and checklists, which are scheduled on a rotational basis. An external certified auditing body conducts annual external surveillance and triennial recertification audits.

The site has a specific Environmental Management System (EMS) that forms part of the Integrated Management System. The EMS is a step-by-step approach to environmental management that ensures environmental aspects are not overlooked, tasks are completed and checked, provision is made for changes, and response procedures are established for emergencies. An EMS also provides a process that is applicable across the different levels of the organisation to develop objectives and targets and review progress against those targets.

The NH EMS is applicable to all areas of the organisation's processes.

Additional to the aforementioned accreditations, in September 2024, Nyrstar Hobart achieved The Zinc Mark certification meeting best in class requirements for responsible production practices (Figure 3-1).

The Zinc Mark is achieved through The Copper Mark assurance framework and aims to promote responsible production practices along the value chains of the covered minerals.

To receive The Zinc Mark, operations are assessed and independently verified against 32 responsible production criteria including greenhouse gas emissions, community health and safety, respect for Indigenous rights and business integrity and confirmed to meet the required performance threshold.

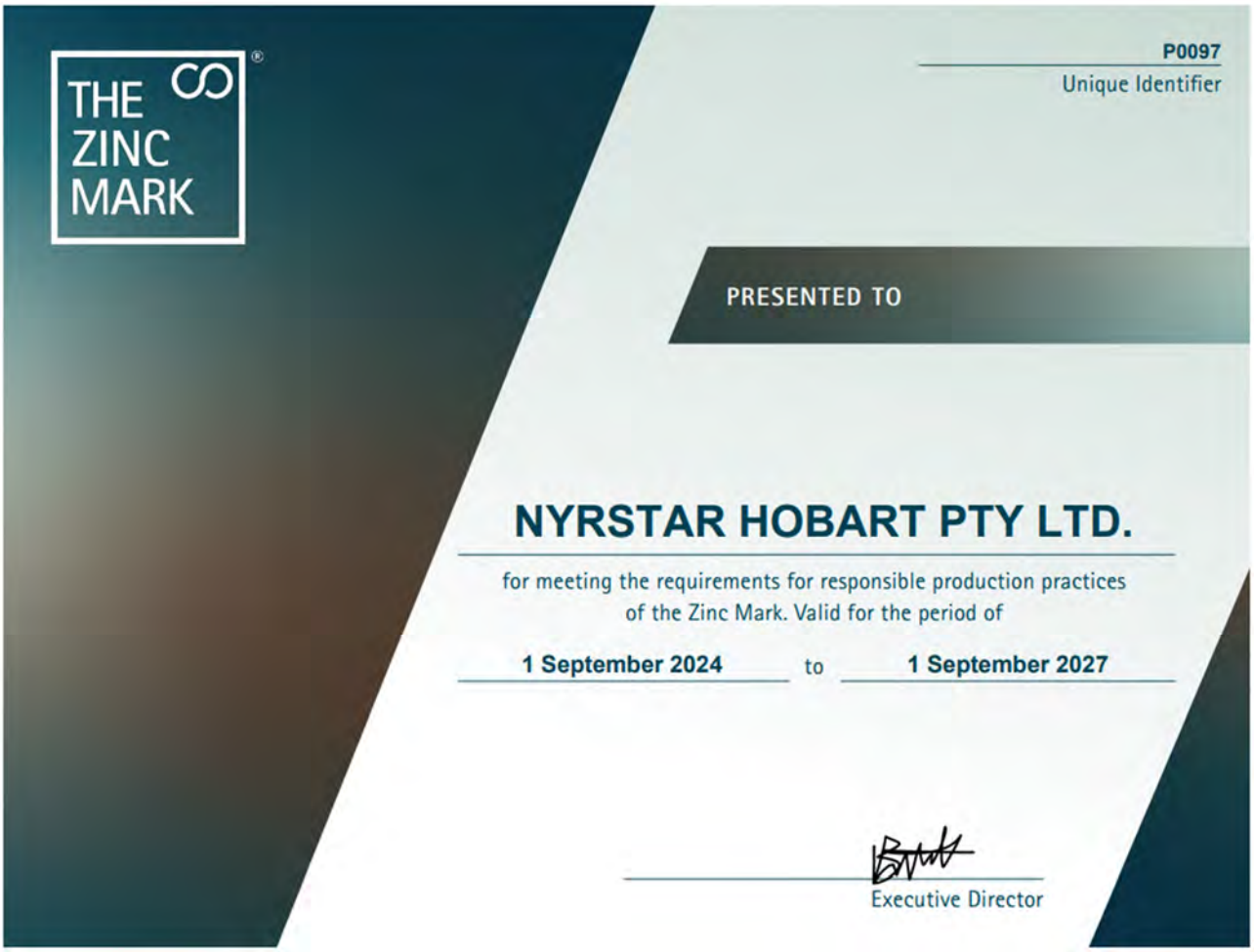


Figure 3-1 Nyrstar Hobart Zinc Mark Accreditation

3.2 Environment Policy

The Nyrstar Environment Policy, as shown in Figure 3-2, is specifically designed to represent all Nyrstar operations. This policy was originally developed in Hobart with representatives from all Nyrstar sites, including regional and corporate offices. The policy was written collaboratively and consultatively with the aim of ensuring it reflected Nyrstar's values and received Board approval.

The Policy comprises three sections; 1 'Overview' which provides the business context, 2 'Intent' which outlines what Nyrstar hopes to achieve with respect to the Policy, and 3 'Action Plan' or 'Bullet Point Actions' to outline how Nyrstar plans to fulfil the commitments made in the policy. This policy is the cornerstone of our EMS. It drives the goals, objectives and strategies we use to achieve targets against which we measure our performance.

Nyrstar Environment Policy Statement

We are a global leader in mining, metals processing and recycling with operations across multiple cultures and continents. Our metal products meet society's needs worldwide and are inherently recyclable. We are located within communities who have expectations of us, which we must meet.

We operate our business in an environmentally responsible way. Our aim is to prevent harm to the environment and the community. We will build trust with our key stakeholders by meeting our commitments and maintaining open and honest communications.

To achieve this, we will:

- ✓ Minimise the environmental impact of our operations by applying leading practice, innovation and sound science.
- ✓ Continually improve our performance through the identification and management of environmental risks and establishment of measurable objectives and targets.
- ✓ Comply with legal obligations as a minimum and meet the requirements of our voluntary agreements.
- ✓ Engage with our stakeholders, understand and respond to their expectations and effectively communicate our environmental performance.
- ✓ Provide material stewardship through efficient and responsible procurement, transport and use of resources. Minimize waste and expand recycling options by following the waste management hierarchy for hazardous, non-hazardous and inert wastes.
- ✓ Implement risk-based freshwater management measures in collaboration with relevant stakeholders to minimise impact on other water users and on fauna and flora in the catchment area of each of our facilities.
- ✓ Ensure that sufficient information and resources are available to achieve greenhouse gas emission reduction objectives and energy targets, and that design activities consider energy performance improvement.
- ✓ Assess and manage our operational impacts on biodiversity and explore initiatives to protect and enhance natural ecosystems.
- ✓ Recognize the environmental impact from past operations and address legacy issues.
- ✓ Develop a culture of environmental ownership through integration of business goals and by increased awareness, skills and competency of our people.

We believe that these commitments provide the foundation for a sustainable business.

nyrstar

Guido Janssen - Chief Executive Officer April 2024

Figure 3-2 Nyrstar Environment Policy Statement

3.3 Leadership

The NH senior management team demonstrates leadership and commitment with respect to the EMS through a number of channels. These include but are not limited to:

- The development of an Environmental Policy (Figure 3-2).
- Establishing environmental objectives and tracking of those objectives through internal NH reporting, and reporting to the Nyrstar Corporate group.
- Establishment of a specialist environment team, whose responsibility includes the continual improvement of the environmental management system.
- Ensuring the integration of the environmental management system requirements into the business process through the implementation of tools, systems, equipment, training etc. Examples include; risk assessment tools, emergency management tools, environmental incident and hazard reporting tools, and a document management system.
- Assigning the responsibility and authority for the EMS to the SHEQ Manager and the Environment Principal through specific position descriptions.

3.4 Planning

3.4.1 Environmental Aspects & Impacts

NH holds a register of environmental aspects and impacts for all issues related to current and historical activities. The register fulfils requirements for identification of aspects and impacts as well as risk, and has been verified through external audit as part of ISO14001:2015 certification. This register is reviewed on a continual basis as identified risk profiles change and when new risks are identified. The risk register is held in the site's Risk Information Management System (RIMS) database, which is routinely reviewed to ensure the currency of information.

3.4.2 Environmental Objectives and Targets

Nyrstar's key environmental objective is to 'operate our business in an environmentally responsible way by preventing harm to the environment and the community'.

NH environmental objectives, targets and programs are determined through the following means:

- NH significant environmental aspects;
- Nyrstar Corporate Environmental Policy; and
- The Permit issued by EPA Tasmania.

The environmental objectives and targets are developed each year as part of the strategic planning process. NH reviews the site's environmental performance, including progress against the environmental objectives and targets on an ongoing basis and reports this information to the Tasmanian EPA on an annual basis via an Annual Environment Review (AER).

Objectives as defined through the aforementioned documents are assigned at the commencement of the NH financial year to relevant personnel. Actions associated with achieving environmental objectives may also be assigned to personnel as an action in the RIMS database.

In 2022 objectives were set that would see NH work towards this strategy. A summary of progress against those objectives is included in Table 3-6.

New objectives have been developed for the coming three year period and are included in Table 3-1. Progress against these objectives will be reported in each AER, and in the 2025-2027 Public Environment Report.

As strategic planning is conducted on an annual basis, there may be some changes/additions to this three year plan. These will be clearly outlined in subsequent annual reports.

Table 3-1 Environmental objectives 2025–2027

Waste and By-products

- Reduce existing stockpiles of process and non-process wastes by seeking out new and innovative recycling and stabilisation technologies.
- Develop outlets for future waste products to prevent stockpiling.

Energy Use and Carbon Efficiency

- Sustain third-party verification of recycled zinc claim
- Meet 'Zinc Mark' certification obligations/commitments

Soil and Groundwater

- Continued implementation of the site's Groundwater Management Strategy, including:
  - » Progressing with the assessment of hydrocarbon contamination across the site.
  - » Work towards hydrogeological isolation of the site via improving existing groundwater extraction systems and exploring opportunities for new systems.
  - » Support for repairs to bunds that present a high risk to the environment due to disrepair, including inspections and advice on priorities for repair.
- Continue to review groundwater data as it's collected to assess trends in metal concentrations.
- Undertake an annual review of the groundwater monitoring program to ensure it continues to provide the necessary data to inform decisions.

Water

- Increase site use of the recycled water produced through the site's Reverse Osmosis plant and reduce potable water consumption 3-year average by 5% each year.
- Focus on maintaining storage capacity within the site's stormwater and contaminated water ponds through progressive recovery of accumulated solids.

Air Emissions

- Implement the Lead Emissions Control Plan in order to reduce the concentration of lead in air.

Stakeholder Engagement

- Meet all self-imposed obligations for community engagement, including community meetings and community newsletters.

3.4.3 Legal Requirements

The NH Environmental Management System (EMS), certified to ISO 14001:2015, defines the process for managing the site's compliance program. Key components of the management system that assist in the maintaining our strong compliance record are:

- A procedure outlining the identification and management of site-specific legal and other environmental obligations.
- A consents register detailing all of the environmental permits and other consents with environmental requirements, that have been specifically issued to the site.
- The principal environmental obligation for NH operations is the *Environmental Management and Pollution and Control Act 1994* (EMPCA). Tasmania enacts the requirements under EMPCA through a

suite of legislation which forms the framework for Tasmania's resource management and planning systems, comprising the following:

- *Land Use Planning and Approvals Act 1993;*
- *Resource Planning and Development Commission Act 1997;*
- *Resource Management and Planning Appeal Tribunal Act 1993;*
- *State Policies and Projects Act 1993;*
- *Environmental Management and Pollution Control Act 1994;*
- *Historic Cultural Heritage Act 1995;* and
- *Major Infrastructure Development Approvals Act 1999.*

3.4.3.1 Permit

NH operates under Permit (former Licence to Operate Scheduled Premises) No. 3314, as varied by Environment Protection Notice No. 7043/5 and 7043/6 (hereafter referred to as 'The Permit' or 'The Permit as varied') issued by the Environment Protection Authority (EPA) Tasmania under the EMPCA. The Permit as varied is included as Appendix 3 – The Permit as Varied.

3.4.3.2 Proceedings and Infringements

NH did not incur any of the following during the reporting period 01/01/22 to 31/12/24:

- Proceedings (prosecutions) issued under Tasmanian or Commonwealth environmental legislation, or the environmental provisions of other legislation; or
- Enforcement action taken under any other Tasmanian or Commonwealth environmental legislation, the environmental provisions of other legislation, or the environmental provision of council by-laws; or
- Infringement notices issued under the EMPCA.

3.4.3.3 Other Regulatory Instruments Relevant to Operations†

- Tasmanian policies under the *State Policies and Projects Act 1993*;
- Tasmanian Coastal Policy 1996;
- State Policy on Water Quality Management 1997;
- Environmental Management and Pollution Control Regulations;
- *Australian Energy Efficiency Opportunities Act, 2006*;
- *Australian National Greenhouse & Energy Reporting System Act 2007 (NGERS)*;
- *Clean Energy Legislation (Carbon Tax Repeal) Act 2014* (superseding the *Clean Energy Act 2011*);
- *Environment Protection and Biodiversity Conservation Act 1999*;
- *Hazardous Waste (Regulation of Exports and Imports) Act 1989*;
- National Environment Protection Measures (NEPMs) are automatically adopted as State Policies under section 12A of the *State Policies and Projects Act 1993* and are administered by the EPA. Relevant NEPMs to the operation include:

» National Environment Protection (Air Toxics) Measure 2004;

» National Environment Protection (Ambient Air Quality) Measure 1998;

» National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended 2013;

» National Environment Protection (Diesel Vehicle Emissions) Measure 2001;

» National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998;

» National Environment Protection (National Pollutant Inventory) Measure 1998; and

» National Environment Protection (Used Packaging Materials) Measure 2011.

† This list represents a sample of key regulatory mechanisms relevant to operations at NH, however is not exhaustive.

3.4.3.4 Voluntary Agreements and Other Requirements

- Australian Industrial Chemicals Introduction Scheme (AICIS);
- International Zinc Association (IZA) Sustainability Charter;
- International Lead Association 'Lead Action 21' Charter.

3.5 Implementation and Operation

3.5.1 Environmental Training

Competence, training and awareness are critical to the continued implementation of the EMS as the framework for continual improvement. While accepting that the highest responsibility for the EMS lies with the Environment Department, NH uses a number of tools to provide basic understanding to the broader workforce and key users. The following tools and forums are used to propagate awareness of environmental issues at NH and the EMS and its requirements, particularly with respect to legal obligations:

- Site Induction – covers the general hazards associated with the plant, site policies, systems of work and other requirements. Environmentally it clarifies responsibilities with respect to environmental incident reporting, materials movement authority, hazardous chemicals, waste management, spill response and general care for the environment.
- Departmental Inductions – personnel working in operating departments must also undertake a specific departmental induction, which provides more detailed information about hazards in that respective area of the plant, and also informs personnel of specific environmental aspects and impacts associated with that section of the process. A competency test is also conducted as part of these inductions.
- Contractor Site Work Conditions – contractors who work on site must comply with documented standard site work conditions known as SC1. A section of these conditions deal with contractor's obligations in regard to site environmental requirements such as the Environmental Policy, EMS, waste management, materials movement, emissions and incident reporting.
- Emergency Response Officers (EROs) – undergo a specific environmental training program to enable them to appropriately respond to incidents that may have an environmental impact. ERO's are also specifically trained to conduct environmental inspections for material leaving site under the Materials Movement Authorisation Procedure.
- Training and Assessment Guides – a process by which employees / contractors are deemed competent in all aspects of the required duty of work through a combination of on-the-job training, verification of learning outcomes, completion of an assessment and demonstration of a sound understanding of operating procedures, that apply to their tasks.
- Standard Operating Procedures – of most critical importance for current environmental performance is the inclusion of environmental aspects into Standard Operating Procedures (SOP) where impacts on the environment could result. This ensures that operators are aware of the critical operating parameters for the plant they are operating and the impact of operating outside of those parameters. This is most critical

for Roast operations where loss of plant stability could result in SO_2 emissions, and at the Effluent Treatment Plant where failure to follow SOPs could result in discharge of contaminated effluent to the Derwent Estuary.

- Job Safety and Environment Analysis – is used to identify the jobs steps, associated safety and environment hazards and mitigating controls for work where a SOP has not been developed and the task risk rating is greater than low or involves Defined Hazardous Work (DHW).

3.5.2 Communications

NH has implemented a number of internal environmental communication processes for the site.

Internal communications are carried out through the following means:

- Daily Reporting – a RIMS report is circulated site wide to all NH email recipients, which covers the site's safety and environmental performance for the last 24 hours.
- Weekly Reporting – management team review of significant environmental incidents through the weekly site report.
- 'The Feedbook' – a monthly newsletter which communicates general information relating to site activities. Environmental information and initiatives are communicated as needed.
- Monthly reporting to the Management Team via the Monthly Performance Review meeting held by that group.

NH have well-established processes to facilitate external communication with key stakeholders, including neighbouring industry, local residents, interested community groups, government and regulatory agencies and customers. These include:

- Community Consultation Meetings – NH is committed to hosting at least one meeting annually to provide a forum to update and engage local residents, general members of the public and other interested parties about our operations. This is an opportunity to share information about the important work taking place on site, promote discussion of relevant issues, disseminate general information on the broader business and receive direct feedback from our stakeholders.
- Community Notices – Where a specific environmental issue warrants community notification NH produce and distribute this material to residents, as required.
- Annual Environmental Review (AER) – NH produces an AER on an annual basis, and a Public Environment Report (PER) on a triennial basis. The AER and PER are submitted to the Tasmanian EPA and includes details of NH environmental objectives and targets and the site's progress towards meeting objectives and targets and annual environmental performance.
- Trafigura Sustainability Report – Reports on the annual sustainability performance of the Trafigura group of companies, which includes Nyrstar mine and smelter sites.

In addition, NH uses a range of platforms and channels including social media to communicate with the local community, employing such tools as:

- The Nyrstar website for general information including environmental reports and information relating to the site's Major Hazard Facility status.
- Social media including a NH Facebook page and Nyrstar Australia LinkedIn page

A register of all community complaints received by the facility, along with follow-up investigations and actions, is maintained. Complaints received over the reporting period are summarised in Appendix 1 – Community Complaints 2022 – 2024.

Nyrstar Hobart proactively engages in community activities and, where appropriate, provides financial and in-kind support for not-for-profit community groups and projects that align with its corporate values and objectives.

Every year, NH also provides support to the neighbouring New Town Bay Golf Club which is located close to its Lutana operations.

During the reporting period, NH was involved with and sponsored a number of events including the Annual Nyrstar Hobart Charity Golf Day, the Beaker Street Festival, University of Tasmania STEM Ball, Nyrstar Hobart's Annual Engineering Dinner, Hazell Bros Corporate Golf Day and The Mind Games.

2024 was the 30th Anniversary of the Annual Nyrstar Hobart Charity Golf Day held in March and it raised a record $14,573. This was donated to Cancer Council Tasmania to help in their important work supporting people diagnosed with cancer through their treatment.

In 2024, Nyrstar Hobart was proud to again be a stage sponsor for The Mind Games, which is focused on raising money for workplace mental health research through the University of Tasmania's Menzies Institute for Medical Research. This event took place in May 2024 and helped raise $60,000 for this worthy cause.

In 2023, NH became a member of 26TEN – Tasmania's campaign for adult literacy – joining a growing network of organisations and individuals working hard together to improve adult literacy and numeracy in Tasmania. This membership continued throughout 2024.

3.6 Checking

3.6.1 Monitoring and Measurement

NH conducts extensive environmental monitoring and measurement to:

- Ensure that smelting activities do not unduly impact upon the receiving environment and surrounding community.
- Assess compliance against the site's environmental permit.
- Track performance against the site's objectives and targets.
- Monitor the effectiveness of control and remedial actions taken.
- Fulfil other legal requirements such as National Pollutant Inventory and Derwent Estuary Program partnership.

Environmental monitoring programs are currently in place for groundwater, stormwater, effluent discharge (both to the Derwent Estuary and trade waste), receiving waters and sediments, stacks, ambient air quality, noise, process and non-process waste, and biota.

All monitoring and measurement is undertaken in accordance with the site's Standard Operating Procedures, designed to comply with Australian Standards.

Critical and non-critical monitoring equipment is calibrated and serviced in accordance with the manufacturers' recommendations and relevant Australian Standards. The SAP electronic business system is used to manage the ongoing preventative and special maintenance requirements of critical environmental monitoring equipment. Recurring service requests are generated by this system to notify relevant personnel of calibration testing requirements. Specific controls are also invoked for items listed on the critical equipment / instrumentation register to ensure completion of calibration and maintenance.

3.6.2 ISO 14001 Certification

NH is audited triennially for recertification against ISO 14001:2015 (Environmental Management System), ISO 9001:2015 (Quality Management System) and ISO 45001:2018 (Occupational Health and Safety Management System). The last recertification audit was held in 2022. In addition, two surveillance audits were conducted during the reporting period. All three audits were conducted by JAS/ANZ accredited auditing bodies to monitor and maintain the site's Integrated Management System (IMS), incorporating the Environmental Management System (EMS), and its certification.

NH uses the outcomes for these reviews to operate within the broad intent of the standard and management systems in general – that is, to strive for continuous improvement.

All 'areas of concern' raised during audits are formally tracked in the RIMS system through the year to ensure that any system deficiencies are rectified and opportunities for improvement are acted upon. Non-conformances with the standard or significant areas of concern are the subject of investigations to ensure that not only are deficiencies rectified, but the root cause of failure is understood and addressed.

A summary of the key findings from the audits is included in Table 3-2, Table 3-3 and Table 3-4. Note that as the audits are conducted for all three standards, many of the areas of concern do not directly relate to the EMS.

Table 3-2 Key findings of 2022 ISO 14001, 9001, 45001 IMS Re-certification Audit

Strengths • Business planning was well embedded through yearly tactical plans cascading to departmental plans and their review • Position descriptions identified role responsibilities/accountabilities, including Environment and Health and Safety, as well as minimum role qualifications and skills • Legislative update and review process was in place • Environmental monitoring processes covering ground water sampling, Loogana leachate monitoring, SO_2 emissions and estuarine sampling activities	
Areas of Concern - Corrective Action Required	**Comments/Actions on Area of Concern**
Some gaps in training and some mandatory training requirements missing from the site training matrix. Some incorrect version of forms in use and inconsistencies in some controlled documents.	Review of the training matrix undertaken by Department Heads and gaps closed. Training plan developed for the Emergency Response Officers to increase mandatory training completion to 100%. Review of required documents to ensure references to ISO and legislation are correct and other document errors identified during the audit are corrected.
Some gaps in implementation and maintenance of specified operational controls.	Additional training provided to relevant persons regarding permit to work process in Electrolysis, and the isolation lock process in Casting.. Guidance to Contractor Management team on how to file vendor request forms.
Some gaps in maintenance of emergency preparedness and response processes, specifically regarding fire equipment.	Responsibility for the ERO fire equipment register assigned to the ERO Supervisor. Fire extinguisher compliance is listed as a KPI for the ERO's and will be reported on during quarterly KPI meetings.
Some gaps in performance evaluation processes, specifically the completion of work area inspections, housekeeping of hazardous substance, and collection of one environmental sample missed.	Internal audit training rolled out to defined work groups, which included how to complete a work area inspection adequately. Wharf and Site Services hazardous storage areas were returned to required standards. The sample event that was missed in November 2021 has been included in the Environmental Monitoring Calendar in Microsoft Outlook.
Some gaps in implementation of incident, nonconformity and corrective action processes, specifically some incidents not being recorded in RIMS, and some RIMS action not fully completed and verified.	It is well established on the site that incidents are to go into RIMS. These are discussed at pre-starts each morning. The need to enter incidents into RIMS will continue to be communicated site wide through various mechanisms. Better control of verifications achieved by reporting on overdue verifications to the leadership team on a weekly basis.

Table 3-3 Key findings of ISO 14001 2023 IMS Surveillance Audit

Strengths • Leadership commitment was evident on the need to get the IMS back on track and demonstrate continual improvement. Development of the 2030 strategy and associated FY24 priorities, site tactical plan and departmental plans was a clear demonstration of this. • Emergency preparedness and response process were currently being managed by new service provider MSS. A focus on strengthening currently controls was evident. • Operational areas visited of Roast Acid and Leach demonstrated a high level of engagement by personnel interviewed and controls applied were well demonstrated. • Monitoring and evaluation processes, including tracking and review of performance KPIs, biological monitoring, environmental monitoring were well entrenched. The MPR process was a key meeting covering off on review of site performance.	
Areas of Concern - Corrective Action Required	**Comments/Actions on Area of Concern**
The five minor non-conformances raised in 2022 remained open due to lack of sufficient evidence that they had been closed out.	Action completion reviewed and evidence attached to the actions in RIMS
Some gaps in ensuring nonconformities are adequately investigated and closed out.	Review assurance framework and adopt a risk-based approach, inclusive of audit management. Update Safety Management System Documentation to define action verification requirements and changes required to align to changes to assurance framework post review. Incident Management training delivered to site leaders whom interact with RIMS.

Table 3-4 Key findings of ISO 14001 2024 IMS Surveillance Audit

Strengths • Annual business planning process – site plan cascaded to departmental tactical plans and individual plans • Comprehensive Management Performance Review process • Training matrix well maintained and establishment of compliance dashboard • Renewal of site environmental permit • Waste management was a strong focus in operational areas • Version control of key management system documents was well maintained.	
Areas of Concern - Corrective Action Required	**Comments/Actions on Area of Concern**
Some gaps in ensuring that appropriate documented information as evidence of competence is retained.	Review gaps in communication register with each department. Address issues related with lack of knowledge on procedural change register and what's required from each Panel when changes are made. Set up meetings with relevant stakeholders in each department.

3.7 Environmental Compliance

The prevention of environmental incidents is promoted as an integral part of everyone's work responsibility. When incidents occur there is a procedure to investigate and implement corrective actions to reduce the risk of that particular incident occurring again.

The site uses a database referred to as 'RIMS' to track all environmental incidents impacting both on and off site, as well as near misses and community complaints, which ultimately provides data on areas where the operation can make environmental improvements. A daily incident report is generated from RIMS for all site personnel, which shows the details of reported incidents.

While we ultimately aim to be 100% compliant, NH recorded eight environmental incidents that resulted in a regulatory non-compliance during the 2022–2024 period; four in 2022, one in 2023 and three in 2024.

Details of these incidents and audit findings, including corrective actions, are presented in Appendix 2 – Notifiable and Reportable Environmental Incidents 2022 – 2024.

No incident that constituted material environmental harm as defined by the *Environmental Management & Pollution Control Act 1994* occurred during the reporting period.

3.8 Summary of Fulfilment of 2022–24 Environmental Objectives

NH had a number of environmental objectives for the 2022–24 period. An update against each objective is provided in Table 3-5.

Table 3-5 Progress against 2022–24 environmental objectives

Waste and By-products	
2022–2024 Objectives	**2022-2024 Progress**
Reduce existing stockpiles of process and non-process wastes and by-products by seeking out new and innovative recycling and stabilisation technologies.	Spent acid plant catalyst has long been a problematic waste product for NH, with the material being stored in bulka bags, and stockpiled on site for over 2 decades. In 2021, the site commenced transport of the material to the Nyrstar Port Pirie (NPP) site, where it is treated through their plant. During the reporting period, the entire stockpile of historical spent acid plant catalyst was removed to site and sent to NPP. Contaminated timber is currently stockpiled onsite within the Quarry. Combustion studies are underway at the University of Newcastle aiming to identify optimal process conditions for a purpose built thermal treatment plant and emission scrubbing system. Treatment in this manner has been identified as the most sustainable method of waste management. Manganese is a by-product of the zinc refining process, and is added to other by-products such as PG and LSLC for further treatment at NPP and other refineries. Historically, there have been instances where more manganese is produced than can immediately be returned to the process, resulting in a stockpile of the material. During the reporting period, a historical stockpile of manganese was incorporated in with other by-products, and removed from site.
Develop outlets for future waste products to prevent stockpiling.	During the reporting period, NH were successful in obtaining approvals for disposal of various streams of hazardous waste to the C Cell.
Noise	
2022–2024 Objectives	**2022-2024 Progress**
Develop and implement an action plan for reducing nuisance noise sources.	A nuisance noise source identified in the 2020 triennial noise survey was the reversing beepers on forklifts. In 2022 NH received new forklifts for the Casting Department. The forklifts have been fitted with broad band reversing beepers. The noise from broad band beepers have been shown to travel far less than the traditional style reversing beepers. In 2022 a new steam silencer was fitted to the SH24 steam vent in the area of the #5 roaster. The new silencer has successfully reduced the noise levels from venting steam from this point. The triennial community noise survey was again completed in 2023, with the top nuisance noise sources identified. Prior to the completion of the survey, NH came to understand the impact of nuisance noise from venting of steam from the #6 roaster and use of the new start-up scrubber, with these noise sources resulting in community complaints during the reporting period. In 2024, works to resolve the nuisance noise issues were completed, and included the installation of a new silencer on the #6 roaster primary steam vent, installation of silencers on two of the steam vents associated with a steam turbine, and complete lagging and cladding of the start-up scrubber stack to reduce tonal noise caused by large volumes of air flowing through the stack.

Land Use and Aesthetics	
2022–2024 Objectives	**2022-2024 Progress**
Continue to implement the site wide weed management plan to prioritise weed removal effort.	Limited targeted weed spraying was undertaken during the reporting period, focussing on areas where NH land abuts residential land.
Energy Use and Greenhouse	
2022–2024 Objectives	**2022-2024 Progress**
Continue to identify and pursue energy efficiency and greenhouse gas reduction opportunities through co-ordinated multi-disciplinary stakeholder sessions.	Work commenced in 2022 to short-list, and commence assessments of potential major decarbonisation projects at the Hobart site. This work continued throughout 2023 and 2024. Examples of potential projects include: displacement of diesel use in the cadmium plant with an electric furnace, casting induction furnace efficiency upgrades and changes to the paragoethite (PG) plant to eliminate the PG dryer, thus eliminating the use of natural gas on the site. There is a significant focus on reducing scope 1 and scope 2 emissions from the site, noting that these projects are significant, and represent many years of work. Smaller short-term works 2023 have included the ongoing and continual replacement of lights with LED lighting.
Soil and Groundwater	
2022–2024 Objectives	**2022-2024 Progress**
Continued implementation of the site's Groundwater Management Strategy, including: • Commissioning of the groundwater extraction system, completed in 2021. • Completion of the design for the next groundwater management projects. • Support for repairs to bunds that present a high risk to the environment due to disrepair, including inspections and advice on priorities for repair.	The triennial groundwater management plan was submitted, and subsequently approved by the EPA in 2022. This document outlines the focus areas for the 2022 – 2025 period. During the reporting period, approximately 309 t of zinc was recovered via the site's groundwater extraction systems. Improvements in pump reliability were a focus throughout the reporting period, resulting in an improvement in metal recovery rate from the Old Acid Plant system and the Leach Extraction System with 50 t more zinc recovered during this reporting period compared to the previous. Despite this, pumping reliability remains a challenge with the newly commissioned PG Dryer extraction system suffering from ongoing internal pump fouling. Numerous methods have been trialled to reduce the fouling, and thus improve the reliability of the pump. Trials with on-line citric acid cleaning have shown some success and will continue to be explored throughout the next reporting period. In 2022, NH commenced assessment of the jarosite storage facility, located in the Loogana area. The assessment included the installation of an additional three monitoring bores, and preliminary works to assess the stability of the facility. These works continued throughout 2023-2024. Following the discovery of hydrocarbon contamination in the proximity of the cellhouse in June 2020, NH have undertaken significant investigative works to assess environmental, and health risk associated with the contamination. In 2022 six new monitoring bores were installed to assist with this assessment. In 2023, assessment works were completed, which recommended follow up assessment in the future to confirm assessed trends and to review the efficacy of remedial action taken. This review work will be ongoing throughout the next reporting period.

Continue to review groundwater data as it is collected to ascertain any upward trends in metal concentrations.	This work is completed on an ongoing basis. Groundwater sampling is conducted every 6 months with the data reviewed upon receipt.
Undertake an annual review of the groundwater monitoring program to ensure it continues to provide the necessary data to inform decisions.	This review is undertaken following the assessment of data collected from the end of year groundwater monitoring program.
Water	
2022–2024 Objectives	**2022-2024 Progress**
Increase site use of the recycled water produced through the site's Reverse Osmosis plant to further reduce potable water use.	The RO plant was recommissioned in 2023 following extensive capital works to improve the output, and reliability of the plant and is again now producing recycled water for use on the site. 302 ML of recycled water was used on the site in 2024.
Air Emissions	
2022–2024 Objectives	**2022-2024 Progress**
Installation of continuous emission monitors on the paragoethite stack and the anode casting fume scrubber stack.	The on-line particulate monitor installed on the anode casting fume scrubber stack was commissioned in early 2022. An on-line monitor was also installed and commissioned on the paragoethite dryer stack in mid-2022.
Develop an improved lead in air monitoring and reporting program, and work with departments to reduce dust emissions in general, thus reducing lead in air concentrations	Two EBAM+ PM10 monitors were purchased in late 2022. These monitors, were installed in 2023 and are providing useful live data. Additional sprinklers were installed on roadways around Roast. Repairs to the concentrate shed walls and roof were undertaken on an as required basis throughout the year. Repairs completed on calcine bin #2. The water cart operates 7 days a week throughout the summer period. Two dust suppression chemicals are now in use at the site, and are applied via the water cart. One dust suppressant is sprayed on areas that are not frequently trafficked, and the other is used on roadways in an effort to lengthen the time that the roads remain damp. The installation of rapid close doors on the primary concentrate and residue storage sheds has been completed. A focus on patching holes in calcine conveyors, and cleaning up of calcine spills occurred in 2024, with the data indicating an improvement in lead in air as a result.

Stakeholder Engagement	
2022–2024 Objectives	**2022-2024 Progress**
Meet all self-imposed obligations for community engagement, including community meetings and community newsletters.	NH continues to maintain its community communication strategy. During the reporting period three community consultation meetings were held, and NH actively engaged with the community through events such as the Beaker Street Festival, the Mind Games Race for Research and through bolstering social media presence.
Increase visibility of NH environmental management in the surrounding community through promoting school visits.	NH hosted a number of school and university visits during the reporting period, and a Derwent Estuary Program Monitoring Taskforce meeting, during which members of the group were provided with a site tour, focussing on groundwater recovery systems, and the effluent treatment plant.
Environmental Risk	
2022–2024 Objectives	**2022-2024 Progress**
Continue to review and update the site's Risk Register by department.	The focus for the reporting period was the review of departmental environmental risks that have the potential to have an off-site impact. In 2024, inspections of all bunds and sumps on the site commenced, with the work to be completed in 2025.
Develop management plan/controls for critical environmental risks based on the environmental risk review.	As per the above information, during the reporting period, a number of critical environmental risks were reviewed and where required, additional controls identified and actioned.

4. MONITORING PROGRAMS

4.1 Atmospheric Emissions

The handling, storage and processing of materials at NH has the potential to adversely impact air quality both on and off site. Many process inputs, intermediate streams and residues comprise fine particulate materials that contain compounds of metals such as zinc, lead, cadmium, mercury, arsenic and antimony. Handling and smelting processes used at NH may release airborne particles and gases that contain these contaminants. These releases can be categorised into point source and diffuse source emissions. NH operates and maintains a range of systems to mitigate emissions to air such as gas scrubbing equipment, baghouses and dust minimisation controls.

4.1.1 Point Source Stack Emissions

4.1.1.1 Point Source Stack Emissions Background

Point source emissions originate from stacks, which are used to provide an outlet for air streams involved in the industrial process. Stacks, like chimneys, rely on atmospheric dispersion to reduce contaminant concentration to a low level that does not adversely affect human or environmental health. Where there is potential for an untreated emission to cause environmental harm due to insufficient dispersion, NH uses additional safeguards in the form of gas-cleaning technologies that clean the stream prior to its release. Technologies used at NH to treat air or gas streams from process and hygiene ventilation systems include wet scrubbers, baghouses, chemical absorption towers, and electrostatic precipitators.

Over the reporting period, NH stacks that rely on these gas cleaning processes to achieve sufficient exit air quality have been monitored according to requirements defined in The Permit. Over the reporting period, some changes have been made to the operating plant and the associated stacks in operation.

- Commissioning of a new baghouse in the Casting Department – as part of the dross cooling and handling project, a second baghouse was installed on the dross plant in the Casting Department. The improvements to the dross plant have reduced the risk of fugitive dust emissions.
- Installation of on-line particulate monitors in the Paragoethite Dryer baghouse, the Anode Casting scrubber stack, and the Roaster baghouse. Data collected from the monitors is trended in real-time and enables ongoing assessment of particulate matter exiting the systems and improved early detection of any performance anomalies.

Each of these have been monitored according to the same requirements outlined in The Permit. Therefore, the list of monitored stacks include:

- Anode Casting Plant Exhaust Stack
- Cadmium Smelter Plant Stack
- Copper Sulphate Crystalliser Plant Vent Stack
- Foreshore (Tail Gas Scrubber) Stack
- ^Package Boiler 1 Stack
- ^Package Boiler 2 Stack
- Paragoethite (PG) Dryer Stack
- ^Start-up Scrubber Stack
- Roaster Baghouse Stack
- *Zinc Oxide Fume Unloader
- V1 Furnace Stack
- V2 Furnace Stack
- Zinc Dust Plant 1 (ZP1) Stack
- Zinc Dust Plant 3 (ZP3) Stack
- MZR Furnace Stack
- MZR Dross Stack

The locations of these monitored stacks relative to site are shown in Figure 4.1

*This stack is not listed as a nominated exhaust stacks however it is monitored to the same requirements.

^ As of 5 February 2024, being the date of the current iteration of The Permit, it is no longer required to test these stacks.

Figure 4-1 Locations of monitored exhaust points

4.1.1.2 Point Source Stack Emissions Monitoring Program Details

The Permit details monitoring and compliance requirements for stacks. These requirements are summarised below in Table 4-1. All tests are required to be undertaken during normal plant operating conditions.

As of 5 February 2024, being the date of the current iteration of The Permit, it is no longer required to test the Start-Up Scrubber Stack, and the Package Boiler Stacks. However, these have been included in the below table, as they did form part of the previous Permit, which was in place for part of the reporting period.

The current Permit includes an expanded suite of metals to be tested. The below table reflects this change.

Table 4-1 Point source emissions monitoring, limits and reporting requirements.

Emission point / monitoring location	Test frequency	Test parameter	Emission limits
Foreshore (Tail Gas Scrubber) Stack	Continuous Six monthly	SO_2 SO_3 NO_x Particulates	7.2 g/m^3 (2,520 ppm) 100 mg/m^3 2 g/m^3 100 mg/m^3
Start Up Scrubber Stack	If online >3/12 months and at least three yearly	SO_2 Particulates Metals * Cd Hg	7.2 g/m^3 100 mg/m^3 5 mg/m^3 1 mg/m^3 1 mg/m^3
Package Boilers 1 & 2 Stacks	If online >3/12 months and at least three yearly	SO_2 NO_x Particulates	7.2 g/m^3 2 g/m^3 100 mg/m^3
Anode Casting Plant Exhaust Stack	Six monthly	Particulates Metals * Cd Hg	100 mg/m^3 5 mg/m^3 1 mg/m^3 1 mg/m^3
Cadmium Smelter Plant Stack			
Copper Sulphate Crystalliser Plant Vent Stack			
Paragoethite Dryer Stack			
Roaster Baghouse Stack			
V1 Furnace Stack			
V2 Furnace Stack			
Zinc Dust Plant 1 Stack			
Zinc Dust Plant 3 Stack			
MZR Furnace Stack			
MZR Dross Stack			

*The metals parameter is the sum total of Sb, As, Be, Cd, Cr, Co, Pb, Mn, Hg, Ni, Se, Sn and Vn.

4.1.1.3 Point Source Stack Emissions Results & Discussions

Discrete Emission Monitoring

The results of each annual program of testing between 2022 to 2024 are shown in Table 4-2. For comparison purposes, the results from the preceding three years have also been included.

Stack monitoring at NH is conducted independently by Ektimo. All results from Ektimo in this report are NATA accredited.

The 2022-2024 stack monitoring reports, as produced by the stack monitoring consultants are included as Appendix 4 – 2022 - 2024 Stack Emission Reports

The current Permit, issued on 5 February 2024 includes an expanded metals suite, with the total metals result now comprised of 13 metals. Under the previous Permit, only 5 metals were analysed. Thus, the combined metals results for 2024 are greater than previous years.

Table 4-2 Stack emission results – contaminant concentrations 2019 – 2024

Stack name	Test date	Particulates (mg/m^3)	SO_2 (mg/m^3)	SO_3 (mg/m^3)	NO_x (mg/m^3)	Cd (mg/m^3)	Hg (mg/m^3)	Metals (mg/m^3)
Permit limit		**100**	**7,200**	**100**	**2,000**	**1**	**1**	**5**
Foreshore (Tail Gas Scrubber) Stack	16/05/2019	1.75	*	0.13	32.5	0.0007	<0.0005	0.03344
	18/11/2019	<2	*	1.56	68.5	0.0039	0.0007	0.05813
	24/05/2020	1.15	*	0.21	55.5	0.0026	0.0009	0.04128
	10/12/2020	<1	*	7.15	31.5	0.00115	0.00092	0.0306
	22/04/2021	1.2	*	0.33	56.5	0.0039	0.00106	0.08421
	17/10/2021	1.75	*	0.12	50	0.00205	0.00045	0.03800
	18/05/2022	1.2	*	0.295	41	0.017	0.00087	0.279
	13/10/2022	2.05	*	0.98	40	0.0035	0.0044	0.045
	11/05/2023	<2	*	0.32	35	0.0031	<0.0008	0.036
	14/11/2023	<2	*	0.37	19.5	0.001	<0.0005	0.021
	04/06/2024	<2	*	0.55	12.5	0.059	0.0004	0.1754
	13/11/2024	1.75	*	2.65	13	0.1314	<0.0005	0.2600
Paragoethite Dryer Stack	17/05/2019	17	<5	-	50	0.0081	<0.0009	1.873
	08/10/2019	37	-	-	55	0.0065	<0.0004	1.0699
	25/04/2020	55	<5	-	63	0.056	<0.001	6.719
	10/12/2020	69	-	-	60	0.028	0.0021	5.3501
	23/04/2021	16	-	-	52	0.0096	<0.002	0.9036
	12/10/2021	6.9	-	-	50	0.0033	<0.001	0.0723
	16/05/2022	4.7	<6	-	55	0.0043	<0.001	0.1251
	11/10/2022	5.2	-	-	50	0.0097	<0.001	0.4277
	09/05/2023	24	<6	-	55	0.054	0.0063	0.1353
	16/11/2023	4.7	-	-	59	0.014	<0.002	0.2615
	28/05/2024	<3	<6	-	45	0.0091	<0.001	0.3546
	11/11/2024	<2	-	-	49	0.013	<0.002	0.2644

Stack name	Test date	Particulates (mg/m^3)	SO_2 (mg/m^3)	SO_3 (mg/m^3)	NO_x (mg/m^3)	Cd (mg/m^3)	Hg (mg/m^3)	Metals (mg/m^3)
Permit limit		**100**	**7,200**	**100**	**2,000**	**1**	**1**	**5**
Cadmium Smelter Plant Stack	20/05/2019	<3	<5	-	<3	0.0093	<0.0008	0.1071
	19/11/2019	<2	-	-	<3	0.013	0.00033	0.0583
	23/04/2020	<2	<5	-	4.7	0.093	<0.001	0.424
	09/12/2020	1.7	-	-	<4	0.0036	<0.0005	0.0261
	21/04/2021	<2	-	-	<3	0.0093	<0.0007	0.209
	12/10/2021	<2	-	-	<3	0.0036	<0.0005	0.0461
	12/05/2022	<3	<6	-	<4	0.016	<0.0006	0.1146
	11/10/2022	<2	-	-	<4	0.011	<0.002	0.472
	10/05/2023	<3	<6	-	<4	0.034	0.0021	0.0931
	15/11/2023	<1	-	-	<4	0.036	<0.0005	0.0725
	03/06/2024	5.7	<6	-	<4	1.2	<0.0009	1.6429
	13/11/2024	8.2	-	-	4.7	2.2	<0.0009	2.3434
Copper Sulphate Crystalliser Plant Vent Stack	24/06/2019	<2	<5	-	<3	0.033	<0.0006	0.0826
	17/11/2019	3.7	-	-	<3	0.015	0.0007	0.0577
	22/04/2020	<3	<5	-	<3	0.032	0.047	0.112
	18/12/2020	<3	-	-	<4	0.028	<0.0007	0.0877
	26/04/2021	<3	-	-	<3	0.027	0.015	0.151
	13/10/2021	4.8	-	-	<3	0.031	0.014	0.1755
	10/05/2022	<3	<6	-	<4	0.85	0.012	1.2031
	11/10/2022	5.8	-	-	<4	0.028	0.0051	0.1041
	09/05/2023	66	<6	-	<4	0.1	0.012	0.154
	05/12/2023	<4	-	-	<4	0.011	0.00087	0.05887
	28/05/2024	5.8	<6	-	<4	0.047	0.014	0.2267
	05/12/2024	2.6	-	-	<4	0.078	0.0057	0.2923
Casting V1 Furnace Stack	13/05/2019	<3	<5	-	<3	0.001	<0.0005	0.0405
	04/11/2019	3.3	-	-	<4	<0.0004	<0.0004	0.0133
	21/04/2020	<3	<5	-	<3	0.00067	<0.0006	0.0403
	08/12/2020	<2	-	-	<4	<0.0008	<0.0006	0.0203
	19/04/2021	3.4	-	-	<3	0.0022	<0.0008	0.07
	14/10/2021	>2	-	-	<3	0.004	<0.0006	0.0526
	09/05/2022	<4	<6	-	<4	0.003	<0.0009	0.0609
	10/10/2022	<3	-	-	<4	0.0019	<0.001	0.0689
	08/05/2023	<3	<6	-	<4	<0.0008	<0.0009	0.0225
	15/11/2023	<3	-	-	<4	0.031	<0.001	0.214
	27/05/2024	<2	<6	-	<4	0.00089	<0.0009	0.0586
	12/11/2024	<3	-	-	<4	0.0018	<0.0007	0.0874

Stack name	Test date	Particulates (mg/m^3)	SO_2 (mg/m^3)	SO_3 (mg/m^3)	NO_x (mg/m^3)	Cd (mg/m^3)	Hg (mg/m^3)	Metals (mg/m^3)
Permit limit		**100**	**7,200**	**100**	**2,000**	**1**	**1**	**5**
Casting V2 Furnace Stack	13/05/2019	<3	<5	-	<3	0.0015	<0.0005	0.047
	04/11/2019	<2	-	-	<4	<0.0009	<0.0004	0.0223
	21/04/2020	<2	8.3	-	<3	<0.0008	<0.0005	0.0263
	08/12/2020	<2	-	-	5.6	0.0008	<0.0008	0.0236
	19/04/2021	<2	-	-	<3	0.0016	<0.0009	0.0595
	14/10/2021	<2	-	-	<3	0.0022	<0.0005	0.0297
	09/05/2022	<3	7.6	-	<4	0.0013	<0.0005	0.0488
	10/10/2022	11	-	-	<4	0.0013	0.0012	0.0915
	08/05/2023	<4	<6	-	<4	<0.001	<0.001	0.053
	15/11/2023	<2	-	-	<4	0.014	<0.0005	0.0625
	27/05/2024	<3	19	-	<4	0.00058	<0.0008	0.0992
	12/11/2024	<2	-	-	<4	0.0048	<0.0008	0.0944
Roaster Baghouse Stack	15/05/2019	<3	830	0.4	<3	0.0073	<0.0008	0.3094
	18/11/2019	9	<5	-	<3	0.021	<0.0005	0.4259
	25/04/2020	<3	2.5	0.15	<3	0.0082	0.18	0.3572
	08/12/2020	2.7	-	-	<4	0.028	0.0014	0.531
	20/04/2021	50	1,900	1.1	3.4	0.18	0.012	2.524
	16/10/2021	37	-	-	5.3	0.026	0.018	0.4544
	17/05/2022	52	2800	0.68	<4	0.32	0.0021	4.8513
	12/10/2022	<2	3400	-	<4	0.0046	0.018	0.0846
	16/05/2023	3.5	7.2	0.93	<4	0.026	0.0014	0.3583
	16/11/2023	13	5.9	-	<4	0.031	0.003	0.4259
	29/05/2024	<2	150	1.2	<4	0.026	0.0014	0.3278
	03/12/2024	6.6	650	-	<4	0.026	0.0008	0.2984
Anode Casting Plant Exhaust Stack	14/05/2019	14	<5	-	<3	0.0083	<0.0009	0.2422
	09/10/2019	2.8	-	-	<4	<0.0004	<0.0002	0.1666
	23/04/2020	12	<5	-	<3	0.005	0.0013	0.4043
	09/12/2020	<3	-	-	<4	0.001	0.00093	0.1809
	21/04/2021	4.7	-	-	<3	0.009	0.0012	0.2002
	15/10/2021	120	-	-	<3	0.016	0.0011	1.8271
	12/05/2022	11	<6	-	<4	0.013	<0.0008	0.3308
	12/10/2022	4.7	-	-	<4	0.0084	0.0022	0.1726
	10/05/2023	<2	<6	-	<4	0.014	<0.0008	1.7238
	15/11/2023	9.4	-	-	<4	0.0034	<0.0009	0.1613
	29/05/2024	7.1	<6	-	<4	0.082	0.0031	0.4325
	12/11/2024	4.3	-	-	<4	0.0064	<0.001	0.3438

Stack name	Test date	Particulates (mg/m^3)	SO_2 (mg/m^3)	SO_3 (mg/m^3)	NO_x (mg/m^3)	Cd (mg/m^3)	Hg (mg/m^3)	Metals (mg/m^3)
Permit limit		**100**	**7,200**	**100**	**2,000**	**1**	**1**	**5**
Zinc Dust Plant 1 Stack	15/05/2019	4.3	<5	-	<3	0.0012	<0.0005	0.0697
	19/11/2019	5.5	-	-	<3	0.0037	0.00075	0.1005
	22/04/2020	32	<5	-	<3	0.018	0.0026	0.4406
	09/12/2020	<3	-	-	<4	0.0011	<0.0009	0.038
	27/04/2021	<2	-	-	<3	0.013	<0.0007	0.0727
	15/10/2021	4.4	-	-	<3	0.019	<0.0008	0.1708
	11/05/2022	2.4	<6	-	<4	0.017	<0.0007	0.0807
	11/10/2022	<3	-	-	<4	0.0073	<0.0008	0.0551
	10/05/2023	<3	<6	-	<4	0.0063	<0.0007	0.137
	14/11/2023	<2	-	-	<4	0.0022	<0.0006	0.0488
	30/05/2024	5.6	<6	-	<4	0.022	<0.001	0.3071
	11/11/2024	5	-	-	<4	0.0039	<0.0007	0.088
Zinc Dust Plant 3 Stack	14/05/2019	3.1	10	-	<3	0.0047	<0.0007	0.1844
	17/11/2019	6.5	-	-	<3	0.0056	<0.0007	0.0833
	21/04/2020	24	8.3	-	<3	<0.001	<0.0006	0.0833
	09/12/2020	8.5	-	-	<4	0.00059	<0.0007	0.1033
	21/04/2021	4.7	-	-	<3	0.081	0.0019	1.1069
	16/10/2021	26	-	-	<3	0.0015	<0.001	0.1815
	11/05/2022	27	<6	-	<4	0.011	<0.0006	0.3596
	10/10/2022	12	-	-	<4	0.0011	<0.001	0.1621
	10/05/2023	<2	<6	-	<4	0.0071	<0.005	0.0716
	14/11/2023	5.8	-	-	<4	0.0047	0.0011	0.1078
	30/05/2024	8.7	<6	-	<4	0.0056	<0.0009	0.2208
	11/11/2024	6.9	-	-	<4	0.0021	<0.0008	0.1251
Start Up Scrubber Stack	06/11/2019	18	13	-	12	0.032	<0.0005	0.1367
	03/08/2022	7.3	37	-	5.8	0.013	0.0021	0.2091
	16/05/2023 (new stack)	17	<6	-	5.8	0.054	<0.001	1.3

Stack name	Test date	Particulates (mg/m^3)	SO_2 (mg/m^3)	SO_3 (mg/m^3)	NO_x (mg/m^3)	Cd (mg/m^3)	Hg (mg/m^3)	Metals (mg/m^3)
Permit limit		**100**	**7,200**	**100**	**2,000**	**1**	**1**	**5**
MZR Furnace Stack	14/05/2019	2.5	14	-	4.8	<0.0008	<0.0004	0.0272
	17/11/2019	<2	-	-	<3	0.0045	<0.0005	0.037
	23/04/2020	<3	<5	-	5.9	0.002	<0.0008	0.0308
	08/12/2020	<2	-	-	<4	<0.0008	<0.0006	0.0214
	20/04/2021	<2	-	-	4.7	0.0015	0.0011	0.0376
	16/10/2021	<2	-	-	<3	0.0075	0.0082	0.1247
	10/05/2022	4.2	<6	-	<4	0.032	0.00086	0.07386
	12/10/2022	<2	-	-	16	0.0076	0.0014	0.099
	15/05/2023	<3	<6	-	<4	0.0023	<0.0007	0.028
	16/11/2023	<2	10	-	8.6	0.011	<0.0009	0.1169
	30/05/2024	15	11	-	17	0.009	<0.0009	0.1966
	12/11/2024	23	<6	-	12	0.031	<0.0007	0.2837
MZR Dross Stack	17/05/2022	<2	<6	-	<4	0.003	<0.0005	0.1522
	12/10/2022	<2	-	-	<4	0.0084	<0.0006	0.098
	15/05/2023	<7	-	-	<4	0.005	<0.0009	0.0579
	16/11/2023	<2	-	-	<4	0.0099	<0.0008	0.0577
	03/06/2024	<2	<6-	-	<4	0.2	<0.0009	0.6524
	12/11/2024	<3	-	-	<4	0.007	<0.0009	0.1065
Zinc Oxide Fume Debagging	14/10/2021	<8	-	-	<3	0.0075	0.0082	0.1247
	13/05/2022	<5	<6	-	<4	0.0082	<0.001	0.0872
	12/10/2022	<4	-	-	<4	0.0044	<0.001	0.0963
	12/05/2023	<4	1.8	-	<4	0.0095	<0.001	0.1255
	17/11/2023	<4	<6	-	<4	0.0061	<0.001	0.1441
	31/05/2024	<6	<6	-	<4	0.024	<0.001	0.1926
	13/11/2024	<5	-	-	<4	0.0075	<0.002	0.2192
"Green Text"		Indicates a compliant result for specified parameter under The Permit						
"Red Text"		Indicates a non-compliant result for specified parameter under The Permit						
"Shaded cell"		Indicates results for parameters not specified for testing under The Permit						

* SO_2 emissions are covered in foreshore stack – continuous emission monitoring

Continuous Emission Monitoring Results

15 minute average data for SO_2 emissions from the foreshore (tail gas scrubbing) stack over the current reporting period and the preceding three years is shown in Figure 4.2. Long-term performance statistics for 2019 – 2024 are shown below in Table 4-3. Spikes in SO_2 concentration are the result of plant upsets. Processing rates are controlled to ensure The Permit conditions for the foreshore stack SO_2 emissions are met. The Permit limit is based on a Continuous (air) Emission Monitoring device and the limit for SO_2 is not considered breached unless the limit is exceeded continuously for greater than 15 minutes. At no point during the reporting period did the site breach this condition.

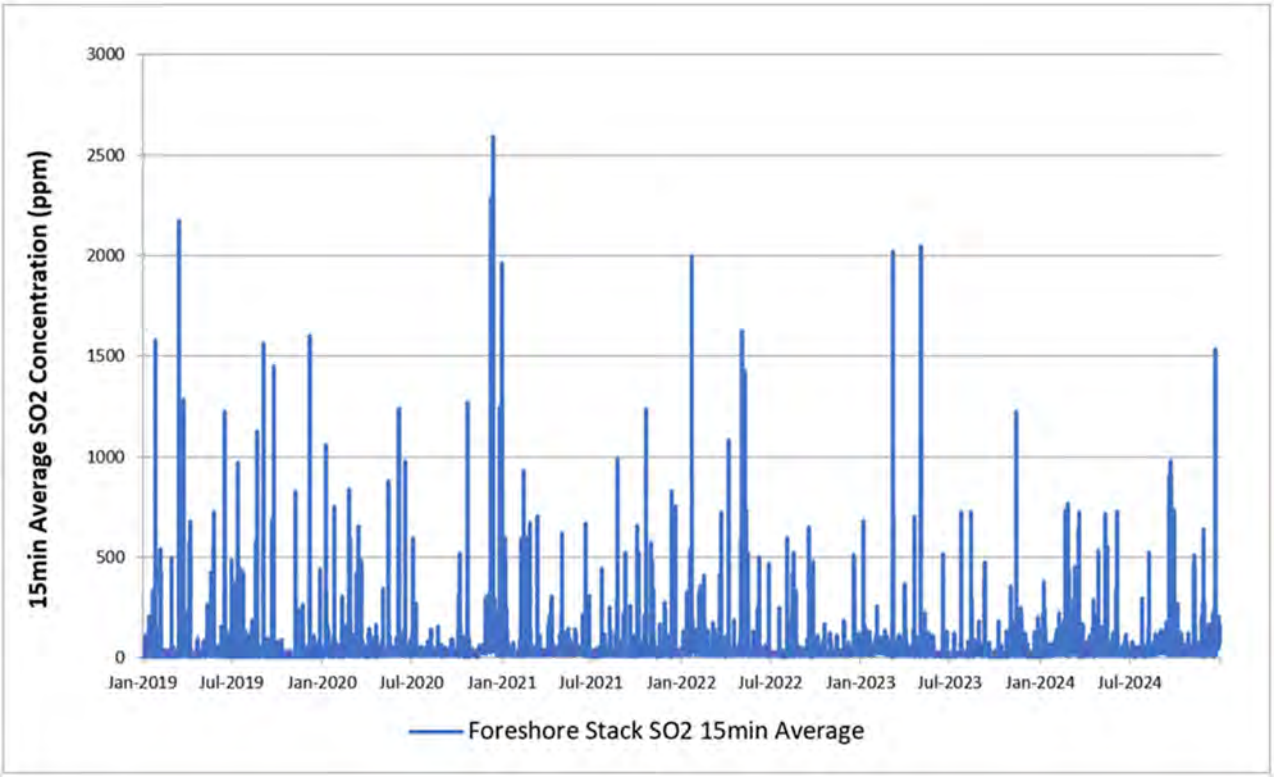


Figure 4-2 Foreshore stack SO_2 continuous emission monitor readings 2019 – 2024 reporting period

Table 4-3 Foreshore stack emissions – long-term performance 2019 – 2024

Continuous Emission Analysis	Year					
	2019	2020	2021	2022	2023	2024
Yearly average SO_2 15min (ppm)	19	27	24	27	25	44
50% of results were below	8	15	13	16	14	31
90% of results were below	29	50	47	57	57	95
99% of results were below	181	239	135	141	137	175

Emission Monitoring Discussion

Two notifiable non-compliances were recorded for emissions to atmosphere during the reporting period. During the biannual Stack Testing, on 03/06/2024 the cadmium emission from the Cadmium Smelter Plant Stack (CSPS) was measured at 1.2 mg/m^3, exceeding the limit as stipulated in The Permit of 1 mg/m^3.The stack testing report was received from Ektimo on 26/07/2024 and upon receipt, a formal investigation commenced.

The primary contributing factors were determined to be:

- Insufficient water delivered to the scrubbing tower
- Dirty water used for gas scrubbing
- Water filtration system damaged/inefficient.

The stack emissions from the CSPS were re-tested by Ektimo on 29/08/2024, with results received on 19/09/2024. A cadmium emission result of 0.56 mg/m^3 was recorded.

On 13/11/2024 during biannual Stack Testing, the cadmium emission from the CSPS was measured at 2.2 mg/m^3, exceeding the limit as stipulated in The Permit of 1 mg/m^3.The stack testing report was received from Ektimo on 24/01/2025 and upon receipt, a formal investigation commenced.

The primary contributing factors were determined to be:

- Insufficient water delivered to the scrubbing tower
- Over application of flux during plant operation.

The stack emissions from the CSPS will be re-tested in 2025, following the implementation of actions from the investigation.

The graphical (Figure 4.2) and tabulated (Table 4-3) trends show that 2024 has seen average, 90th percentile and 99th percentile SO_2 emissions from the tail gas scrubbing (foreshore) stack increasing in comparison to the 2019 – 2023 data. It is considered that this increase is primarily due to operational issues within the acid plant. Actions have been undertaken in early 2025 to address the increase in SO_2 emissions, including the replacement of fouled packing in #3 Tail Gas Scrubber, which improved the scrubbing efficiency in the tower.

4.1.2 Ambient Sulphur Dioxide

4.1.2.1 Ambient Sulphur Dioxide Background

The foreshore (tail gas scrubbing) stack is the major source of SO_2 emitted from NH. In this stack, SO_2 concentrations are monitored continuously in order to manage the production process such that environmental impacts are minimised. To verify that these controls are effective in the receiving environment, additional SO_2 monitors are installed around the plant and in the community. These provide feedback to the plant for monitoring compliance with ground level concentration (GLC) regulations.

Emissions during normal operations are well within accepted guideline and regulatory values, but abnormal or emergency conditions have greater potential for releases of SO_2 gas to impact the community. Damage to or deterioration of infrastructure can also result in diffuse emissions that can increase GLCs.

NH operational emergency response protocols are well-established and any abnormal gas releases are detected and acted upon quickly. GLCs are displayed on process control screens at the Roast and Effluent Treatment control rooms. Trigger values are set for five minute and one hour average data to alert relevant personnel to elevated GLCs so that appropriate controls can be initiated. Operational responses include progressively reducing plant output or, if emissions cannot be controlled, isolating and shutting down the Roasting and Acid plants.

4.1.2.2 Ambient Sulphur Dioxide Monitoring Program Details

The Permit mandates monitoring requirements for the assessment of ambient SO_2. Reportable limits are presented in Table 4-4 below.

Table 4-4 Permit specified limits for SO_2

Emission point / monitoring location	**Test frequency**	**Test parameter**	**Emission limits**
Ambient air	Continuous	GLC SO_2	24 hour average: 0.20ppm
			1 day average: 0.080ppm

Continuous SO_2 monitoring of ambient air occurs at three locations as shown in Figure 4.3. These locations were selected as points most likely to represent areas impacted by plant SO_2 releases.

- Technopark, Dowsing's Point, Goodwood;
- Tennis Court, Risdon Road, Lutana; and
- NH buffer zone, near Birch Road, Lutana.

Ambient SO_2 concentrations are monitored using Teledyne API 100E and Thermo Fisher 43i analysers, certified to be compliant with recognised international standards for performance. SO_2 is measured continuously and five minute average concentration results are sent via telemetry to NH databases.

Figure 4-3 Community SO_2 monitor locations

4.1.2.3 Ambient Sulphur Dioxide Results & Discussions

There were no exceedances of the 24 hour rolling average limit during the reporting period, however there was one exceedance of the 1 hour rolling average limit. During the start-up of #6 Fluidised Bed Roaster on 22 January, the 200 ppb hourly average limit was exceeded at the Technopark monitor.

Annual results from 2019 – 2024 are displayed for each of the three monitoring sites in the following figures. The graphs display the rolling 1 and 24 hour averages as measured every 5 minutes. The emission limit exceedence of the 1 hour rolling average at Technopark, recorded on 22 January 2022 has been removed from the annual results graph (Figure 4-6) for the purposes of better displaying the remainder of the reporting period data, without the scaling issues caused by including the elevated data recorded on 22 January. The data from 22 January 2022 has been included as a separate graph (Figure 4-7).

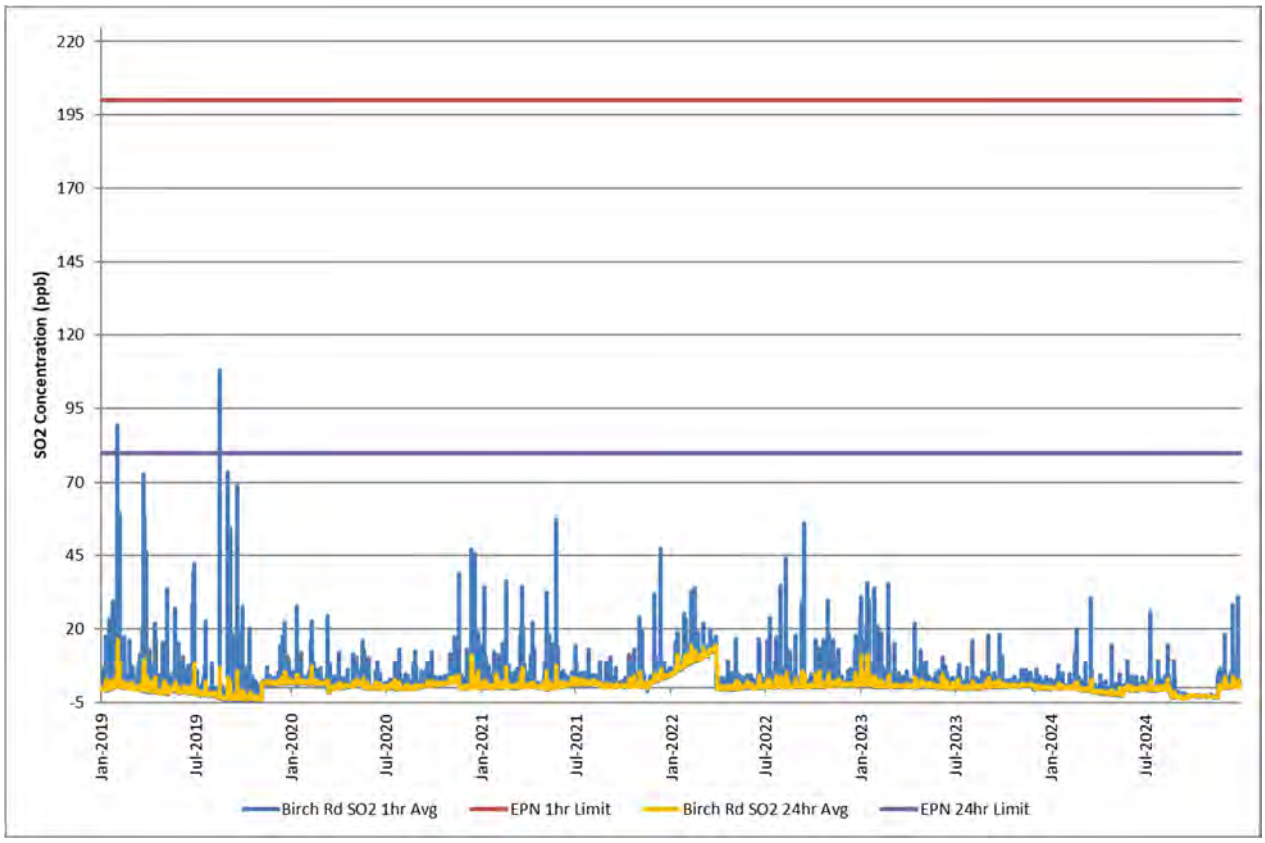


Figure 4-4 Birch Road GLC SO_2 (1 hour and 24 hour averages) 2019-2024

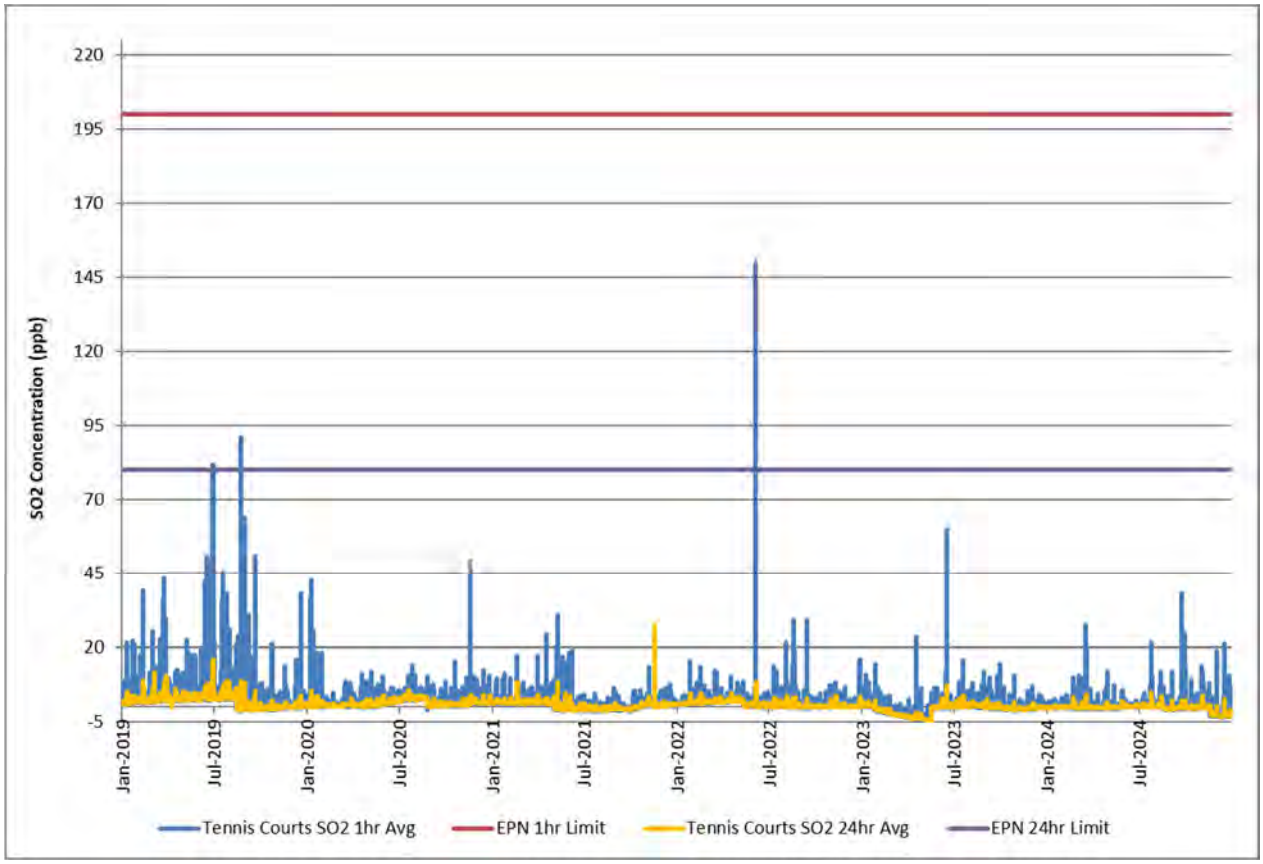


Figure 4-5 Tennis Courts GLC SO_2 (1 hour and 24 hour averages) 2019-2024

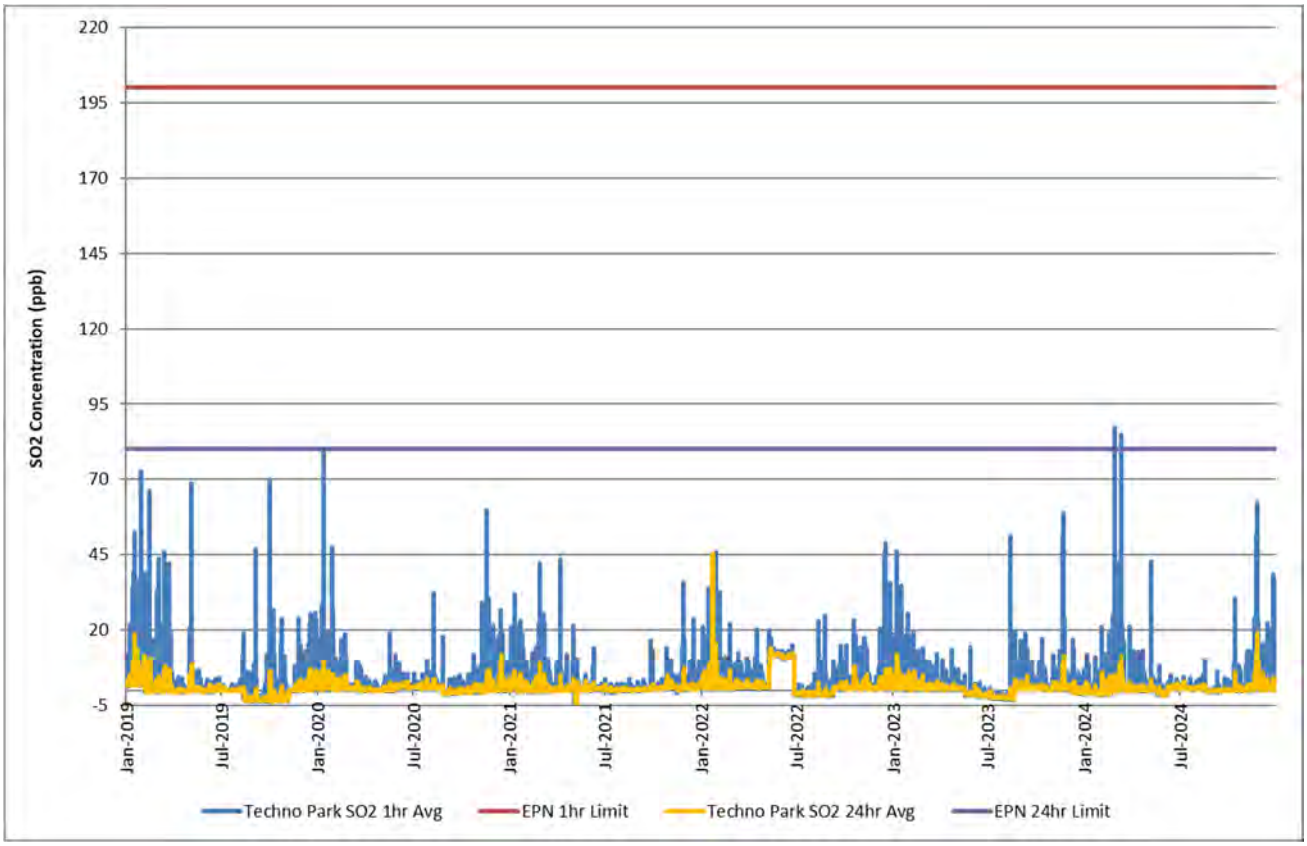


Figure 4-6 *Techno Park GLC SO_2 (1 hour and 24 hour averages) 2019-2024 (excluding 22 January 2022)*

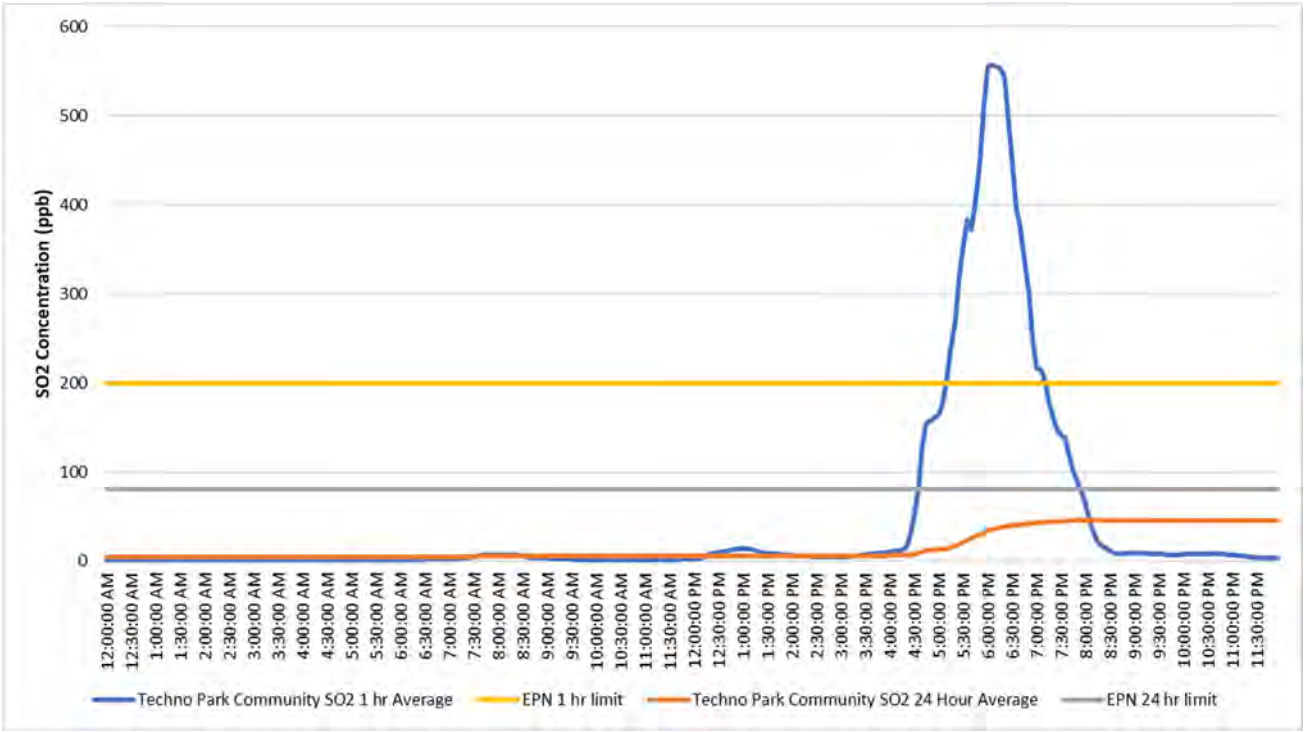


Figure 4-7 *22 January 2022 Techno Park GLC SO_2 (1 hour and 24 hour averages). Note the 1 hour average that exceeded the emission limit*

4.1.3 Ambient Particulate Matter

4.1.3.1 Ambient Particulate Matter Background

Dust generation has the potential to have adverse effects when the material released is high in heavy metals and / or very high in general concentration. Process streams, residual materials, contaminated open areas and vehicle movements can all contribute to dust emissions, particularly in dry and windy conditions.

Dust emissions at NH generally impact the local plant area but may contribute to dust in the broader atmosphere. Ambient particulate matter in air and its composition is measured at several monitoring sites around NH and the surrounding community to gauge the smelter's impact on air quality and to guide ongoing improvement strategies. This monitoring is achieved using high volume air sampling (HVAS) units to capture total suspended particulate matter (TSPM) samples.

NH employs a range of operational and engineering controls in order to prevent dust emissions, including but not limited to; undercover storage, gas-cleaning technologies such as baghouses and scrubbers, sweeper and water trucks to clean and wet roadways and revegetation strategies.

4.1.3.2 Ambient Particulate Matter Monitoring Program Details

TSPM levels are measured at three regulated locations around the NH site (Figure 4-8). Reportable limits are presented in Table 4-5.

Table 4-5 Air quality Permit limits

Emission point / monitoring location	Test frequency	Test parameter	Emission limits
Ambient air at three representative sites	Every six days for a continuous 24 hour period	Lead	0.0015 mg/m^3 90 day rolling average

TSPM results are not regulated per Permit requirements, but are shown in this section in comparison to the QLD EPA guideline of 90 µg/m^3 for annual mean TSPM[1].

High volume sampling of ambient air for compliance reporting purposes occurs at three locations as shown in Figure 4-8. These community monitoring locations are:

- Risdon Road North (RRNT), NH northern exit, Lutana;
- Tennis Courts (TCT), Risdon Road, Lutana; and
- NH buffer zone, near Birch Road (BRT), Lutana.

The sampling units collect 24 hour composite samples, operating continuously for a 24 hour period on a six day cycle. The units draw a large volume of air, approximately 70 m^3/hr, using a vacuum pump, with airborne dust collected on a glass fibre filter paper. Filter papers are analysed for total particulate load and metals including lead, zinc, cadmium, iron and manganese. Average concentrations of dust and metals in air are calculated according to Australian Standard specifications using the HVAS operating hours, flow rate and particulate mass to give a result in micrograms per cubic metre (µg/m^3).

[1] *Queensland Environmental Protection (Air) Policy 2019*

Figure 4-8 Location of high volume TSPM sampling equipment

4.1.3.3 Ambient Particulate Matter Results & Discussions

Mean total suspended particulate matter (TSPM) concentrations were below the QLD EPA guideline for the reporting period across all monitoring sites (Figure 4-9). The Risdon Road North (RRN) monitoring site receives the highest dust load of the three compliance sites. The RRN site is showing a trend of declining average TSPM values, while the remaining two sites show no clear trend.

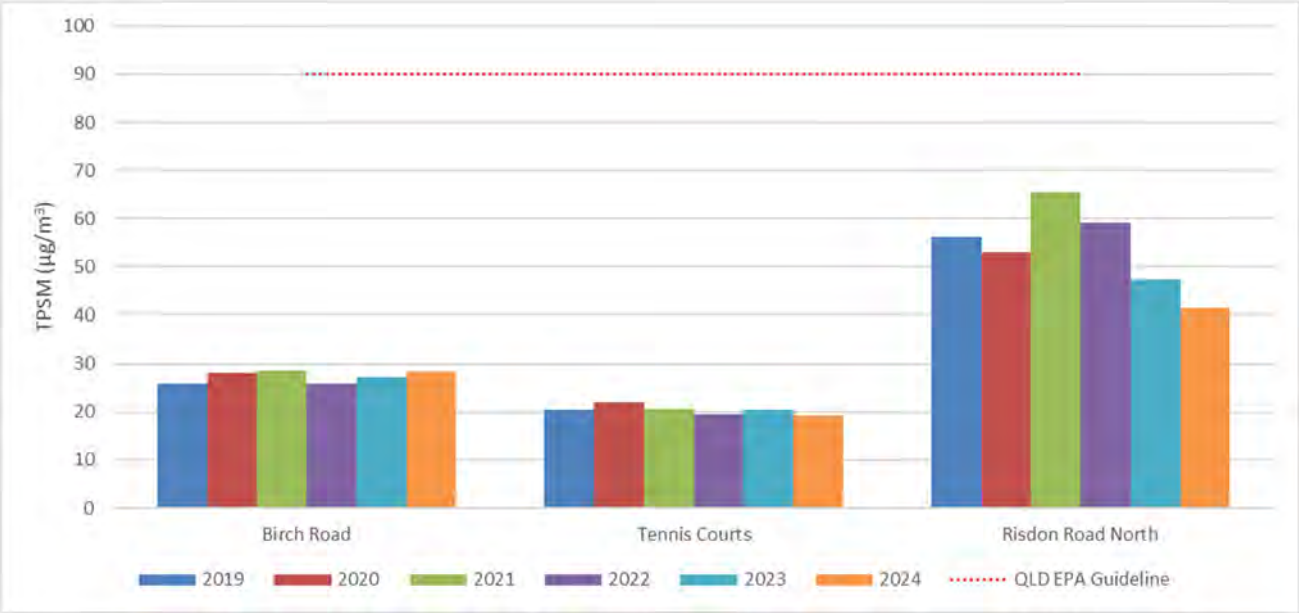


Figure 4-9 Annual mean TSPM Concentrations across three monitoring sites compared to QLD EPA Annual Guideline for 2019-2024

The 90-day rolling average for total suspended particulate matter of lead (TSPM-Pb) is the primary performance indicator for process dust emissions. The TSPM-Pb 90-day rolling average for the three sites between 2022-2024 are shown in Figure 4-10. The lead in TSPM results at Birch Road and the Tennis Courts were consistently well below the limit prescribed by The Permit. These findings are consistent with previous sampling periods during which no non-compliances were recorded at these sites. Historically, the results at these two sites have shown a general downward trend in summer peak values since monitoring commenced in 2007.

In 2022 NH recorded a notifiable non-compliance where the TSPM-Pb concentration at Risdon Road North (RRN) exceeded The Permit 90-day average limit. From the end of February 2022 to early April 2022 the TSPM-Pb was in excess of the limit of 0.0015 mg/m^3, reaching a peak of 0.00176 mg/m^3. Additional information has been included in Appendix 2 – Notifiable and Reportable Environmental Incidents 2022 – 2024. Dust management remains one of the ongoing priorities for environmental management at NH.

The increased lead in air recorded at the site in the 2019-2021 period prompted improvements in the assessment of the data. Four continuous PM10 monitors were installed at the site in 2020 to enable more frequent assessment of ambient dust levels. In 2022, air quality consultants were utilised to provide further advice on best practices for assessing lead in air onsite and as a result in 2022/2023 an additional two continuous PM10 monitors (EBAM+) were installed at the Risdon Road North monitoring site and at Stanhope Point. These additional monitors have a higher sampling volume capacity compared to the monitors installed in 2020.

Within the TSPM-Pb results, seasonal trends are evident, with dust generally lower during the winter months. This is consistent with the data recorded in previous sampling periods.

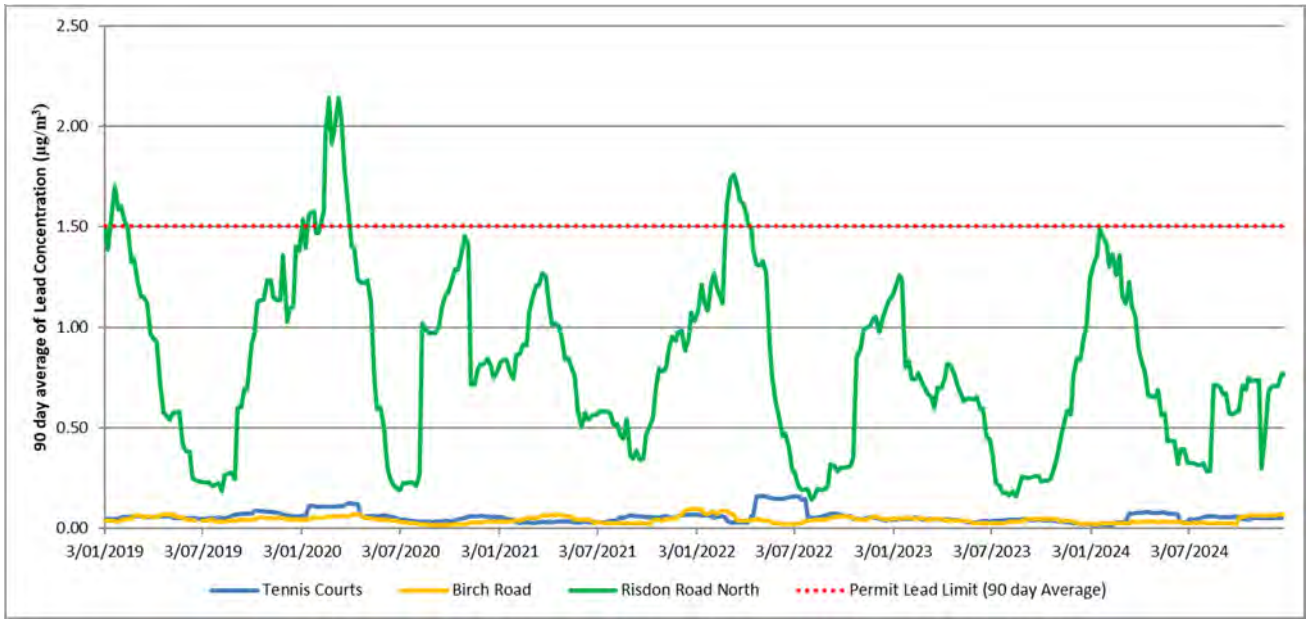


Figure 4-10 90-day rolling average for TSPM-Pb across three monitoring sites compared to The Permit site lead limit 2019-2024

4.2 Site Water Management

Site water management forms a critical element of emissions mitigation and minimisation at NH. This is reflected in the site's permit conditions that require all contaminated and potentially contaminated wastewater that is not recycled or reused in the plant be treated in the Effluent Treatment Plant (ETP). NH also maintains a high-level strategy aimed at improving all aspects of water management at the site.

Contained site stormwater and extracted groundwater is treated through the ETP to remove metals and solids before being discharged through the permitted discharge point. NH operates a closed drainage system to direct all flows to the contaminated water ponds (CWP).

4.2.1 Process Water

4.2.1.1 Process Water Background

Process waters are defined here as those that result from various production processes such as cooling or scrubbing waters, filtrate from the processing of some solids, plant wash-waters and mercury removal filtrate (MRF). Process waters are collected by site drains and directed to either the CWP, the detention basins, or directly to the ETP. The ETP removes metals through lime neutralisation and flocculation to settle solids before discharging effluent to the Derwent Estuary via the foreshore scrubber outfall (FSO). Solids removed from the CWP and ETP process are returned either to the leaching department or sent to Nyrstar's Port Pirie Smelter for metal recovery. Monitoring key site drains helps identify contamination into the ETP and this information is used to ensure unnecessary inputs at the source are minimised.

The ETP was commissioned in 1992 and has a design capacity of 2,500 ML per annum (dependent on influent composition).

Prior to discharge through the permitted outfall, flows from the ETP are combined with tail gas scrubber discharge (refer Figure 4.11).

Potable water usage is a critical element of site water management, as much of this water combines with process waters and requires treatment through the ETP. Monitoring, operational and strategic actions to reduce potable water consumption are important in minimising unnecessary additions to the process circuit. This links with Nyrstar's Environment Policy wherein we aim to minimise the use of natural resources, such as the energy and lime required to treat our effluent.

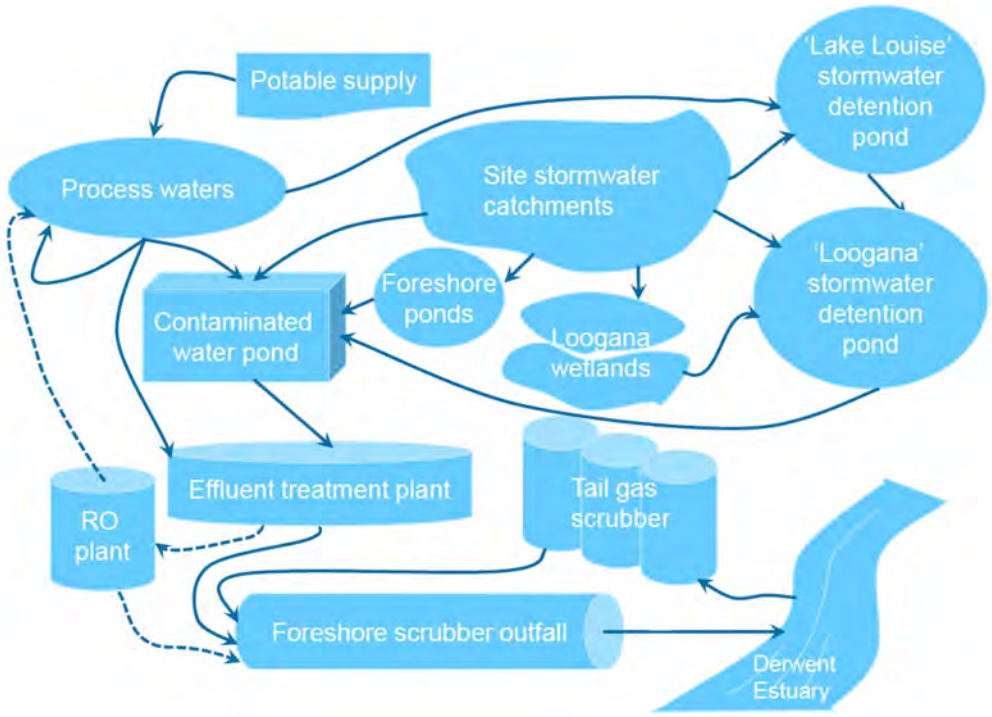


Figure 4-11 Process and stormwater system. Recycled water flows that came online in 2016 shown with a dotted line

4.2.1.2 Process Water Monitoring Program Details

Two daily 24 hour composite samples are taken from the FSO using programmed water auto-samplers. The samplers draw approximately 30 mL of water into a sample bottle at approximately 15 minute intervals from the discharging stream. The samplers are listed on the site's Critical Instrumentation Register and receive three monthly programmed maintenance checks as well as priority repair status if any failures occur. The daily composite samples are analysed for pH, iron, sulphate, copper, cadmium, mercury, lead and zinc.

An average of the two composite samples is taken and used for reporting purposes. The flow rate is measured in the two major contributors to the FSO (estuarine-sourced scrubbing water and effluent from the ETP), the sum of which gives a total discharge.

If the composite sample is above permit limits this constitutes a regulatory non-compliance and is immediately reported to the EPA.

In addition to the daily sampling schedule, further analysis is conducted six monthly in accordance with The Permit, and for National Pollutant Inventory (NPI) reporting purposes. Each year a minimum of two of the 24 hour composite samples are analysed for the extended suite of analyses given in Table 4-6 to ensure that these substances do not exceed The Permit emission limits. The suite is further extended to include beryllium, cobalt and nickel for annual NPI reporting.

Table 4-6 Foreshore outfall monitoring and reporting requirements and permit limits

Monitoring / sampling frequency	Monitoring parameter	Regulatory limit (mg/L)
Daily 24 hour composite	Discharge (L/h)	-
	Zinc	5.00
	Cadmium	0.03
	Lead	0.20
	Mercury	0.01
Six monthly	Arsenic	0.25
	Copper	1.00
	Iron	5.00
	Total suspended solids	60.00
	N (as ammonia)	1.50
	Fluoride	10.00
	Manganese	5.00

Figure 4.12 shows the annual flow discharged from the FSO for both the current reporting period, and the previous triennial reporting period. The total flow is split in to the two streams – the estuarine water used to scrub residual SO_2 from the gas stream through the tail gas scrubbers, and the effluent that is treated, and discharged from the ETP. The total volume of water discharged to the Derwent Estuary (three saltwater intake lines and ETP effluent) during the reporting period was 97.8 GL. This is a slight increase on the previous reporting period 2019 – 2021 where 96.9 GL was discharged.

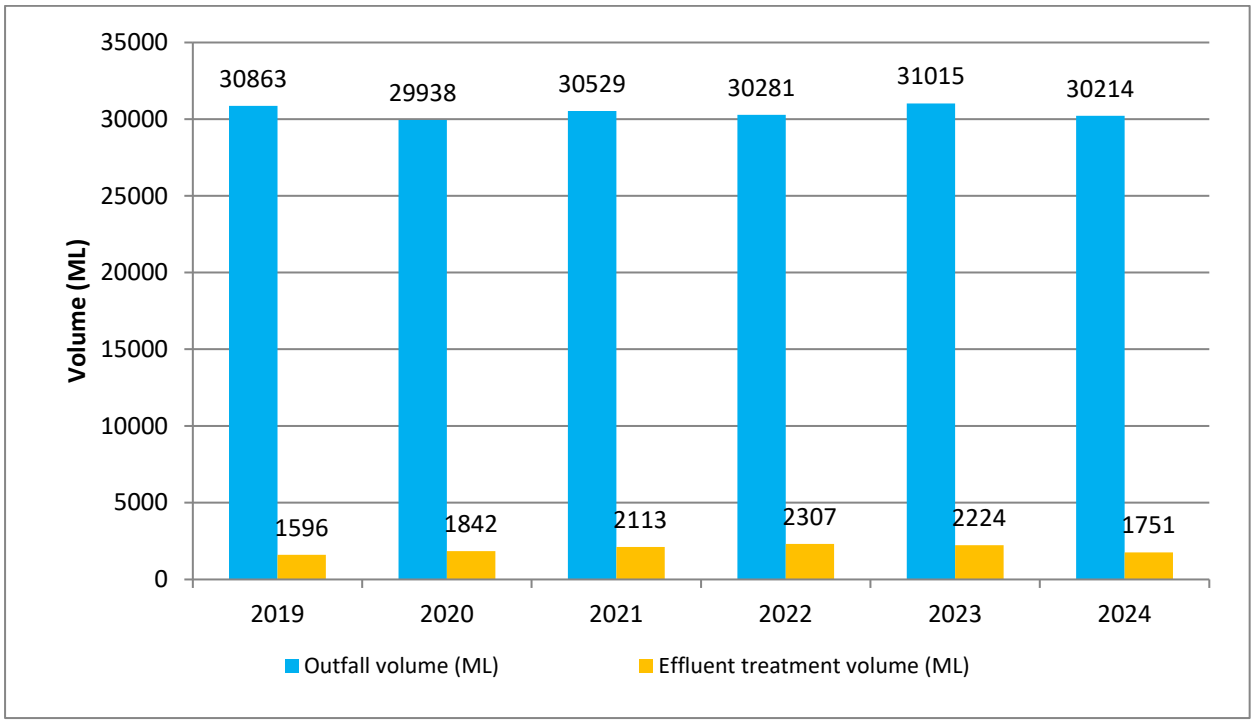


Figure 4-12 Discharge from the foreshore outfall

Composite Sampling Results

Minimum, maximum and mean results of the daily and monthly analyses are presented below in Table 4-7, together with the regulatory limits for each analyte. Note that where the result was recorded at below the laboratory limit of reporting, the limit of reporting value was used.

Table 4-7 Summary of outfall analytical results; 2019 to 2024.

Monitoring / sampling frequency	Monitoring parameter	Limit of reporting (mg/L)	Minimum concentration (mg/L)	Mean concentration (mg/L)	Maximum concentration (mg/L)	Regulatory limit (mg/L)
Daily 24 hour composite	Zinc	0.030	0.030	0.038	0.210	5.00
	Cadmium	0.005	0.005	0.005	0.008	0.03
	Lead	0.030	0.030	0.030	0.070	0.20
	Mercury	0.00005	0.00015	0.0009	0.0061	0.01
Six monthly	Arsenic	0.001	0.002	0.005	0.010	0.25
	Copper	0.010	0.010	0.020	0.030	1.00
	Iron	0.015	0.050	0.140	2.010	5.00
	Total suspended solids	2.000	2.000	4.683	9.200	60.00
	N (as ammonia)	0.001	0.007	0.044	0.080	1.50
	Fluoride	0.1	1.500	1.708	1.900	10.00
	Manganese	0.005	0.008	0.017	0.022	5.00

Of the daily metals analysed on a 24 hour basis, only zinc and mercury are typically present at concentrations above the laboratory limit of reporting. A comparison of the average annual concentration of these metals for the reporting period, and for the previous sampling period are displayed in Figure 4.13 below. Trends are displayed as both the mean and median in an effort to identify longer term trends, less susceptible to short term spikes which may influence the annual mean concentration.

As can be seen in Figure 4.13, the average zinc has decreased across the reporting period, whilst the average mercury has remained reasonably consistent.

In the previous PER, an increase in mercury concentration within outfall between 2019 and 2021 was reported. It is noted that the average and median mercury concentrations have decreased in the 2022 – 2024 period, however do still remain elevated when compared to the 2016 – 2018 period. The site is continuing to work towards reducing mercury in outfall concentrations to historical norms, with ongoing maintenance to the electrostatic mist precipitators, and the tail gas scrubbing system.

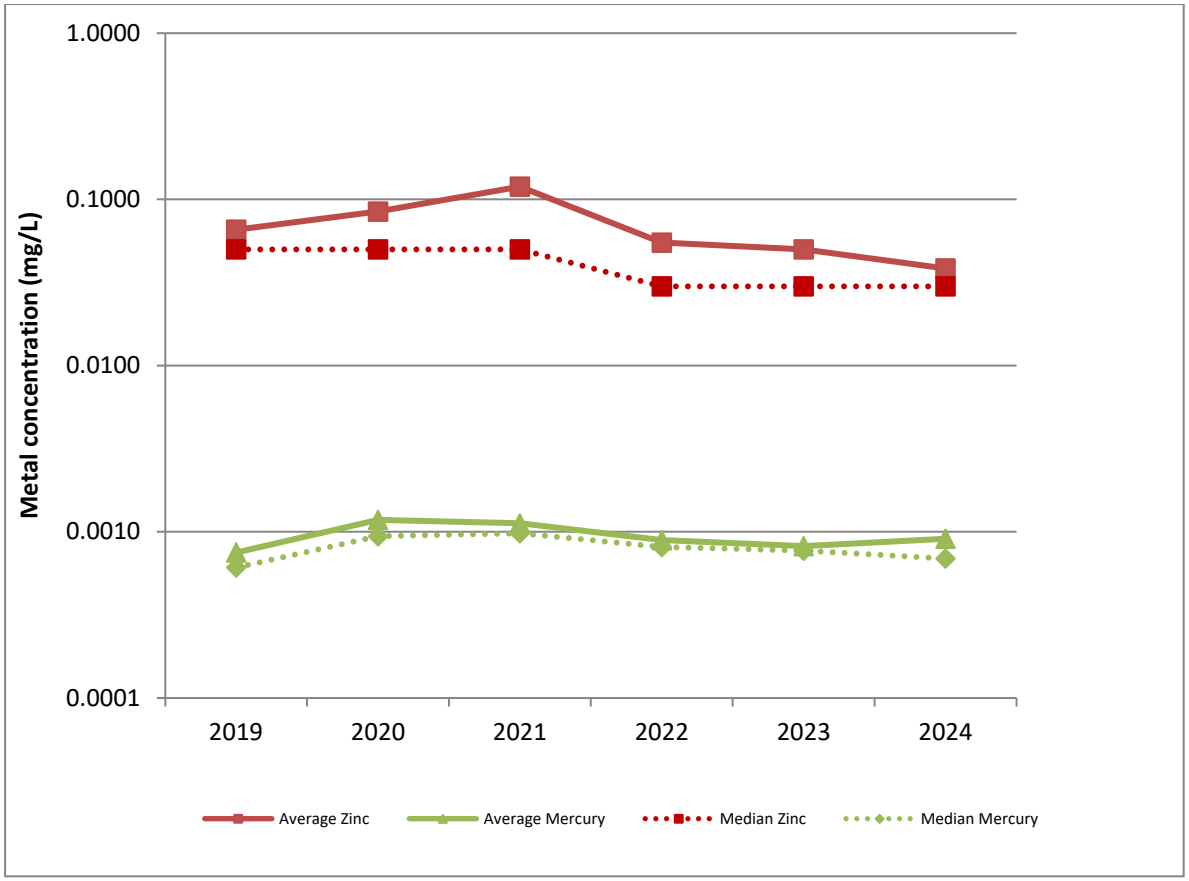


Figure 4-13 Average annual zinc and mercury concentration in outfall

4.2.2 Potable, Reused and Recycled Water Consumption

Monitoring operational and strategic actions to reduce potable water consumption are important in meeting sustainability objectives in accordance with Nyrstar's Environment Policy. Figure 4-14 shows the site's potable water consumption over the current, and previous triennial reporting period, and the volume of reused/recycled water utilised on site.

The recycled water is generated through two different sources:

- Wastewater collected in the CWP and reused in the plant.
- The on-site RO plant through which water is recycled and used in the plant.

The site has achieved a considerable increase in recycled water consumption in 2024. This follows a capital project that commenced in late 2022 to re-instate the RO plant after a period of downtime. The project was completed in late 2023, and the RO plant produced high quality recycled water for use on the site throughout 2024.

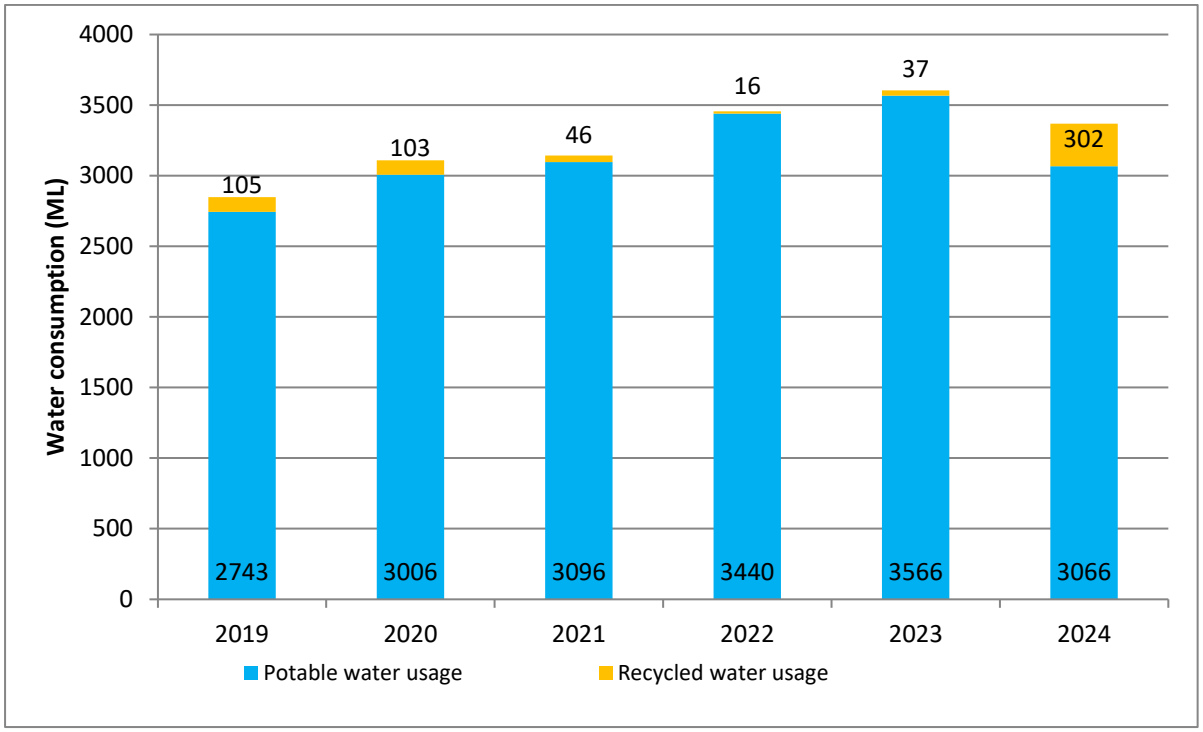


Figure 4-14 Water consumption (potable and recycled) 2019 – 2024

4.2.3 Stormwater

4.2.3.1 Stormwater Background

Due to contamination of surfaces, stormwater flow from the site has the potential to exceed prescribed limits for discharges to surface waters. The State Policy on Water Quality Management 1997 requires that diffuse sources of pollution be controlled in order to meet declared water quality objectives for the receiving waters. These requirements are reflected in Condition SW1 of The Permit as varied which requires all stormwater to be contained on site and treated through the Effluent Treatment Plant (ETP) prior to discharge from the monitored outfall point.

Key to this process is the Site's closed drainage system that ensures flows within the process area report to the Contaminated Water Pond (CWP) or to a detention basin. Flows exceeding the capacity of the ETP and interim storages must only be discharged from the nominated emission points as illustrated in Figure 4-15.

NH has developed and progressively implemented the Stormwater Management Strategy to ensure regulatory requirements are met and continuous improvement is achieved through best practice environmental management principles.

4.2.3.2 Stormwater Monitoring Program Details

The present stormwater system has six emergency overflow points to the Derwent Estuary as defined in Attachment 9 of The Permit as varied. These are depicted within Figure 4-15 and listed below:

- New Town Bay outfall;
- Loogana overflow;
- C drain outfall;
- B drain outfall;
- #2 CWP outfall; and
- Wharf stormwater pond overflow.

High frequency storm events are contained within the site's stormwater infrastructure for treatment at the ETP. During larger storms, the most contaminated flows (based on catchment land use) are directed to the CWP as a priority.

The CWP has a total containment volume of approximately 7,000 m^3, of which the nominal operating volume is 1,000 m^3, leaving 6,000 m^3 available as surge volume for stormwater during rain events. Operational controls exist during storm events to preserve the capacity of the CWP which typically contains the sites most contaminated stormwater. This ensures that should an overflow occur, it will likely contain a lower concentration of contaminants. These controls are detailed in the Rain Event Strategy and include actions such as ceasing non-critical process tasks that generate wastewater and utilising the peripheral detention storages efficiently.

Should such an overflow occur, sampling is conducted from any point at which discharge of stormwater occurs and is analysed by a laboratory. Stormwater incidents are reported to the EPA in accordance with permit requirements.

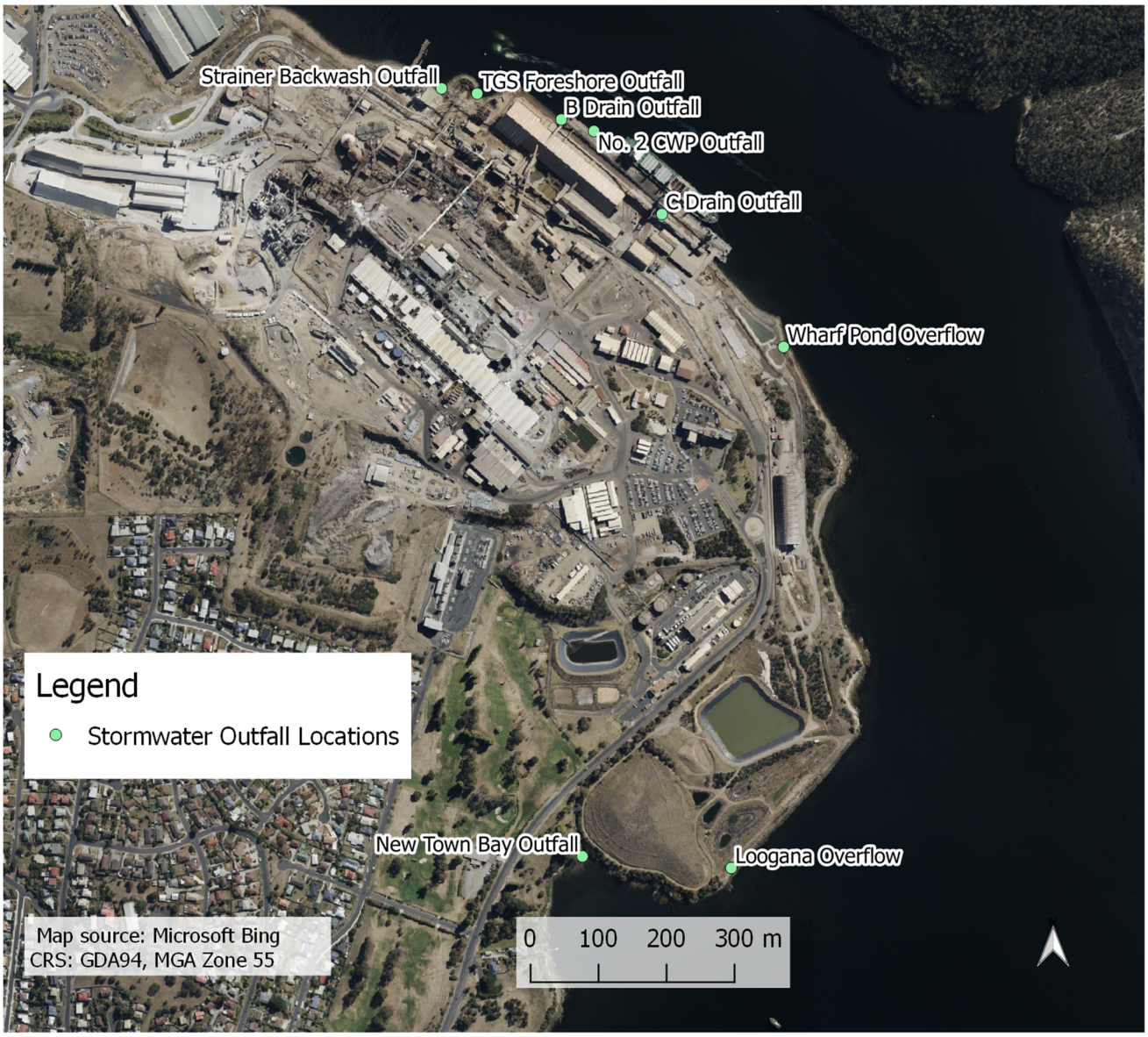


Figure 4-15 Surface water discharge monitoring locations – all points are emergency stormwater overflow points

4.2.3.3 Stormwater Results and Discussion

NH's regulatory obligations for stormwater monitoring relate to the identification of stormwater overflows which may have breached the provisions of The Permit.

Provision SW2 of The Permit identifies that NH may only discharge untreated stormwater during a critical duration storm event, with 0.2 annual exceedance probability (AEP), and that as far as reasonably practicable stormwater must only be discharged from nominated points (Figure 4-15). During the reporting period, untreated stormwater was discharged to the Derwent Estuary on four occasions. Three of the overflow events occurred where the stormwater arose from a critical duration storm event with an 0.2 AEP.

May 2022

During the period between 3:20 pm on 5 May 2022 and 08:30 am on 6 May 2022 the NH site recorded 100 mm of rainfall. Using the Bureau of Meteorology (BOM) Intensity-Frequency-Duration (IFD) estimations, the AEP for the rain event was calculated to be 0.05 (5%) at the time of the overflows, reaching 0.02 (2%) shortly after. The high volume of runoff generated during the rainfall event exceeded the capacity of the site stormwater catchment infrastructure, causing an overflow to the Derwent Estuary at 5 different locations. Metrics of the overflow are presented in the Table below.

Table 4-8 Stormwater Overflow Metrics 5 May 2022

Emission Point	Overflow volume estimate (m^3)	Cadmium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)	TSS (mg/L)	TPH (µg/L)
Wharf area	240	0.359	0.232	1.89	21.5	306.7	870
B Drain Outfall	136	15.9	14.5	4.47	300	48	580
#2 CWP	1,808	16.9	45.4	4.8	279	36	<50
Substation 8	7.2	4.5	1.92	3.15	820	111	190
Strainer Backwash		3.18	0.356	0.171	518	33	<50

Actions completed following the event which could mitigate or prevent future events

- Investigate the purchasing of portable pumps for use during peak storm events
- Complete design for CWP sludge removal system
- Investigate options for redirecting Wharf Pond stormwater; and
- Clear spillway at the Wharf Ponds.

October 2023

During the period between 11:30 pm on 21 October 2023 and 05:30 am on 22 October 2023 the NH site recorded 30.3 mm of rainfall. The Hobart (Ellerslie Road) weather monitoring station recorded 31.4 mm. Using the Bureau of Meteorology (BOM) Intensity-Frequency-Duration (IFD) estimations, the AEP for the rain event was calculated to be 0.2 (20%) using site based data and 0.1 (10%) using Hobart BOM data. The high volume of runoff generated during the rainfall event exceeded the capacity of the site stormwater catchment infrastructure, causing an overflow to the Derwent Estuary at the B Drain Outfall. Metrics of the overflow are presented in the Table below.

Table 4-9 Stormwater Overflow Metrics 21-22 October 2023

Emission Point	Overflow volume estimate (m^3)	Cadmium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)	TSS (mg/L)	TPH C6-C9 (mg/L)	TPH C10-C36 (mg/L)
B Drain Outfall	9	10.9	8.05	3.12	597	10	<0.02	0.18

Actions completed following the event which could mitigate or prevent future events

- Order and replace pump in B3 sump with larger capacity pump.

December 2023

During the period between 8 pm on 13 December and 5 am on 14 December 2023 the NH site recorded 19.5 mm of rainfall. Using the Bureau of Meteorology (BOM) Intensity-Frequency-Duration (IFD) estimations, the AEP for the rain event was calculated to be greater than 0.5 (50%), but less than 0.2 (20%) using site-based data. Metrics of the overflow are presented in the Table below.

Table 4-10 Stormwater Overflow Metrics 14 December 2023

Emission Point	Overflow volume estimate (m^3)	Cadmium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)	TSS (mg/L)	TPH C6-C9 (mg/L)	TPH C10-C36 (mg/L)
B Drain Outfall	7.5	36.3	2.81	11.2	336	211	<0.02	0.12

Actions completed following the event which could mitigate or prevent future events

- Replace capping on B2 Drain line to prevent B2 discharging into B3 catchment.
- Clean B2 Drain between Risdon Road and B2 Sump pit via high pressure water blasting.
- Review B2 drain line and replace pipework where required; and
- Fabricate and install overflow diversion infrastructure to prevent A1 drain discharging into B3 catchment during peak flow.

The replacement pump ordered as a result of the October 2023 event noted above had not yet arrived onsite at the time of this incident.

December 2024

On 7 December 2024, the NH site recorded 48.8 mm of rainfall. Using the Bureau of Meteorology (BOM) Intensity-Frequency-Duration (IFD) estimations, the AEP for the rain event was calculated to be greater than 0.2 (20%) using site-based data. Metrics of the overflow are presented in the Table below. The overflow occurred from a location at the Wharf that was not a nominated overflow point, and was therefore considered by the regulator to be non-compliant with condition SW2 of The Permit.

Table 4-11 Stormwater Overflow Metrics 7 December 2024

Emission Point	Overflow volume estimate (m^3)	Cadmium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)	TSS (mg/L)	TPH C6-C9 (mg/L)	TPH C10-C36 (mg/L)
Wharf area	1.4	0.96	<0.1	0.36	20	<5	<0.02	<0.1

Following this event, an open spoon drain which was partially obstructed with sediment was cleared. The partial blockage diverted stormwater into a low capacity sub-catchment of the Wharf Catchment. It is unclear if the overflow would have been prevented should the drain have been clear at the time of the rain event.

4.2.4 Groundwater

4.2.4.1 Groundwater Background

Significant soil and groundwater contamination has occurred across the site as a result of over 100 years of operations. Sources have included; leakage of process solutions in operational areas, ground infiltration of contaminated surface water, infiltration through stockpiled feedstocks and residues and leaks from above and below ground storage tanks and pipes. The majority of these sources have been eliminated, with work continuing to address current, known, ongoing sources.

Groundwater is monitored for relative standing water level (RSWL)/ hydraulic head and water quality across the site at all active monitoring bores and nine individual groundwater extraction systems.

All references to RSWL/hydraulic head is in meters above Australian Height Datum (AHD).

4.2.4.2 Groundwater Monitoring Program Details

Groundwater monitoring requirements are stipulated within The Permit. This includes the frequency of monitoring and the data collection required (Section GW4) and the specific bores requiring monitoring (Attachment 5).

A minimum of six monthly measurements of standing water level (SWL)/ depth to water (DTW) must be taken at all bores nominated within The Permit. Operational bores are shown within Figure 4-16. SWL/DTW is measured from the top of the bore casing to the top of the bore water. To calculate the hydraulic head/relative standing water level, the DTW value is subtracted from the surveyed top of casing elevation.

Each of nominated bores must be sampled to assess groundwater quality once every two years.

In April 2016, the sample frequency for many onsite bores was increased to obtain higher resolution data from areas deemed to be high risk, to ensure that emerging issues were recognised as early as possible. The following method, put forward by GHD (2012) to determine individual bore sampling frequency using a risk based approach was adopted:

- All bores with decreasing or stable contaminant trends and with concentrations below 1000 x the ANZECC (2000) guidelines for 80% protection of marine ecosystems (for any contaminant) are to be monitored on a biennial basis.
- All bores with decreasing or stable contaminant trends but with concentrations higher than 1000 x the ANZECC (2000) guidelines for 80% protection of marine ecosystems (for any contaminant) are to be monitored on an annual basis.
- All bores with increasing contaminant trends and with concentrations below 1000 x the ANZECC (2000) guidelines for 80% protection of marine ecosystems (for any contaminant) are to be monitored on an annual basis.
- All bores with increasing contaminant trends but with concentrations above 1000 x the ANZECC (2000) guidelines for 80% protection of marine ecosystems (for any contaminant) are to be monitored on a biannual basis.
- In the event of a paucity of data from an individual bore, the geographic location of the bore was also taken into account and if the location was deemed to be high risk (e.g. within the main operational footprint of the plant), the bore was assigned a biannual sampling frequency. It is the intention that the program will be reviewed each year as new data is collected and assessed.

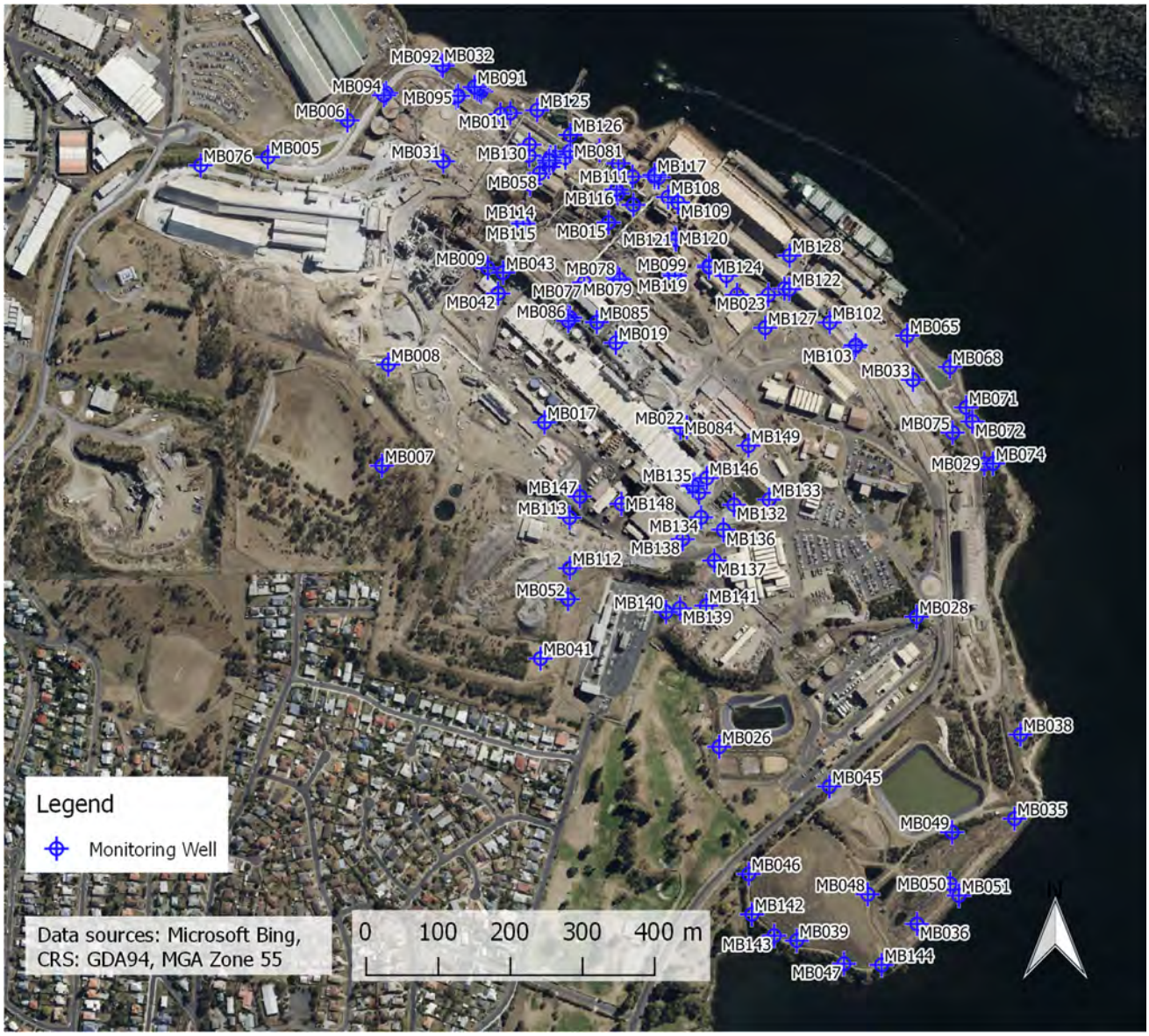


Figure 4-16 Groundwater monitoring borehole locations

4.2.4.3 Groundwater Results & Discussion

Standing Water Levels (SWLs)

SWL must be measured at a minimum, six monthly in all wells. The captured data is used to assess changes in groundwater levels over time, which may indicate:

- Sources or sinks in the system that could require investigation;
- Changes in the hydrogeological model for the site; and
- The performance of groundwater harvesting systems in creating hydraulic drawdown towards extraction locations.

Rainfall typically influences the hydraulic head within the unconfined aquifer onsite via infiltration, leading to aquifer recharge. In some monitoring locations, the hydraulic head within the deeper, semi confined system is also influenced by seasonal rainfall indicating a leaky upper boundary.

The measured hydraulic head across the reporting period is presented within the following pages, utilising data obtained during the summer monitoring round. Whilst some changes are apparent between the winter and summer monitoring programs, generally flow pathways are consistent across the two periods.

2022 Quarter 4

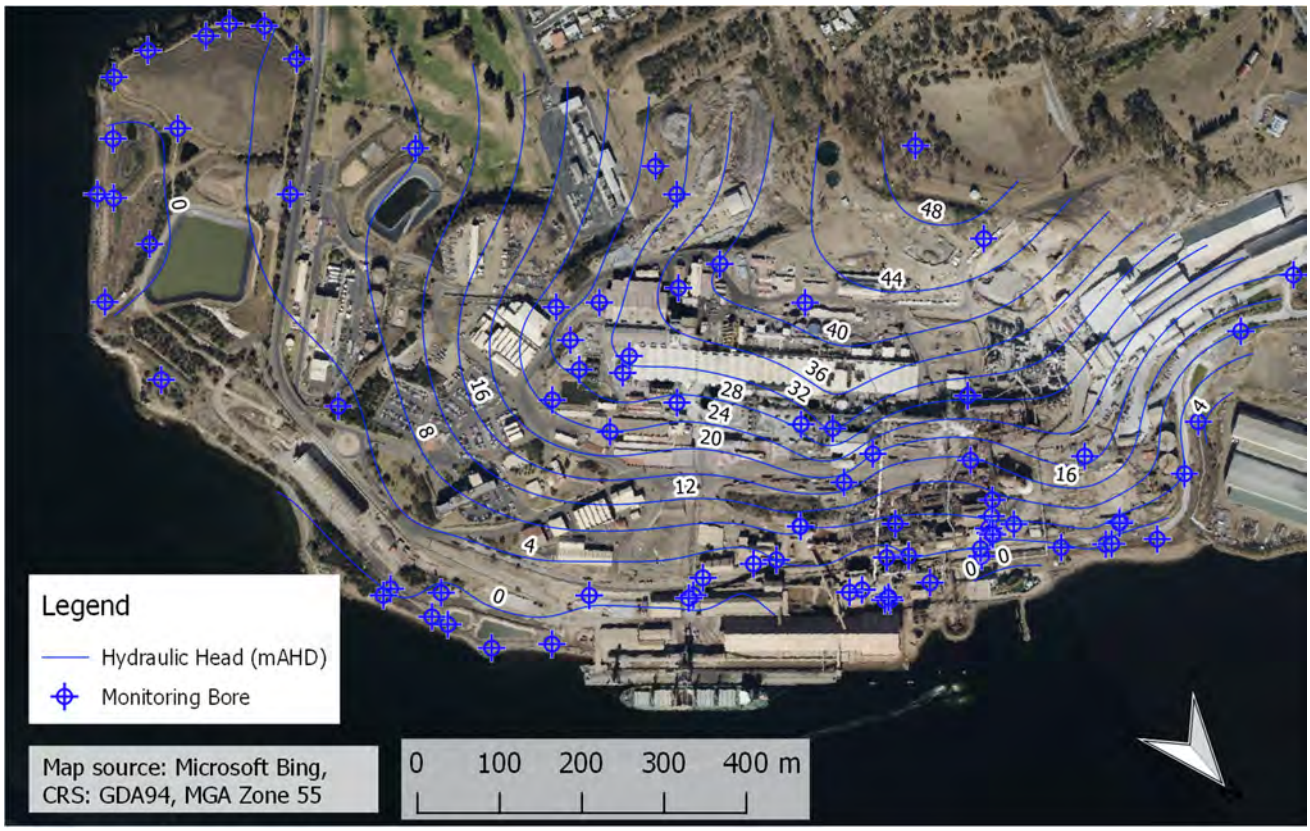


Figure 4-17 Hydraulic head within the shallow aquifer Q4 2022

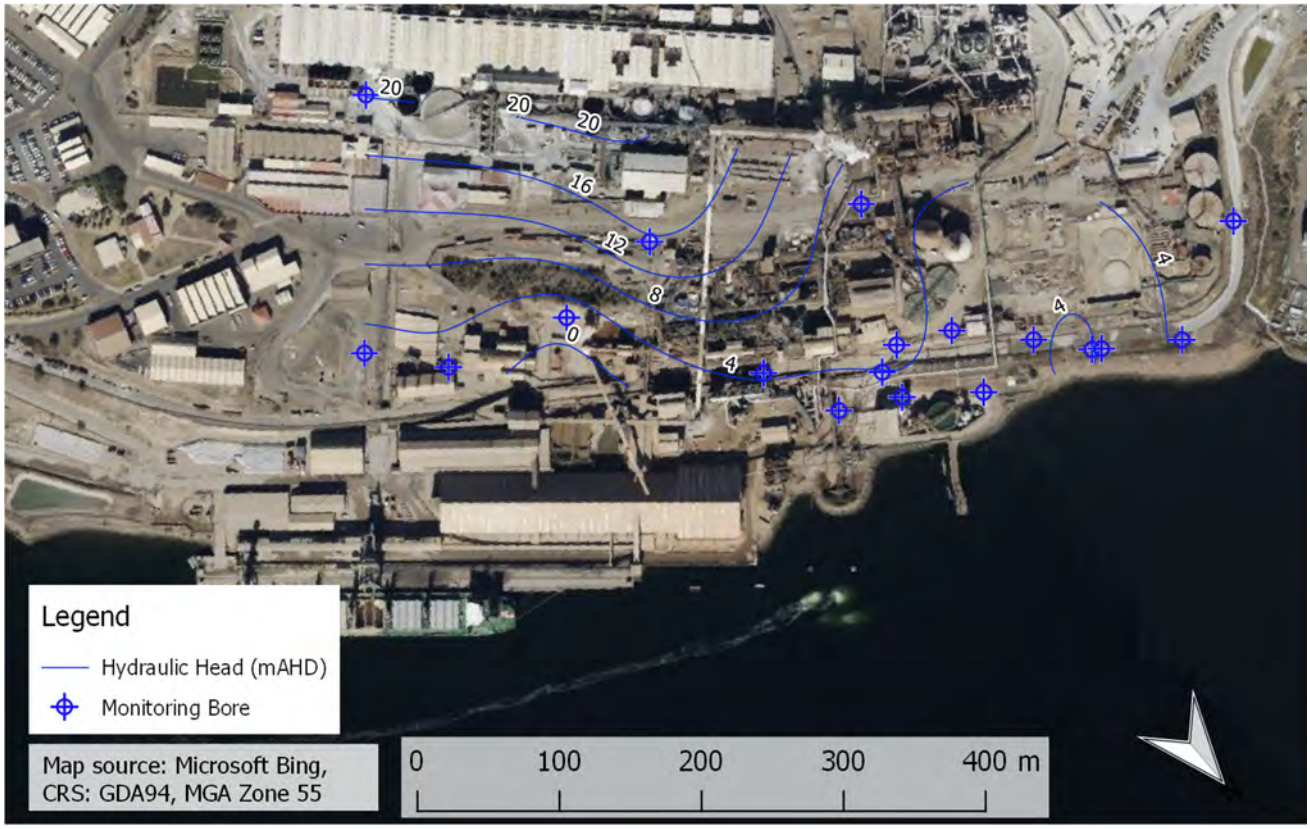


Figure 4-18 Hydraulic head within the semiconfined aquifer Q4 2022

2023 Quarter 4

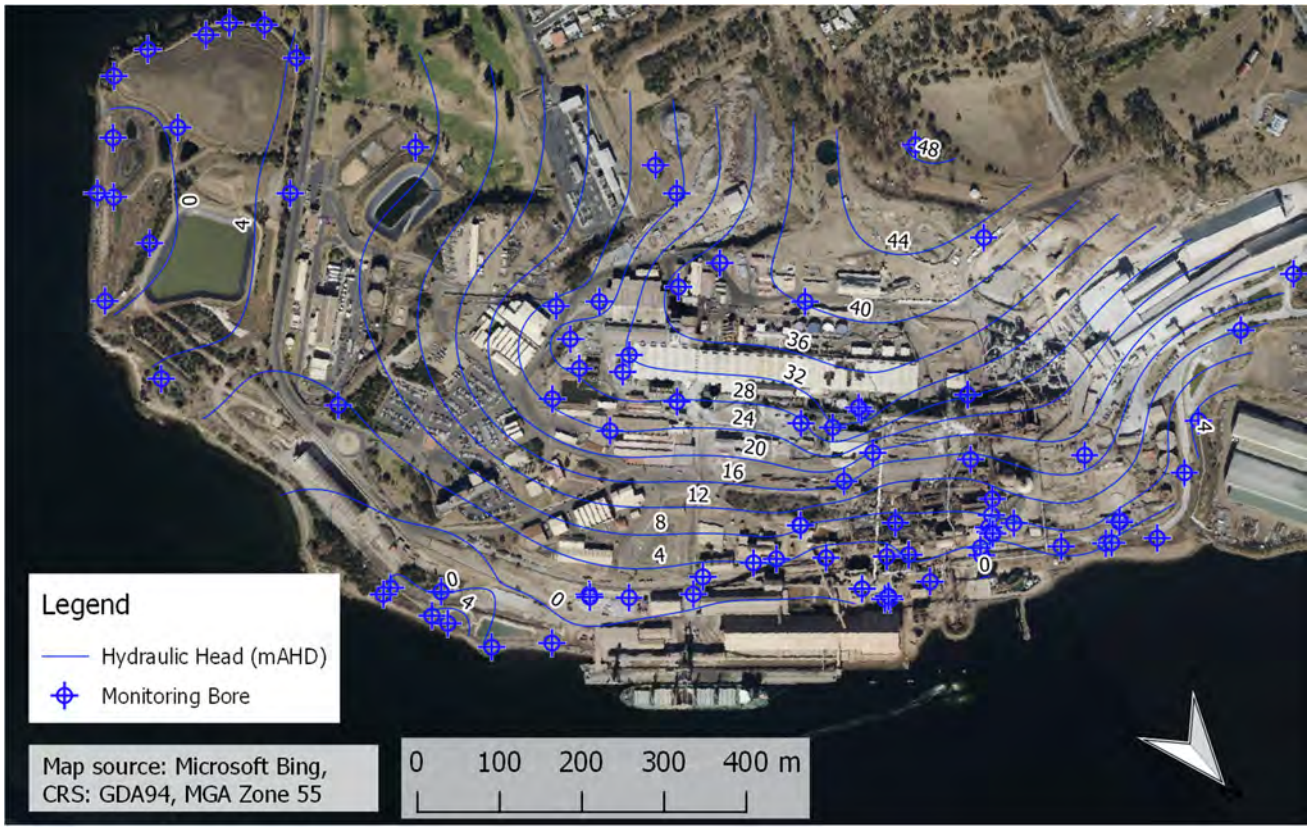


Figure 4-19 Hydraulic head within the shallow aquifer Q4 2023

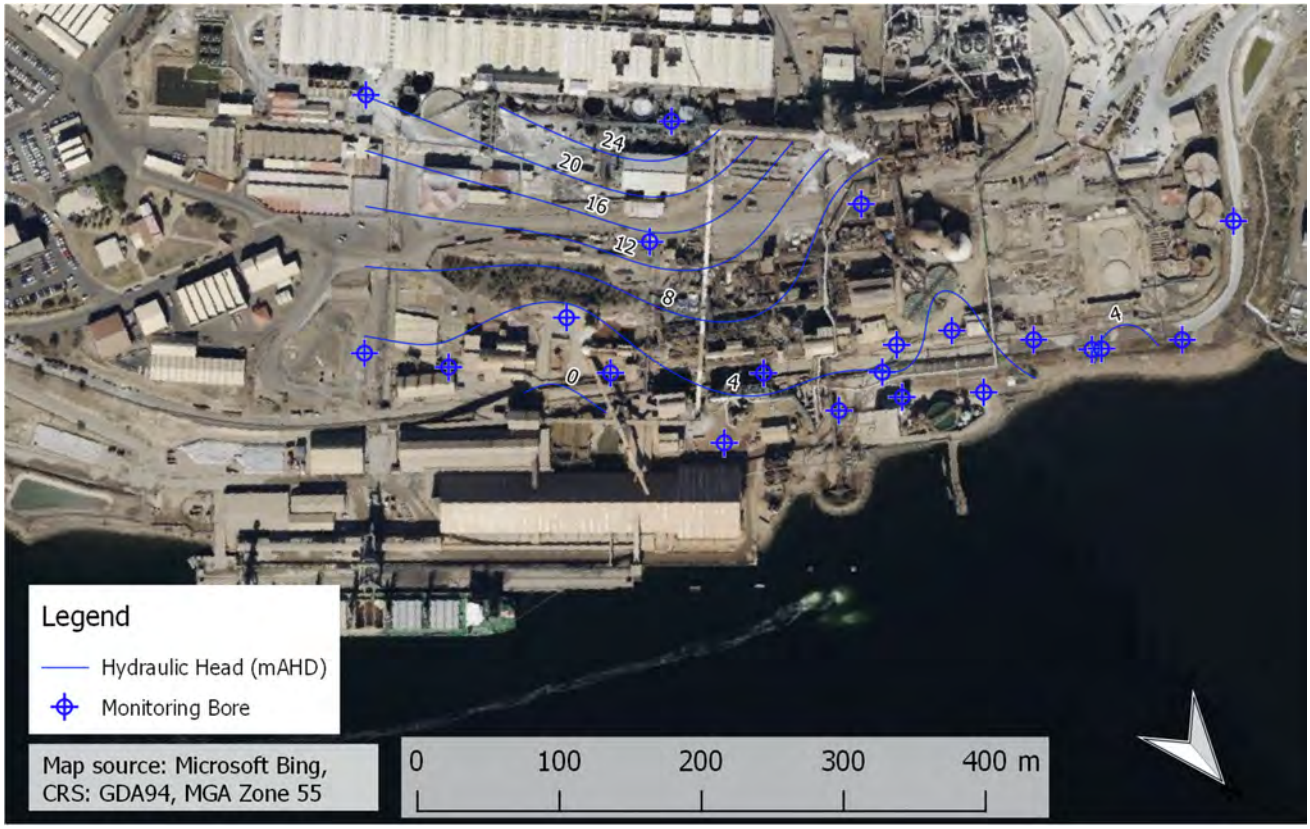


Figure 4-20 Hydraulic head within the semiconfined aquifer Q4 2023

2024 Quarter 4

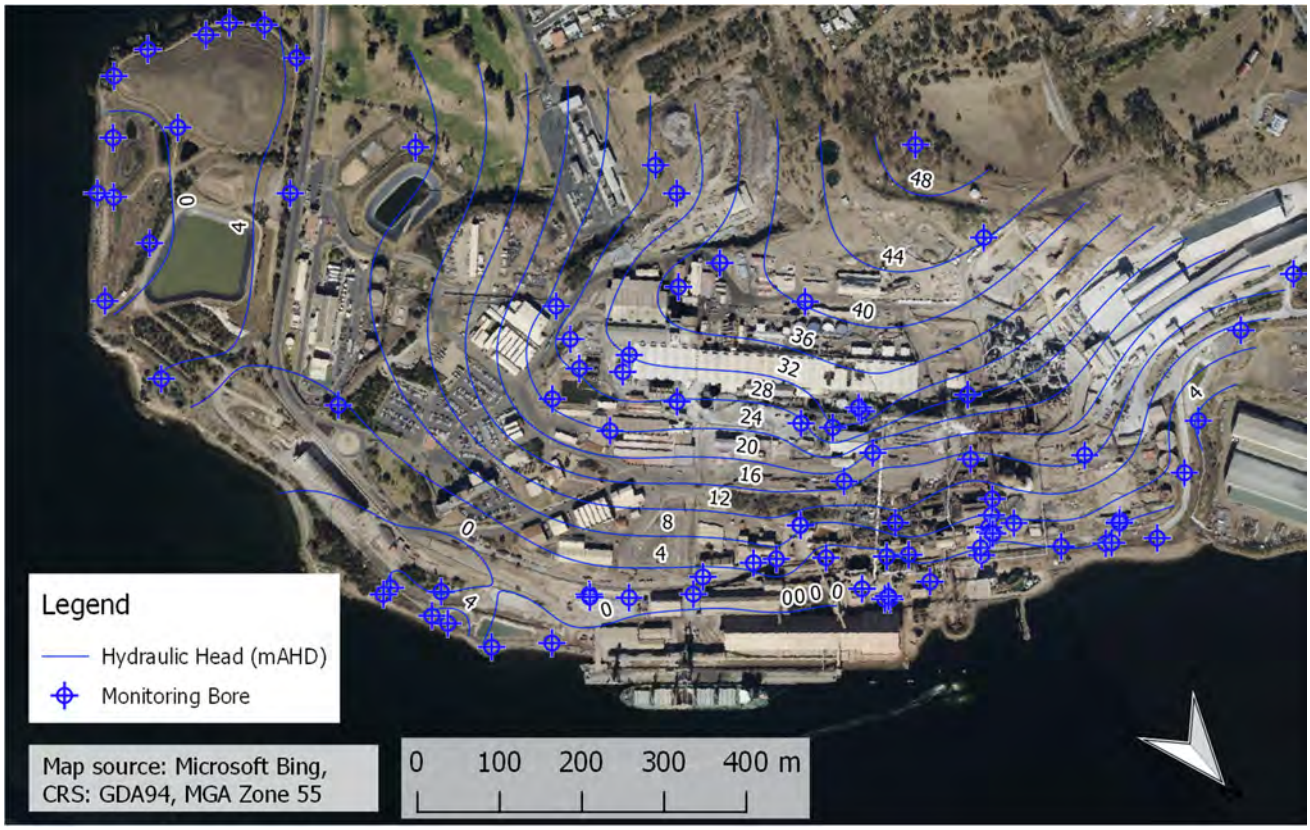


Figure 4-21 Hydraulic head within the Shallow Aquifer Q4 2024

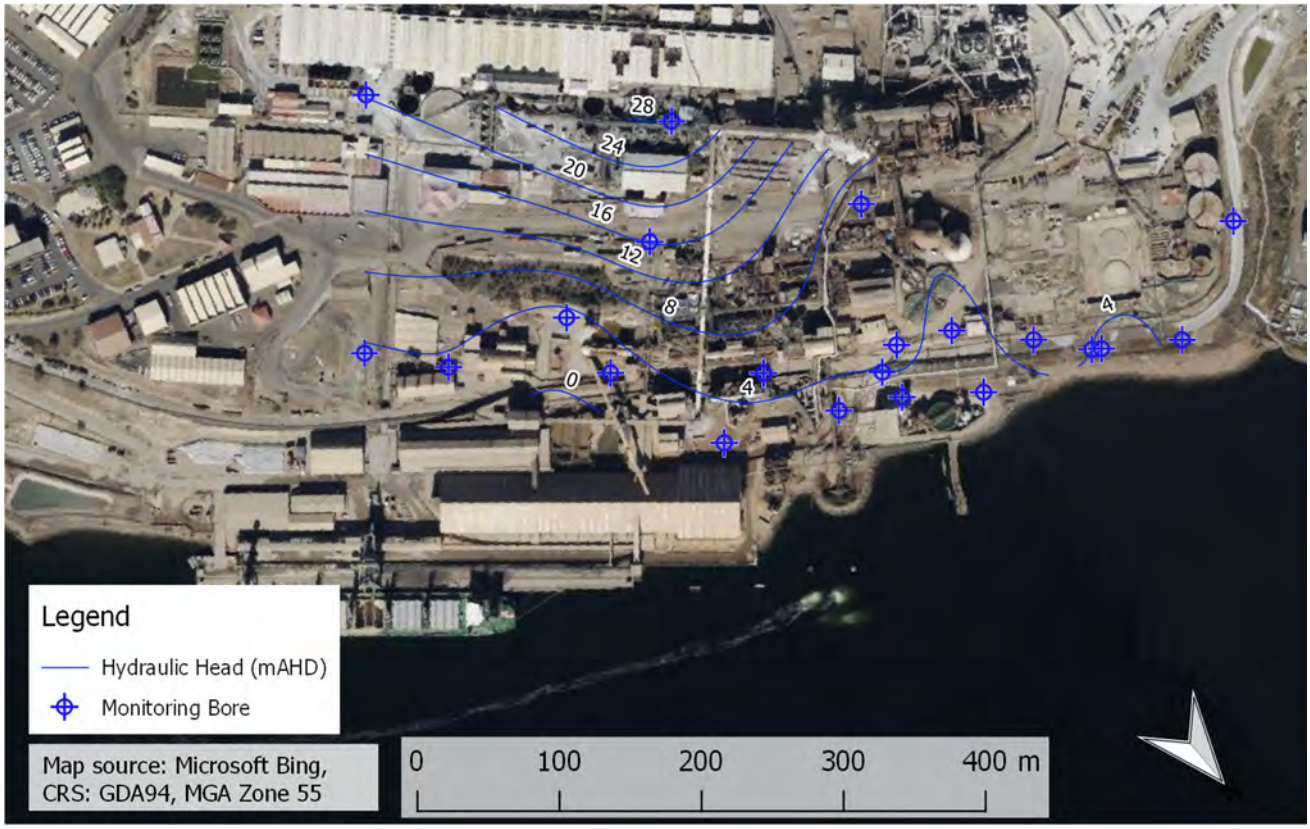


Figure 4-22 Hydraulic Head within the semiconfined aquifer Q4 2024

Groundwater Quality in Site Monitoring Bores

As per the requirements of The Permit as varied section GW5, groundwater quality across site is, at a minimum, measured biennially. Across the reporting period, the following sampling events took place:

- June 2022 sampling of 51 bores.
- November 2022 sampling of 80 bores.
- June/July 2023 sampling of 48 bores.
- November/December 2023 sampling of 115 bores.
- July 2024 sampling of 45 bores.
- November/December 2024 sampling of 77 bores.

Through the above sampling programs the mandatory frequency for bore sampling was achieved, each bore was sampled at or above the minimum frequency of once every two years, provided that access to the well was not restricted and the well remains in commission.

Spatial Distribution of Groundwater Contaminants

The distribution of contaminant concentrations within groundwater bores is depicted in the box and whisker plots on the following pages. The results have been segregated into three groups;

- Bores up hydrogeological gradient of operational departments;
- Bores located within the main operational footprint of the site, termed ‘source’ bores; and
- Down hydrogeological gradient, boundary bores.

Comparison of the datasets can be used to compare and contrast the distribution of contaminant concentrations in groundwater between; onsite bores situated within operational areas against up and down gradient bores.

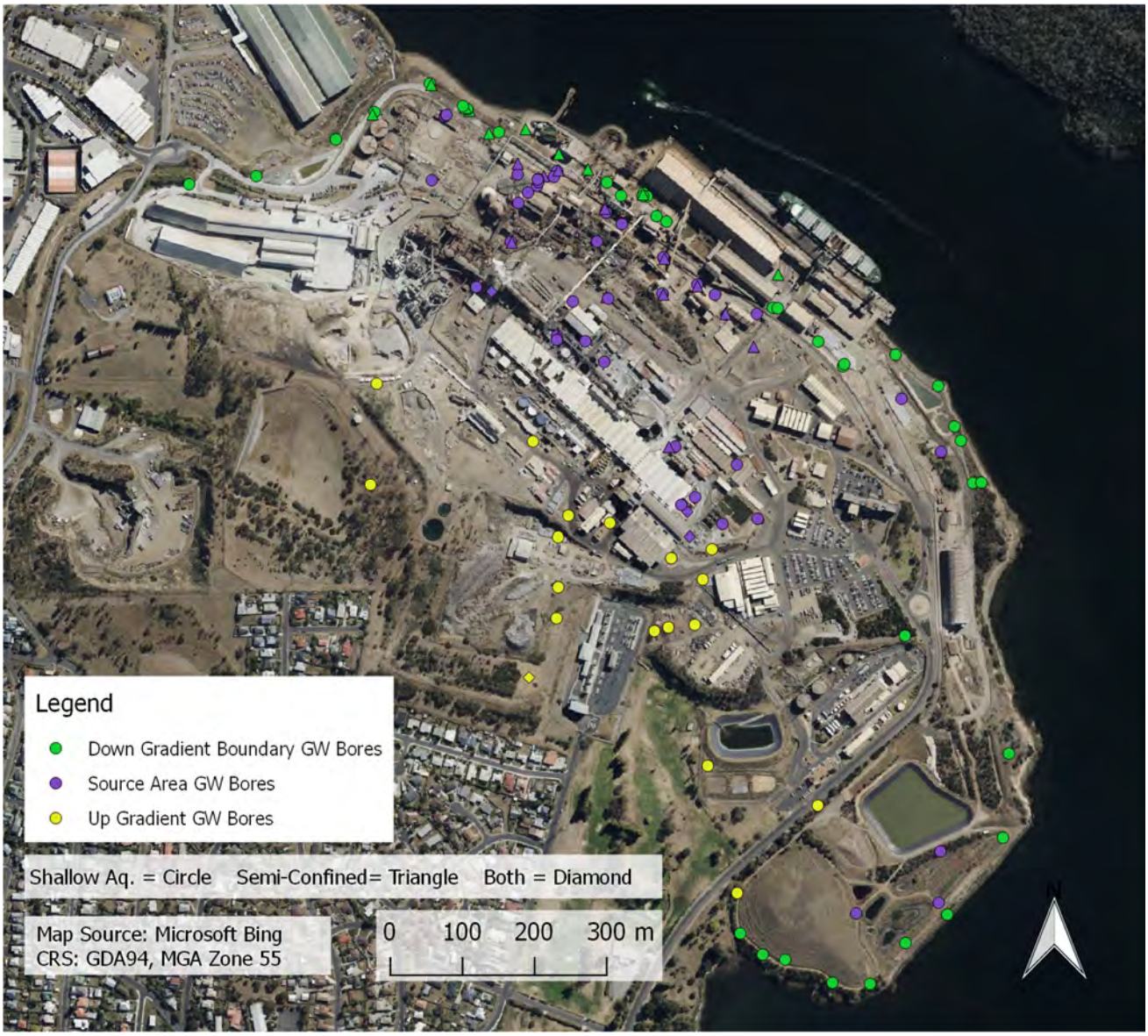


Figure 4-23 Groundwater monitoring bore locations, upgradient vs source area vs foreshore.

Data collected over the reporting period has been collated by calendar year and is presented within the three box and whisker plots below. The red line represents ANZECC (2000) guidelines for 80% protection in marine waters[2]. Green line represents the laboratory limit of reporting (LOR)[3].

[2] ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
[3] Note that the LOR may change for each analyte depending on the concentration of other substances present within the sample. The LOR presented in the chart is the lowest LOR within the grouped dataset.

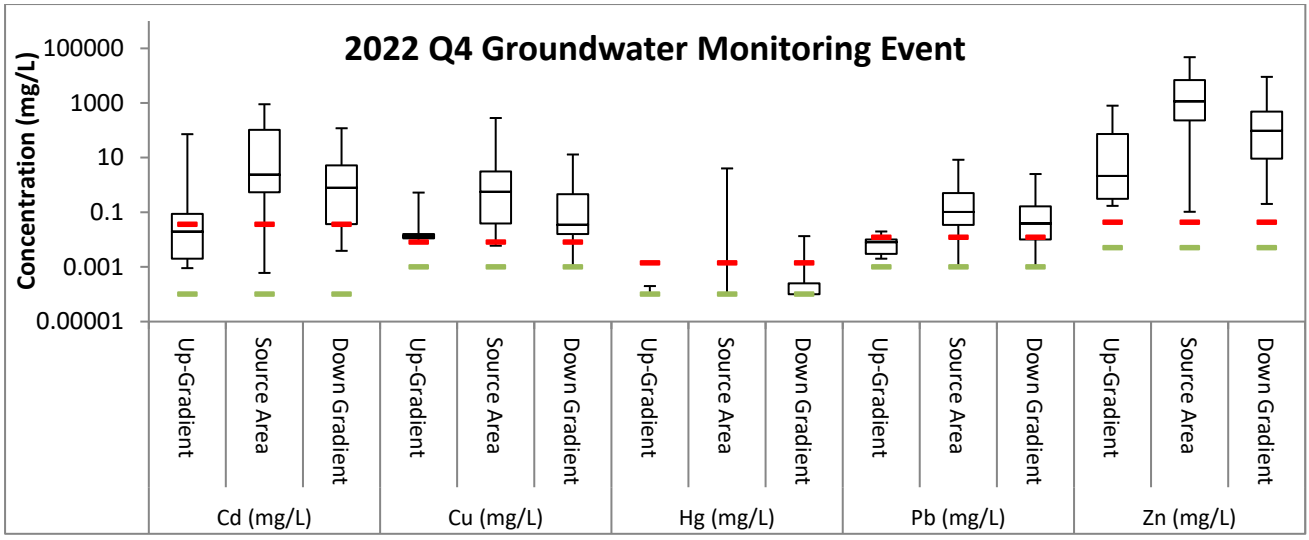


Figure 4-24 *Summary of groundwater quality in monitoring bores located up gradient (n=9), source areas (n=40) and bores located on the down gradient boundary (n=23) sampled during Q4 2022*

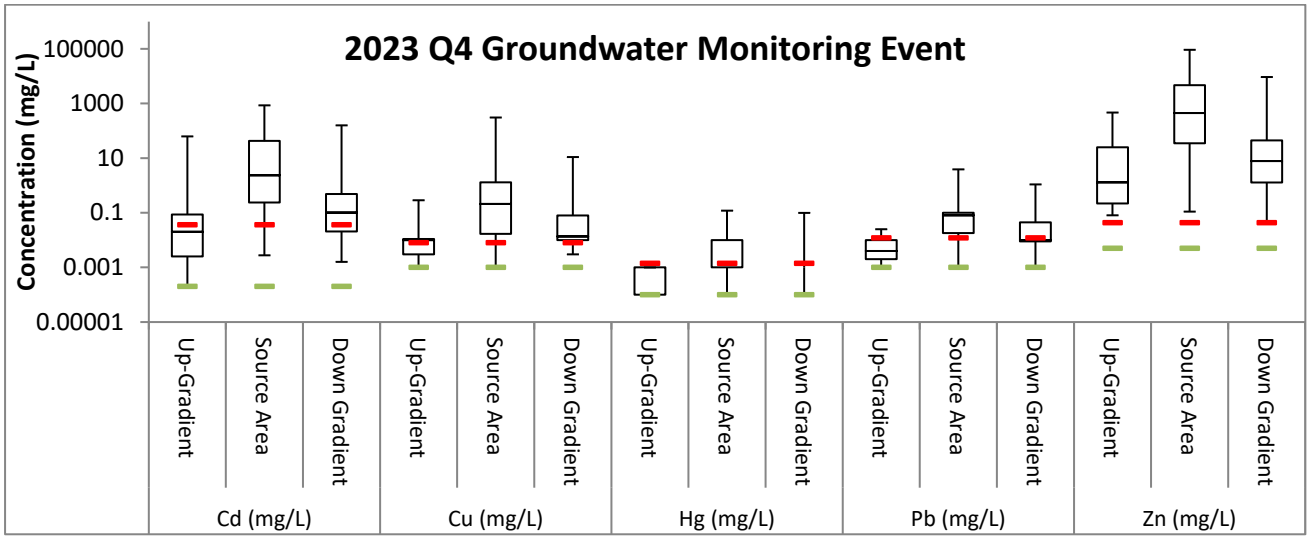


Figure 4-25 *Summary of groundwater quality in monitoring bores located up gradient (n=17), source areas (n=56) and bores located on the down gradient boundary (n=42) sampled during Q4 2023*

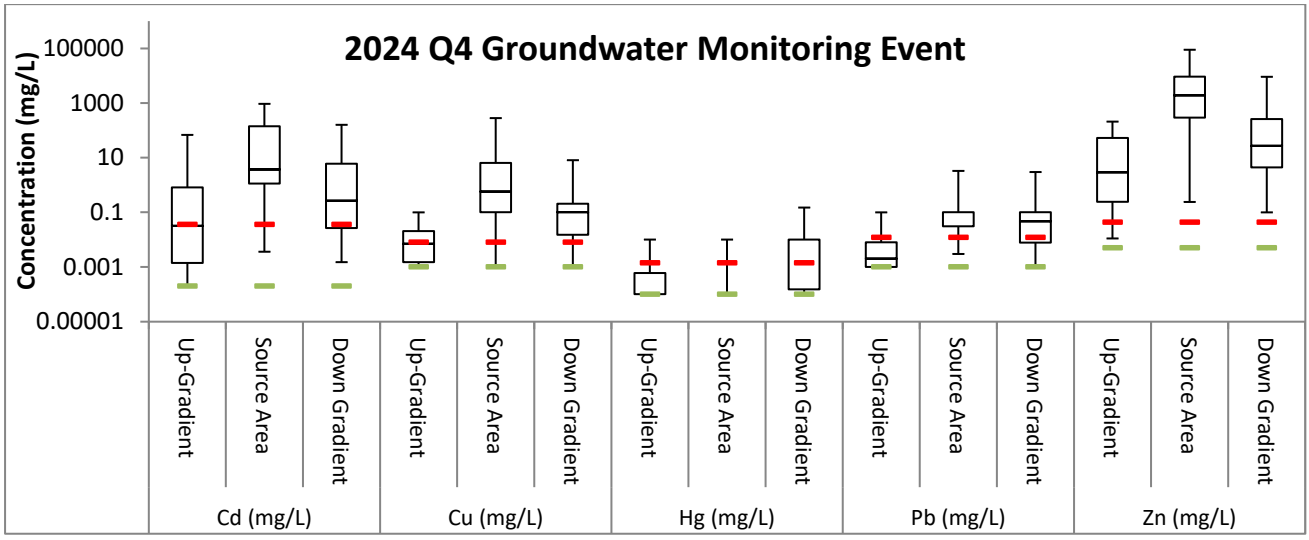


Figure 4-26 *Summary of groundwater quality in monitoring bores located up gradient (n=11), source areas (n=40) and bores located on the down gradient boundary (n=26) sampled during Q4 2024*

The distribution of results presented in the above charts was relatively consistent across the reporting period. The results plotted in the figures above, found that typically the concentration of contaminants was greatest within source area bores within the sites main operational footprint. Generally, the concentration of contaminants was found to be lower, down hydrogeological gradient. Whilst the concentrations are still elevated, it is promising to see the decline in levels along the downgradient boundary. This general reduction in contaminant concentrations indicates that the groundwater extraction programs operating across the site are likely assisting in reducing the mass of contaminants being discharged into the Derwent Estuary via groundwater seepage. The concentration of metals within up-gradient bores was found to be elevated beyond what one may expect to be background levels. This is likely due to varied land usage over the course of the operation of the site. Whilst current land usage may indicate that the bore is situated up-gradient of operational areas, historical use of that area of land may have put it within what could be deemed to be an operational area.

Contaminant Concentration Mapping

Within the following pages, several figures have been prepared indicating the concentration of individual metal contaminants within groundwater across the site. The data originates from groundwater samples collected during the Q4 2023 sampling event. This monitoring event was selected as it was numerically the most comprehensive sampling round completed during the reporting period, where 115 bores were sampled. The following images display the relative concentration of contaminants within both the interpreted shallow (circle) and deep (triangle) aquifers. Colour scaling is relative to the 80% species protection criteria, with order of magnitude intervals. As such, locations marked in dark blue are below the 80% species protection criteria.

Cadmium

The mapped concentration of cadmium, measured in the site's monitoring bores is presented below. The spatial distribution of cadmium within groundwater is consistent with previous reporting periods. The main hotspot identified is the area surrounding and down gradient of the Leach and Purification Department. Elevated cadmium is also encountered within the Loogana area, likely as a result of the historical stockpiling and washing of Leach residues in unlined stockpiles between the 1930's and 1990's.

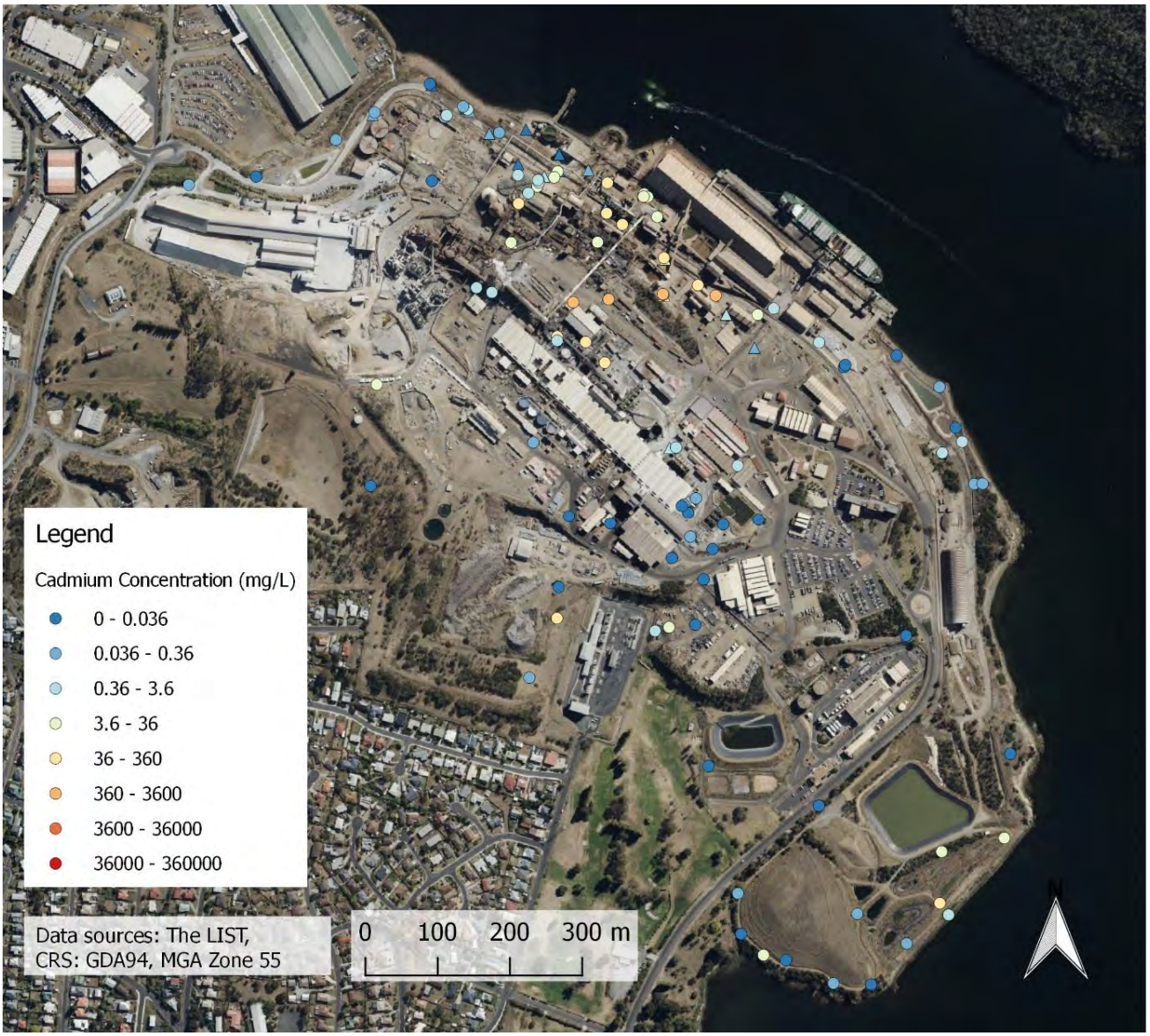


Figure 4-27 Cadmium (mg/L) in groundwater beneath the NH site, Q4 2023 groundwater monitoring data

Copper

The mapped concentration of copper, measured in the site's monitoring bores during the 2023 Q4 monitoring round is presented below. Generally, the greatest concentrations of copper are found to be down gradient of the Purification department, where copper is removed from process solution as copper sulphate.

The concentration of copper was also found to be elevated at both the upriver end (MB9 and MB43) and downriver end (MB22, MB84 MB146) of the electrolysis department. The cause of this is unknown, as copper is removed from the hydrometallurgical circuit down gradient of these locations and it is therefore unlikely to result from process solution leaking to ground. The most plausible explanations are the result of the historical practices of utilising process residues as fill, or disposing of copper pickling liquor to ground.

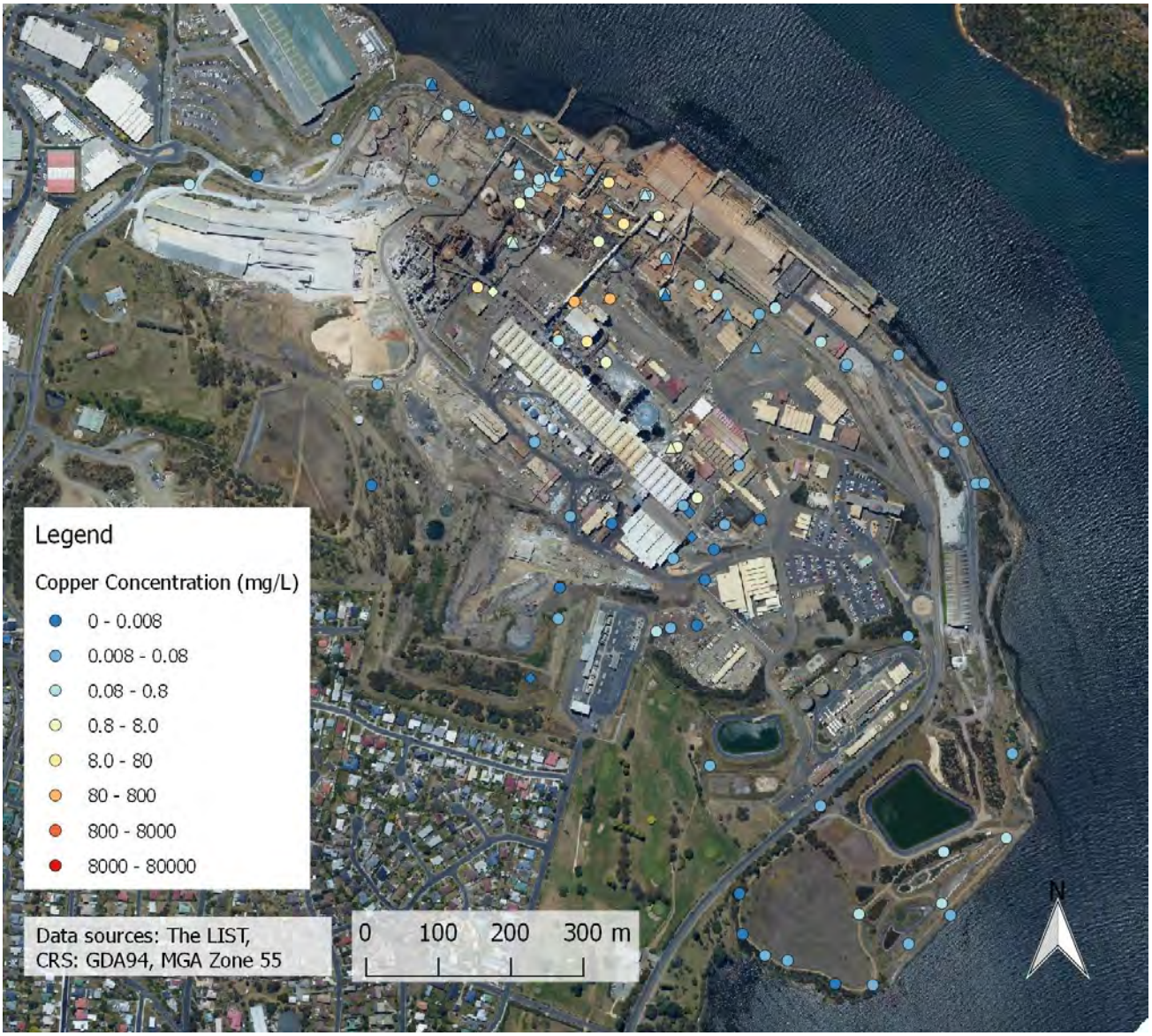


Figure 4-28 Copper (mg/L) in groundwater beneath the NH site, Q4 2023 groundwater monitoring data

Mercury

The distribution of mercury within groundwater across the site is presented within the figure below. Generally, mercury concentrations within groundwater bores were found to be below the 80% species protection criteria across site, with only seven wells identifying concentrations above 0.0014 mg/L. There were however 20 samples where the limit of reporting (LOR) was 0.01 mg/L. In this instance for the purposes of mapping the LOR was taken to be the actual value which has resulted in the dot being shaded mid-light blue on the map below.

The wells where the mercury concentration was above the LOR and the 80% species protection criteria were all in the northern section of the site, surrounding either current or historical Acid Plant locations. The results are consistent with previous years.

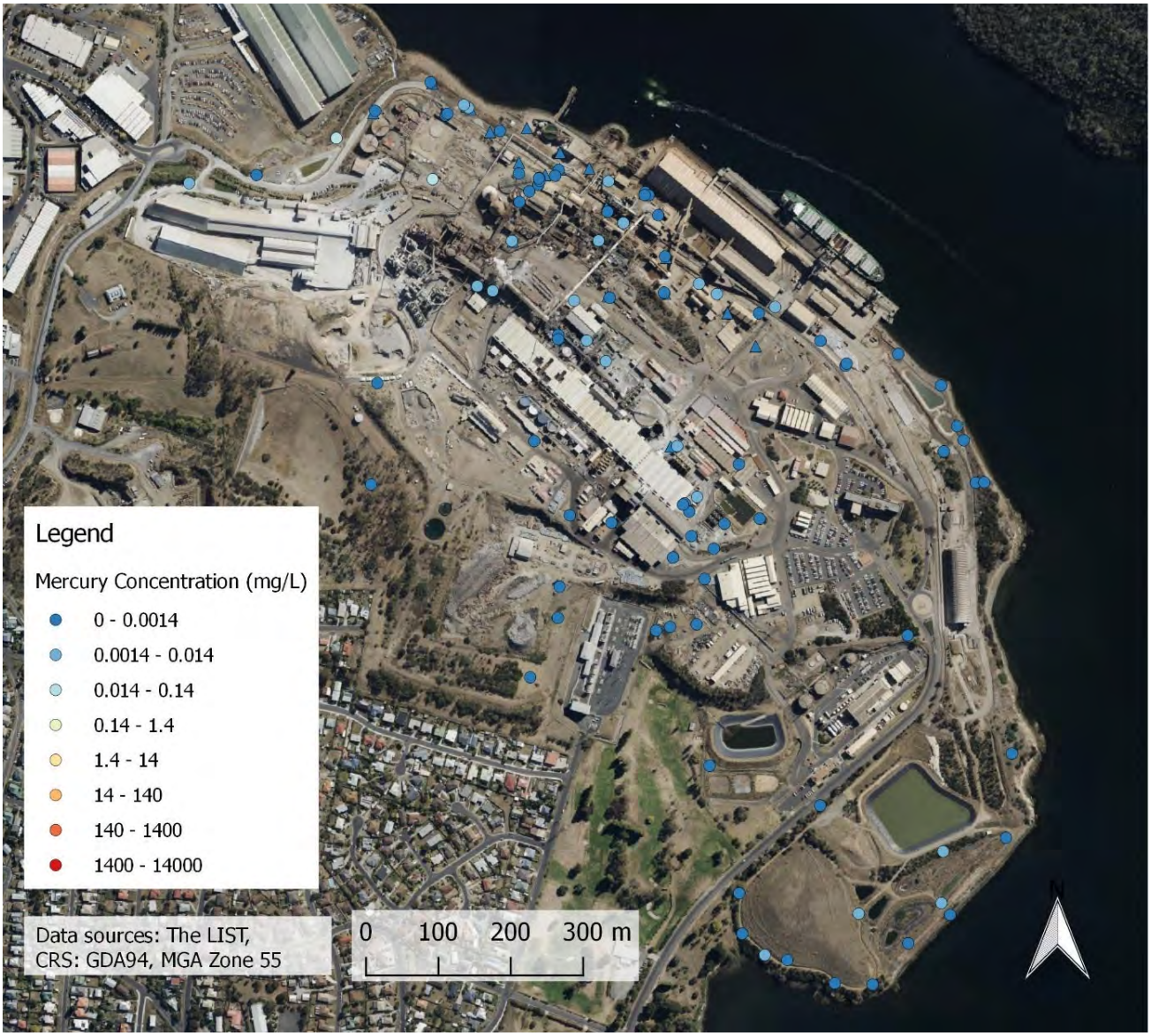


Figure 4-29 Mercury (mg/L) in groundwater beneath the NH site, Q4 2023 groundwater monitoring data

Lead

The concentration of lead within groundwater bores during the Q4 2023 groundwater monitoring event is presented within the figure below.

Concentrations are typically greatest within areas down hydrogeological gradient of the Leach department, where lead is removed from the hydrometallurgical circuit. The majority of wells exhibit lead concentrations within two orders of magnitude of the 80% species protection criteria. The results presented below are consistent with previous reporting periods.

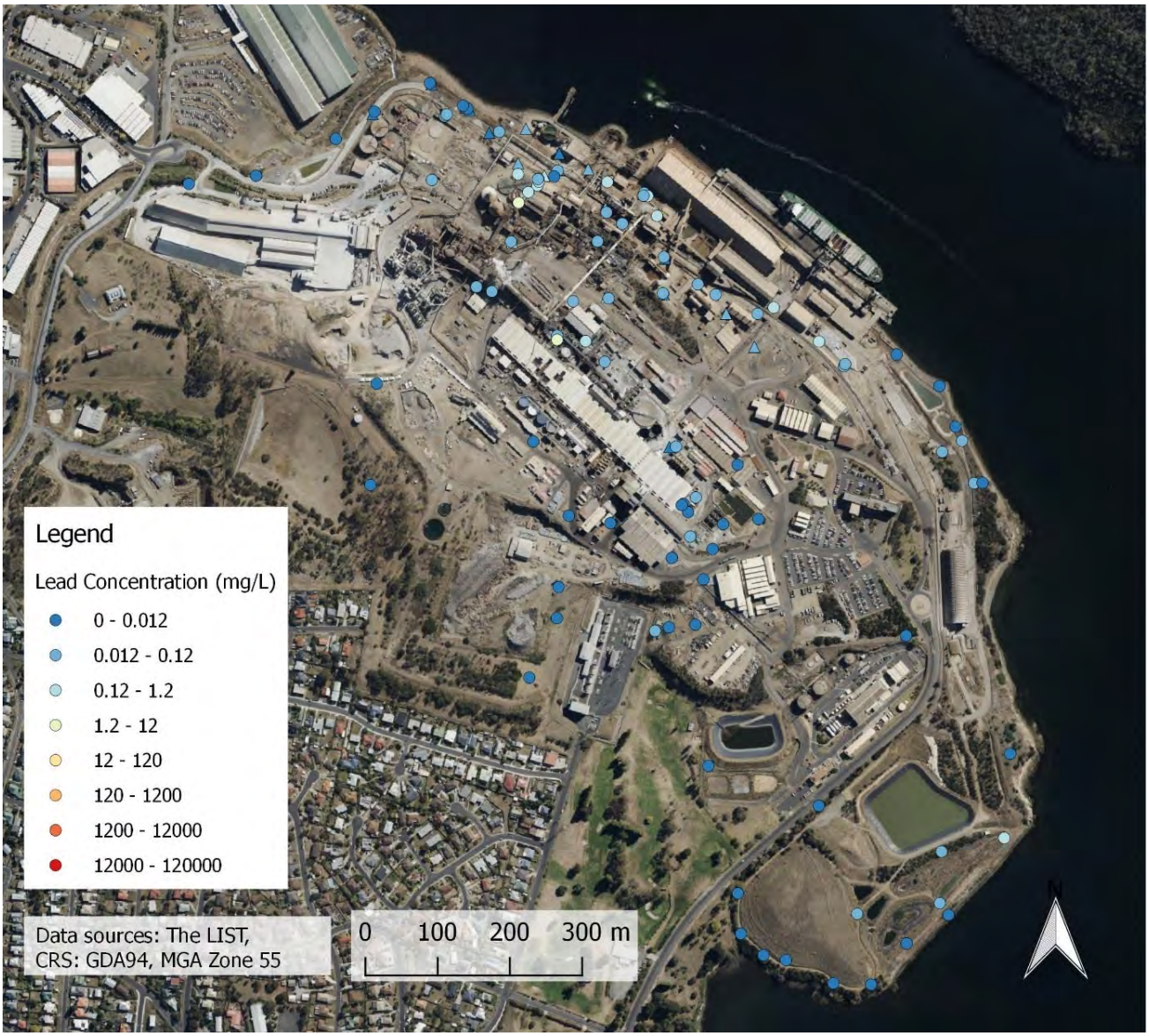


Figure 4-30 Lead (mg/L) in groundwater beneath the NH site, 2023 Q4 groundwater monitoring data

Zinc

The concentration of zinc within bores sampled during the 2023 Q4 monitoring campaign is presented in the figure below. Generally speaking, monitored concentrations diminish with distance from the operational areas of Electrolysis and Leach/Purification. Elevated concentrations were also identified within the Loogana area. These results are consistent with previous monitoring rounds.

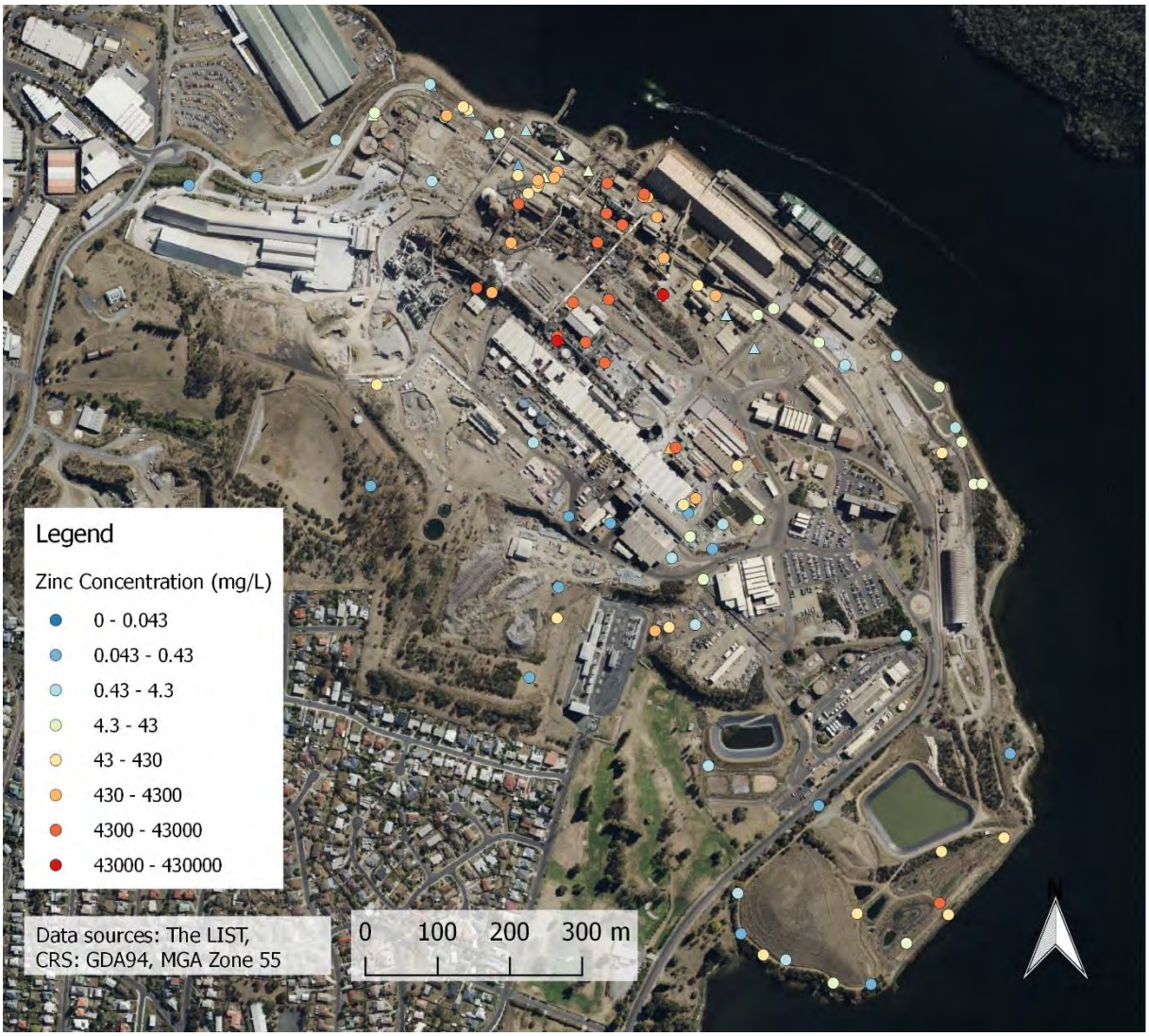


Figure 4-31 Zinc (mg/L) in groundwater beneath the NH site, 2023 Q4 groundwater monitoring data

In general, the mapped concentrations presented within the figures above indicate that the areas subject to the most significant contamination appear to be within and down hydrogeological gradient of the Electrolysis Department. This area includes the Leach/Purification Departments. These three operational departments operate in a hydrometallurgical circuit, whereby roasted concentrates (calcine) are dissolved and metals are sequentially removed from solution.

Relative to unroasted concentrates, process solution poses a much greater risk to groundwater contamination, as metals are dissolved in acidic solution, rather than being present as a relatively insoluble metal sulphide.

Historical Trends in Groundwater Quality

As a means to identify statistically significant trends in groundwater quality, a Mann-Kendall analysis has been adopted to not only identify a positive or negative trend, but also provide a measure of the confidence in the strength of the trend.

The Mann-Kendall analysis stands out as a popular method in environmental studies for detecting consistent upward or downward trends, commonly referred to as monotonic trends in datasets collected over time, particularly when data deviates from the bell curve of normal distribution. This statistical test is highly regarded for its robustness, as it maintains its reliability even when outliers are present. Outliers can often distort the results of more assumption-dependent tests, but the Mann-Kendall analysis is designed to withstand such anomalies, which is useful when examining extensive environmental datasets where abnormal values occasionally arise.

Despite its strengths, the Mann-Kendall analysis does have certain limitations. One such limitation is the treatment of all changes between data points as equal, regardless of their actual magnitude. For example, in the context of monitoring contaminant concentrations, a minor increase of 1% is given the same consideration as a more substantial, perhaps more significant, increase of several orders of magnitude. This equal weighting can lead to underestimation of the importance of large shifts in data, which may be critical in identifying emerging contaminant sources through trend assessment. Despite this limitation, Mann-Kendall analysis is a versatile and robust choice for trend analysis.

The table on the following pages provides a summary of the Mann-Kendall analysis of all site wells sampled in the assessment period (accessible and in service), provided a minimum number of 4 samples have been collected. The analysis has been confined to cadmium, copper and zinc as based on the data presented in the previous section, these metals were found to be the most significant contaminants, relative to ANZECC (2000) guidelines for 80% species protection in marine waters.[4]

In order to assess relatively recent trends in groundwater quality, the analysis has been restricted to samples collected during both the current reporting period of 2022-2024 but also the previous period of 2019-2021. This approach has been adopted in an attempt to identify changes in groundwater quality relative to the previous reporting period. Excluding older data will remove any bias introduced to the dataset from trends apparent 20 years ago which have since been rectified.

Any statistical tool used for trend analysis requires a determination of what level of confidence is required to determine whether the observed trend in the data is statistically significant or if it could have occurred by random chance. When conducting a Mann-Kendall test, the null hypothesis is that there is no trend, meaning that any variation or trend is not related to time, rather simply related to random chance. Statistical test methods such as Mann-Kendall calculate a probability value. This p-value is then used to accept or reject the null hypothesis. The analysis adopted as part of this assessment has adopted p-value thresholds of:

- P=<0.05, there is a less than 5% chance that the observed trend could have occurred due to random variation alone. In other words, when this condition is satisfied, a statistically significant trend has been identified and an ‘increasing’ or ‘decreasing’ trend in the 8 most recent data points for the selected location will be recorded.
- P=0.1-0.05, there is between 5 and 10% chance that the identified trend is due to random variation alone. In this circumstance the trend will be noted as a ‘probably increasing’ or ‘probably decreasing’.
- P=>0.1, there is a greater than 10% chance that any trend or variation is due to random chance. In this situation, ‘no trend’ will be placed within the summary table.

[4] ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality

Table 4-12 Mann-Kendall trend analysis for select contaminants in groundwater

Sample Loc.	Cadmium		Copper		Zinc		Interpreted Aquifer
	p-val	Trend	p-val	Trend	p-val	Trend	
MB005		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB006	0.042	Increasing	0.174	No Trend	0.174	No Trend	Shallow
MB007		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB008	0.573	No Trend	0.26	No Trend	0.06	Probably Increasing	Shallow
MB009	0.022	Decreasing	1	No Trend	0.144	No Trend	Shallow
MB011	0.014	Decreasing	0.806	No Trend	0.014	Decreasing	Shallow
MB012	0.095	Probably Decreasing	0.466	No Trend	0.211	No Trend	Shallow
MB013	0.091	Probably Decreasing	0.188	No Trend	0.707	No Trend	Shallow
MB015	0.325	No Trend	0.655	No Trend	0.929	No Trend	Shallow
MB017	0.042	Decreasing	0.174	No Trend	1	No Trend	Shallow
MB019	0.297	No Trend	0.095	Probably Decreasing	0.144	No Trend	Shallow
MB022	0.01	Decreasing	0.052	Probably Decreasing	0.161	No Trend	Shallow
MB023	0.011	Decreasing	0.035	Decreasing	0.011	Decreasing	Shallow
MB026	1	No Trend	0.308	No Trend	0.174	No Trend	Shallow
MB028	0.042	Decreasing	0.174	No Trend	0.174	No Trend	Shallow
MB029	0.327	No Trend	0.142	No Trend	0.624	No Trend	Shallow
MB031	0.368	No Trend	0.035	Decreasing	0.133	No Trend	Shallow
MB032		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB033	0.089	Probably Increasing	0.308	No Trend	1	No Trend	Shallow
MB035	0.131	No Trend	0.583	No Trend	0.064	Probably Increasing	Shallow
MB036	0.392	No Trend	0.161	No Trend	0.001	Decreasing	Shallow
MB038	0.881	No Trend	0.176	No Trend	0.881	No Trend	Shallow
MB039	0.02	Decreasing	0.016	Decreasing	0.531	No Trend	Shallow
MB041		Insufficient Data		Insufficient Data		Insufficient Data	Both
MB043	0.677	No Trend	0.211	No Trend	0.917	No Trend	Both

Sample Loc.	Cadmium		Copper		Zinc		Interpreted Aquifer
	p-val	Trend	p-val	Trend	p-val	Trend	
MB045	0.621	No Trend	0.386	No Trend	0.458	No Trend	Shallow
MB046	0.297	No Trend	0.917	No Trend	0.835	No Trend	Shallow
MB047	0.602	No Trend	0.754	No Trend	0.917	No Trend	Shallow
MB048	0.276	No Trend	0.01	Decreasing	0.161	No Trend	Shallow
MB049	0.815	No Trend	0.312	No Trend	0.586	No Trend	Shallow
MB050	0.001	Decreasing	0.034	Decreasing	0.005	Decreasing	Shallow
MB051	0.945	No Trend	0.034	Decreasing	0.891	No Trend	Shallow
MB052	0.573	No Trend	0.091	Probably Decreasing	0.452	No Trend	Shallow
MB053	0.016	Increasing	0.009	Increasing	0.009	Increasing	Shallow
MB054		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB055	0.012	Decreasing	0.152	No Trend	0.049	Decreasing	Shallow
MB057	0.002	Decreasing	0.012	Decreasing	0.002	Decreasing	Shallow
MB058	0	Decreasing	0.025	Decreasing	0.001	Decreasing	Shallow
MB059	0.755	No Trend	0.087	Probably Increasing	0.436	No Trend	Shallow
MB060	0.805	No Trend	0.536	No Trend	1	No Trend	Shallow
MB061	0.624	No Trend	0.624	No Trend	0.142	No Trend	Shallow
MB062	0.003	Decreasing	0.245	No Trend	0.003	Decreasing	Shallow
MB063	0.029	Decreasing	0.061	Probably Decreasing	0.009	Decreasing	Shallow
MB065	0.707	No Trend	0.091	Probably Decreasing	0.851	No Trend	Shallow
MB068	0.386	No Trend	0.174	No Trend	0.621	No Trend	Shallow
MB071	0.142	No Trend	0.327	No Trend	0.327	No Trend	Shallow
MB072		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB074	0.497	No Trend	0.497	No Trend	1	No Trend	Shallow
MB075	0.024	Decreasing	0.007	Decreasing	0.004	Decreasing	Shallow
MB076		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB077	0.047	Decreasing	0.273	No Trend	0.337	No Trend	Shallow
MB078	0.174	No Trend	1	No Trend	0.497	No Trend	Deep
MB079	0.003	Increasing	0.025	Increasing	0	Increasing	Shallow

Sample Loc.	Cadmium		Copper		Zinc		Interpreted Aquifer
	p-val	Trend	p-val	Trend	p-val	Trend	
MB080	0.174	No Trend	0.497	No Trend	0.042	Increasing	Deep
MB081	0.174	No Trend	0.089	Probably Decreasing	0.308	No Trend	Deep
MB083	0.007	Increasing	0.128	No Trend	0.049	Increasing	Shallow
MB084	0.881	No Trend	0.293	No Trend	0.051	Probably Increasing	Deep
MB085	0.21	No Trend	0.929	No Trend	0.655	No Trend	Shallow
MB086	0.293	No Trend	0.051	Probably Decreasing	0.176	No Trend	Shallow
MB087		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB088	0.086	Probably Decreasing	0.086	Probably Decreasing	0.624	No Trend	Deep
MB089	0.532	No Trend	0.144	No Trend	0.532	No Trend	Shallow
MB090	0.308	No Trend	0.089	Probably Decreasing	0.089	Probably Decreasing	Deep
MB091	0.917	No Trend	0.144	No Trend	0.835	No Trend	Shallow
MB092		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB093	0.089	Probably Increasing	0.308	No Trend	0.497	No Trend	Shallow
MB094		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB095	0.221	No Trend	0.327	No Trend	0.327	No Trend	Shallow
MB096	0.014	Decreasing	0.05	Decreasing	0.05	Decreasing	Shallow
MB097	0.174	No Trend	0.042	Decreasing	0.042	Decreasing	Shallow
MB098		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB099	0.039	Decreasing	0.26	No Trend	0.573	No Trend	Shallow
MB100	0.06	Probably Decreasing	0.452	No Trend	0.015	Decreasing	Shallow
MB101	0.026	Increasing	0.386	No Trend	0.138	No Trend	Shallow
MB102	0.573	No Trend	0.851	No Trend	0.091	Probably Increasing	Shallow
MB103	0.142	No Trend	0.624	No Trend	0.327	No Trend	Shallow
MB104	0.011	Decreasing	0.133	No Trend	0.133	No Trend	Shallow
MB105	0.851	No Trend	0.452	No Trend	0.348	No Trend	Shallow

Sample Loc.	Cadmium		Copper		Zinc		Interpreted Aquifer
	p-val	Trend	p-val	Trend	p-val	Trend	
MB106	0.497	No Trend	0.042	Decreasing	0.497	No Trend	Shallow
MB107		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB108	0.327	No Trend	1	No Trend	0.142	No Trend	Shallow
MB109		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB110	0.175	No Trend	0.404	No Trend	0.095	Probably Increasing	Shallow
MB111		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB112	0.042	Decreasing	0.089	Probably Decreasing	0.042	Decreasing	Shallow
MB113		Insufficient Data		Insufficient Data		Insufficient Data	Shallow
MB114	0.902	No Trend	0.621	No Trend	0.216	No Trend	Shallow
MB115	0.06	Probably Increasing	0.707	No Trend	0.039	Increasing	Deep
MB116		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB117		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB118	0.297	No Trend	0.754	No Trend	0.144	No Trend	Shallow
MB119	0.042	Decreasing	0.174	No Trend	0.497	No Trend	Deep
MB120	0.573	No Trend	0.133	No Trend	0.851	No Trend	Shallow
MB121	1	No Trend	0.221	No Trend	0.142	No Trend	Deep
MB122	0.327	No Trend	0.462	No Trend	1	No Trend	Shallow
MB123	0.142	No Trend	0.624	No Trend	0.806	No Trend	Shallow
MB124		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB125	0.327	No Trend	0.086	Probably Decreasing	0.624	No Trend	Deep
MB126	0.26	No Trend	0.133	No Trend	0.851	No Trend	Deep
MB127	0.221	No Trend	0.086	Probably Decreasing	0.806	No Trend	Deep
MB128		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB129	0.174	No Trend	0.734	No Trend	1	No Trend	Deep

Sample Loc.	Cadmium		Copper		Zinc		Interpreted Aquifer
	p-val	Trend	p-val	Trend	p-val	Trend	
MB130	0.089	Probably Decreasing	0.089	Probably Decreasing	0.089	Probably Decreasing	Deep
MB131		Insufficient Data		Insufficient Data		Insufficient Data	Deep
MB132	0.276	No Trend	0.02	Decreasing	0.243	No Trend	Shallow
MB133	0.754	No Trend	0.917	No Trend	0.297	No Trend	Shallow
MB134	0.076	Probably Increasing	0.466	No Trend	0.118	No Trend	Both
MB135	0.851	No Trend	0.707	No Trend	0.039	Decreasing	Both
MB136	0.297	No Trend	0.095	Probably Decreasing	0.095	Probably Decreasing	Shallow
MB137	0.26	No Trend	0.06	Probably Decreasing	0.348	No Trend	Shallow
MB138	0.099	Probably Decreasing	0.368	No Trend	0.881	No Trend	Shallow
MB139	0.806	No Trend	0.086	Probably Decreasing	0.806	No Trend	Shallow
MB140	0.091	Probably Decreasing	0.348	No Trend	0.091	Probably Decreasing	Shallow
MB141	0.26	No Trend	0.133	No Trend	1	No Trend	Shallow
MB142	1	No Trend	0.462	No Trend	1	No Trend	Shallow
MB143	0.014	Increasing	1	No Trend	0.624	No Trend	Shallow
MB144	0.624	No Trend	0.327	No Trend	0.327	No Trend	Shallow
MB145	0.174	No Trend	1	No Trend	0.174	No Trend	Both
MB146	0.624	No Trend	0.624	No Trend	1	No Trend	Shallow
MB147	0.624	No Trend	0.221	No Trend	0.624	No Trend	Shallow
MB148	0.624	No Trend	0.086	Probably Decreasing	0.624	No Trend	Shallow
MB149	1	No Trend	0.142	No Trend	0.624	No Trend	Shallow
MB150	0.327	No Trend	0.142	No Trend	0.142	No Trend	Shallow

Trend status identified via the Mann-Kendall analysis is discussed in the following pages.

Cadmium

Figure 4-32 Mann-Kendall Analysis – Cadmium concentration in groundwater.

Trend analysis identified the following trends relative to cadmium concentrations in groundwater across site bores:

- 6 wells were found to have an increasing trend;
- 4 well was found to have a probably increasing trend;
- 7 wells were found to have a probably decreasing trend;
- 20 wells were found to have a decreasing trend;
- 66 wells were found to have no statistically significant trend; and
- There was insufficient data from 20 wells for analysis.

The spatial distribution of wells with an increasing or potentially increasing trend for cadmium were found to be largely focused on areas down hydrogeological gradient of the current and historical Leach/Purification Plant where cadmium is removed from impure solution.

Cadmium concentration within wells exhibiting an increasing trend is presented in the figure below.

Error bars are included on the chart for results where the reported result was below the laboratory limit of reporting. The error bar extends to the limit of reporting and the plotted result, which is 10% of the limit of reporting.

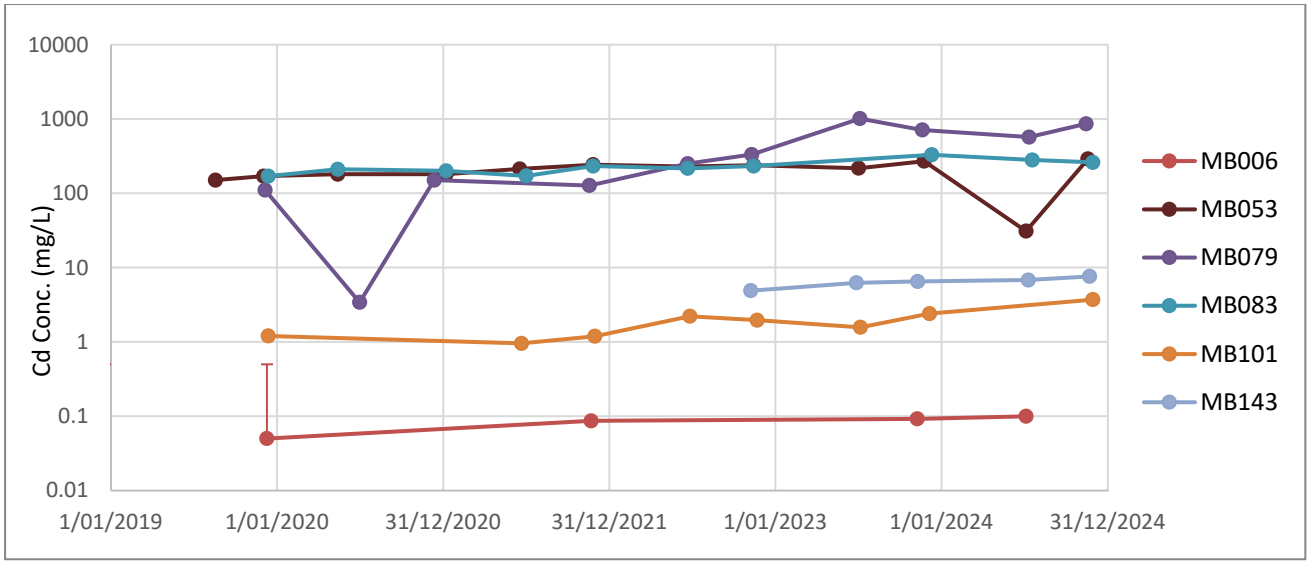


Figure 4-33 Cadmium concentrations in wells exhibiting an increasing trend

Reviewing the plotted trend for MB06 in light of the error bar demonstrates a limitation of any form of trend analysis where a particular value is unknown due to the analysed result falling below the laboratory limit of reporting. In this instance, the reported result for 10 December 2019 was <0.5 mg/L. Should the actual concentration of cadmium in this sample have been 0.4 mg/L, no statistical trend (p=>0.1) would have been identified.

When undertaking this trend analysis, Nyrstar have adopted the relatively conservative approach of utilising 10% of the limit of reporting as the reported value for trend analysis. In 2020, Nyrstar changed analytical laboratories in order to achieve lower analytical limits of reporting.

Copper

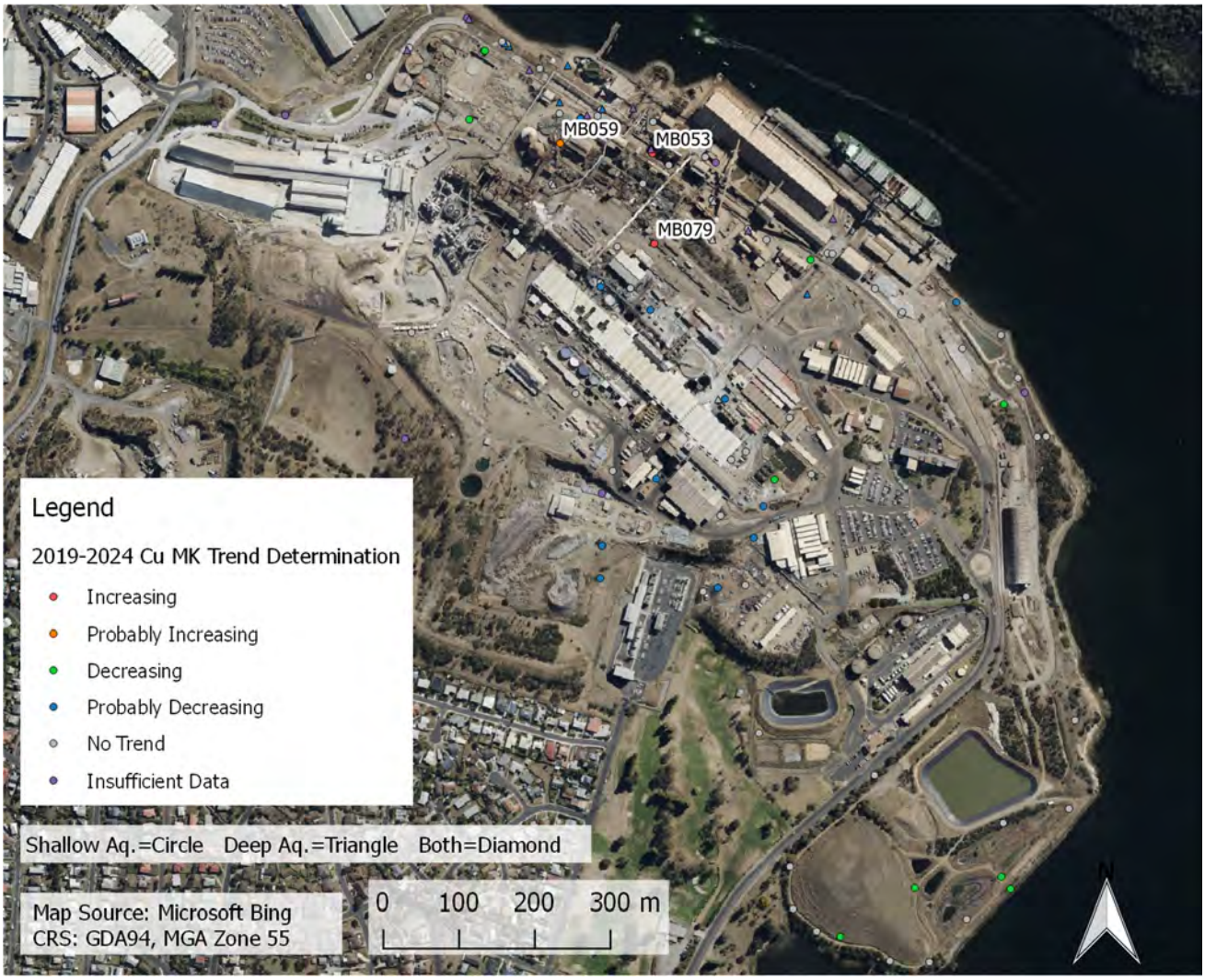


Figure 4-34 Mann-Kendall Analysis – Copper concentration in groundwater.

Trend analysis identified the following trends relative to copper concentrations in groundwater across site bores:

- 2 wells were found to have an increasing trend;
- 1 wells were found to have a probably increasing trend;
- 17 wells were found to have a probably decreasing trend;
- 13 wells were found to have a decreasing trend;
- 70 wells were found to have no statistically significant trend; and
- There was insufficient data from 20 wells for analysis.

The locations where an increasing trend in copper has been identified are consistent with those displaying a similar positive trend for cadmium – down hydrogeological gradient from the Leach/Purification Department.

Copper concentration within wells exhibiting an increasing trend is presented in the figure below.

Error bars are included on the chart for results where the reported result was below the laboratory limit of reporting. The error bar extends to the limit of reporting and the plotted result, which is 10% of the limit of reporting.

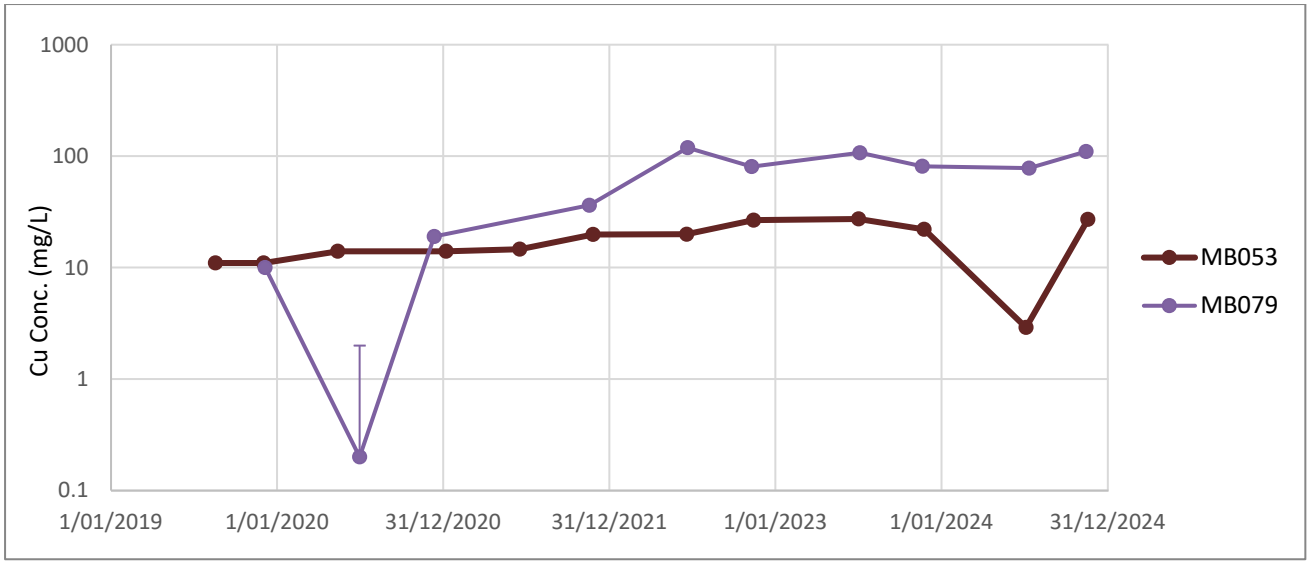


Figure 4-35 Copper concentrations in wells exhibiting an increasing trend

Whilst there is evidence to suggest that the concentration of copper is increasing with a small number of site wells, 40 wells were found to have a statistically significant negative trend, indicating a general improvement in groundwater quality with regards to copper across much of the site. Some of these areas include the Loogana area, where leach residues were washed and stockpiled and the historical leaching plant which has long been regarded as one of the most heavily contaminated areas of the site.

Zinc

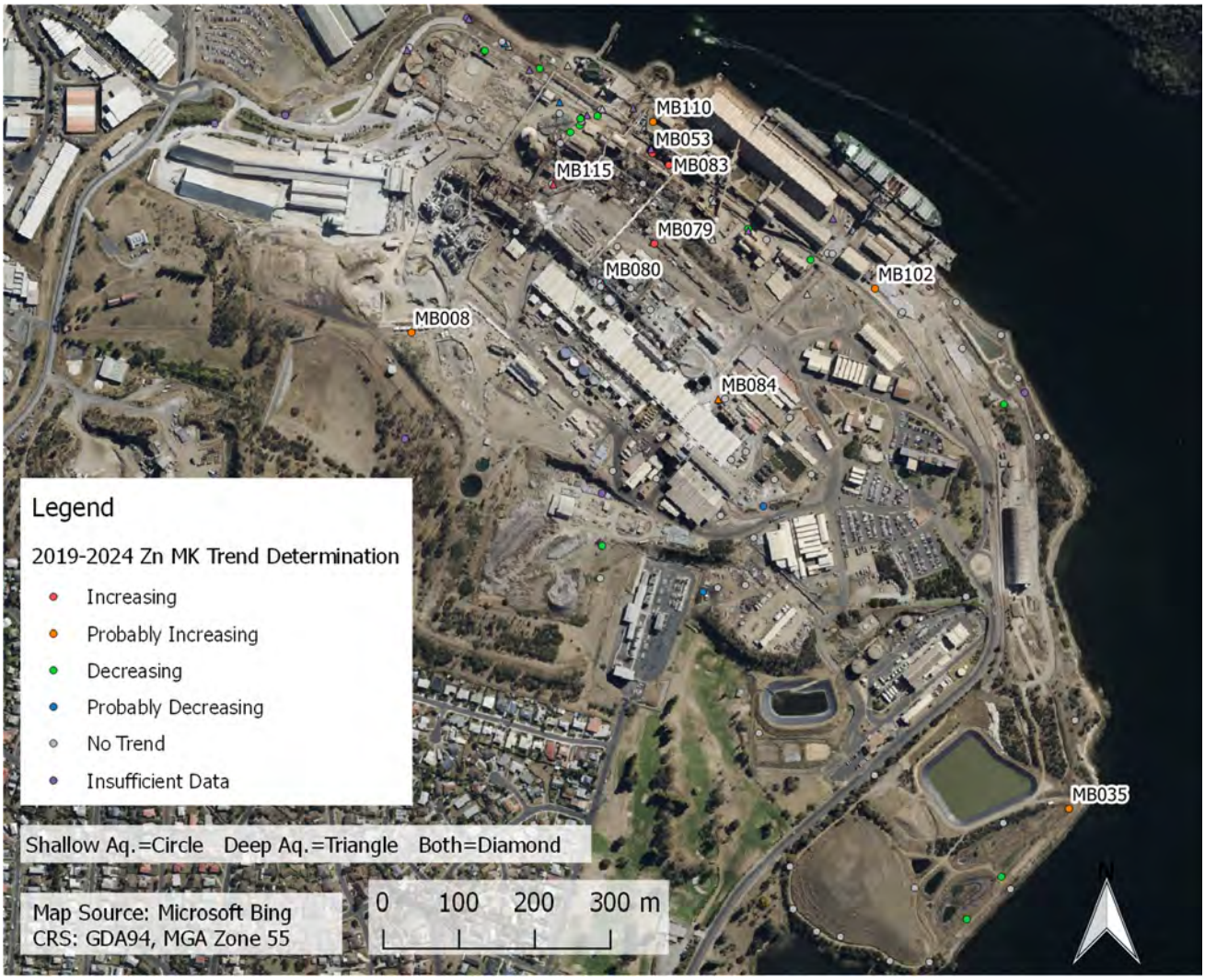


Figure 4-36 Mann-Kendall Analysis – Zinc concentration in groundwater.

Trend analysis identified the following trends relative to zinc concentrations in groundwater across site bores:

- 5 wells were found to have an increasing trend;
- 5 well was found to have a probably increasing trend;
- 4 wells were found to have a probably decreasing trend;
- 15 wells were found to have a decreasing trend;
- 74 wells were found to have no statistically significant trend; and
- There was insufficient data from 20 wells for analysis.

The location of nearly all wells identifying an increase in zinc concentration were found to be down hydrogeological gradient from the Electrolysis Department. Five of these locations are also down gradient of the Purification Department.

Zinc concentration within wells exhibiting an increasing trend is presented in the figure below.

Error bars are included on the chart for results where the reported result was below the laboratory limit of reporting. The error bar extends to the limit of reporting and the plotted result, which is 10% of the limit of reporting.

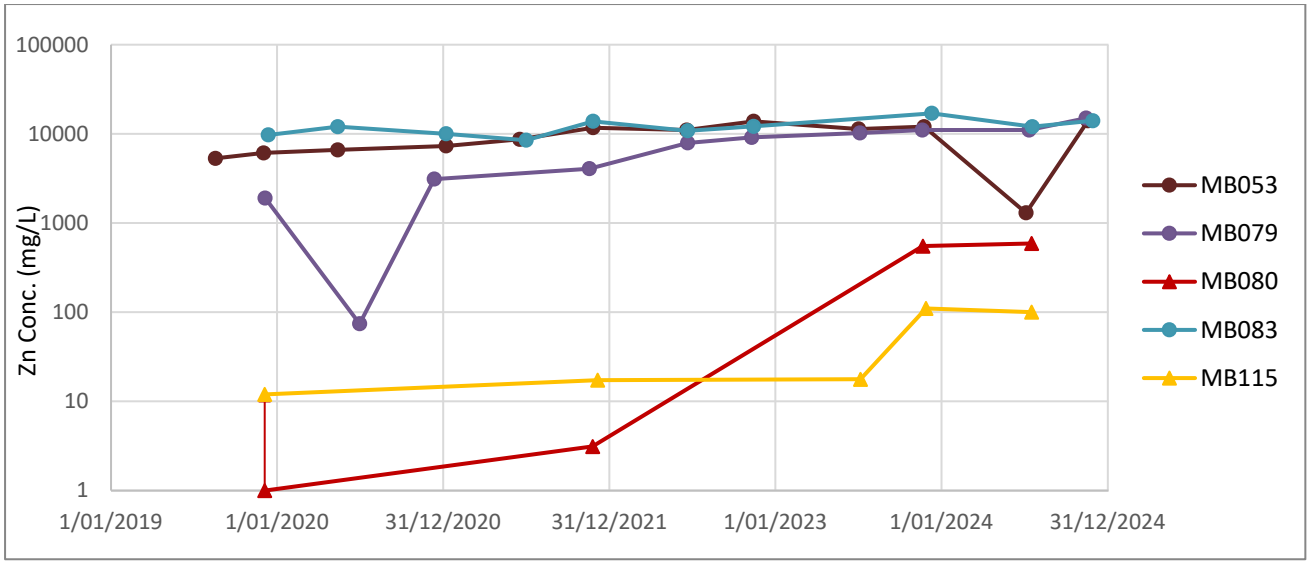


Figure 4-37 Zinc concentrations in wells exhibiting an increasing trend

The concentration of zinc identified within MB80 and MB115 over the past two monitoring rounds indicates the source is likely to be 'Pure Solution', which is the zinc sulphate solution fed into the electrolytic cells within the Electrolysis Department. This is due to the step change in zinc concentration in the absence of similar increases in either copper or cadmium.

Comparison of Results Relative to Previous Monitoring Period

Monitoring data presented within the previous sections have demonstrated that whilst there are levels of contaminants present within groundwater beyond 80% Marine Ecosystem Protection Levels, the concentration of these contaminants are generally much lower within foreshore monitoring wells where groundwater is discharging into the Derwent Estuary.

Positive/increasing trends have been identified within some wells, indicating ongoing or relatively new sources however, there is a large body of evidence to suggest that as a whole - groundwater quality has improved over the last two reporting periods across much of the site.

The figure below demonstrates the spatial distribution of wells where statistically significant contaminant trends have been identified. An explanation of the figure is provided below.

Figure 4-38 Mann-Kendall Analysis – Aggregate contaminant concentration in groundwater.

The figure above is an amalgamation of the three similar figures presented in the previous section. If a positive trend has been identified for one contaminant and a decreasing trend has been identified for another within the same well, the positive trend will be assigned and plotted. Similarly a trend with more statistical significance, determined via a lower p-value will be displayed in preference to one with a higher p-value. Adoption of these rules enables a simplistic assessment of contamination change over time. This protocol has identified:

- 8 wells were found to have an increasing trend;
- 9 wells were found to have a probably increasing trend;
- 18 wells were found to have a probably decreasing trend;
- 29 wells were found to have a decreasing trend;
- 39 wells were found to have no statistically significant trend; and
- There was insufficient data from 20 of the wells for statistical analysis.

The relatively small lateral footprint where increasing trends have been identified will expediate remedial efforts, enabling a more targeted approach, both in terms of ongoing source elimination and secondary source removal.

Of the 103 wells with sufficient data for trend analysis, the fact that 47 of these wells demonstrated a statistically significant trend indicating that contaminant concentrations are either declining, or likely to be declining is a noteworthy finding.

Contaminant concentrations remain elevated in the area down hydrogeological gradient of the historical Leaching Department, however trend analysis indicates that contaminant concentrations within groundwater are declining. Similarly, in the area down gradient of both the historical and current acid plants, groundwater quality was found to either be improving, or ‘probably’ improving.

Whilst there has been a reduction in contaminant concentrations across areas of the site following land use changes, such as those two noted above it is promising to see a reduction in contaminant concentrations in the upriver section of the operational Leach Plant. Trend analysis indicates the improvement in groundwater quality extends across both the shallow and deeper aquifer.

Groundwater Recovery

Groundwater is recovered from strategic locations and targets known hot spots of contamination across the site in accordance with the Groundwater Management Strategy. Ten groundwater extraction systems have been established, each are detailed in the sections below.

The location of each extraction system is identified within Figure 4-39 and Figure 4-40.

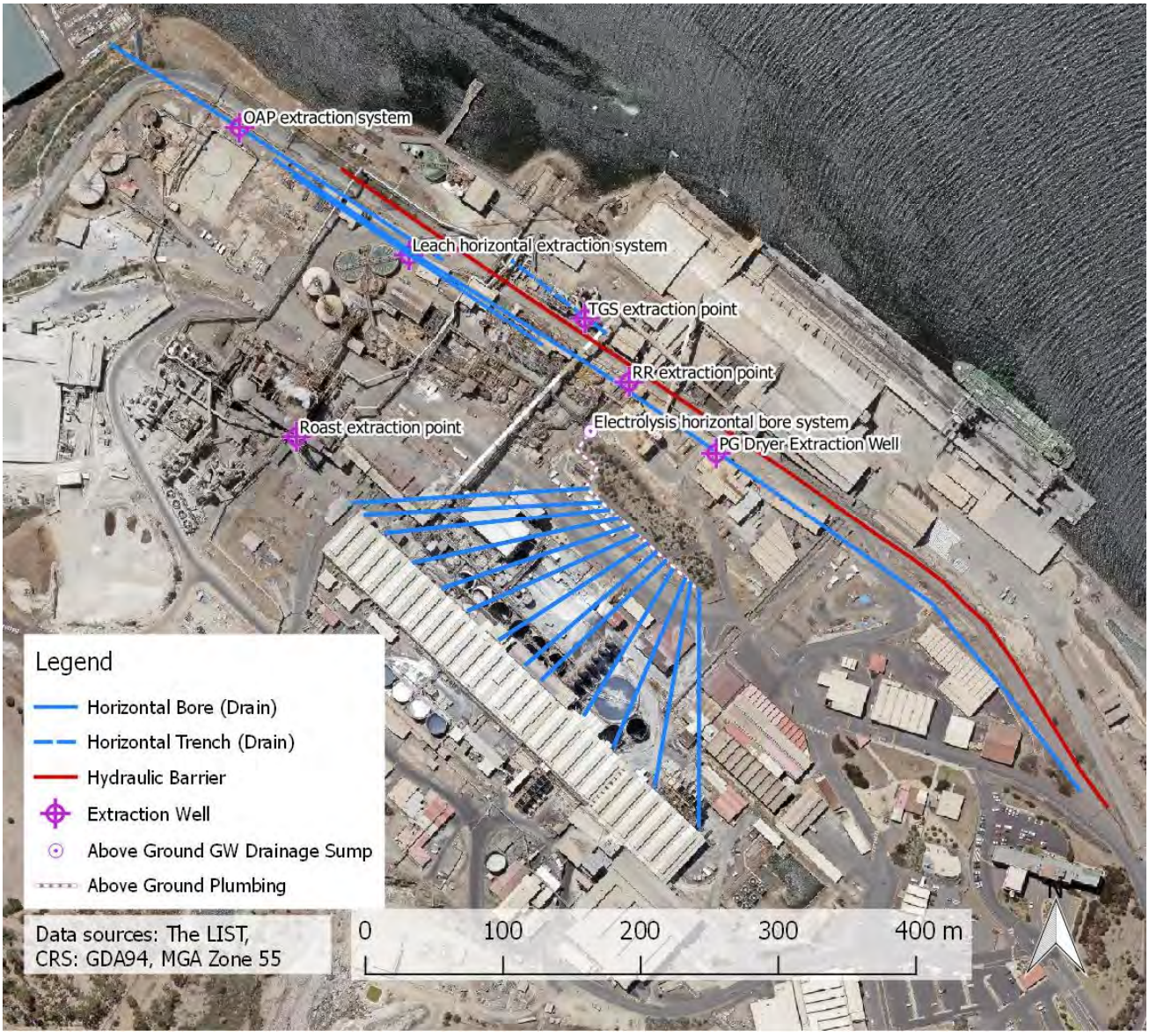


Figure 4-39 Location of operational site area groundwater extraction systems

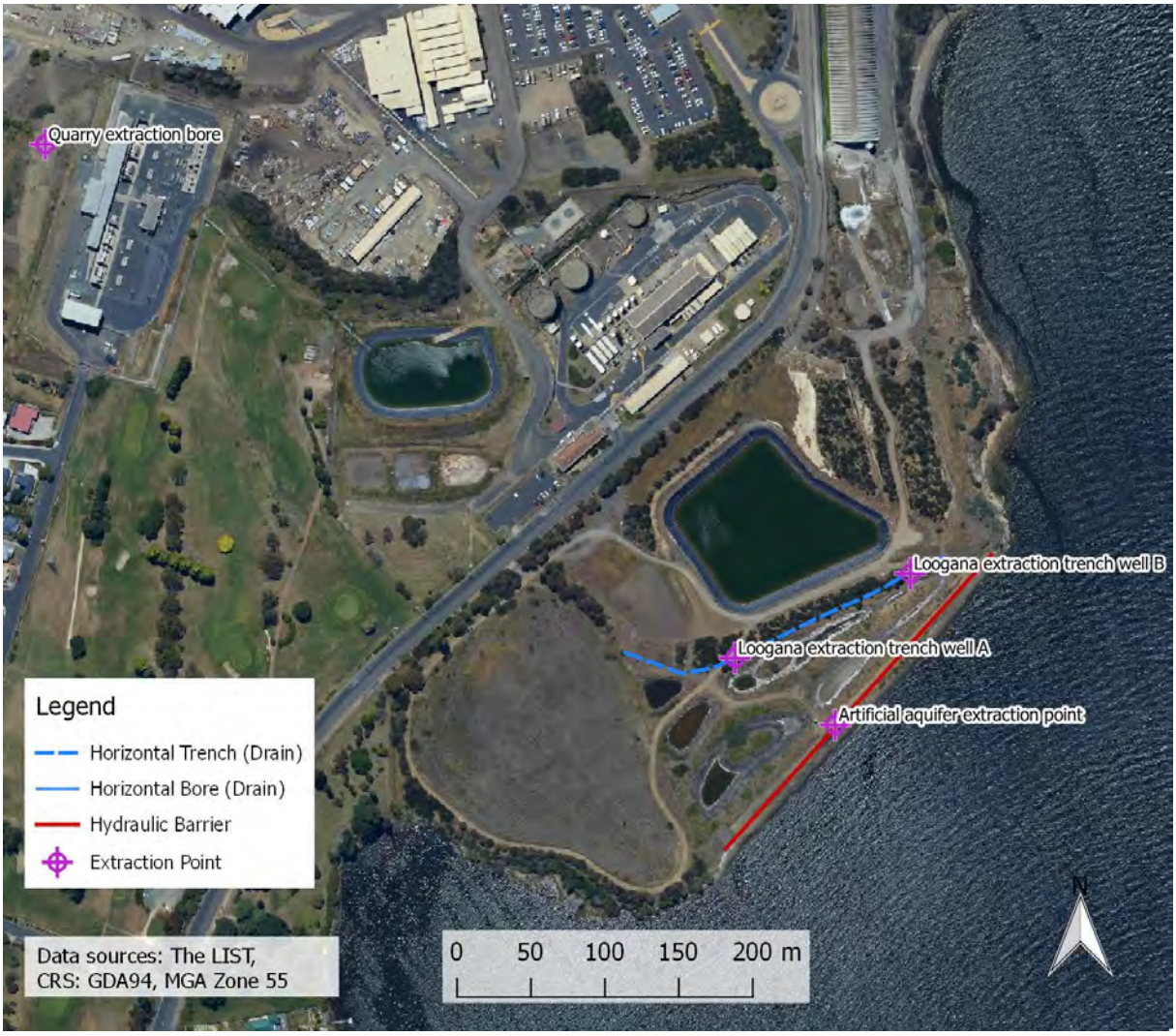


Figure 4-40 Location of southern groundwater recovery systems

All extracted groundwater reports to the Contaminated Water Ponds, prior to treatment within the Effluent Treatment Plant to remove heavy metals prior to discharge through the permitted foreshore outfall point or is recycled within the plant following reverse osmosis filtration.

The established recovery systems continue to deliver good performance throughout the reporting period, however many of the extraction pumps experienced extended periods of downtime. The recovered volume and metal load for the reporting period is shown in Table 4-13. For comparison purposes, the previous sampling periods are also included.

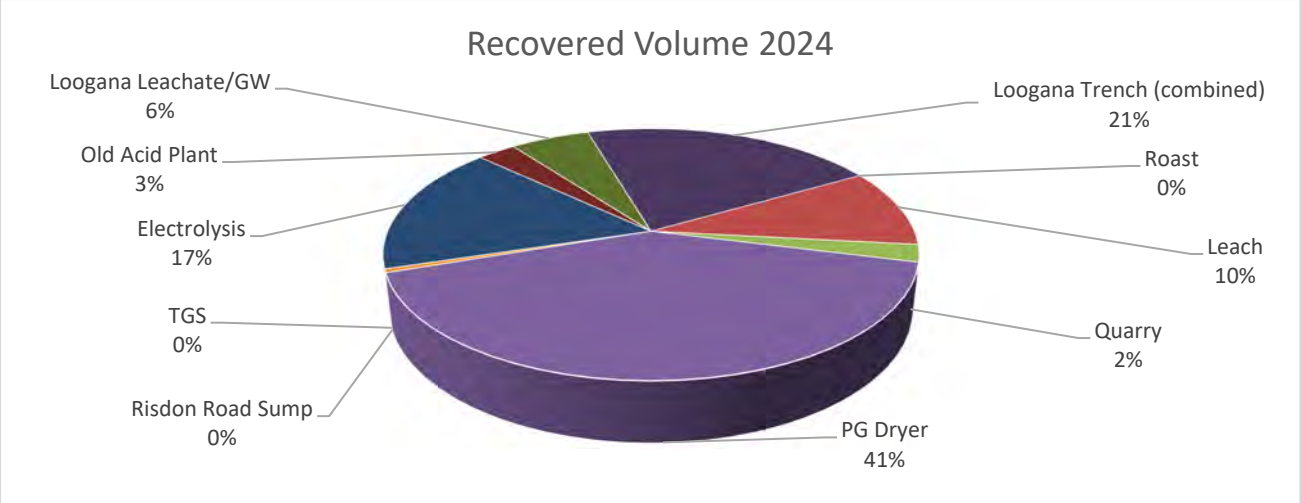
Table 4-13 Summary of estimated loads extracted from groundwater recovery points during both the current and previous reporting period

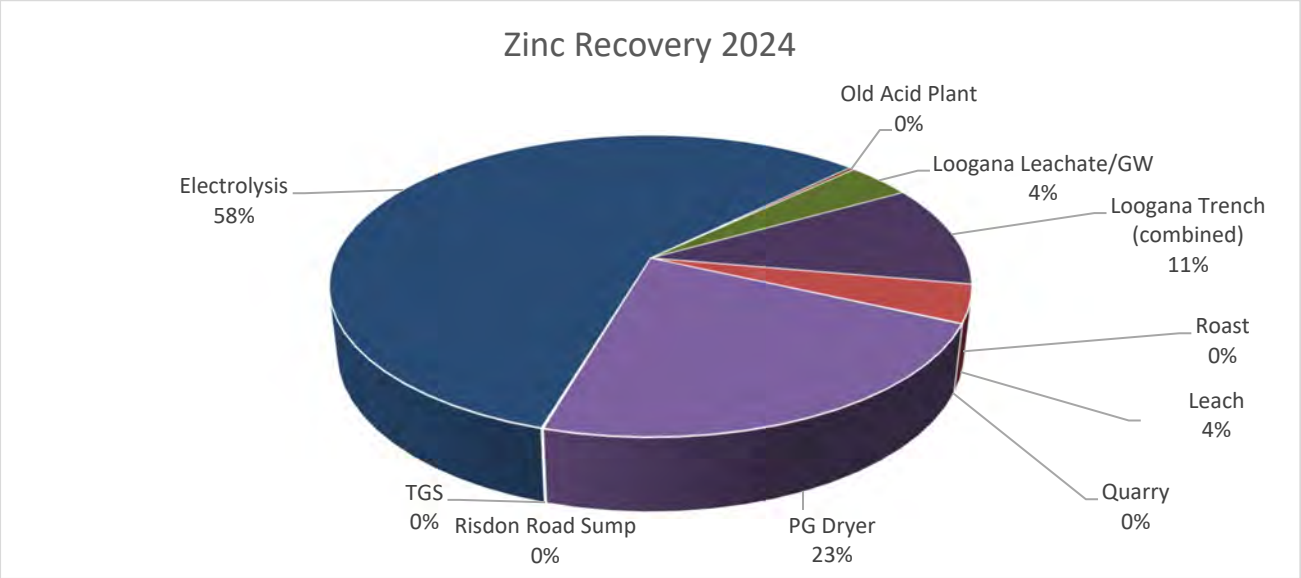
Year	Volume (m^3)	Zinc (kg)	Cadmium (kg)
2024 CY Total	36,424	93,274	5,813
2023 CY Total	32,358	90,455	4,249
2022 CY Total	49,011	125,369	3,007
2021 CY Total	33,193	92,251	1,909
2020 CY Total	39,152	83,323	1,682
2019 CY Total	41,713	82,575	1,966

The table below summarises the performance of each extraction system throughout the reporting period. The figures on the following page present the recovery from 2024 pictorially. An overview of each extraction system is presented in the following pages however it can be seen within the table and figures below that the vast majority of metal recovery occurs within the Electrolysis Horizontal Bore system.

Table 4-14 Groundwater abstraction per system

Extraction System	Volume (m3)			Zinc (kg)			Cadmium (kg)		
	2022	**2023**	**2024**	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**
Roast	122	-	-	-	-	-	-	-	-
Leach	3,771	6,012	3,656	3,352	6,875	3,759	25	51	31
Quarry	16	649	805	1	43	46	0	20	21
PG Dryer	20,464	5,454	14,887	36,474	8,181	21,131	502	98	260
Risdon Road Sump	-	-	-	-	-	-	-	-	-
TGS	118	242	173	35	82	65	1	2	1
Electrolysis	6,684	6,089	6,090	59,883	56,259	54,156	2,166	3,857	5,334
Old Acid Plant	886	2,435	1,010	429	765	271	1	2	1
Loogana Leachate/GW	4,333	3,000	2,069	5,827	4,608	3,632	50	39	31
Loogana Trench (combined)	12,527	8,477	7,734	19,194	13,642	10,213	261	180	135





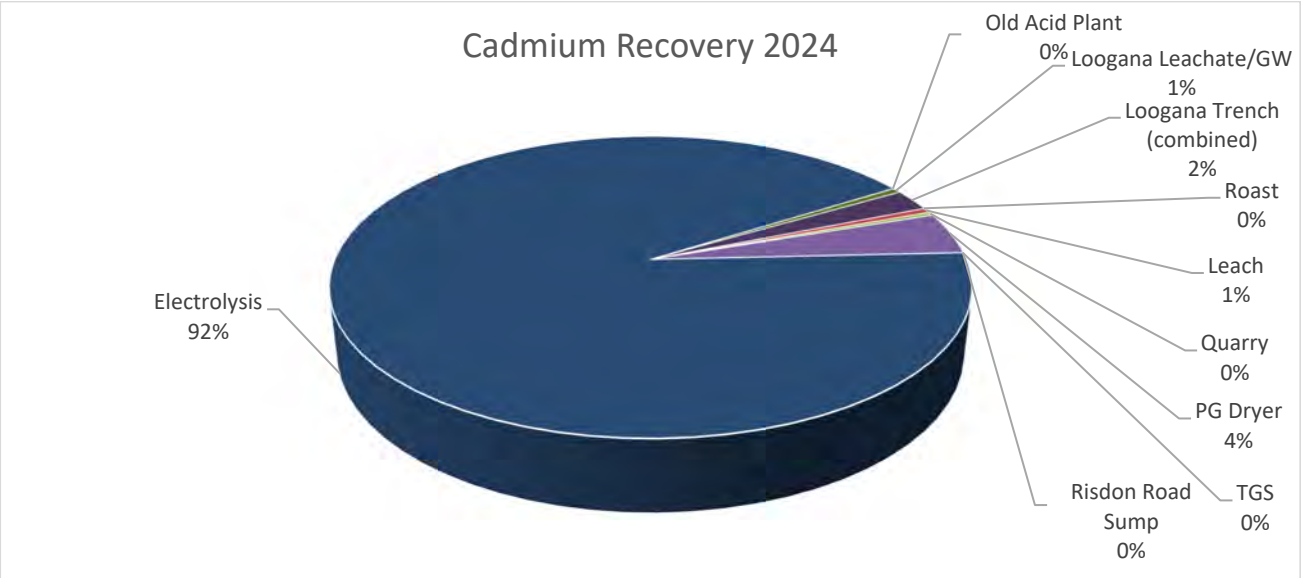


Figure 4-41 Relative yield of individual groundwater extraction systems

Roast Vertical Extraction Bore (EB01)

The Roast extraction bore is a 300 mm diameter well installed in August 2000, 40.5 m into dolerite bedrock with a 28.5 m long, 150 mm diameter screen. The location of the system relative to local monitoring bores and modelled hydraulic head (2024 Q4) within the unconfined aquifer is presented in the figure below.

Figure 4-42 Location of the Roast Vertical Extraction Bore

The concentration of zinc within abstracted water from the system is presented in the chart below alongside monitoring data collected from two observation wells in the near vicinity, MB09 and MB43. Generally a reduction in zinc concentration was observed from 2001 until 2020. From 2020 onwards concentrations within both extracted water and samples collected from monitoring wells surrounding the extraction system appear to have increased. In April 2022, the pump within the extraction bore failed due to becoming bogged in silt, preventing removal for maintenance. Some attempts to recover the pump and return the bore to operation were undertaken in 2023, further attempts will be undertaken in 2025.

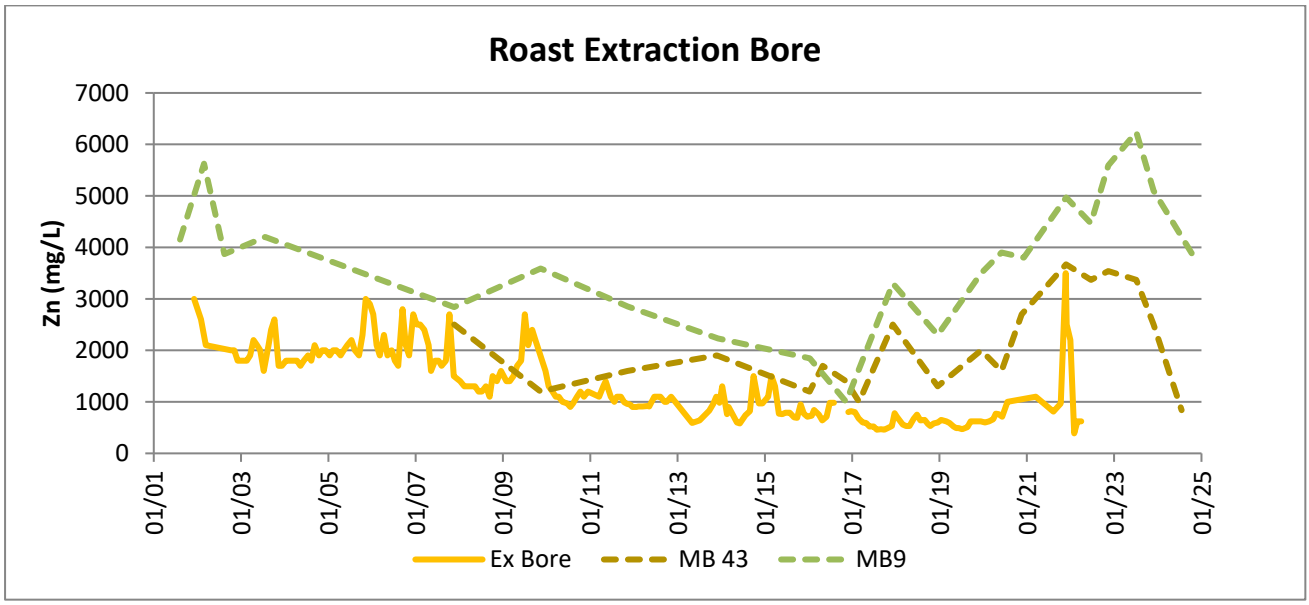


Figure 4-43 Zinc in groundwater surrounding the Roast Vertical Extraction Bore

Leach Horizontal Extraction Bore (EB02)

The Leach extraction bore is a 16 m deep, 380 mm diameter bore, intersecting the horizontally drilled groundwater drain that extends approximately 220 m in a northwest/southeast direction below the Neutral Leaching section and Mercury Removal Plant to the northwest and the Paragoethite section to the southeast. The horizontal collection drain lies within dolerite and extends towards, but does not intersect the contact with the Triassic sandstone to the southeast. The typical depth of the horizontal drain is approximately 5 m below sea level, approximately 16 m below ground level at the extraction point. The 112 mm open hole collection drain was installed in June/July 2001, while the vertical extraction point was installed prior to this in May 2001.

The location of the extraction system relative to local monitoring bores and modelled hydraulic head (2024 Q4) within the unconfined aquifer is presented in the figure below.

Figure 4-44 Leach Extraction Bore layout

The concentration of zinc within abstracted groundwater and water within proximal monitoring wells is presented in Figure 4-45 below. Since the commissioning date, the concentration of zinc within extracted water has generally declined over time at a relatively consistent rate. In 2002 the observed concentration of zinc within abstracted water was typically found to be 4000-5000 mg/L, however this has declined to 1000-2000 mg/L by the end of 2024.

The concentration of zinc within groundwater abstracted from EB02 is considerably lower than up gradient monitoring wells MB15 and MB57, whist generally remaining higher than MB60. This indicates the bulk of the zinc flux is likely occurring along the southeastern extent of the bore.

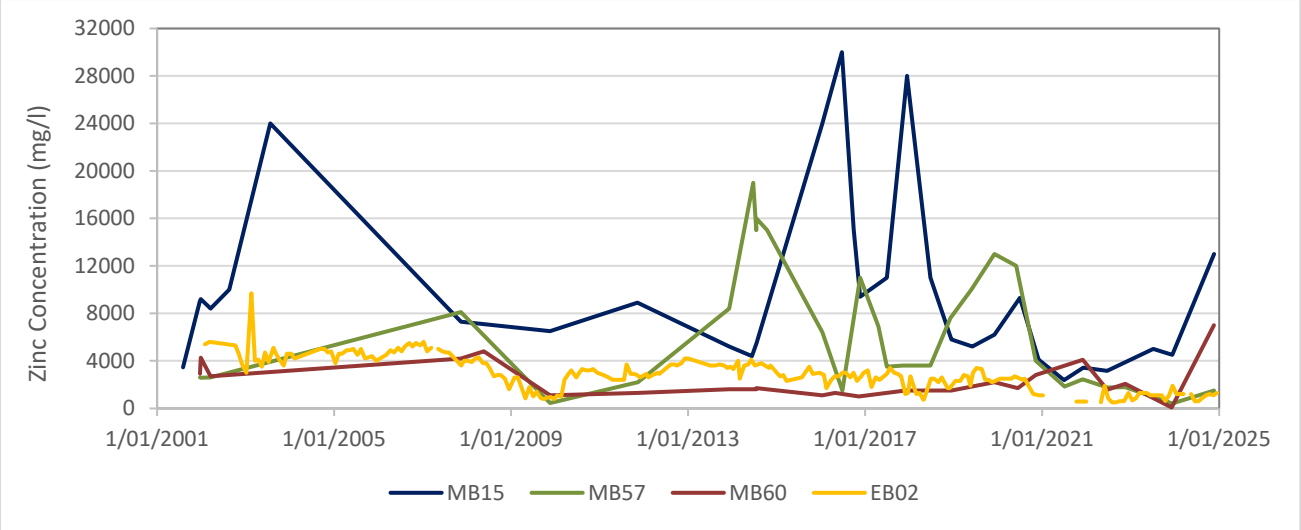


Figure 4-45 Long term zinc in groundwater concentration – Leach Extraction System area

The groundwater yield of the system varied throughout the reporting period. Seasonable variability and pump reliability accounts for some variation, however the commissioning of EB05, discussed in greater detail later within this report is chiefly responsible for the reduction in yield.

Monthly groundwater abstraction for the two systems is presented in the graph below. In the January 2018 to January 2021 period, the mean abstraction rate from EB02 was 700 m^3 per month. This reduced significantly during the commissioning phase of EB05 to the point where EB02 ran dry in early 2022.

From May 2023 until December of that year, EB05 was inoperable, which lead to a step change increase in volumetric yield from EB02 to a point where it approached 700 m^3 per month. This finding is not unexpected, as the expected capture zone for EB02 is expected to be similar to that of the northwestern extent of EB05.

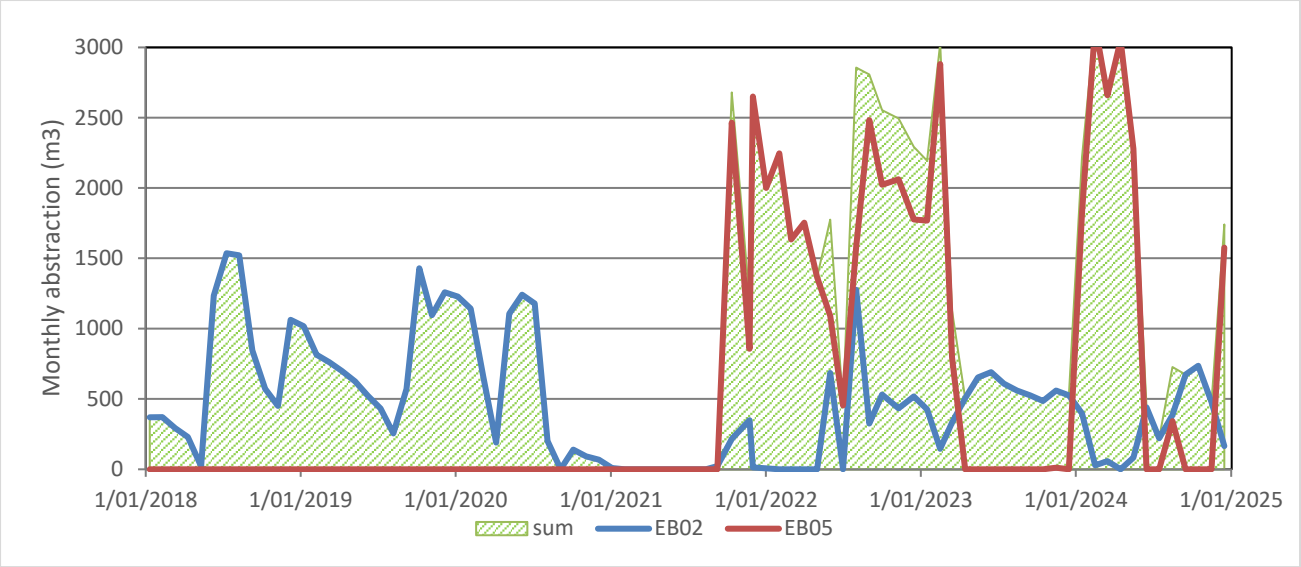


Figure 4-46 Groundwater extraction rates, EB02 and EB05

Loogana-Inshallah Seawall System and Recovery Trench System

Commissioned in 1998, the Loogana-Inshallah seawall extraction system is comprised of a groundwater pump, coupled with a 278 m long bentonite grout seawall acting as a hydraulic barrier, preventing the migration of groundwater into New Town Bay. The hydraulic head on the landward side of the cut-off wall is maintained below that of the seaward side, ensuring the hydraulic gradient falls towards the pumping system, rather than New Town Bay. The layout of the system is provided in Figure 4-47.

During the construction of the Loogana Dam in 2013-2014, a groundwater recovery trench was installed with a linear length of approximately 250 m, situated between the newly constructed stormwater dam and the Loogana wetlands. The installation of the extraction trench creates a hydraulic sink within the centre of the Loogana area, establishing a hydraulic flow towards the collection system, reducing the volume of contaminated groundwater that may discharge into New Town Bay. The potentiometric surface, based on hydraulic head observations within monitoring bores taken during Q4 2024 is presented in the figure below. Whilst there are relatively few wells across the approximately 9 ha area, it is apparent within the modelled surface below that there is an area of depression towards the centre of the Loogana area.

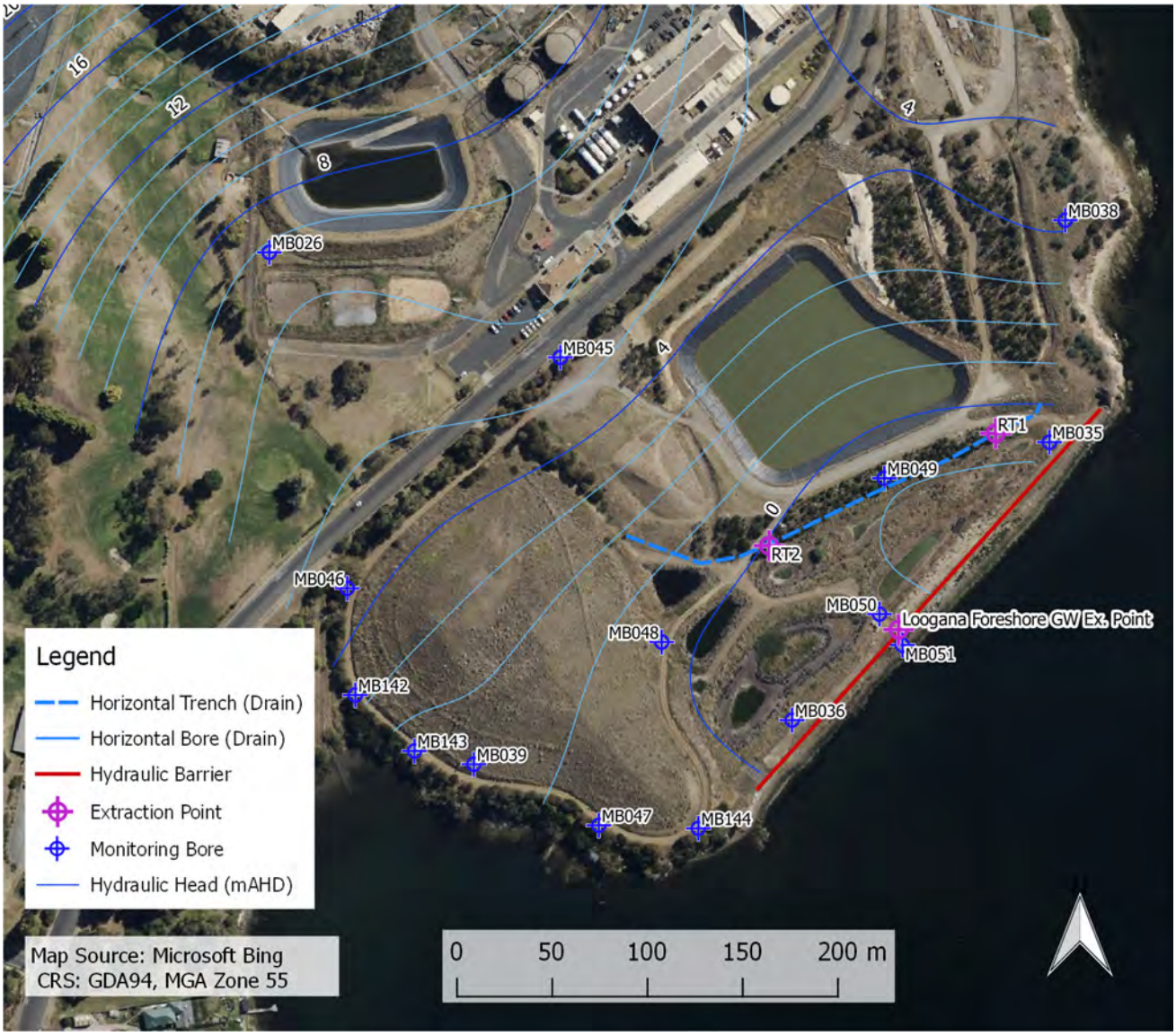


Figure 4-47 Loogana Cut-off wall and Collection Sump

The concentration of metals within groundwater recovered from the Loogana-Inshallah foreshore cut off wall system was relatively low throughout the reporting period, other than a sporadic increases found in March 2023 and August 2024. Groundwater quality within the shallow aquifer has been steadily improving since 2010, This can be seen within Figure 4-48 below as a reduction in metal load within extracted water.

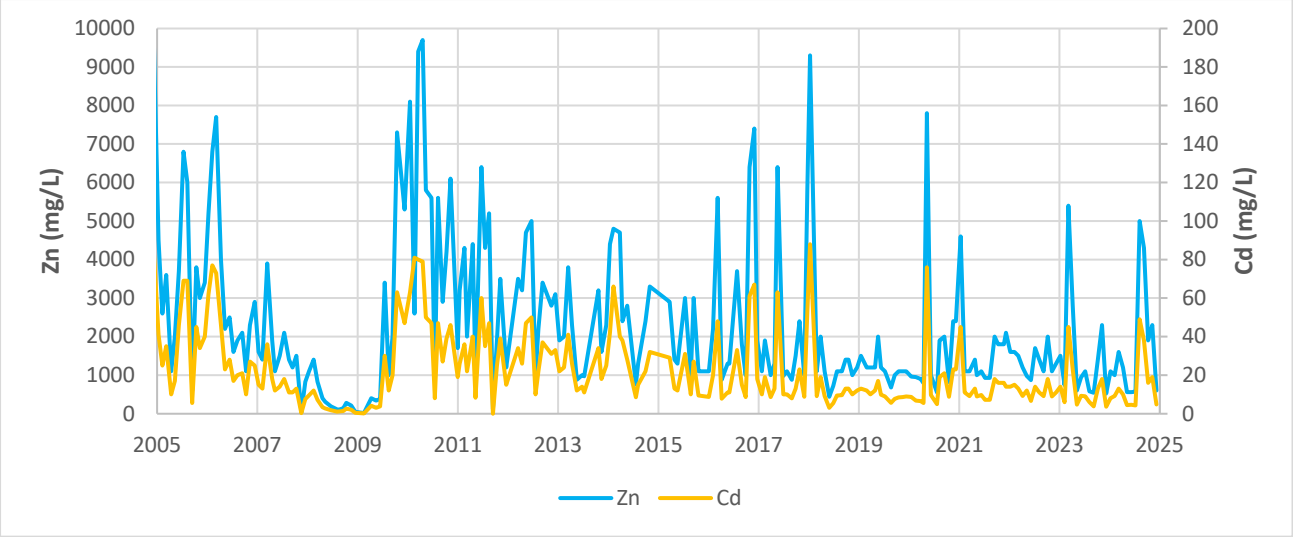


Figure 4-48 Metal concentrations in groundwater extracted from the Loogana–Inshallah recovery system

The concentration of zinc and cadmium within groundwater recovered from the Loogana Dam Trench is presented in Figure 4-49 below. Axis have been kept consistent with the above graph for comparison.

Throughout the reporting period, the concentration of both zinc and cadmium generally declined within RT2 (Trench Well A) and remained relatively consistent within RT1 (Trench Well B).

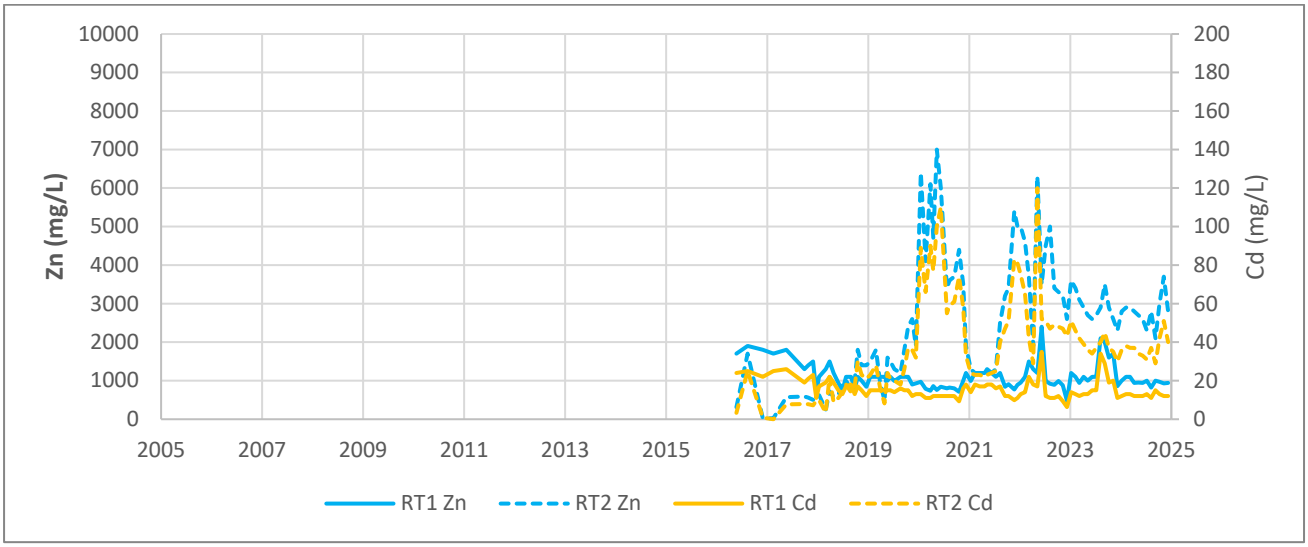


Figure 4-49 Metal concentrations within groundwater extracted from the Loogana Dam Recovery Trench

Risdon Road Sump Extraction System

The Risdon Road Sump includes a vertical extraction well situated within a shallow excavated sump. The layout of the extraction system is presented within the figure below, overlain with modelled hydraulic head within the unconfined aquifer, using measurements taken from the Q4 2024 monitoring round.

Figure 4-50 Risdon Road Sump Extraction System

Safe access to the extraction system was lost in July 2021. The contaminant load within groundwater extracted from the Risdon Road Extraction System has been steadily decreasing over the past 20 years. This can be clearly seen within Figure 4-51 below. The system did not operate during the reporting period.

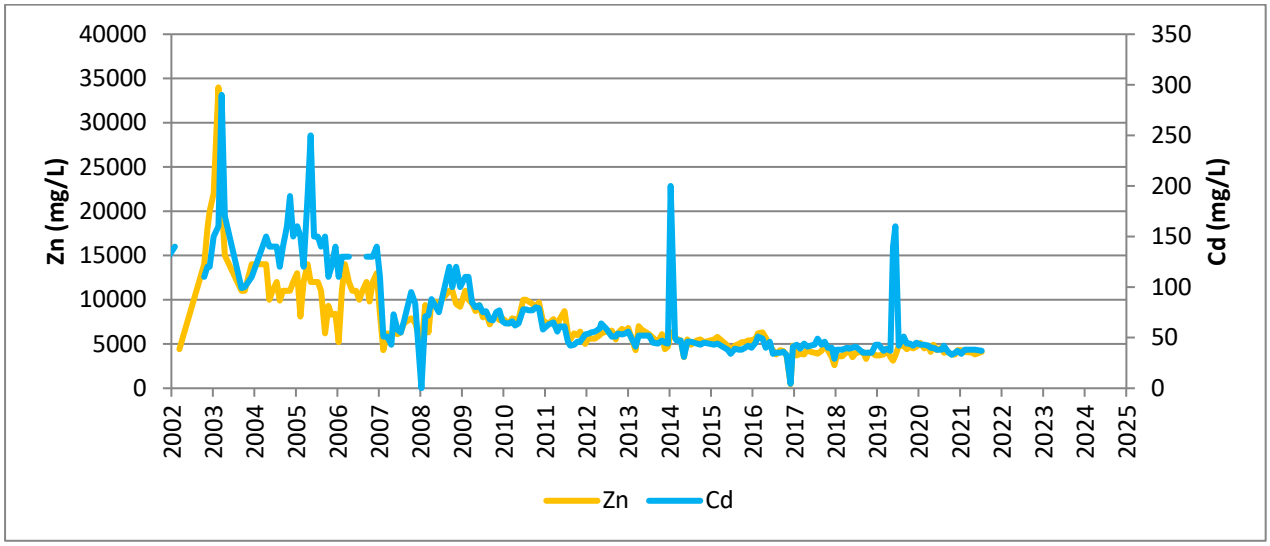


Figure 4-51 Metal concentrations in groundwater extracted from the Risdon Road Sump recovery system

Tail Gas Scrubber Extraction Trench

The Tail Gas Scrubber extraction system comprises of a trench approximately 80 m long excavated typically 1-2 m below ground surface. A drainage pipe lies at the base, surrounded with coarse gravelly fill. A sump approximately 2.5 m in depth acts as a collection point for groundwater extraction. The system, commissioned in 2001 targets the unconfined aquifer onsite, as the collection trench largely sits within poorly consolidated sediments or fill over the underlying dolerite. The layout of the extraction system is presented within the figure below, overlain with modelled hydraulic head within the unconfined aquifer, using measurements taken from the Q4 2024 monitoring round.

Figure 4-52 Location of Tail Gas Scrubber Trench Extraction System

The concentration of contaminants in recovered groundwater reduced significantly in October 2021, coinciding with pre-commissioning pumping trials within EB05 situated on the up hydrogeological gradient side of the hydraulic barrier, displayed in the figure above. Despite the intermittent operation of EB05 since this time, the concentration of both cadmium and zinc has not returned to that encountered prior to the operation of EB05.

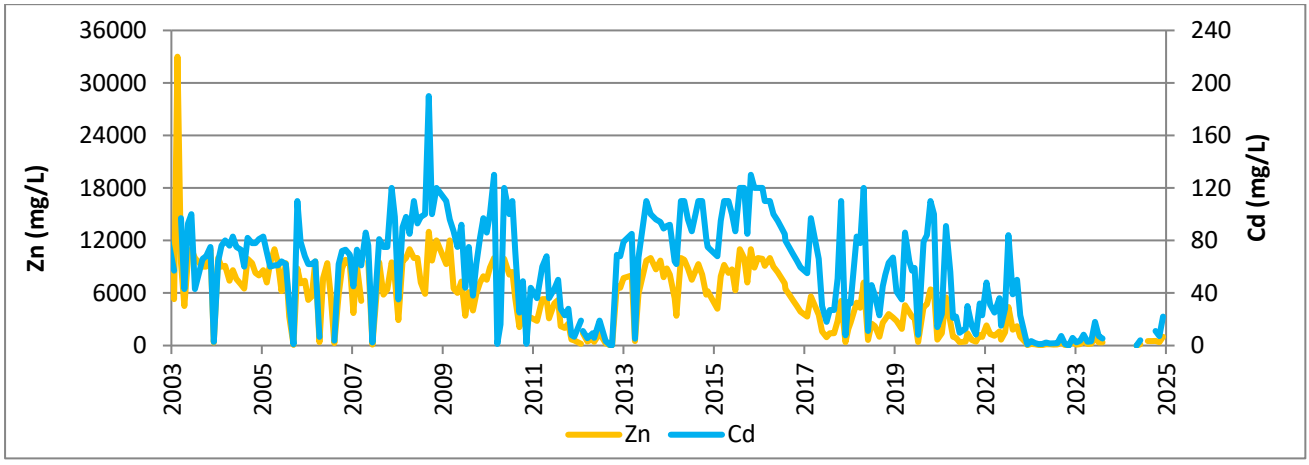


Figure 4-53 Metal concentrations in groundwater extracted from the TGS Extraction System

Electrolysis Horizontal Extraction Bores

In 2008, 13 horizontal bores were drilled with an inclination of approximately 0.7 degrees from the horizontal in a fan-like manner extending from the historical leaching section of the Site towards the operational Electrolysis Department. Each of the bores are connected via a manifold to a common drain and flows via gravity to the site Contaminated Water System. The location of the extraction system relative to local monitoring bores and modelled hydraulic head (2024 Q4) within the unconfined aquifer is presented in the figure below.

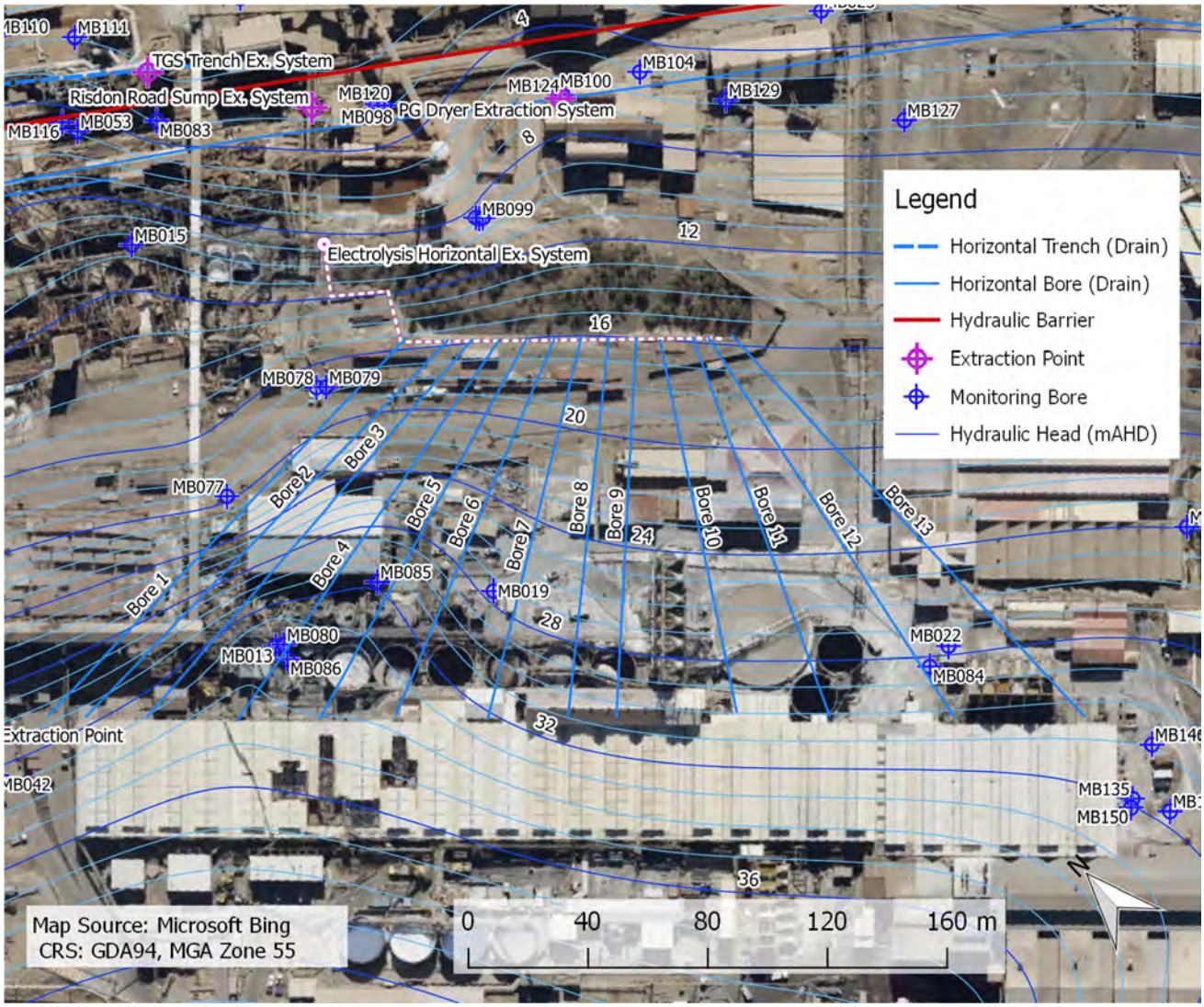


Figure 4-54 Location of Electrolysis Finger Bores

The modelled hydraulic head presented in the above figure indicates the extraction system may be inducing hydraulic drawdown in the vicinity of MB85. The drawdown may not be as apparent within the southern bores, 7 through 13 as they are primarily installed within the Triassic sandstone unit which generally has a lower permeability than the Jurassic dolerite. This observation is supported by typically greater groundwater drainage/extraction rates in the northern finger bores.

As mentioned above, groundwater from each of the individual bores drains to a common manifold, prior to discharging to the sites contaminated water system. The concentration of zinc, cadmium and copper in the common drainage is presented in the graph below.

The concentration of zinc has been increasing steadily from approximately 6000 mg/L in mid-2016, to approximately 8000 mg/L at the end of 2024. Cadmium concentrations have demonstrated greater relative variation since the extraction system was commissioned. In February 2023, the concentration of cadmium more than doubled without an associated increase in zinc or copper.

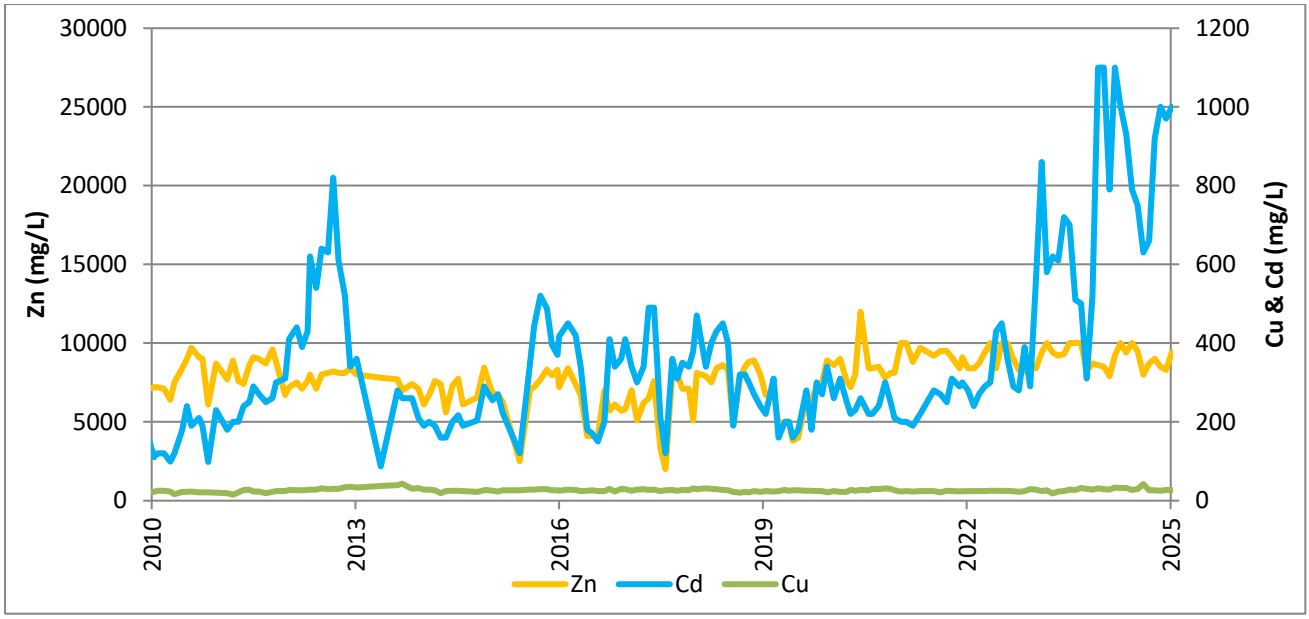


Figure 4-55 Metal concentrations in groundwater extracted from the combined Electrolysis Horizontal Bore System

Cadmium is removed from the hydrometallurgical circuit within the Secondary Purification stage within the Purification Department. This is achieved via a cementation step followed by filtration, sluicing and further multi-step filtration in order to produce a cadmium sulphate solution, free of other metals. An increase in cadmium concentrations within groundwater without an associated increase in zinc or copper indicates that the source of the cadmium contamination is likely to be associated with a loss of containment within the Secondary Purification stage within the footprint of the Purification Department. At the time of reporting, an assessment of bunds and sumps within the Purification Department was in progress.

Quarry Vertical Extraction Bore (EB03)

The Quarry Vertical Extraction Bore was installed in 2010 to a total depth of 28.6 m below ground surface. The bore is located down hydraulic gradient of a historical dolerite quarry that has been used as a storage repository for contaminated soil and contaminated timber, resulting from various demolition projects that have occurred at the site. The layout of the extraction system is presented within the figure below, overlain with modelled hydraulic head within the unconfined aquifer, using measurements taken from the Q4 2024 monitoring round.

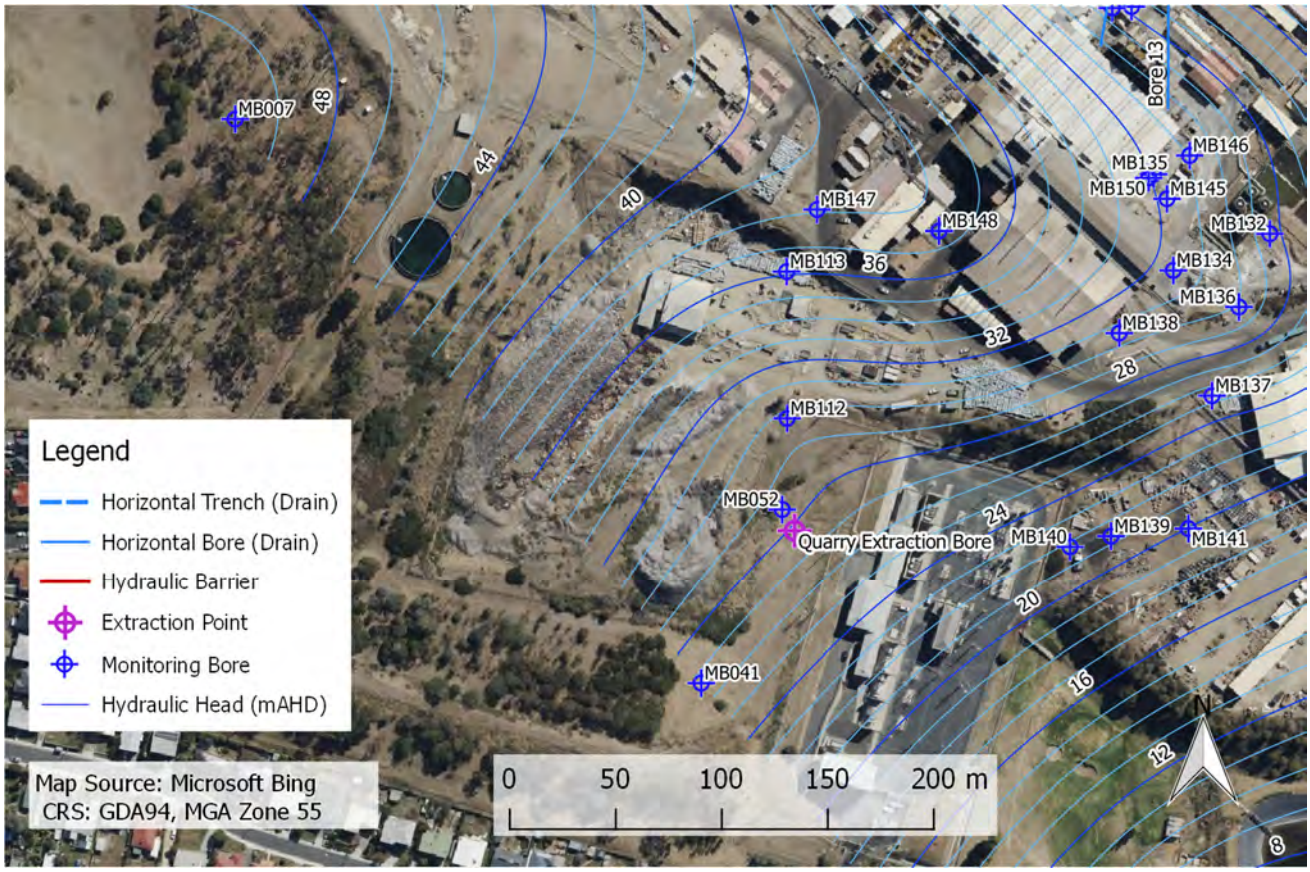


Figure 4-56 Location of the Quarry Vertical Extraction Bore

Results from the Quarry Bore reveal no discernible trends during the current, or previous reporting periods. Statistically significant decreasing trends were identified within surrounding wells MB52 and MB112. The Quarry bore recovers the lowest mass of zinc of all operable extraction systems onsite.

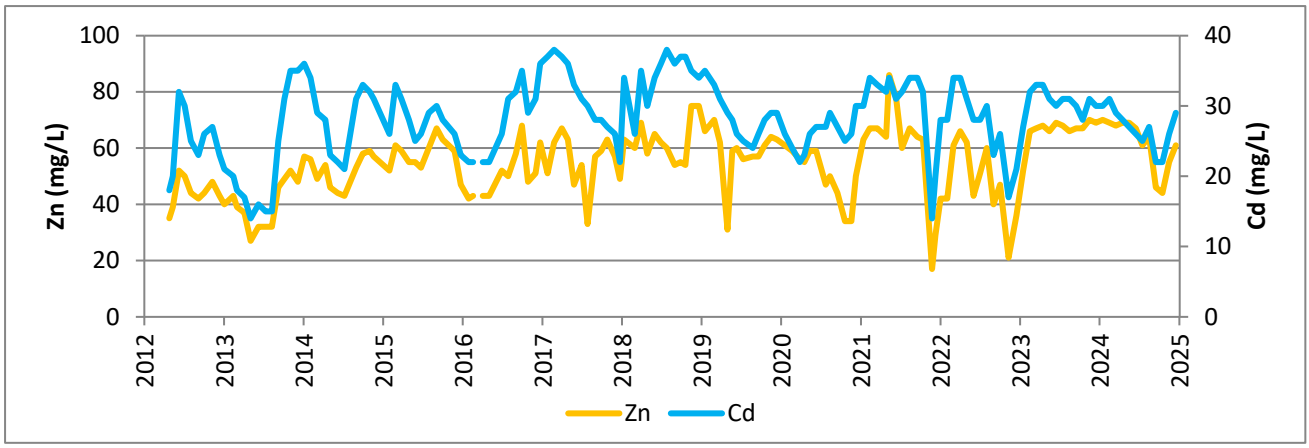


Figure 4-57 Metal concentrations in groundwater extracted from the Quarry recovery system

Old Acid Plant Horizontal Extraction Bore (EB04)

The Old Acid Plant Horizontal Extraction Bore, as the name suggests lies directly down gradient of a section of the Site previously occupied by the lead chamber acid plants (1917-1948), Number 1, 2 (1948-1981) 3 & 4 (1958-1992) Contact Sulphuric Acid Plants. The bore was constructed to extend the capture zone of groundwater along the site frontage at a depth of approximately 5 m below sea level, the same typical depth as the Leach Horizontal Extraction System. The bore was drilled from the neighbouring INCAT property and follows a roughly parabolic path, with an extraction well intersecting the horizontal path at the lowest section of the curve. The layout of the extraction system is presented within the figure below, overlain with modelled hydraulic head within the unconfined aquifer, using measurements taken from the Q4 2024 monitoring round.

Figure 4-58 Location of Old Acid Plant Extraction System

The concentration of both zinc and cadmium within abstracted water is presented in the figure below. The increase in both zinc and cadmium concentrations apparent within 2018 is considered to be a result of the use of the emergency acid bund located immediately up gradient of the horizontal bore to temporarily store neutral leach liquor from late 2017 to mid-2018. This practice has since been abandoned and the issues with the emergency bund rectified. The concentration of zinc and cadmium have since been declining, indicating that the cause of the concentration spike has largely been resolved. Statistical analysis presented pictorially in Figure 4-58 above indicates that groundwater quality is generally improving within the capture zone of this extraction system.

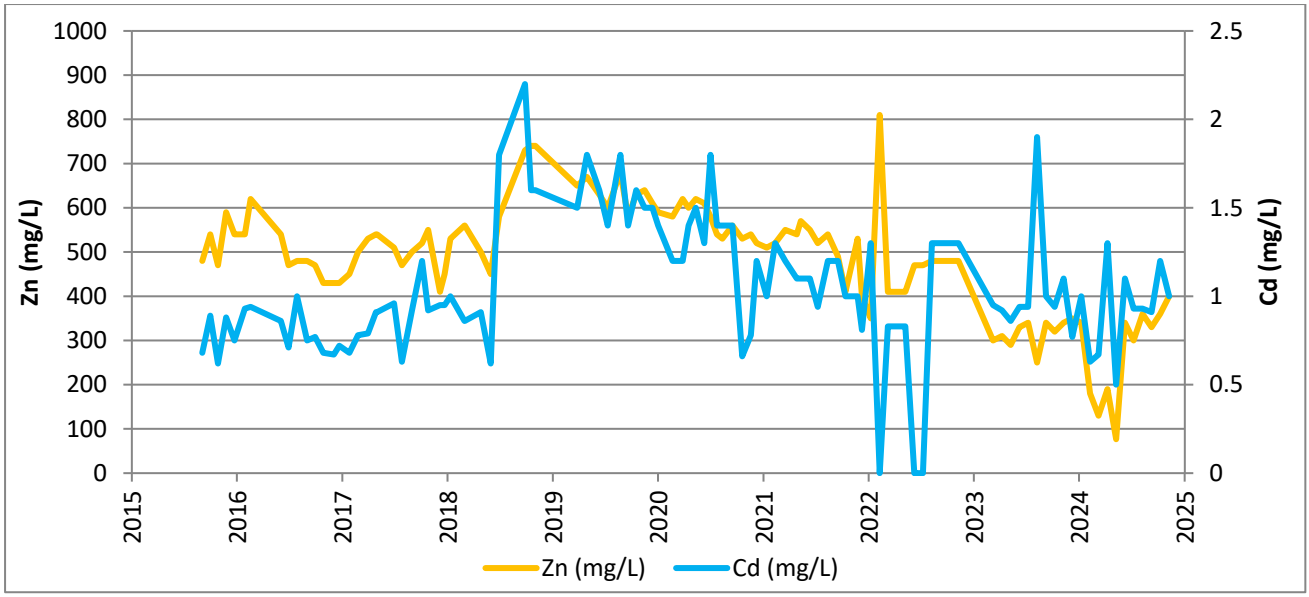


Figure 4-59 Metal concentrations in groundwater extracted from the Old Acid Plant Extraction System

PG Dryer Extraction Well (EB05)

The PG Dryer Extraction System includes a 730 m long pressure-injected grout curtain and a directionally drilled groundwater drain, approximately 750 m in length. These two components were installed from early 2020 through to mid-2021.

The grout curtain is located on the fringe of the natural shoreline, acting as a hydrogeological barrier. The function of the curtain is twofold:

- Retarding the flow of groundwater between contaminant source zones (the production areas on site) and the down hydrogeological gradient receptor – the Derwent Estuary
- Impeding saltwater incursion into the extraction zone of influence.

The layout of the extraction system is presented within the figure below, overlain with modelled hydraulic head within the unconfined aquifer, using measurements taken from the Q4 2024 monitoring round.

Figure 4-60 Location of PG Dryer Extraction System

The curtain itself was constructed via the drilling of bore holes, with a grout mix injected into void sealing the horizontal and vertical fractures through which groundwater travels. Each hole was advanced to a nominal depth of 30 m below ground surface.

Following the completion of the grout curtain, the horizontal bore was drilled up hydrogeological gradient of the curtain, to collect the groundwater 'dammed' by the grout curtain.

The horizontal collection drain is 140 mm wide, and is intersected by a 600 mm vertical extraction well from where the groundwater is pumped to the site's contaminated water circuit.

The concentration of zinc and cadmium within abstracted water is displayed in the figure below. Breaks in the plotted concentration lines indicate periods of pump inactivity. Generally, the concentration was found to be relatively consistent, at approximately 1800 mg/L zinc and 20 mg/L cadmium.

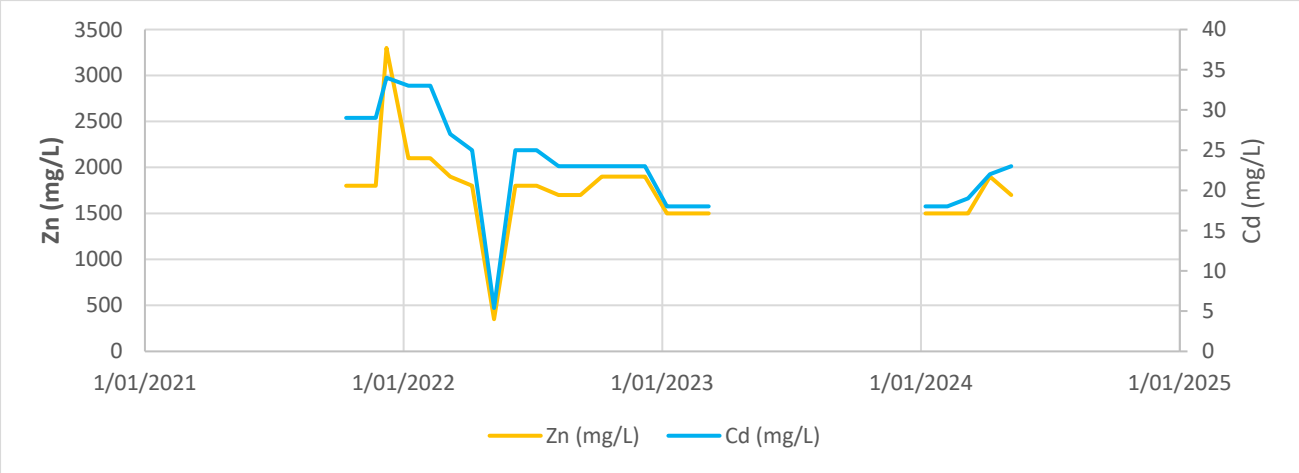


Figure 4-61 Metal concentrations in groundwater extracted from the PG Dryer Extraction System

On 3 February 2022 the pump was operating at 3.87 m^3/h. At this abstraction rate, monitored head within the extraction well remained constant. This observation indicates that on this day, inflow into the extraction system matched the discharge. It is expected that inflow into the extraction system will fluctuate at steady state due to seasonal variation, however the observation indicates that the predicted stabilised yield of 83 m^3/d was relatively close to the measured yield of 93 m^3/d.

Since the commissioning of the extraction system, pump reliability has been a cause of concern. Investigations indicate one issue is the accumulation of solids, believed to be residual drilling fluid exiting the formation and adhering to pump components, as seen in the figure below. Electronic scale inhibition technology was trialed during the reporting period however this did not yield the desired results.

In March 2023, the pump experienced an electrical malfunction internally. Persistent electrical, mechanical and instrumentation issues have hindered the operational capabilities of the extraction system. The system was restarted in December 2024.

Figure 4-62 EB05 pump components. Left; inlet to foot valve. Right; one of the three impellers

4.3 Receiving Waters

4.3.1 Water Quality Monitoring

4.3.1.1 Water Quality Monitoring Background

NH interacts with the Derwent Estuary in a number of ways, including:

- Estuarine water extraction for tail gas scrubbing;
- Effluent discharged from the tail gas scrubbers and effluent treatment plant (ETP); and
- Passive discharge of contaminated groundwater.

NH is a key member of the Derwent Estuary Program (DEP). The DEP was established in 1999 as a partnership between state and local government and industry partners (NH, Norske Skog, Entura (Hydro Tasmania) and TasWater) to provide a management framework for the restoration and protection of the Derwent Estuary. NH has a strong involvement in the program through collaborative monthly monitoring, attendance at regular taskforce meetings and commitment of resources and funding.

NH monitors the potential impact of site operations by sampling estuarine water quality and estuarine benthic sediments in accordance with The Permit. The receiving water quality and sediment sampling program is integrally linked with the NH estuarine biota monitoring program (refer Section 4.3.2– Biota).

To assess the impact of the point source discharge from the site, NH maintains a mixing zone sampling program around the permitted discharge point at the foreshore outfall (Figure 4-63). The aim of this program is to confirm that sufficient dilution of effluent has occurred within the mixing zone in order to meet Tasmanian State Water Quality Objectives at the boundary of that zone. Sampling sites within the mixing zone were used to define the mixing zone in 2001.

Figure 4-63 Point source mixing zone boundary

NH monitors pH levels monthly at the boundary of the defined mixing zone to ensure the minimum pH requirement of 7.0 (as the indicator of dispersion) is being met in accordance with permit requirements (refer to Table 4-15).

Table 4-15 River Monitoring program parameters

Emission point / monitoring location	Monitoring and sampling frequency	Monitoring parameters	Regulatory limits that must not be exceeded	Reporting
Derwent Estuary interim mixing zone boundary	Monthly Minimum of four samples at boundary locations likely to be impacted by mixing plume.	pH	Not less than pH 7 under any degree of influence of NH treated waste water	Annually *
Water quality: U3, U4, U5, U7, PWB, NTB1, NTB2, NTB5	Monthly	Zn, Cd, Hg, TSS, Cu, Pb	None specified	Annually *
New Town Bay sediments: NTB01, NTB02, NTB08, NTB10, NTB12	Annually	Zn, Cd, Hg	None specified	Annually *

* If results indicate non-compliance with regulatory limits, reporting must be within 24 hours of monitoring results becoming available. Report on an annual basis via Annual Environmental Review.

4.3.1.2 Water Quality Monitoring Program Details

Water grab samples are collected monthly in the Derwent Estuary from two depths: 0.1 m below the water surface and 1 m above the estuary floor (benthos). The monitoring sites are shown in Figure 4-64 and Figure 4-65. Samples are analysed at a NATA certified laboratory for total zinc, cadmium, mercury and suspended solids.

Results for these parameters are assessed with respect to ANZECC guidelines[5] using the 80% protection level for highly disturbed ecosystems as given in Table 4-16.

Additional physio-chemical field measurements (pH, salinity, temperature and dissolved oxygen) are taken using a MiniSonde™ Hydrolab at 1 m intervals through the water column starting at the water surface.

Monitoring is conducted in accordance with the procedure Estuarine Sampling (HP-826-00731), which includes duplicate sampling and field blanks for quality control purposes and ensures compliance with relevant Australian Standards[6].

Sediment samples are collected annually at five NTB locations, with sampling protocols also outlined in the estuarine sampling procedure. Sediment grab samples are collected using a pipe dredge, which samples the top 3–4 cm of sediment.

Samples are sent to the NH laboratory for analysis of total zinc, total cadmium and total mercury. Results are viewed with respect to the ANZECC guidelines for sediment quality given in Table 4-16.

[5] Australian and New Zealand Environment and Conservation Council, Australian Water Quality Guidelines for Fresh and Marine Waters, 2000.
[6] AS/NZS 5667.9; 1998 Water Quality – Sampling, Part 9; Guidance on Sampling from Marine Waters and Part 12; Guidance on Sampling of Bottom Sediments.

Table 4-16 ANZECC water quality guidelines for marine waters (2000)

Analyte	Sediments		Water
	Effects range low (adverse effects 10% of the time) mg/kg	**Effects range high (adverse effects 50% of the time) mg/kg**	**80% protection level μg/L**
Total zinc	200	410	43
Total cadmium	1.5	10	36
Total mercury	0.15	1	1.4
Total Copper	65	271	8
Total Lead	50	220	12

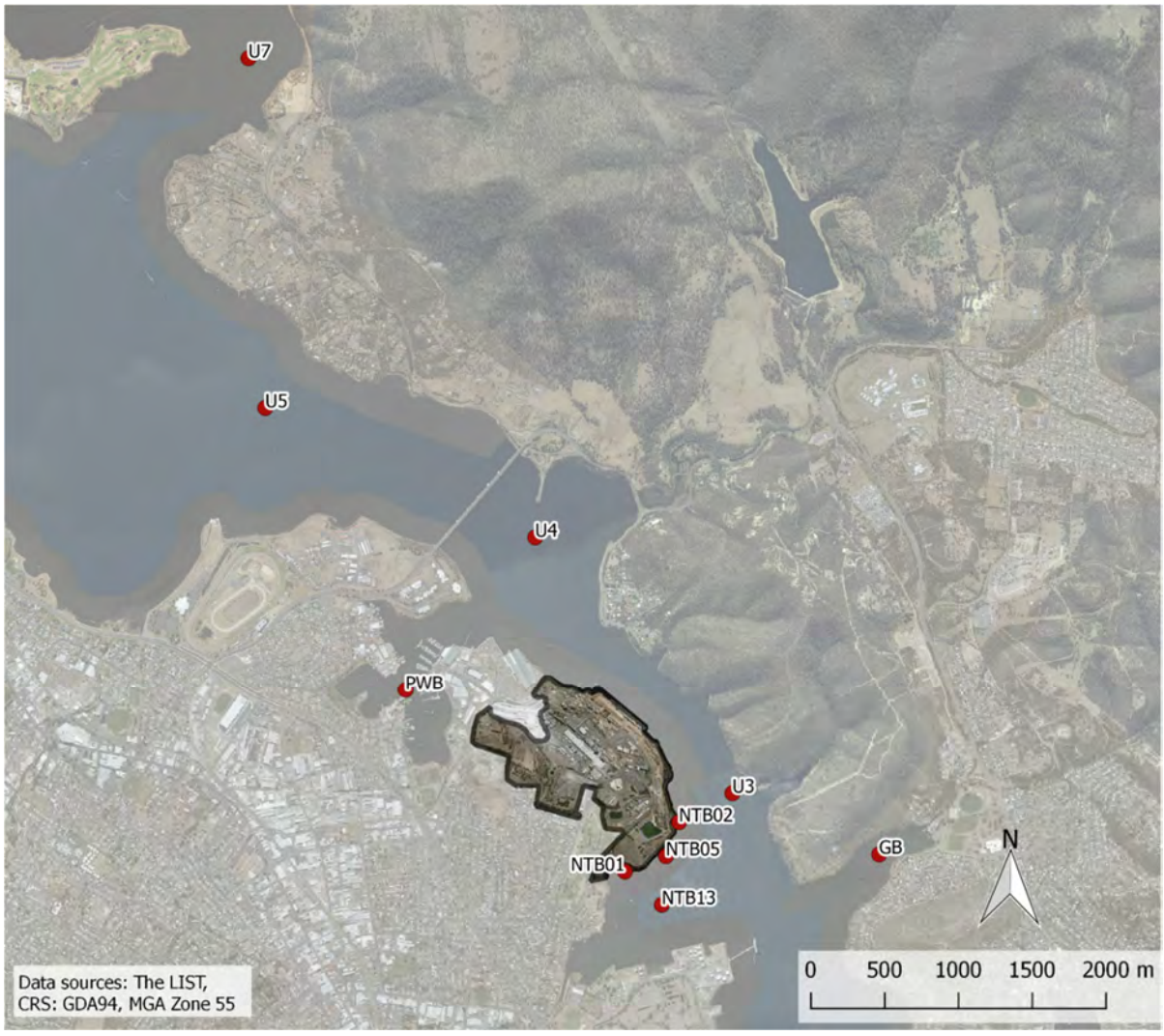


Figure 4-64 Derwent Estuary water quality monitoring sites

Figure 4-65 New Town Bay water and sediment quality monitoring sites

4.3.1.3 Water Quality Monitoring Results & Discussion

Ambient Water Quality Monitoring

The monthly surface water quality monitoring across the 2022-2024 reporting period showed typically higher heavy metal concentrations in surface waters in comparison to benthic samples at New Town Bay (NTB) sites, with less stratification evident in the estuary proper (Figure 4-66). This pattern of metal concentration has been evident since monitoring began.

Average zinc concentrations across all estuarine monitoring sites were found to be below the ANZECC 80% protection level trigger value of 43 μg/L at both surface and depth, with respective surface and depth values of 42.23 μg/L and 20.16 μg/L (2022), 35.15 μg/L and 16.92 μg/L (2023), and 35.93 μg/L and 19.60 μg/L (2024). There is a reasonable consistency in the average surface sample concentrations year on year with a standard deviation of 3.88 μg/L within the reporting period. The average depth sample concentration was also relatively consistent with a standard deviation of 1.75 μg/L between 2022 and 2024. These results show greater variation than the 2019-2021 reporting period (2.38 μg/L and 0.65 μg/L surface and benthic respectively).

The average zinc concentration at surface level at NTB sites was 65.26 μg/L, this has increased when compared to both previous sampling period (50.99 μg/L 2019-2021) and the past 10 year average (53.09 μg/L 2015-2024). These levels exceed the guideline value of 43 μg/L. During the reporting period, NTB01 readings

exceeded guidelines on 20 out of 33 occasions, NTB02 on 29 of 33 occasions, NTB05 on 24 of 33 occasions and NTB13 on 25 of 33 occasions. NH will continue to monitor and assess these sites and determine if further assessment is required in order to manage the increased surface zinc concentrations. Concentration levels at depth at NTB were found to be considerably lower than those recorded at the surface. At NTB sites a 5.44 μg/L increase in average benthic zinc concentration sites from the 2019-2021 reporting period was observed.

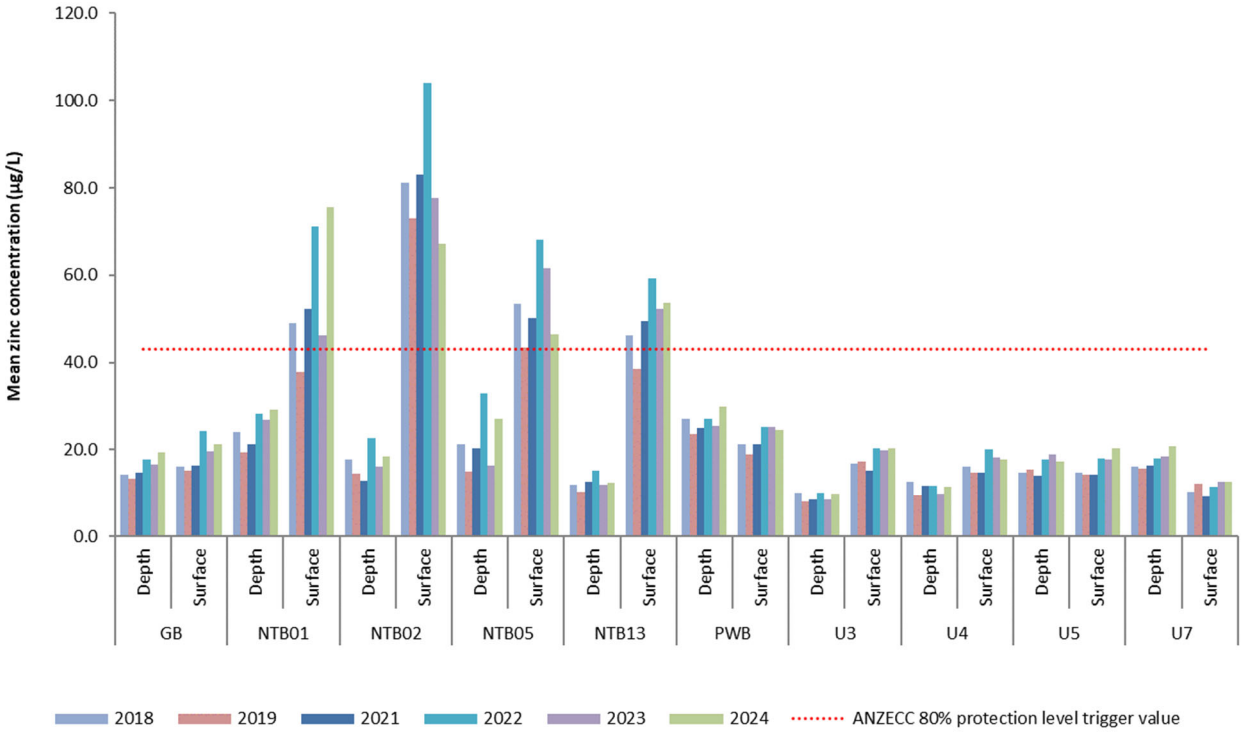


Figure 4-66 Total zinc in surface and bottom water quality samples at estuarine monitoring sites

As depicted in Figure 4-67, there was a significant increase in Total Suspended Solids (TSS) from 2021 to 2022 at most monitoring sites, both at depth and surface. This was followed by a decrease in 2023 and a small increase in 2024. Depth samples at NTB02, NTB13, U3 and U4 did not follow this trend, showing only minor change from 2021 to 2022, and an increase from 2023 to 2024. Surface samples at U3 and U5 showed a small decrease from 2023 to 2024. Overall we observe an average surface TSS of 4.40 mg/L at surface and 4.10 mg/L at depth, the 10 year average (2015-2024) is 4.98 mg/L and 5.09 mg/L respectively, indicating an overall downward trend for TSS.

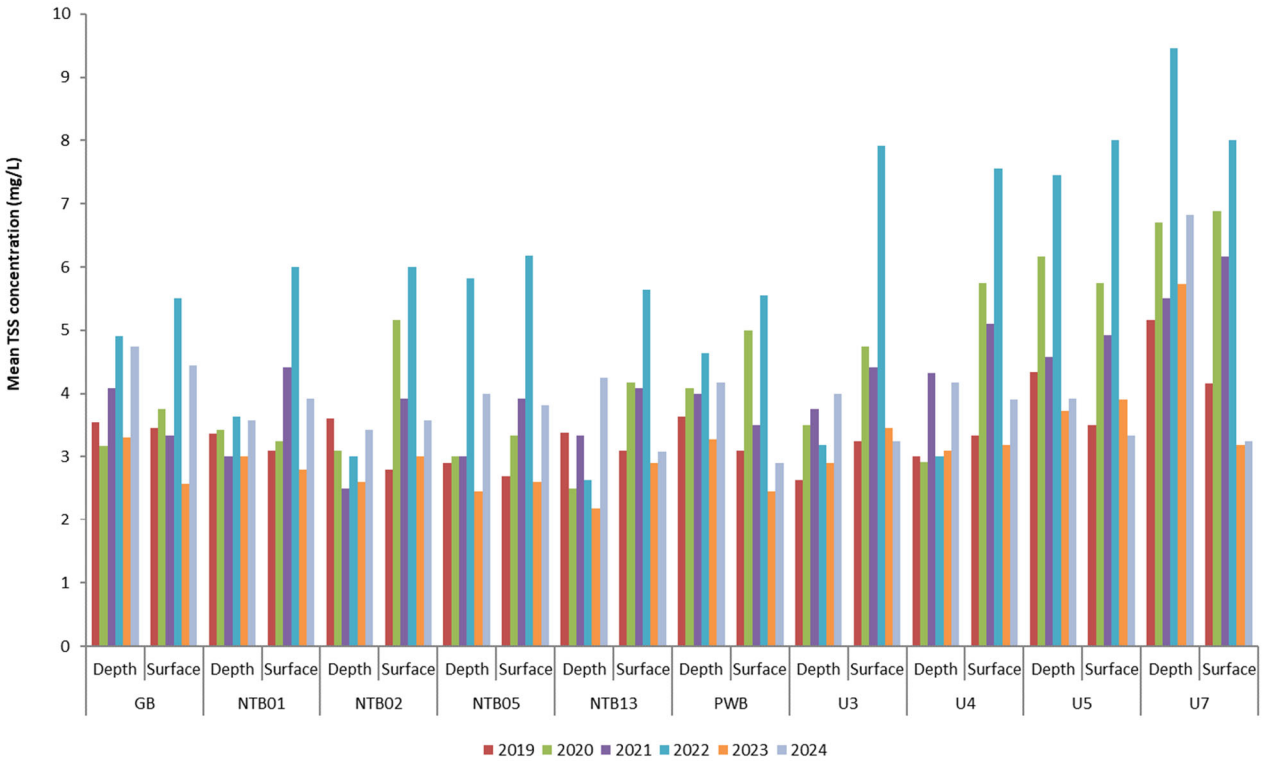


Figure 4-67 Total TSS in surface and bottom water quality samples at estuarine monitoring sites

Mercury, copper, cadmium and lead are monitored monthly in line with the River Monitoring program parameters (refer Table 4-15). The following instances where metals were recorded above the laboratory limit of reporting (LOR) and ANZECC 80% protection level trigger value are listed below, results from the 2019-2021 reporting period are included for comparison.

In the 2022-2024 reporting period mercury levels above the LOR (0.05 μg/L) were recorded on three occasions, all occurring at U7. None of these exceeded 0.07 μg/L, and thus were all well below the guideline of 0.15 μg/L. In the 2019-2021 period, there were two detects, one of which exceeded the guideline.

Of the 30 reports of copper above the LOR (2 μg/L) in the reporting period, there were five exceedances of the guideline value (8 μg/L), two of these occurred at NTB02 at depth, (11 μg/L 20/12/2022 and 176 μg/L 22/02/2024), one occurred at PWB (11 μg/L 21/02/2023), one at U3 (14 μg/L 21/02/2023) and one at GB (16 μg/L 19/03/2024). In the 2019-2021 period, there were 20 detects, two of which exceeded the guideline.

Lead was detected above the LOR and guideline of 12 μg/L at depth at U4 on 17/01/2023 with a value of 15 μg/. In the 2019-2021 reporting period no samples were detected above LOR.

No cadmium was detected above LOR at any monitored site in the 2022-2024 reporting period, a decrease from two detects in the 2019-2021 period.

Point Source Discharge: Mixing Zone pH

Routine monthly sampling of pH is undertaken at the mixing boundary zone. The yearly pH results demonstrate that during normal plant operating conditions, adequate dispersion of foreshore scrubber outfall (FSO) effluent is being achieved at the boundary of the mixing zone under all monitored tidal and plant operations. The pH ranged between 7.0-8.2 at the upstream and downstream boundaries of the mixing zone during the 2022-2024 reporting period.

New Town Bay Sediment Quality

Results from annual monitoring of NTB sediment samples in relation to past years are shown in Figure 4-68 to Figure 4-70.

Routine sampling since 2000 has shown concentrations of zinc, mercury and cadmium in NTB sediments to be substantially higher than the ANZECC guidelines. Despite this, testing carried out by DEP[7] in 2007, has shown that although heavy metal contamination in estuarine sediments is high in NTB, heavy metals are typically chemically bound to the sediment or other organic materials and are not usually biologically available (hence the lower heavy metal content in bottom water in the bay as compared to surface waters).

The source of these contaminants was also shown to be predominantly historical contamination, although fugitive dust, diffuse groundwater inflows and point source inflows do currently add to the bound and soluble metal levels within the estuary.

Results from the annual sampling program indicated that total zinc, mercury and cadmium levels all showed some variability with no observable definitive trends through time.

In a recent report published in 2020 by DEP[8] , it was notably reported that sediment coring and surface sediment sampling from a site adjacent to NH found decreased zinc concentrations to 13% of the recorded historical maximum for this location. Overall, the testing gave evidence that zinc and lead concentrations were steadily decreasing, indicating the successful reduction efforts in reducing metal-contaminated effluent entering the estuary since the 1970s. This could likely be contributed to the gradual burial of metal-contaminated sediments along with other NH actions to reduce metal input loads.

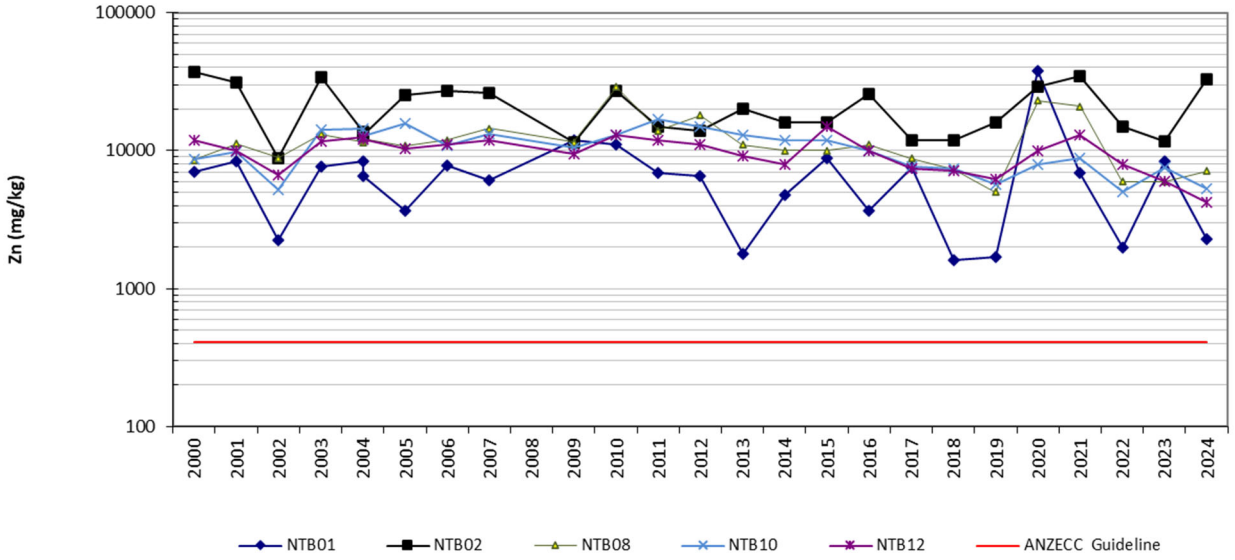


Figure 4-68 Total zinc concentrations in New Town Bay sediment

[7] DEP (Derwent Estuary Program), 2007, Derwent Estuary Water Quality Improvement Plan Stage 2: Heavy Metals and Nutrients.
[8] State of the Derwent Estuary 2020 Update

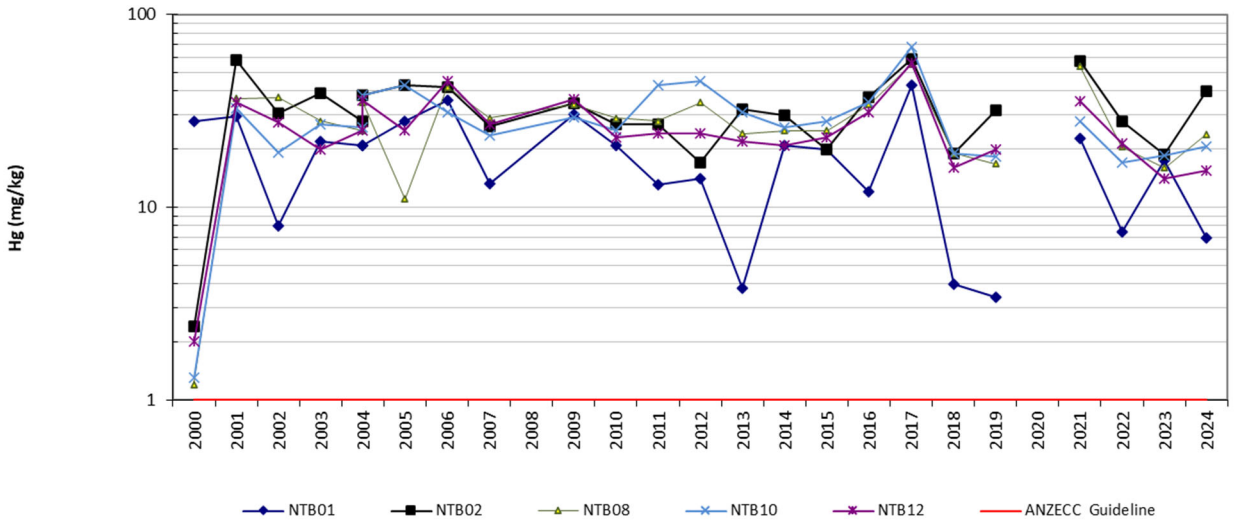


Figure 4-69 Total mercury concentrations in New Town Bay sediment

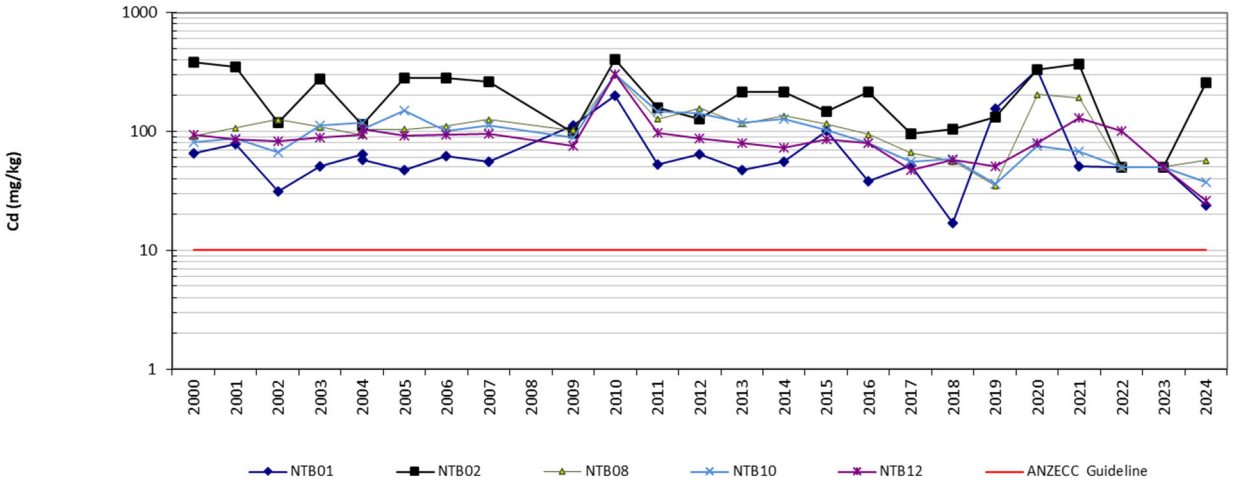


Figure 4-70 Total cadmium concentrations in New Town Bay sediment

4.3.2 Biota

4.3.2.1 Biota Monitoring Program Background

The NH biota monitoring program is comprised of three components – annual deployed oyster monitoring, biennial wild fish sampling, and triennial wild shellfish sampling. The aim of the program is to assess the concentrations of various heavy metals in seafood. The information recorded has also been used to provide seafood consumption advisory notices to the general public.

4.3.2.2 Biota Monitoring Program Details

Deployed Oysters

Oysters of the same known age are sourced from a commercial shellfish operation on the north-west coast of Tasmania (to ensure sound baseline conditions). A minimum of 20 individuals are analysed with no estuarine deployment to give a baseline for accumulation of metals.

The remaining oysters were housed in plastic mesh cages with approximately 25–30 individuals per cage (with the additional 5–10 oysters to account for any mortality). Cages are deployed at nine nominated locations in the middle Estuary and one background location at Bruny Island (refer Table 4-15 and Figure 4-72). The oysters are secured sub-tidally to existing structures as close to the bottom as possible.

Triple deployment through the water column is conducted at three locations with cages secured at the bottom, mid-point and surface (remaining sub-tidal to ensure 100% exposure) of the water column.

Deployed oyster cages are retrieved after six weeks. Twenty oysters are shucked, flushed with distilled water and combined to form a single sample for each location. Retrieved samples plus the control sample are then submitted to a NATA accredited laboratory and analysed for heavy metals including zinc, cadmium, lead, mercury and copper.

Fish

The common sand flathead (*Platycephalus bassensis)* was selected as a target species as they are resident in the estuary for their entire life cycle (i.e. they are not migratory).

Fish are caught under a permit issued under Section 14 of the *Living Marine Resources Management Act 1995* specifically granted for the purposes of heavy metal monitoring.

Flathead sampling is conducted during the same months every even numbered year (August–September) to minimise seasonal variations in hydrology and life cycles.

In 2015, the flathead monitoring program was reviewed by scientific officers with the Derwent Estuary Program. The review resulted in the program moving from annual to biennial, with the addition of selenium analysis and fish aging by assessment of otoliths. New catch sites were recommended, with these shown in Table 4-18. The sampling program consists of obtaining a minimum of 20 *P. bassensis* individuals by handline fishing, at each of the five sampling regions (refer Table 4-18 and Figure 4-71).

Individual fish were measured from snout to tail fin base, filleted (no gut tissue included), then frozen and sent for metal analysis at a NATA certified laboratory. Results for the individual samples were averaged to give a single result for the different metals at each of the five sampling regions.

Results are compared to the Food Standard Australia New Zealand (FSANZ) *Food Standards Code* (2016) and the Food Standards Code *Additional Guidelines for Generally Expected Levels (GELs) for Metal Contaminants* (2001) (refer Table 4-17). The heads of each fish was retained, frozen, and send to the University of Tasmania (Institute of Marine and Antarctic Studies division) for aging by the processing of the otoliths. Previously, the size of the fish was taken as an indicator of age. However, this is not considered to be reliable indicator, and thus, the accurate age information obtained from the otoliths will enable a better understanding of bioaccumulation of metals in fish flesh.

Wild Shellfish

Wild oysters and mussels are collected on a triennial basis to determine long-term trends in heavy metal accumulation.

Wild oysters are collected from 26 locations, and wild mussels from 30 locations throughout the estuary and surrounding waters (refer Table 4-18).

Wild oysters are sampled by randomly taking twenty individuals from the species *Ostrea angasi* or *Crassostrea giga* at each sampling location specified and combining them to form a single sample for each location.

Similarly, twenty individuals of the mussel species *Mytilus galloprovincialis* are taken from each specified sampling location and combined to give a single sample for each site. Composite sampling assists in smoothing variability between individuals to give a representative result.

Samples are then submitted to a NATA accredited laboratory and analysed for zinc, cadmium, lead, mercury and copper. Results are compared to the Food Standard Australia New Zealand (FSANZ) *Food Standards Code* (2016) and the Food Standards Code *Additional Guidelines for Generally Expected Levels (GELs) for Metal Contaminants* (2001) (refer Table 4-17).

The program was conducted in 2023.

Table 4-17 National food guidelines for metal levels in seafood (FSANZ, 2016)

Food Category	***Maximum Levels (mg/kg)***			***Generally Expected Levels median/ 90th percentiles (mg/kg)***	
	Cadmium	**Lead**	**Mercury**	**Copper**	**Zinc**
Mollusc	2	2	0.5	3 / 30	130 / 290 **
Fish	*	0.5	0.5	0.5 / 2	5 / 15

***** No level prescribed in FSANZ guidelines

** Specific for oysters only

Table 4-18 Biota monitoring locations and target species.

Region and location	Location code	Target species: F=fish, DO=deployed oyster, M=wild mussel, O=wild oyster
Upstream Tasman Bridge		
Geilston Bay	GB	DO
Elwick Bay Red Pylon	EBP	DO, M, O
Dowsing's Point	DP	DO, O
Dogshear Point	DSP	M, O, F
Pavilion Point	PP	DO
Bedlam Walls	BW	DO, O, M
Nyrstar Wharf	ZHW	DO
Beltana Beacon	BB	DO, M, O
New Town Bay	NTB	DO, F, M
Cornelian Bay	CB	DO, M, O
Eastern Shore		
Bellerive	BEL	F
Opossum Bay	OB	F
Tranmere Point	TMP	M
Trywork Point	TWP	M, O
Gellibrand Point	GLBP	O
White Rocks	WR	O
Pigeon Holes	PH	M, O
Iron Pot	IP	M, O
Western Shore		
Kingston Beach North	KBN	F
Sandy Bay Beach	SBB	F
John Garrow Light	JGL	M
Cartwright Point	CWP	M
Taroona Beach	TAR	M, O
Blackmans Bay	BLB	O
Fossil Cove	FC	M
Dennes Point	DNP	O, M
Ralph's Bay		
Ralph's Bay Spit	RBS	F
Ralph's Bay	RB	F
Gibsons Point	GBP	M, O
Richardsons Beach (Nth)	RBN	M, O
Maria Point	MAP	M, O
Mortimer Bay	MTB	M, O
Old Lease	OL	M, O
Ice House Bluff	IHB	M, O
Frederick Henry Bay		
Black Jack Rock	BJR	M
Seven Mile Beach	SMB	M, O
Sloping Island	SPI	M
Spectangle Island	STI	M
Carlton River	CR	M, O
Apollo Bay	APB	M, O
Aiken Point	AKP	M, O
Old Ferry Terminal, Barnes Bay	BBFT	M, O
Mickey's Bay	MB	DO, F, M, O

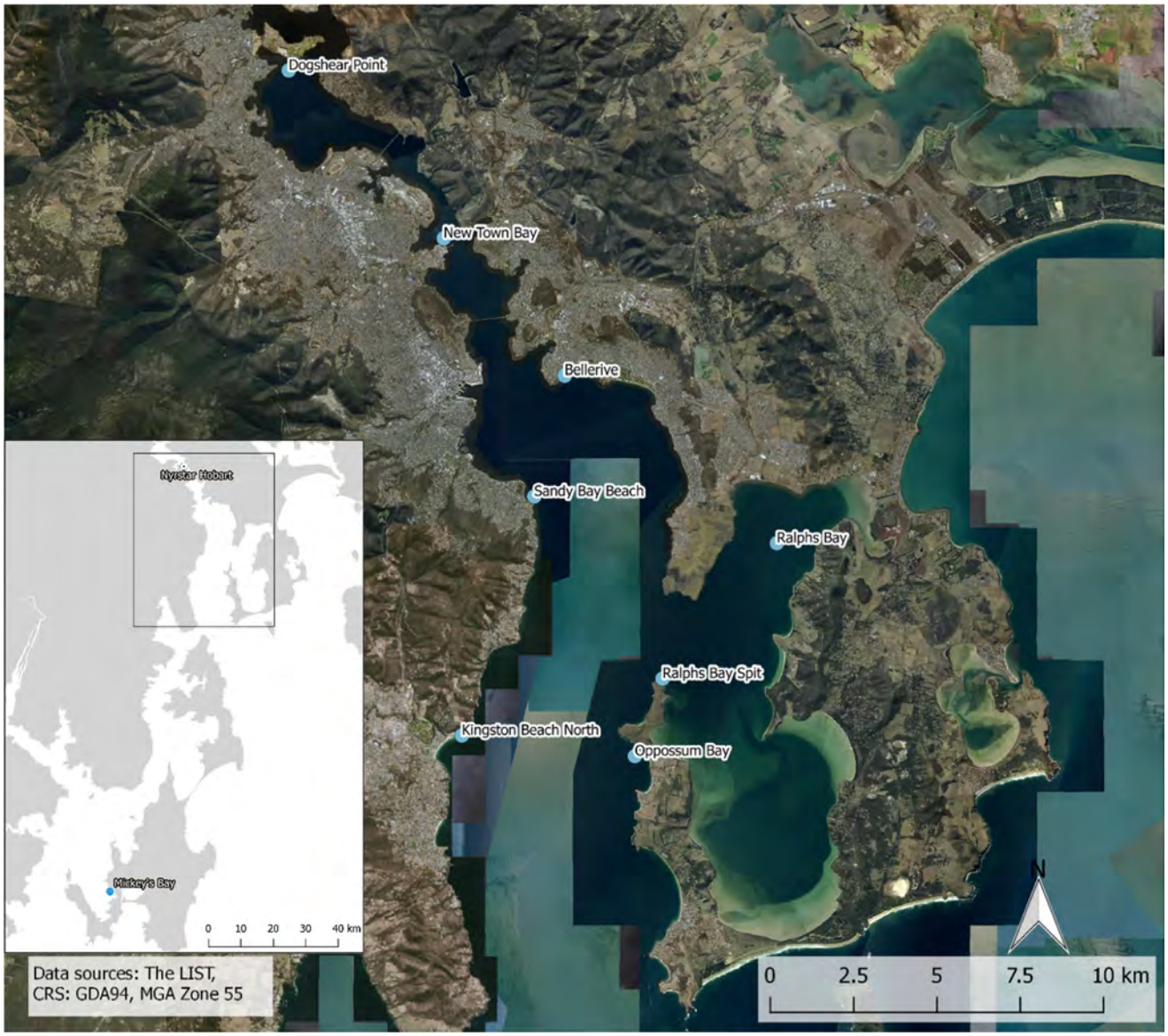


Figure 4-71 Flathead monitoring locations

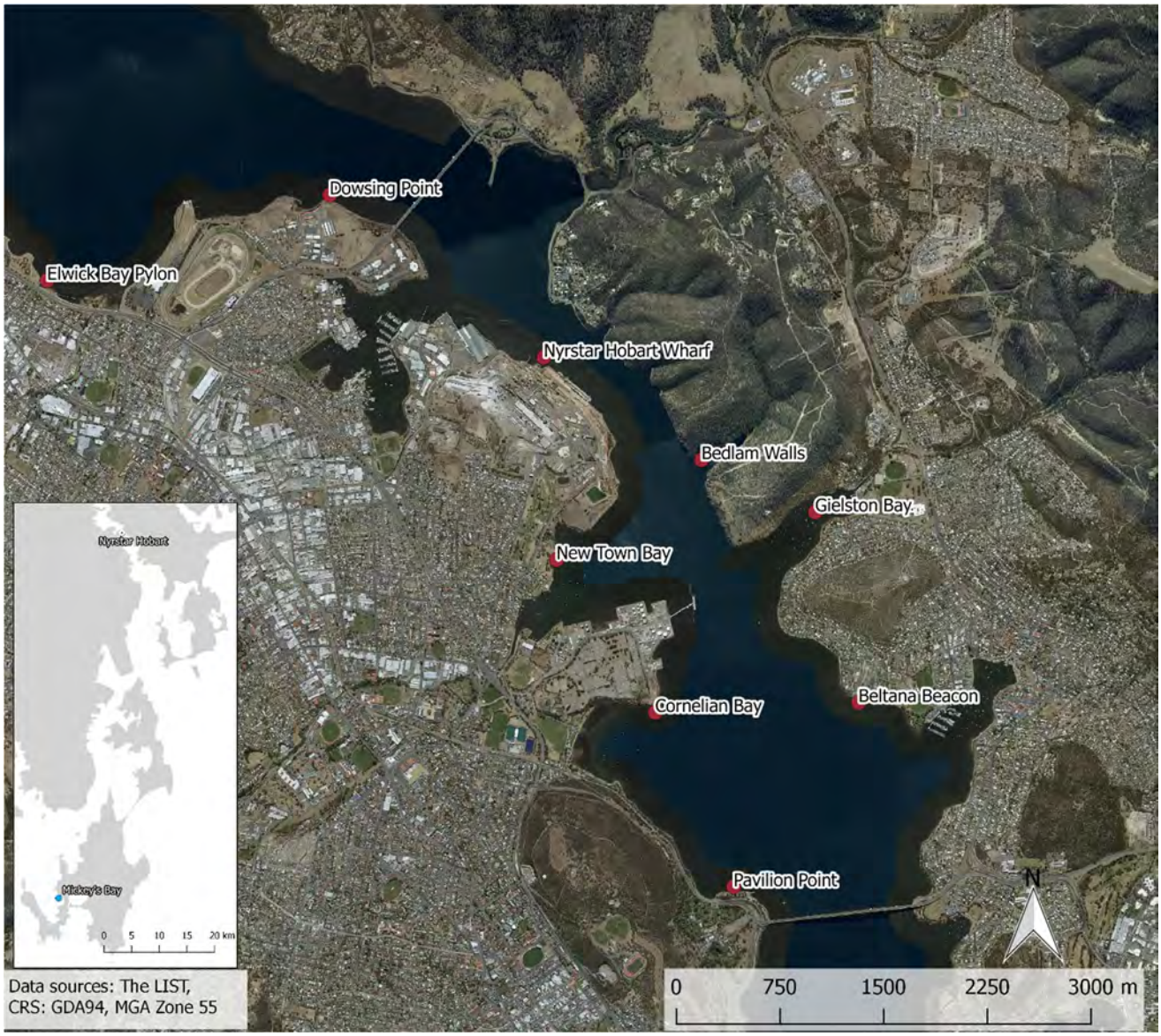


Figure 4-72 Deployed Oyster Sampling Locations

4.3.2.3 Biota Results & Discussion

Deployed Oysters

Figure *4-73* to Figure 4-76 show the accumulation of zinc, mercury, cadmium, lead and copper over the exposure period from the baseline level (deployed oyster control site). The cage that was located in Geilston Bay was removed on the 31/01/2023, as such, Geilston Bay is missing data from 2023.

Changes in zinc concentrations at most locations was comparable to the variability in the control group, indicating no significant change in zinc accumulation, with the exception of Nyrstar Wharf and Pavilion Point, both of which saw increased zinc concentrations over the monitoring period.

Cadmium concentrations decreased or remained consistent at most sites over the reporting period, with the exception of the Nyrstar wharf site which saw a significant increase in concentration.

Lead concentrations decreased overall at all sites excluding Nyrstar Wharf when compared to the previous reporting period. Geilston Bay and New Town Bay show an overall decrease over the three year period, but yearly results may indicate a rising trend that will continue to be monitored.

Copper levels were mostly steady or decreasing, increases were noted at Elwick Bay Red Pylon, Geilston Bay and Mickeys Bay that were comparable to variation in the control group. Significant increases in 2024 were noted at Pavilion Point and the Nyrstar Wharf locations.

The Nyrstar Wharf monitoring location saw a dramatic increase in concentration of zinc, cadmium, lead and copper in 2024, owing to a single extremely high result from the surface sample in that year. The results were an order of magnitude greater than previous years, and represents a second year of elevated zinc for this site.

Mercury levels decreased or remained steady at all sites, There has been a significant decline at the Nyrstar Wharf location in particular, with concentration returning to levels comparable to 2020.

The recent DEP report positively comments on the decline in zinc, mercury and lead in oysters deployed upstream of NH at Elwick Bay and decline in zinc concentrations downstream of NH in Cornelian Bay and Bedlam Walls.

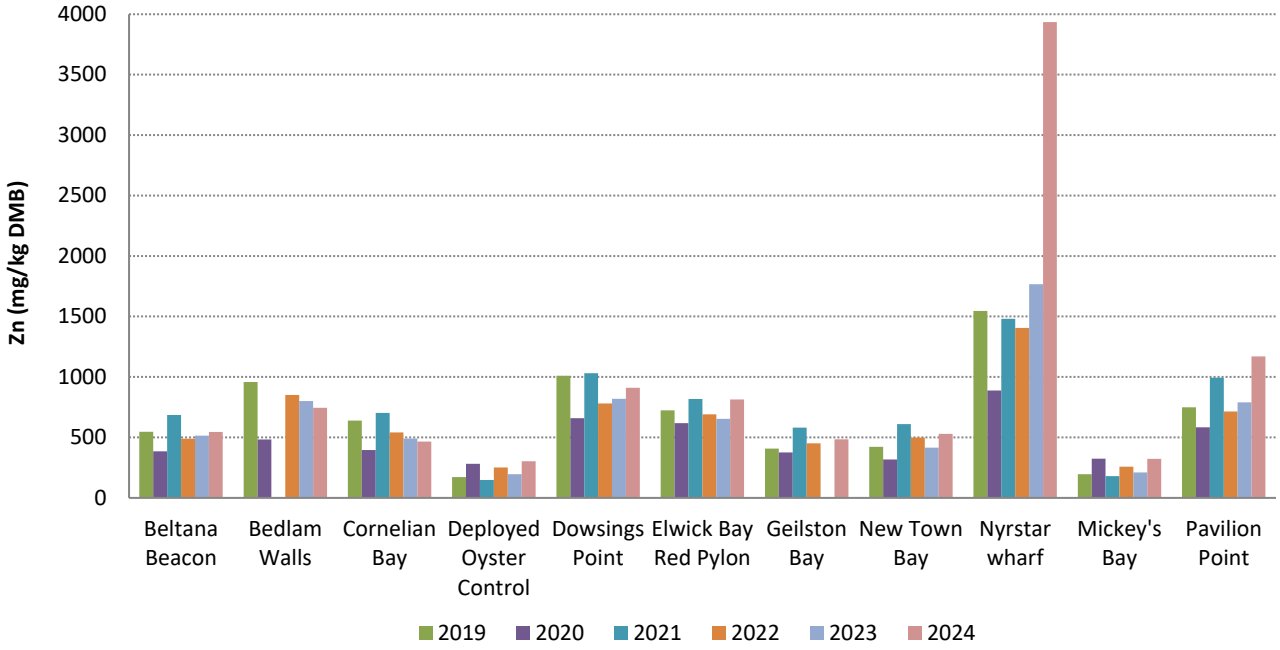


Figure 4-73 Zinc concentration in oyster deployments 2019-2024

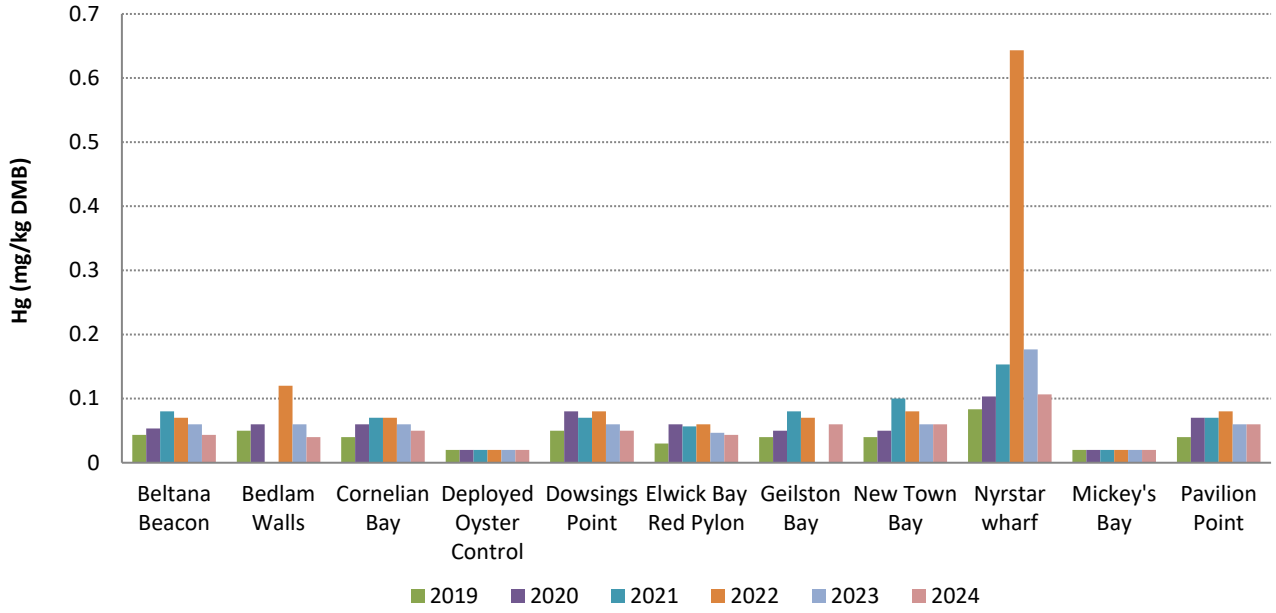


Figure 4-74 Mercury concentration in oyster deployments 2019-2024

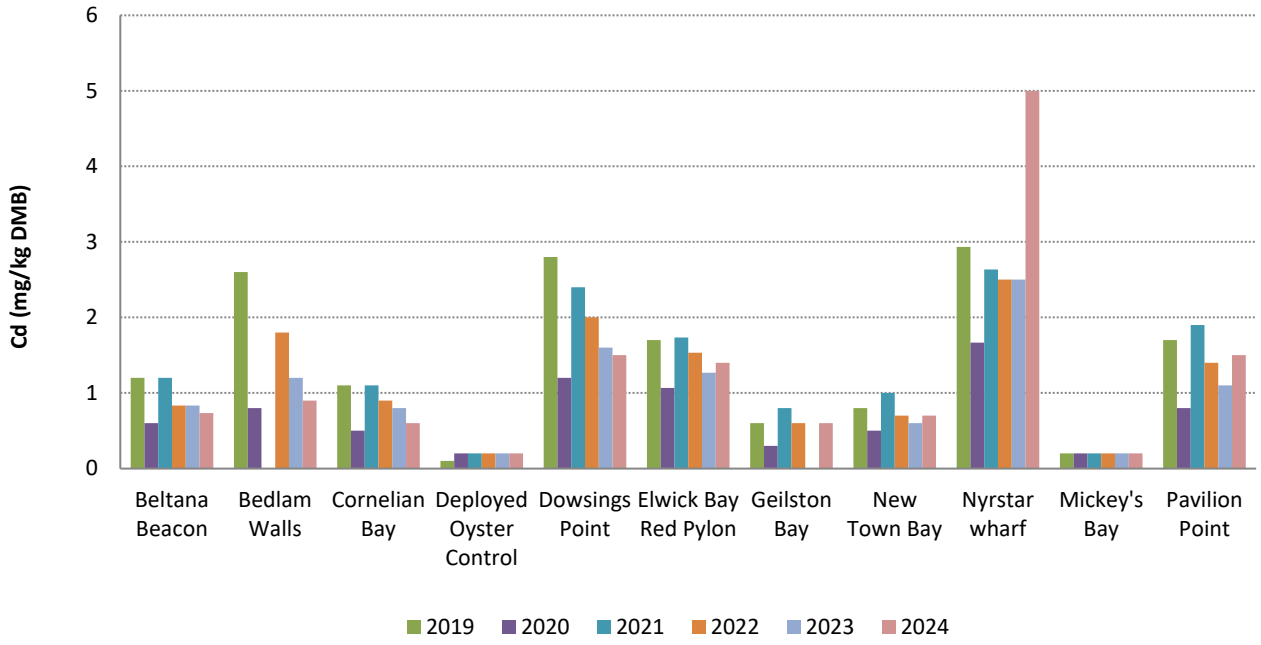


Figure 4-75 Cadmium concentration in oyster deployments 2019-2024

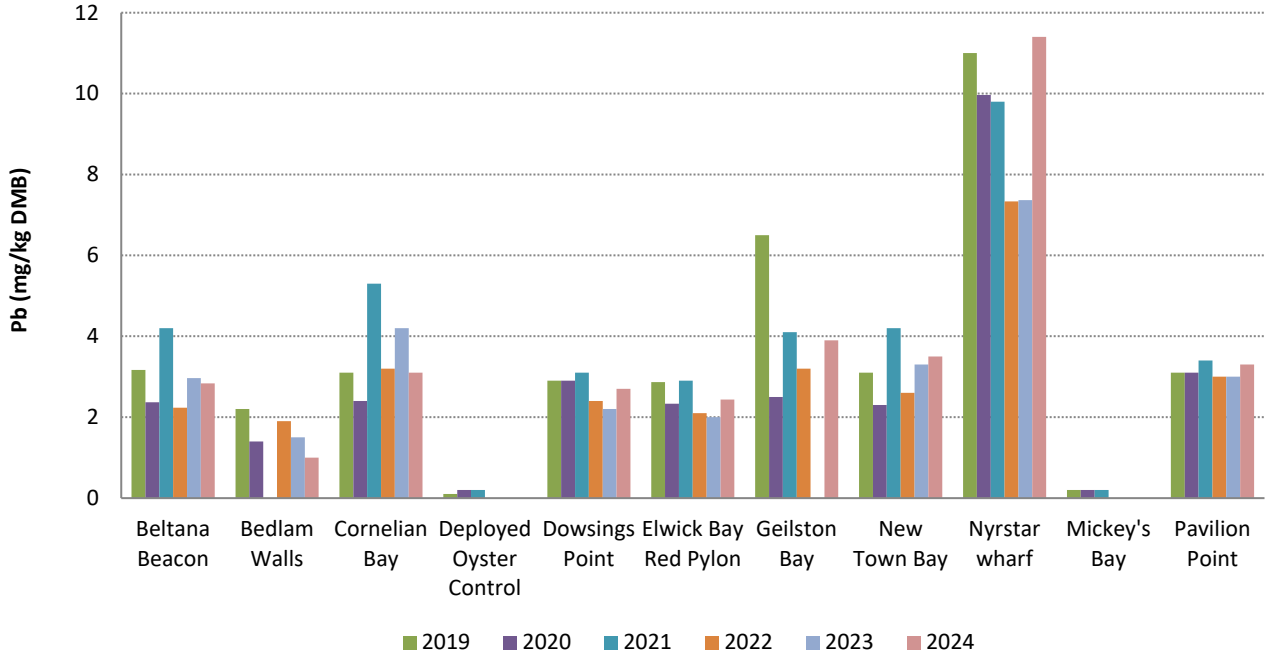


Figure 4-76 Lead concentration in oyster deployments 2019-2024

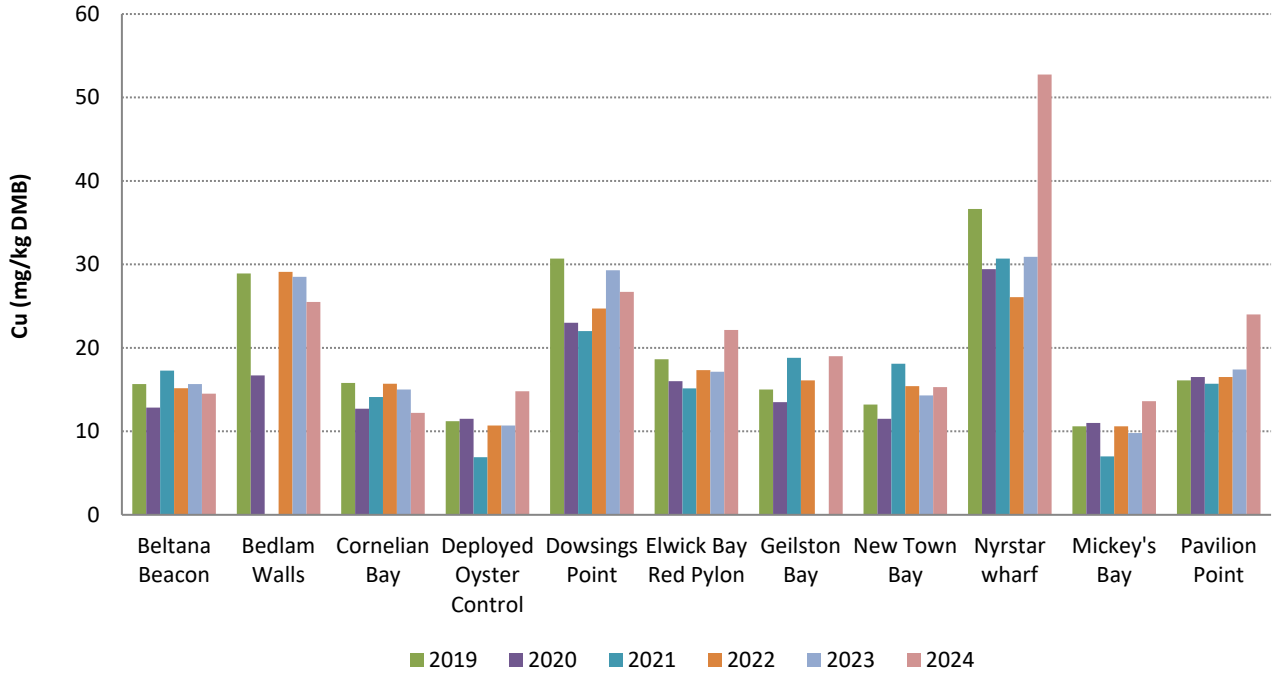


Figure 4-77 Copper concentration in oyster deployments 2019-2024

Figure 4-78 and Figure 4-79 below show the comparison between the surface, middle and benthos results for the deployed oysters at Nyrstar Wharf, Elwick Bay and Beltana, confirming the trends observed above, especially the unusual results at the surface level for the Nyrstar Wharf location.

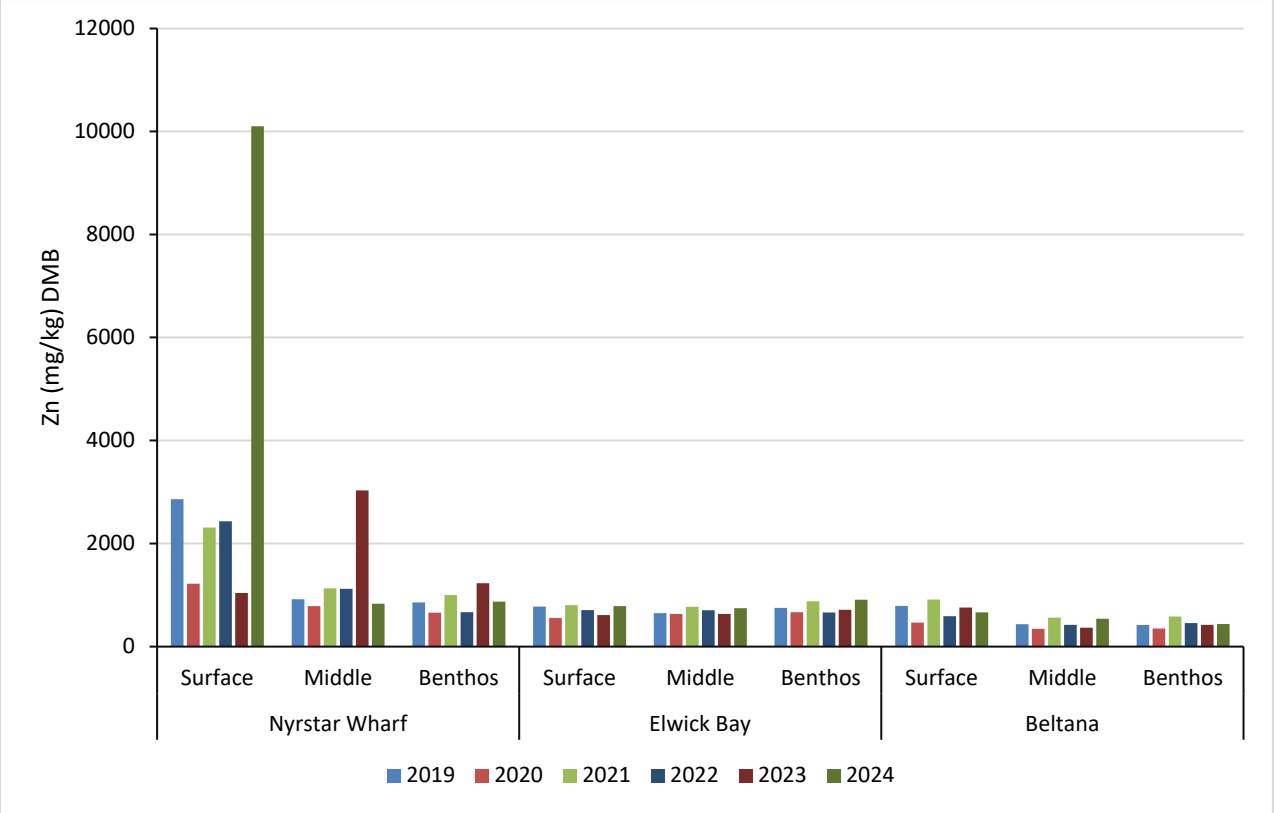


Figure 4-78 Zinc levels from triple deployment of oysters through the water column 2019-2024

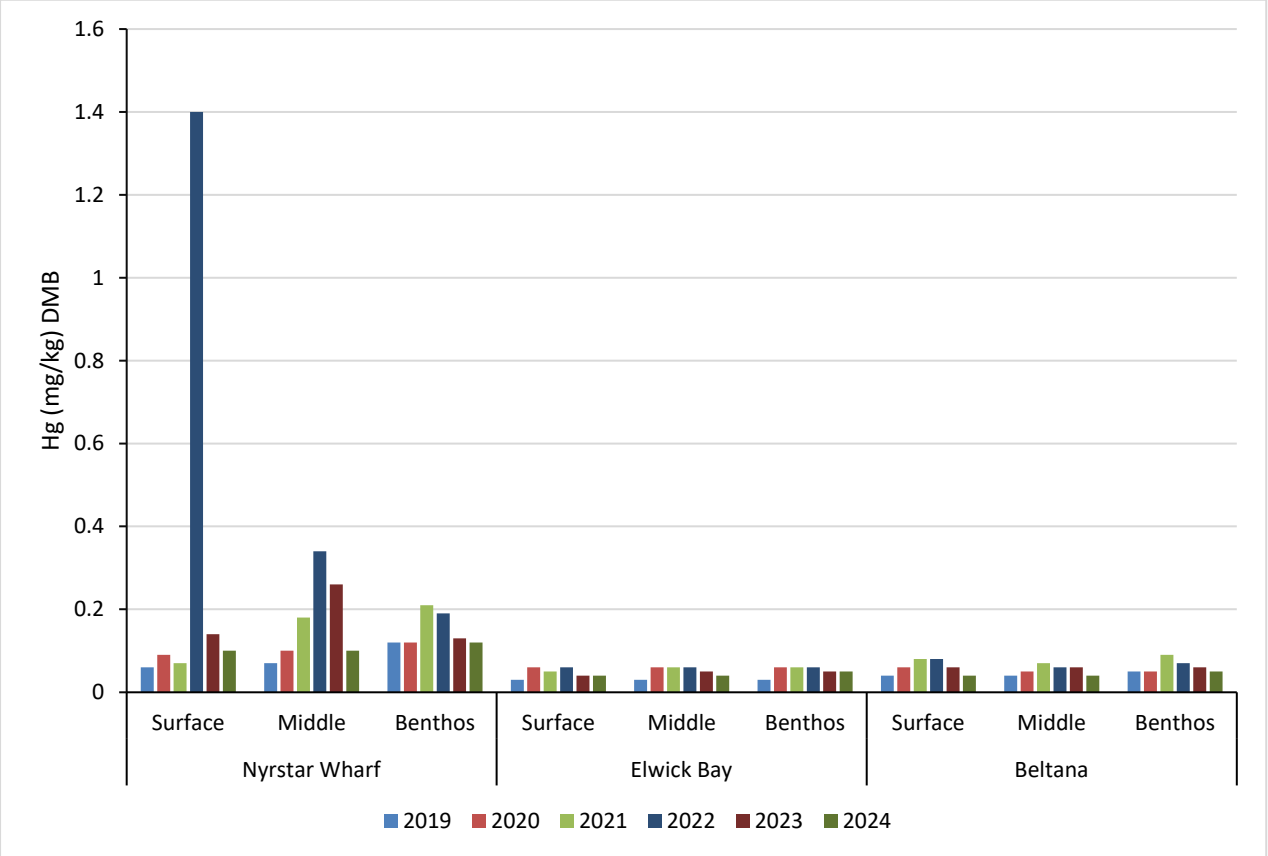


Figure 4-79 Mercury levels from triple deployment of oysters through the water column 2019-2024

Flathead

The collected data for mercury levels in the caught fish Figure 4-80 shows no clear long term trends, although a decrease in median and maximum levels appears to have emerged from 2013 which may indicate gradual improvement, the high variability in this data significantly reduces confidence in any such analysis.

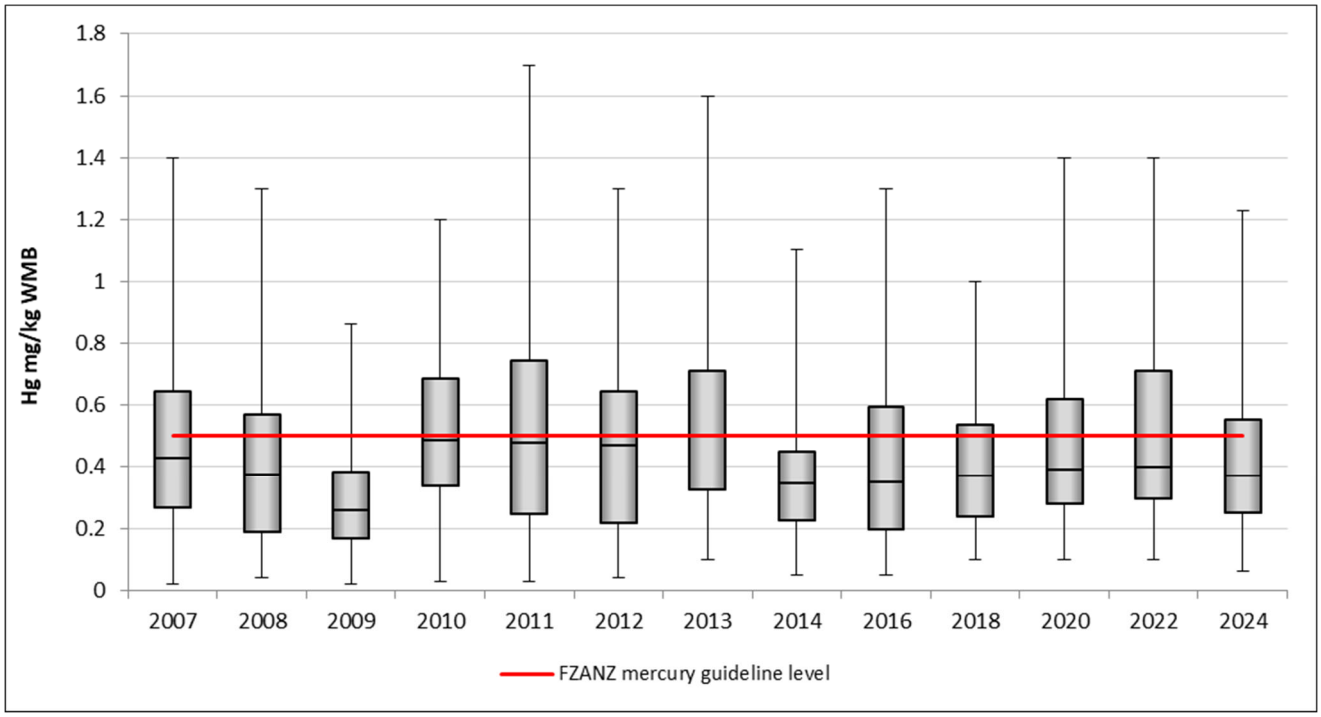


Figure 4-80 Mercury levels from wild caught flathead per year 2007-2024

The inclusion of fish age estimation by otoliths has added another element to the interpretation of these levels. The report[9] into the age estimation of the fish caught in 2024 noted the inconsistent distribution of fish age brackets between survey years, changing environmental conditions and spawning periods, reinforcing the high variability in the characteristics of the flathead samples.

The following advice has been published by the Director of Public Heath:

- Do not consume any shellfish or bream from the Derwent, including Ralphs Bay
- Other fish from the Derwent should not be eaten more than twice a week and the following should further limit their consumption to once a week:
    - Pregnant and breastfeeding women
    - Women who are planning to become pregnant
    - Children aged six years and younger
- When eating fish from the Derwent, it is best to avoid eating fish from other sources in the same week.

[9] Age estimates of Nyrstar's 2024 Southern Sand Flathead samples from the Derwent Estuary, Coulson P. 2025

Wild Shellfish Survey

The triennial wild shellfish survey was conducted in 2023.

Between 2001 and 2020 mercury in wild oysters was showing a gradual decrease, but increased in the 2023 sampling round (Figure 4-81). The median concentration was elevated due to samples collected on the Eastern Shore and Ralphs Bay. Since 2001 lead levels can be observed to be declining in wild oyster samples with 2023 recording the lowest median concentration of lead since monitoring began (Figure 4-82). Figure 4-83 and Figure 4-84 show cadmium and zinc concentrations continue to be consistent with results observed over recent monitoring rounds.

Over the past 23 years, mercury and lead concentration in wild mussels has seen little variation as shown in Figure 4-85 and Figure 4-87. The zinc concentration in wild mussels consistently decreased between 2001 and 2008, and increased across 2011 and 2014. Since then, median concentration has slowly been decreasing as seen in Figure 4-88. Cadmium concentration in 2023 was observed to be consistent with results seen prior to the increase observed in 2014. The median cadmium concentration recorded in 2023 equalled 2020 results, which is the lowest since the monitoring campaign begun (Figure 4-86).

Wild oyster and mussel populations continue to show lead levels in excess of FSANZ maximum level guidelines. Figure 4-84 shows zinc concentrations in wild oysters continue to be well beyond the FSANZ 'generally expected level'. Both wild oyster and mussels continue to record concentrations under the FSANZ maximum level guidelines for mercury (Figure 4-81, Figure 4-85).

Both the wild mussel and wild oyster data suggests shellfish are more contaminated in the upper Derwent Estuary (Upriver of the Tasman Bridge) and along the lower Eastern Shore/Ralphs Bay. Estuarine flows preference the Eastern Shore whilst exiting the river, with heavy metals likely settling out of the water where tidal energy decrease, such as Ralphs Bay. Although heavy metal concentrations are higher along the Eastern Shore and Ralphs Bay, there are no clear trends for the individual monitoring locations within these areas.

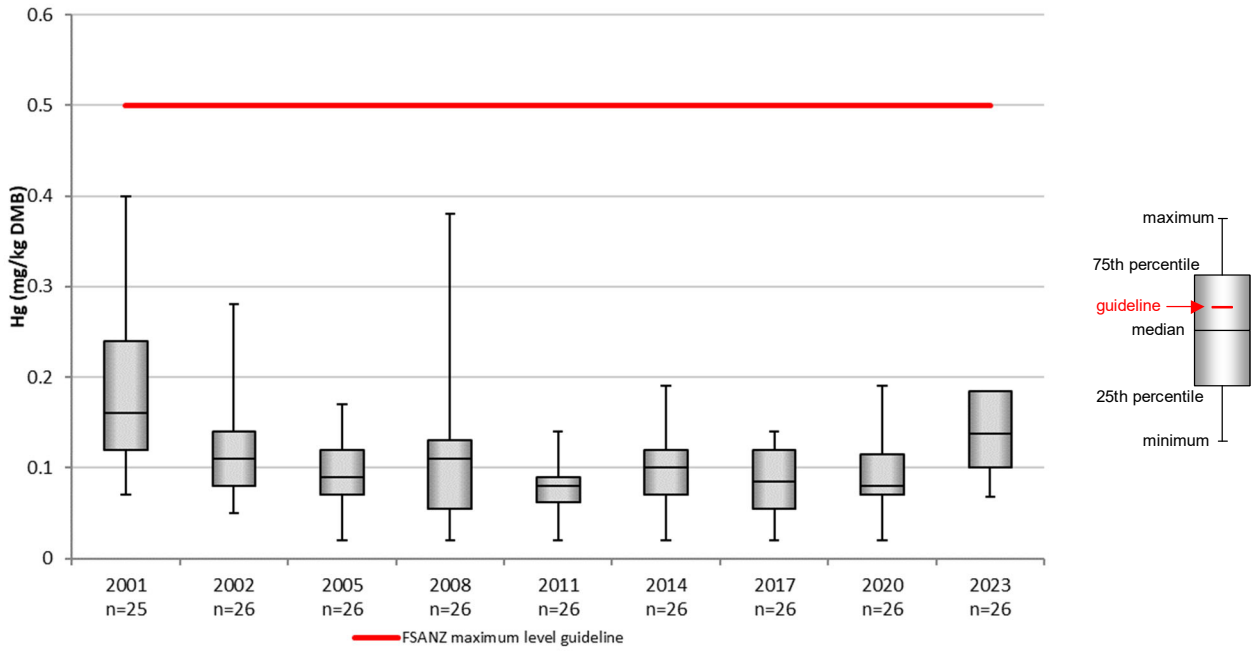


Figure 4-81 *Mercury in wild oysters 2001 – 2023*

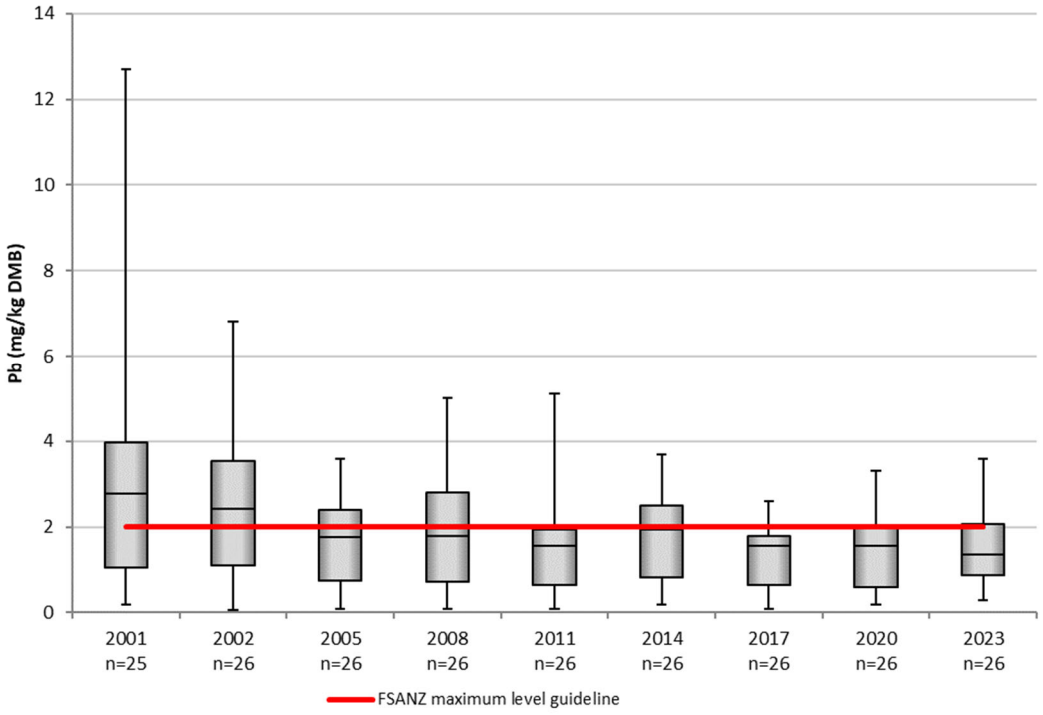


Figure 4-82 Lead in wild oysters 2001 – 2023

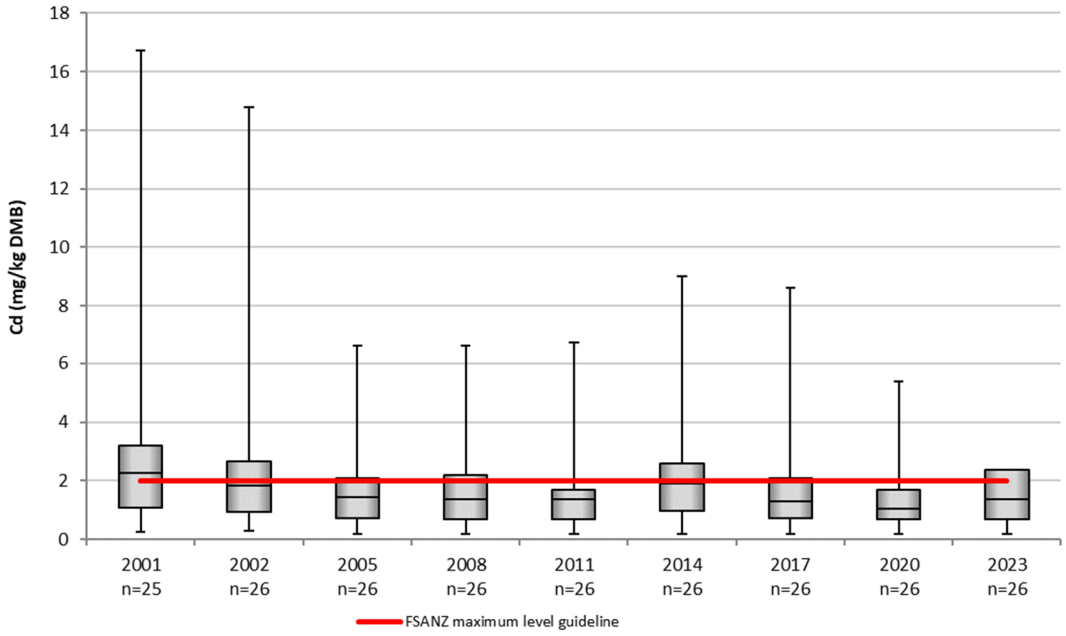


Figure 4-83 Cadmium in wild oysters 2001 – 2023

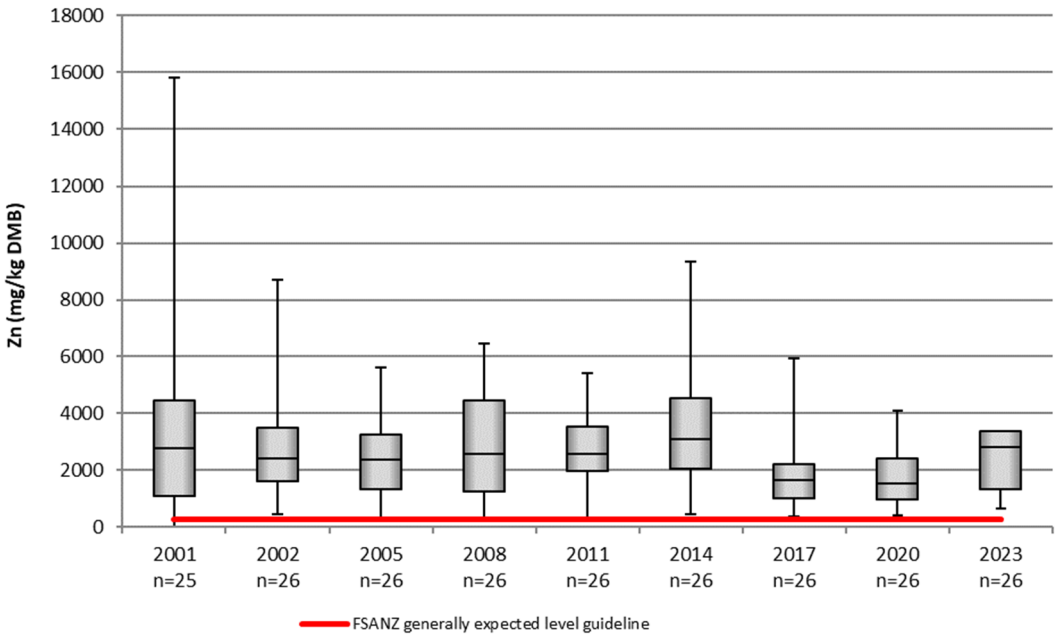


Figure 4-84 Zinc in wild oysters 2001 – 2023

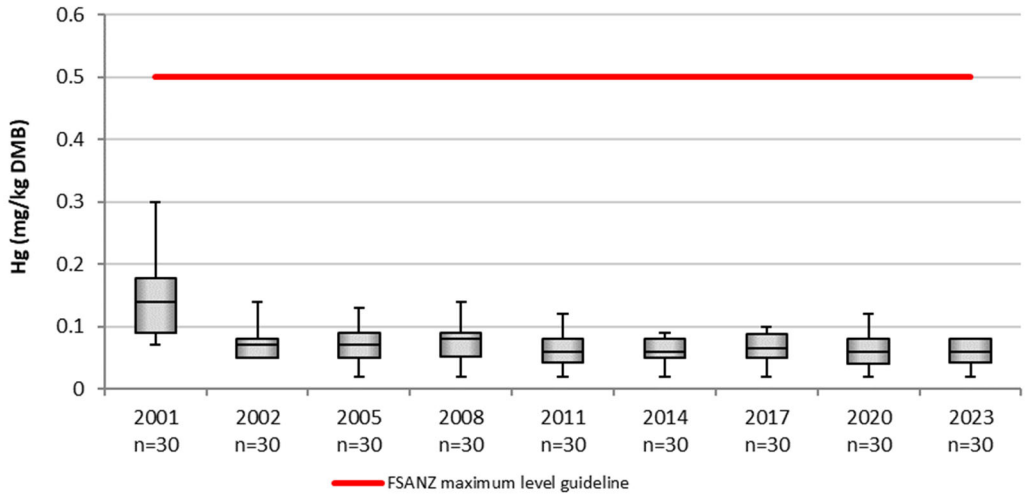


Figure 4-85 Mercury in wild mussels 2001 – 2023

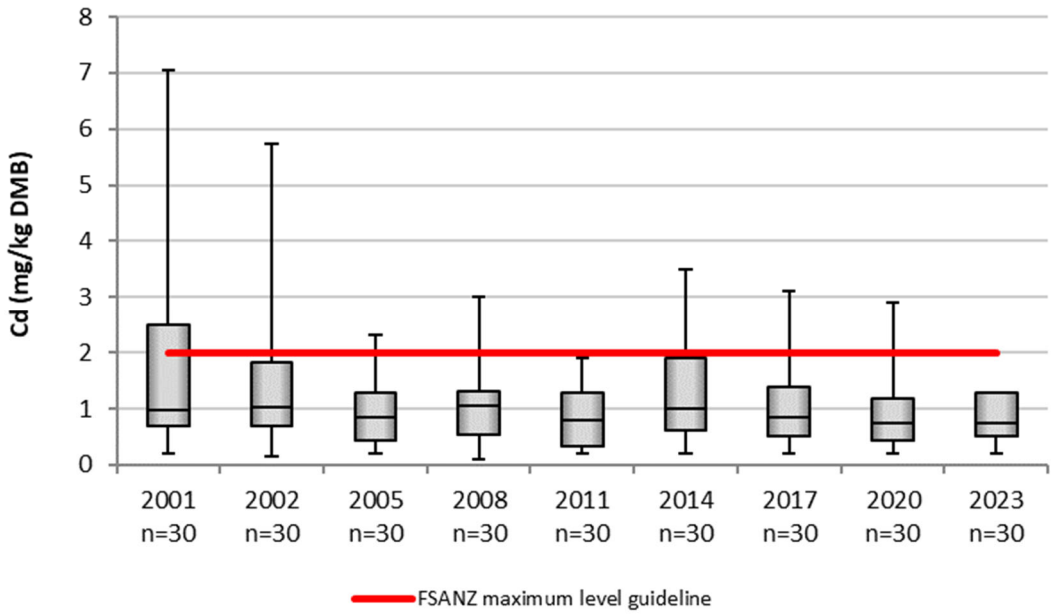


Figure 4-86 Cadmium in wild mussels 2001 – 2023

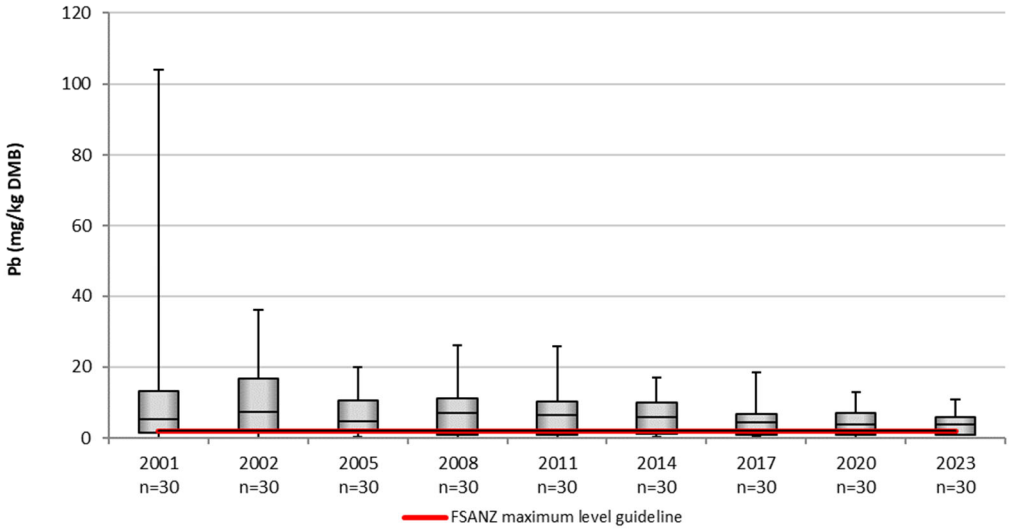


Figure 4-87 Lead in wild mussels 2001 – 2023

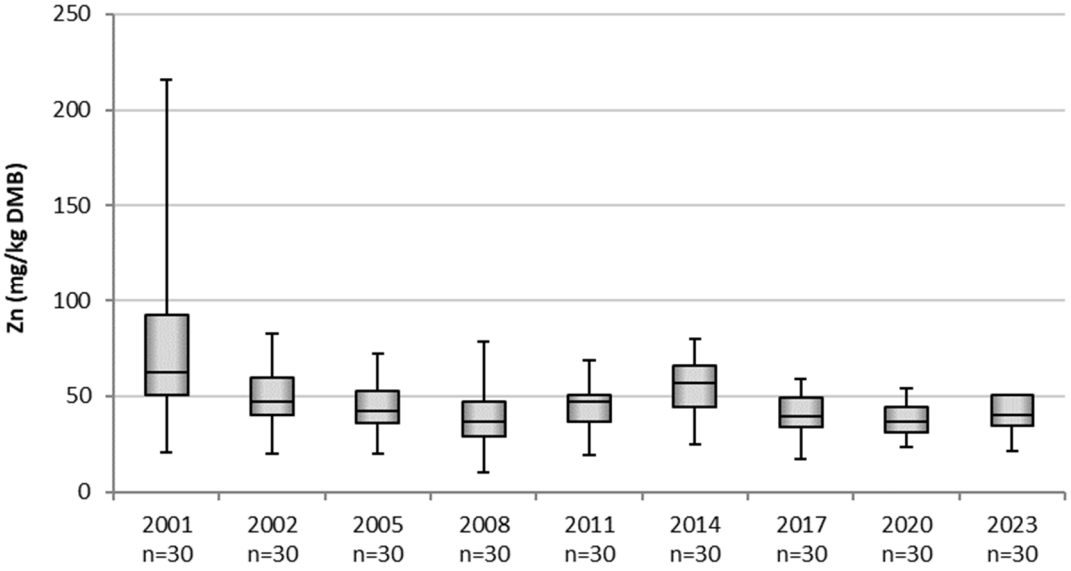


Figure 4-88 Zinc in wild mussels 2001 – 2023

4.4 Noise

NH monitors noise continuously at three stations within the neighbouring community. The stations are located in Birch Road and Delwood Drive, Lutana and at Saundersons Road, East Risdon (Figure 4-89).

Figure 4-89 Noise monitoring locations

The Permit specifies noise emissions limits from site activities, both as measured by the aforementioned community noise monitors, and when measured at any noise sensitive premises in the neighbouring communities. These limits are shown in Table 4-19. In addition to continuous monitoring, NH is required to undertake a three yearly site wide comprehensive noise survey to identify noise sources. The most recent report was completed in October 2023 based on measurements conducted between September and October 2023. The results of this survey are discussed in Section 4.4.2.

Table 4-19 Permit limits for noise levels in the receiving environment

Monitoring location	Test frequency	Emission limits
Test Parameter - A-weighted sound pressure L_{90} & L_{EQ}		
Birch Road, Lutana	Continuous	Monthly median L_{90} 52 dB(A)
	Attended	10-20 minute average 52 dB(A) if 5d B(A) > Ambient
Delwood Drive, Lutana	Continuous	Monthly median L_{90} 52 dB(A)
	Attended	10-20 minute average 52 dB(A) if 5dB(A) > Ambient
Saundersons Road, East Risdon	Continuous	Monthly median L_{90} 56 dB(A)
	Attended	10-20 minute average 56 dB(A) if 5 dB(A) > Ambient

4.4.1 Noise Monitoring Program Details

In 2020 NH replaced the three previous noise monitors, the Larson Davis 870 Sound Level Meters, with contemporary noise monitors, SV 307 Integrated Noise Monitoring Stations. The installation of new monitors improved the reliability and capability of the NH noise monitoring network and also increased our capacity to collect additional meaningful data. The three noise monitors operate continuously, sampling A-weighted sound pressure levels in L-value measurements. Each unit is attached to a power pole at 3 m above ground level to reduce the risk of vandalism and to facilitate the supply of mains power to the monitors.

All continuous noise monitoring is conducted in accordance with Australian Standard 1055.1-1997 Acoustics – Description and Measurement of Environmental Noise – General Procedures.

Noise may be classified into two categories; continuous noise and nuisance noise. Continuous noise contributes to a relatively constant background and is usually described by L90 where Ln is the sound pressure level that is exceeded for n% of the time. Nuisance noise is intermittent and raises ambient noise above usual background levels and L10 describes these noise events during the interval. Of greatest relevance to the community are nuisance noise sources, which pose the greatest management challenge, given their intermittent and changeable nature. Nuisance noise can also be subjective within the community.

Sources of noise on site depend on operational activities, including but not limited to:

- Vehicles including heavy vehicles and fork lift trucks;
- Fans on cooling and ventilation systems;
- Conveyors such as rubber belts, walking beams, and chain conveyors;
- Materials handling such as stacking zinc or excavating concentrates;
- Minor explosions from the cell house and roast boiler cleaning;
- Power tools including grinders, impact guns, and construction equipment;
- Steam emissions from heating and venting operations;
- Warning alarms or PA announcements that indicate vehicle movement or process communications; and
- Sirens during emergencies or emergency drills.

Over time, site wide noise surveys have been conducted to identify specific noise sources that contribute to impacts around the smelter. These studies have supported work toward ameliorating major noise sources.

NH specifies strict hours of operation for non-routine tasks or those that produce excessive noise, and proactively considers the management of potential noise issues when planning on site work. NH encourages feedback regarding noise issues from the local community. In the event of a noise complaint, investigative procedures are initiated in an attempt to identify and mitigate the source of the noise. External noise monitoring experts are engaged where in-depth analysis of noise impacts is required.

4.4.2 Noise Results and Discussion

Results

Figure 4-90 shows monthly median L_{90} values at the monitoring sites for the reporting period. These show variable measurements across the community noise monitoring locations. A seasonal trend is apparent for both monitors situated in Lutana, Birch Road and Delwood Drive which is considered likely to be a result of seasonal wind speed variation.
Some loss of data occurred during the reporting period:

- On 8 May 2022 the secure digital (SD) card became corrupted and stopped recording data. The monitor was removed and send away for repairs and calibration. The monitor was reinstalled on 8 June 2022.
- The Birch Road (8 June 2022 – 20 June 2022) and Saundersons Road (20 June 2022 – 28 June 2022) monitors were sent offsite for calibration.
- In September 2024, the monitors were shipped to Poland to upgrade the data communication system from 3G to 4G due to the impending decommissioning of the 3G telecommunications network.
    - During this period, Nyrstar hired identical monitors to retain continuity of data.
    - Data was stored locally within the hire monitors during this time with data being transmitted to a third party web based platform for regular review by Nyrstar staff.
    - Despite every effort by Nyrstar to obtain the logged data, data was lost for the Saundersons Road monitor between 28 November 2024 and 6 December 2024. No data was lost for other monitors during this period. The overall trends show that the regulatory limit was not exceeded at the three monitoring locations.

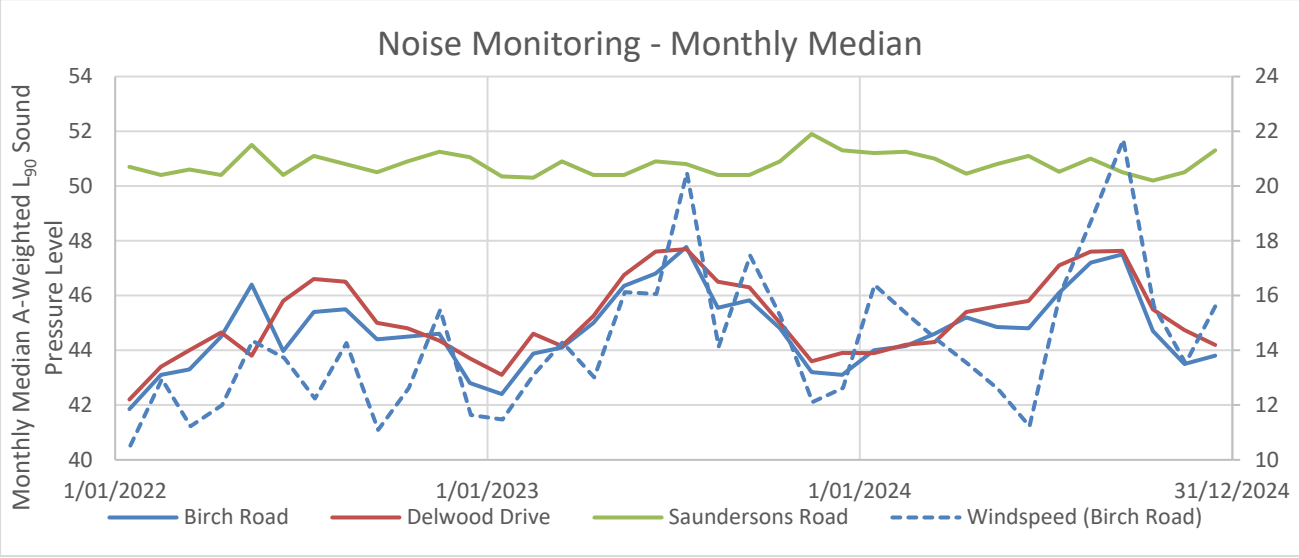


Figure 4-90 Monthly median L_{90} noise dB(A) results for Birch Road, Delwood Drive, Saundersons Road 2022–2024

Community

22 noise complaints resulting from NH operations were received during the reporting period. The majority of the complaints were due to nuisance noise emanating from the Roast Department, specifically from venting steam from the #6 Roaster, and from the use of the start-up scrubber. In 2024, engineering works were completed to address these noise concerns.

The full public complaints register is provided in Appendix 1 – Community Complaints 2022 – 2024 and includes complaints relating to nuisance noise, and NH's response.

As in the past, general site noise is addressed both as issues arise in connection with particular activities, and also proactively, by reinforcing protocols for considering noise before and during routine and non-routine tasks. Most of the noise complaints are related to noise at night (such as banging, reversing beepers and alarms) and the activity of steam venting in the Roasting department.

Proactive management of site activities is a priority for NH and is critical to the mitigation of any new noise sources. All new capital work projects and significant maintenance activities on site are required to consider potential noise emission sources during design, construction and operational phases. A risk assessment approach ensures due consideration is given to minimising impacts of potential noise emissions at all stages through:

- Specifically understanding noise that would be generated from new plant and equipment or as the result of a new process or maintenance activity;
- Using the opportunity to 'design' out new noisy operational aspects where possible;
- Using JSEAs to ensure specific noise emissions controls were identified and implemented during construction activities (including baseline and activity noise monitoring where considered necessary); and
- Allowing sufficient time to give the community advance warning of a potential increase in noise and what it may be associated with.

NH is committed to working with the local community to address noise concerns. In the event of a complaint, NH makes every effort to respond by immediately investigating the specific source of the noise and subsequently ceasing or changing the offending operation where possible. In some instances, where there are no feasible solutions for specific nuisance noise sources, NH is proactively seeking to better understand and identify practical ways to manage these sources.

Lastly, it is important to note that while NH activities are a significant contributor to noise in the local area, weather conditions, time of day, season and local community activities can also contribute to noise data collected at community monitoring sites.

Triennial Noise Survey

The triennial noise survey was conducted by Noise Vibration Consulting (NVC) between September and October 2023, in compliance with The Permit conditions N3 and N4. The survey utilised six monitoring locations as well as a control location approximately 2.9 kilometres away from the site. Noise measurements were made during the day, evening and night at all locations. The results of this survey demonstrate that:

- Measured noise levels within the surrounding community were compared to the criteria outlined within The Permit satisfying all the relevant criteria.
- NH noise emissions have changed very little over the last three years, results are consistent with noise levels measured between 2008 and 2020, suggesting no significant new noise sources.
- In the community surrounding NH (East Risdon and Lutana), noise emitted from NH controls the background noise. Noise levels at Delwood Drive and Saundersons Road are similar across day, evening and night. Birch Road noise is more variable across these times.
- NH's ongoing operation involves actively reducing its noise emissions. Noise measurements compared to the community complaints register identified the more intrusive noises generated on site. The three most problematic sources were identified as steam venting, Start-up Scrubber Fan and the #6 SO2 Blower.

The survey showed that there are many noise sources from NH which contribute to community noise levels. It is considered based off the data and complaints register that nuisance noise is of more concern, rather than NH controlling the background noise.

A number of noise mitigation projects were implemented in the Roast Department in 2024 to reduce the risk of nuisance noise in the community. Works included installation of a new silencer on one of the primary steam vents, installation of silencers on two of the steam vents associated with a steam turbine, and complete lagging and cladding of the start-up scrubber stack to reduce tonal noise caused by large volumes of air flowing through the stack.

4.5 Process and Non-process Waste

4.5.1 Process Waste and By-products

The production process at NH uses raw materials (concentrates), which contain zinc as well as other metals and sulphide. Metals do not degrade so the principle of 'mass balance' applies to the smelting process whereby all metals entrained in concentrates will present as a residue or by-product. Figure 4-91 shows a schematic of the NH process flow sheet highlighting key by-products and wastes that are generated as part of zinc production. Materials are removed from the process as either products for direct sale, by-products for potential reuse and / or sale, or process wastes requiring disposal. Some stockpiled waste residues/by-products that are no longer produced are still present on NH land as described in the following sections.

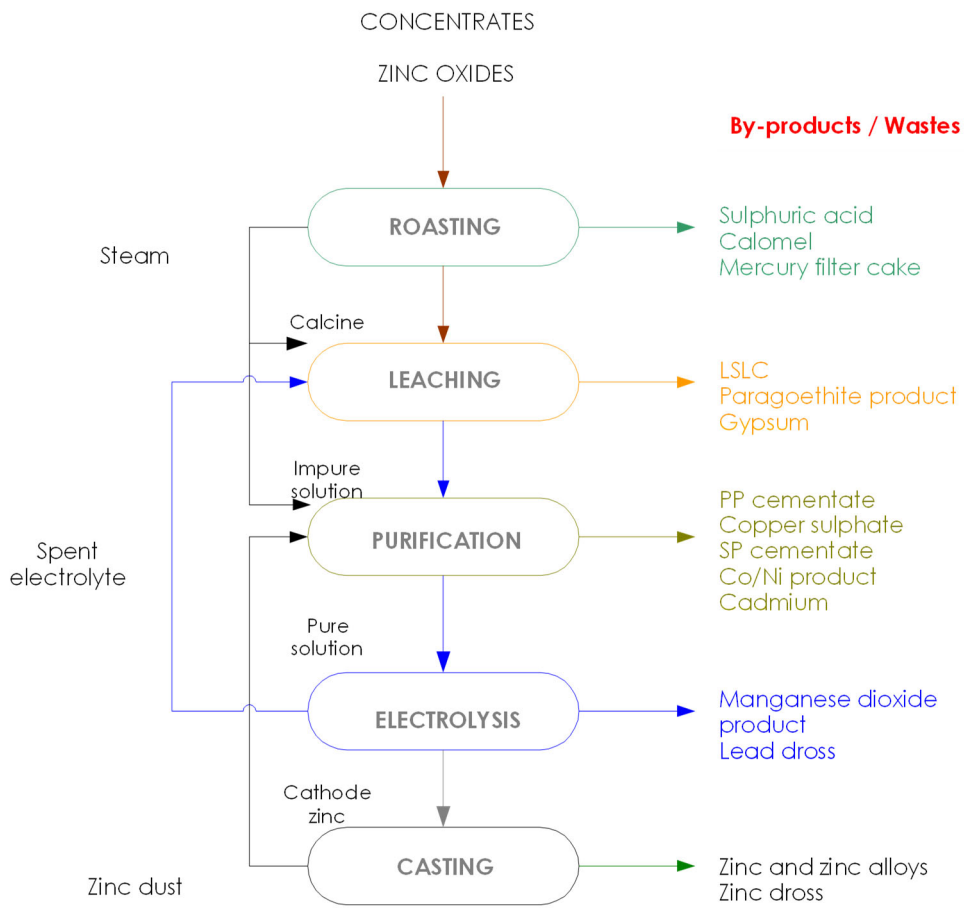


Figure 4-91 By-product flow sheet

4.5.1.1 Process Waste Description and Management

Hobart Leach Product No. 1 (HLP1)

HLP1 is no longer produced at NH, though two known areas of HLP1 material remain in the Loogana precinct after the 2013 removal project. These are in close proximity to TasNetworks power infrastructure adjacent to the 2014 rehabilitation area (Figure 4-92), and in a section of the foreshore at Woodman's Point. During rehabilitation works, the material near the TasNetworks infrastructure was delineated with geofabric between the HLP and the rehabilitated area. The parcel at Woodman's Point was found during exploratory potholing on the foreshore embankment and further investigative work will be required to define the product boundaries. Recovery and rehabilitation in this area is challenged by the proximity of the material to indigenous midden artefacts.

Figure 4-92 Remaining HLP1, shown on far right

Jarosite

The temporary secure landfill cells for jarosite (Figure 4-93 and Figure 4-94) are monitored so as to ensure that no environmental harm results from the stockpiling of the material. Results of regular groundwater monitoring suggest that as a whole groundwater quality is generally improving across the Loogana-Inshallah area. The concentration of metals in groundwater was found to be elevated in a localised area following the installation of a new groundwater well, MB143 in 2022. The cause of this is currently under investigation.

Future management options for the material in the jarosite cell have been broadly assessed; however no management decision has yet been taken. NH recognise that any decisions made in regards to the management of the jarosite would need to be made in consultation with the relevant stakeholders.

Management options investigated to date have included:

- Reuse – it is considered that jarosite reuse technology is not readily available in a form that would support the application of this option. Considerable evidence would be required to demonstrate a reuse option that is safe for health and environment, low-risk from a legal perspective, and logistically and economically feasible.
- Reprocessing - technical constraints associated with each of the reprocessing options assessed limit the feasibility of reprocessing jarosite either locally or through another smelter.
- Extraction of high value metals – a desirable option, however the cost involved to extract the high value metals is significantly more than the value of the metals extracted. This is due to the relatively low

concentrations of high value metals in the jarosite and also the lack of local infrastructure to pursue this option.

- Construction of a new storage site at NH – one location on the NH site is considered to be potentially suitable for long term storage of the material. Investigations into this option recommenced in 2020 and extended into the reporting period.
- Off-site disposal - not currently considered to be a feasible option without prior treatment.
- Assessment of treatment technologies – in 2011, three specialist contracting companies conducted treatment trials on the jarosite. The trials indicated that the leachable fraction of metals within the material could be successfully immobilised using a range of different reagents.

Figure 4-93 Jarosite secure landfill

Figure 4-94 Jarosite secure landfill

Effluent Treatment Solids

All stormwater and process water collected on site is treated in the Effluent Treatment Plant (ETP). The heavy metals are precipitated with the resulting underflow slurry from the thickener generally being returned to the Leach plant. However, return of the underflow slurry to the Leach process is limited by the accumulation of fluorine, magnesium and manganese in the circuit. When the operational fluorine, magnesium and manganese limit is reached in Leach, the ETP underflow slurry is diverted through a filter bed system in ETP. The resulting ETP underflow solids are temporarily stockpiled in a covered bunded area. The solids are then transported by truck to the residue shed to be blended directly with PG or LSLC, and sent to the Nyrstar Port Pirie multi-metal smelter for further processing and recovery of valuable metals.

Mercury Filter Cake and Mercury Contaminated Materials

Mercury Filter Cake (MFC) is generated through the mercury removal process at the Mercury Removal Plant. Chemical stabilisation of the material followed by disposal at an approved facility is the current management method for MFC. Success of the chemical stabilisation program has been variable due to changes in the composition of MFC over time.

In early 2020, approximately 25 t of MFC was sent to a mercury recycling plant in Melbourne, in order to trial the transport and recycling of the material. The transport of the MFC proved to be extremely challenging, due to the classification of the material as a Dangerous Good, and the limitations of the containers in which the material is stored.

During the reporting period, NH disposed of 1,462 t of treated MFC and mercury contaminated waste to the Copping C Cell.

4.5.2 Non-Process Waste Materials

NH's non-process waste refers to waste materials that are generated during normal plant operations or projects and are not by-products from the process. The non-process waste hierarchy at NH is based around segregation of waste streams depending on opportunities for reuse, recycling and where no such opportunities exist, disposal. An overview of the non-process waste types delineated at NH follows.

4.5.2.1 Non-Process Waste Materials Description & Management

Reusable / Recyclable Materials

Non-process reuse / recycling initiatives include:

- Oil, grease and lubricants (dedicated waste oil collection area);
- Scrap steel (dedicated steel bins);
- Cardboard (dedicated blue bins with lids);
- Office paper (dedicated blue wheelie bins);
- Security shredding (dedicated blue wheelie bins);
- Toner cartridges (dedicated collection boxes);
- Timber pallets (collected and stored for reuse);
- E-waste (dedicated collection bin);
- Battery recycling (dedicated collection bin);
- Mobile phones, charges and accessories (dedicated collection box);
- Clean timber and green waste (dedicated collection bin); and
- Fluorescent tubes and lamps.

General Waste

Domestic and inert waste is collected by a cleaning contractor and placed into department based general waste bins for disposal at an approved waste disposal site. This waste consists of office, crib room and change house refuse and inert materials such as packaging, strapping, scrap wire and clean electrical conduit.

All non-process waste materials that may have had contact with process materials must be cleaned prior to placement in the general waste bins located around the site for disposal at an approved waste disposal site.

Redundant Chemicals

Redundant chemicals that cannot be utilised in NH production processes are stored on site for collection by a registered agent on an as required basis.

Management Systems

In addition to the classification and segregation of materials to determine the suitable recycling or disposal option, the site maintains a tracking procedure for off-site movement of materials. The system is an authorisation process, which:

- Ensures contaminated items are not taken off site;
- Ensures non-contaminated materials are authorised for transport off site; and
- Tracks the quantities of wastes and recyclable materials being generated.

4.5.2.2 Non-Process Waste Materials Results & Discussion

Quantities of waste materials requiring off-site disposal, treatment or recycling at an approved waste facility for the past three years is tabulated in Table 4-20 and presented graphically in Figure 4-95. The amount of hazardous waste to landfill during the reporting period is mainly attributed to the disposal to the Copping B and C Cells of the following waste streams:

- 440 tonnes of contaminated fibreglass, plastic and rubber
- 147 tonnes of contaminated bulka bags / filter cloths / baghouse bags
- 1,133 tonnes of contaminated refractory
- 454 tonnes of contaminated soil

Approximately 1,090 tonnes of non-hazardous waste collected from around the site was disposed of at the Copping landfill.

Table 4-20 Total tonnes of waste materials recycled for the period 2022 to 2024

Material	2022	2023	2024
Cardboard and paper	5.88	8.31	0.00
Scrap metal	397.03	338.24	380.04
Clean timber and greenwaste	25.56	7.12	3.70
Oil	17.53	6.10	3.60
Demolition waste	27.00	319.50	0.00
Other	3.60	2.30	3.80
Total waste recycled (t)	**476.87**	**681.59**	**391.17**

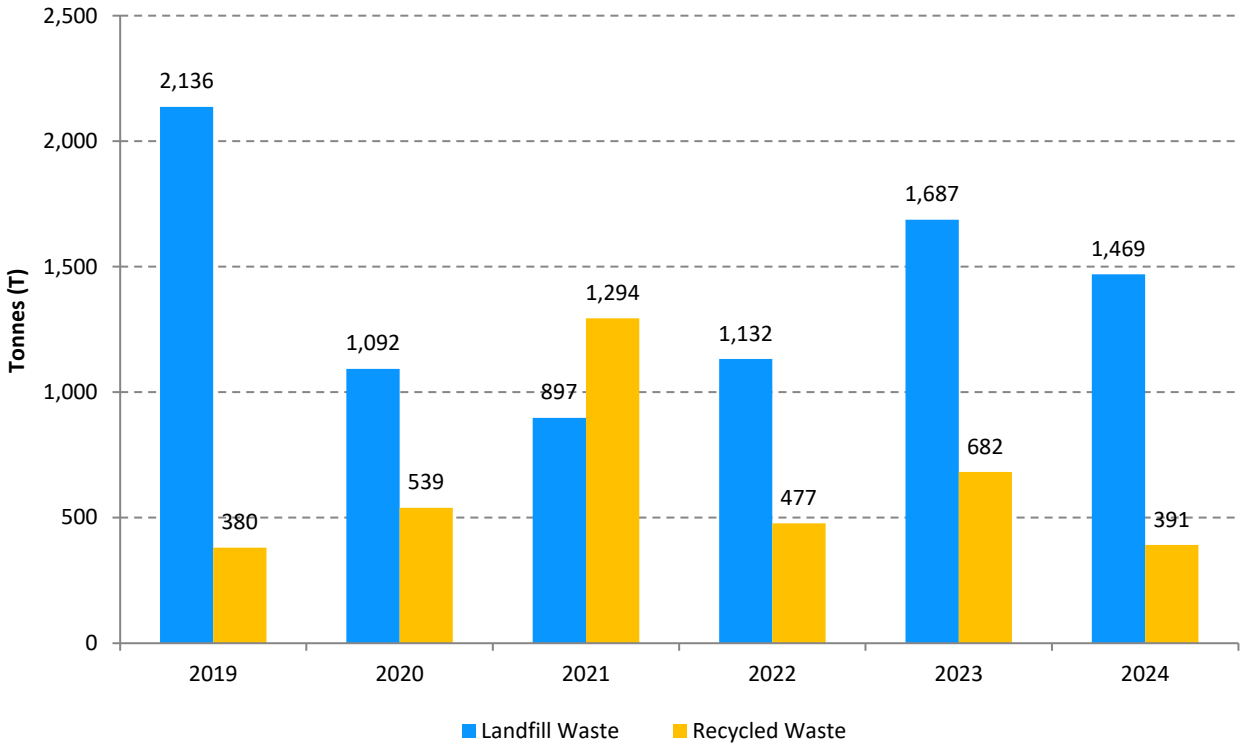


Figure 4-95 Waste to landfill and recycled for the period 2019 - 2024

An summary of the quantities of controlled wastes being held on the site is shown in Table 4-21.

Table 4-21 Estimated quantities of controlled waste held on the site as at 31 December 2024

Waste / By-Product	Type	Storage Location	Inventory as at 31/12/22 (t)	Inventory as at 31/12/23 (t)	2024 produced (t)	2024 disposed-recovered (t)	Inventory as at 31/12/24 (t)
Jarosite	Process Waste	Jarosite Cells	206,328	206,328	0	0	206,328
Neutralised Acid Sludge (screened)		Pad upriver of Dome	1,300	1,300	0	0	1,300
MFC (untreated)		Environment bund/Hydromet Building	252	252	342	260	334
Contaminated soil	Non Process Waste	Quarry	31,658	31,658	0	0	31,658
Contaminated soil		Environment Bund area	673	673	278	454	497
Contaminated timber		Quarry	12,513	12,632	44	0	12,676
Bulka bags		Waste Transit Yard Shed	32	21	7	30	2
Rubber		Waste Transit Yard	4	4	13	17	0
Asphalt		Quarry	5,128	5,179	47	0	5,226
Fibreglass/Plastics		Waste Transit Yard/Site	3	3	149	119	33
Grease		Waste Transit Yard Shed	4	24	5	0	29
Oil		Waste Transit Yard Shed	8	8	6	11	3
Filter media, baghouse bags		Waste Transit Yard	17	3	10	9	4
Acid plant sludges		Environment bund	10	10	90	0	100
Refractory bricks		Area near Environment bund	815	815	802	0	1,617
Vanadium pentoxide - spent catalyst		Zinc shed, Waste Transit Yard, Riggers' locker	170	220	0	220	0
Contaminated concrete		Environment bund area	233	700	50	700	50

4.6 Review of the Storage and Handling of Environmentally Hazardous Materials

In 2021, NH submitted a report to the EPA detailing the storage and handling of environmentally hazardous materials at the site. This report included an assessment of the storage facilities, and identified any high risk locations, requiring improvement works. It was a requirement of the acceptance of the report that progress updates on the works were to be provided to the EPA on an annual basis.

The improvement works completed in the past 12 months include:

- Repairs to the #6 acid plant mercury bund sump
- Repairs to a hole in a section of the pre-neutralisation bund
- Replacement of the sump in the secondary purification bund
- Repairs to address damage in one corner of the premix and flocculant tank bund in Electrolysis
- Repairs to the roof and walls of the Concentrate Shed
- Repairs to the roof and wall of the Dome

The majority of bunds and sumps were cleaned, and inspected during 2024, with the assessment results to be submitted to the EPA in 2025 in the form of an updated report on storage and handling of hazardous materials.

4.7 Energy Management & Climate Change

Zinc plays a fundamental role in the energy transition. However, its extraction and transformation can be energy intensive. Nyrstar zinc smelters are amongst the most energy efficient in the industry, and we continually investigate opportunities for further improvement. The majority of NHs greenhouse gas emissions relate to the electricity we use rather than from direct emissions from our production plants, so our carbon footprint is in fact highly dependent on the regional electricity generation source. The electricity used at the Hobart smelter is primarily generated from hydroelectric sources (a form of renewable energy), resulting in lower greenhouse emissions than other Nyrstar sites. A Life Cycle Assessment for NH zinc was conducted during the reporting period, with the carbon footprint calculated to be 1.461 t/CO_2 equivalent per tonne of zinc metal. This is the second lowest carbon intensity in the Nyrstar Group, with the smelter located in Auby, France achieving a lower carbon intensity due to the use of nuclear generated power.

Greenhouse gas emissions are also generated through the use of LPG, diesel, natural gas and reagents.

NH tracks energy consumption on a monthly basis. Annual consumption for the current, and previous reporting period is shown below in Figure 4-96. Diesel consumption has been included as a separate graph for optimal data display.

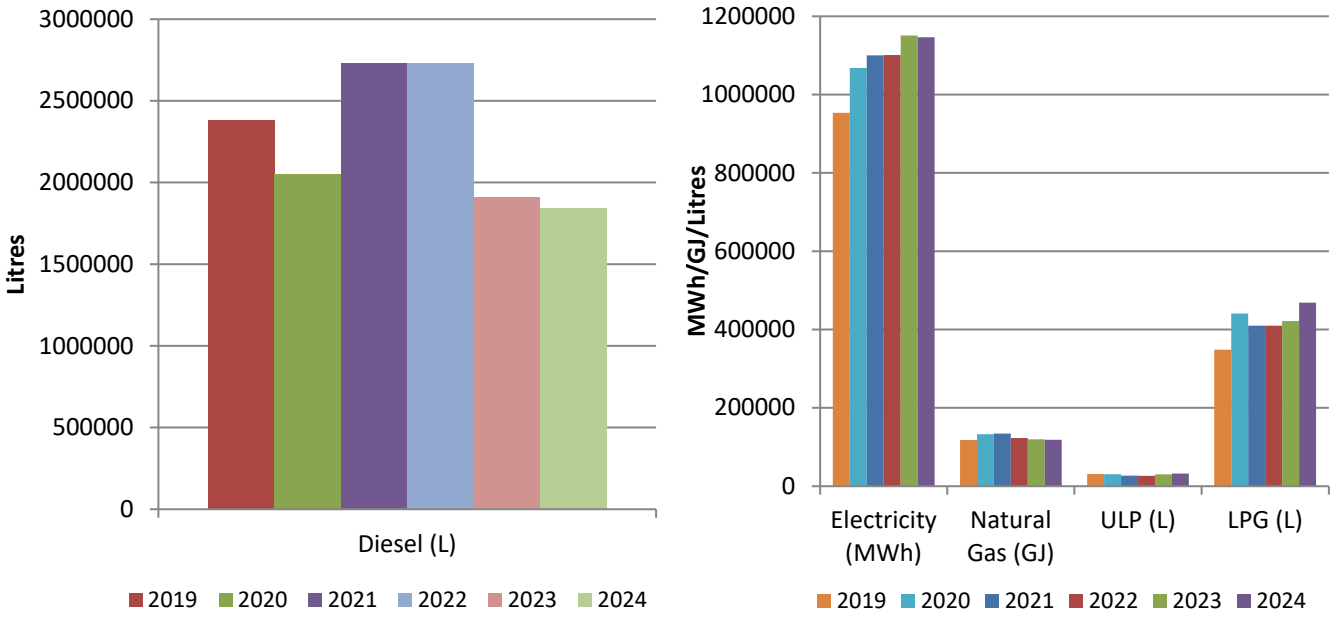


Figure 4-96 2019 – 2024 energy consumption

With the exception of diesel, energy consumption has remained reasonably stable over the reporting period. The bulk of the diesel consumption on site is a result of shutdown events. The roasting process generates a considerable volume of steam which is used to power other parts of the plant. When the roasters are not operating, as is the case during shutdowns, the steam must be produced using diesel fuelled package boilers. In addition, it requires a significant amount of diesel to start up the roasters after a shutdown. Even with the shutdown, the energy content of the waste heat recovery (in the form of steam) equates to approximately 616,000 GJ per year. This is almost five times the energy consumed in the form of natural gas for the year, and thus represents a significant energy recovery program.

Both zinc and lead products of Nyrstar smelters make an important contribution to sustainable development and reducing CO_2 emissions: zinc through the galvanising of steel to prevent corrosion and extend its useful life; and lead through batteries, which power electric vehicles and facilitate the storage of electricity from alternative energy sources.

4.8 Flora and Fauna

A search of the EPBC Act Protected Matters Database identified 52 threatened fauna species and 10 threatened flora species listed under the EPBC Act database as potentially present within 1 km of the site[10]. There are two EPBC Act-listed threatened ecological communities in the vicinity of the Nyrstar Hobart site.

The operational area of the Nyrstar Hobart site contains minimal to no suitable habitat for EPBC Act-listed threatened fauna or flora species and it is considered highly unlikely that any threatened species have the potential to be present on the smelter site. The company owns substantial buffer zones, 90 ha of which are located on the eastern shore of the Derwent River, in which there may be the potential for the presence of some EPBC Act-listed threatened fauna or flora species. The buffer zones were put in place primarily to prevent residential development within too close of a proximity to the smelter.

In 2007, a Natural and Cultural Values Inventory of the buffer zone on the eastern shore was conducted (Hydro Tasmania Consulting 2007 – Natural and Cultural Values Inventory Pegara). The site was described as being comprised of dry vegetation types, with 4 native vegetation communities and a small area of exotic pasture land. The vegetation types and area were listed as follows;

- *Eucalyptus amygdalina* forest on mudstone – 36 ha
- Eucalyptus risdonii forest – 27 ha
- Eucalyptus globulus dry forest – 10 ha
- Lowland grassland complex – 2 ha

The dry forest is mostly regrowth trees, as a result of past farming activities and wildlife. Few trees with hollows were noted, and little fallen timber. Thus, the fauna habitat value of the site is considered to be low to moderate, due to paucity of nesting and shelter sites for hollow dwelling fauna, and little fallen timber to provide habitat for ground dwelling species.

Lowland grassland areas provide foraging habitat for some species, where the dry forest would not be suitable, due to the thin soils associated with them.

NH maintains an operating procedure to provide guidance on the protection of known threatened species and habitat associated with their occurrence. The document describes actions to be taken in the event of the following:

- A new species suspected to be of threatened status is identified on land owned by NH; and
- A species known to occur on the site is elevated to threatened status; or the status of a known threatened species changes.

A review of the Commonwealth threatened species database is undertaken each year to assess changes to threatened species lists for the area surrounding the smelter, and to enable NH to determine if any changes to management of the buffer zones are required.

4.9 Cultural Heritage

The NH site is home to a number of identified sites of cultural heritage value. Aboriginal middens have been mapped along the southern foreshore area on the operating site and various items of cultural heritage value have been observed on the Pegara property on the eastern shore of the estuary. A site procedure outlines corporate responsibilities relating to the management of known cultural heritage sites within the NH footprint, and actions to be taken in the event of the discovery of any previously unrecognised cultural heritage sites. This procedure does not provide instructions for developing action plans for management of a relic or heritage site. The Department of Natural Resources and Environment (NRE) is consulted if there is a need for such a plan to be developed.

[10] Protected Matters Search Tool - DCCEEW Accessed 5 March 2025.

5. GLOSSARY

AER	Annual Environmental Review
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZFA	Australia New Zealand Food Authority
ARI	Average recurrence interval
As	Arsenic
Cd	Cadmium
CO_2	Carbon dioxide
Cu	Copper
$CuSO_4$	Copper sulphate – secondary product sold to external parties
CWP	Contaminated water pond
dB(A)	Unit to measure 'A-weighted' sound pressure levels. A weighting is an adjustment made to approximate the frequency response of the human ear.
DEP	Derwent Estuary Program
EMPCA	Environmental Management and Pollution Control Act 1994
EMS	Environmental Management System
EPA	Environmental Protection Authority
ETP	Effluent Treatment Plant
F	Fluorine
Fe	Iron
FSO	Foreshore scrubber outfall
GLC	Ground level concentration
HAL	Hot acid leaching
Hg	Mercury
HLP1	Hobart Leach Product No. 1
HVAS	High volume air sampler
JSEA	Job Safety and Environment Analysis
Kg/d	Kilograms per day
L_{90}	Static noise level
L_{eq}	Equivalent continuous sound level
LSLC	Lead sulphate leach concentrate – high lead containing product from strong acid leach stage of filtration
m^3/h	Cubic meters per hour
MFC	Mercury filter cake – material left on filter after MRF is bled off
mg/L	Milligrams per litre
mg/m^3	Milligrams per metre cubic
ML	Megalitre
Mn	Manganese
MRF	Mercury removal filtrate
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure

NOx	Oxides of Nitrogen
NH	Nyrstar Hobart
NPP	Nyrstar Port Pirie
OAP	Old acid plant
Pb	Lead
PG	Paragoethite – iron by-product
PM	Preventative maintenance
ppb	Parts per billion
ppm	Parts per million
RIMS	Risk information management system
RL	River level – mean high tide level
SAL	Strong Acid Leaching
SHEQ	Safety Health Environment and Quality
SO_2	Sulphur dioxide
SO_3	Sulphur trioxide
SO_4	Sulphate
SWL	Standing water level
t	Tonnes
TGS	Tail gas scrubber
TSPM	Total suspended particulate matter
TSS	Total suspended solids
µg	Micrograms
µg/g	Micrograms per gram
$\mu g/m^3$	Micrograms per cubic meter
Zn	Zinc

6. APPENDICES

6.1 Appendix 1 – Community Complaints 2022 – 2024

Date raised & RIMS ref	Type	Nature of contact	Nyrstar response
1/06/2022 CTC-1742	Noise	Resident visited the site to complain of noise that occurred the early hours of the morning of 1 June. Describing the noise as a “doof doof” sound. She said that it woke her up at 2 am, and it kept going until approximately 4 am.	The resident was questioned about the noise, and we discussed why it is important for community members to bring these matters to Nyrstar's attention. They did not want to leave a number for feedback, however they were informed that we may have a community meeting coming up soon, and if she would like to come along, feedback on the matter would be provided then. They normally attend the community meetings.
21/07/2022 CTC-1750	Noise	Noise complaint was received due to steam venting	Contacted stakeholder to discuss concerns and identified that during the current TAR, it is in plan to replace SH24 and add a tricot to the other vent.
9/09/2022 CTC-1766	Odour	A resident of Lutana called the EPA at approximately 5:15 pm on the Friday evening to complain of "sulphuric acid odour". The EPA officer reported that the complaint stated that the odour had been an issue for 2 days.	Discussed the matter with the EPA officer. Informed them of the response from the ERO's. Informed him that there was an environmental advisor still on site who was investigating. The area of the resident was attended at approximately 6:30pm and could not pick up on odour - however wind conditions etc may have changed. Further information was put into an email and send through to our regulating officer. The ERO's rang the control rooms to make enquiries. They also called Impact, as it had been noted earlier in the day that Impact seemed to be more odorous than usual. Impact confirmed they were processing a new blend and it smelt more than usual.
16/09/2022 CTC-1772	Other	The site's EPA regulating officer called to pass on a complaint made by a Qube employee. The complaints were: Washing down of the boat deck into the river Washing down of the wharf apron into the river.	Discussed the issue with the Wharf Superintendent and the Wharf Supervisor. Inspected the wharf apron for holes, drainage issues etc. Responded to the EPA by email.
9/11/2022 CTC-1780	Odour	Resident contacted the ERO's on Wednesday evening at approximately 9 pm to complain of a bad smell.	The Environmental Principle contacted the resident to discuss further. Talking about the odour and how the site had been dealing with some odour issues related to Impact Fertilisers. It was mentioned that the odour may continue for a little while. The resident also mentioned noise from the PA, but understood this was for safety precautions. Finished by providing contact information should the resident need to make contact again.
21/03/2023 CTC-1788	Noise	Resident of East Risdon contacted the site to complain about a high pitch squealing noise coming from the site. The noise was not consistent, it would	Contacted Roast and Wharf to discuss. Both departments were going to organise for plant inspections to be completed to see if they could locate the noise source.

		come and go. They stated that it sounded like metal on metal grinding.	It was thought that the noise may be emanating from C8 conveyor, this was confirmed at a later date when the resident called to let us know the noise was back. Maintenance was already planned for a later date.
31/03/2023 CTC-1739	Noise	Resident called to complain about the noise arising from the use of the Roast SO_2 alarm. Whilst they acknowledged that an alarm is required, their concerns were around the duration of the alarm, and the lack of alternative means for alerting workers of the issue.	The Environment team called the resident to outline the reason for the siren sounding and the important nature of the alarm, stating why it needs to go off and why it is used rather than using pagers. The duration of the alarm was also explained to the resident.
06/06/2023 CTC-1812	Noise	Resident of Derwent Park Road contacted the EPA to complain of general noise. An aspect of the noise complaint was truck movements at night time.	Sent EPA information regarding the movement of Toll trucks at night time.
07/07/2023 CTC-1816	Noise	Noise complaint was raised overnight, describing an intermittent roaring noise emanating from the site. Resident stated the noise sounded like an “off-balance washing machine”. Resident contacted the EPA who passed on the complaint to NH.	Production departments were contacted, discussing any possible sources of noise which may match this description. No noise sources were identified to match this description. At the time of the complaint, the community noise monitor closest to the complainant on Delwood Drive showed no significant increase in dBa. This information was passed onto the EPA.
09/07/2023 CTC-1821	Noise	Resident of Lindisfarne contacted the site to complain about a noise they believe is being emitted from the NH site. The noise is intermittent in nature and occurs at varying times during the day. The noise consists of an intrusive rising and falling low frequency noise, sounding similar to diesel powered earth moving machinery.	Environment team contacted resident to gain some more information on the noise. Multiple emails were exchanged between NH and the resident. It was reported that the noise is present on a daily basis, which indicates it may be part of day-to-day processes, either at NH or from an alternative industrial source.
12/07/2023 CTC-1818	Noise	Resident of Lutana contacted the site to complain about excessive noise. They stated that it had been going for a couple of weeks and described it as: Blown flange, fan, worn bearing, electric motor and a plane going overhead.	#5 FBR was shut down at the time, so Roast was contacted. It took approximately 24 hours to recognise that the noise was being emitted by the Start-up Scrubber fan. The resident was contacted by the Environment team and informed that the noise source had been tracked down, and that the part of the plant which was making this noise was planned to be shut down on the afternoon of 14/07/2023. The resident called late on the afternoon of 14/07/2023 and left a voice message saying the noise had ceased.
16/09/2023 CTC-1823	Noise	Complainant called up raising concerns about noise over the weekend.	Complainant made initial contact with Emergency Response Officers (EROs) over the weekend. Senior Environmental Advisor returned the call on Sunday morning. Elevated noise was due to venting of steam as a result of a shutdown in the Leach department. Noise data was provided to the EPA on 19/09/2023.

10/10/2023 CTC-1843	Noise	Resident of Lutana contacted site to complain about steam venting noise and noise from the Start-up Scrubber.	Resident complained multiple times over the course of the major shutdown of the #6 roaster, which took place in October 2023, regarding steam venting noise and noise from the Start-up Scrubber. The sources of the noises were discussed with the resident.
13/10/2023 CTC-1845	Noise	Resident of East Risdon contacted the Environment team to inform that the squeal they had previously complained about had returned.	Source of the noise was already known so was investigated efficiently. On October 17th maintenance re-tensioned the drag line in the C8 system. Complainant confirmed that the noise had stopped.
14/11/2023 CTC-1846	Noise	Resident of East Risdon contacted site to inform that the noise they had complained about in the past had started up again.	Leach operations were contacted who confirmed they were using C8. They ceased using it almost immediately.
04/12/2023 CTC-1844	Noise	Nearby resident complained of steam venting noise.	Immediately went to Roast to determine what was happening. The steam venting noise was a result of regular weekly testing the steam turbines, which occurs most Monday's. Complainant was given this information.
22/12/2023 CTC-1840	Noise	Resident of East Risdon contacted site over excessive noise. Noting a high pitched noise had been running since the early hours of the morning.	High pitch noise was found to be coming from C8 which was running between 4:20am and 8:20am. Leach team leader was contacted who was going to pass on to the department that the conveyor system was not to be ran during the night. Leach Maintenance confirmed that the chain and wear strips were going to be replaced in January 2024.
31/12/2023 CTC-1842	Noise	Emergency Response Officers were contacted by a Lutana resident regarding steam venting noise.	The feed rate on #6FBR was increased resulting in high steam pressures. This caused a safety vent to open allowing the pressure to return to operating requirements. Roaster feed was lowered during this time. Steam was venting for approximately 5 minutes until the valve seated.
18/01/2024 CTC-1852	Noise	Resident of Lutana contacted Environmental Protection Authority to complain about steam venting noise.	Cause of noise was found to be venting of steam and utilisation of steam turbine system, maintenance was required on the electric duty system, as such the emergency system was required to be used. Explanation was provided to the EPA
28/02/2024 CTC-1869	Noise/ Air Quality	Resident of Lutana contacted site Emergency Response Officers to complain of SO_2 alarm and to report fallout visible on resident's CCTV system.	Complainant informed no major event occurring at site, SO_2 alarms ended approximately 20 minutes later, investigation into nature of fallout was launched, no compliance breach was found on monitoring network. Feedback provided to complainant at time of complaint.
29/02/2024 CTC-1870	Noise	Resident of Lutana contacted site Emergency Response Officers to complain about venting noise.	Noise source investigated, most likely noise from a steam leak above the Roast control room, to be repaired in the morning. Feedback provided to complainant at time of complaint.
18/03/2024 CTC-1883	Air Quality	Resident of Lutana contacted EPA to complain of dust from 18-21 March 2024	Weather data and on site monitoring data was provided to the EPA. Source of dust was confirmed to not be associated with excavation works at back of site based on prevailing wind conditions and continual monitoring at that site. As complaint was directed to EPA, no additional feedback was provided to complainant.
3/4/2024 CTC-1874	Noise	Resident of Lutana contacted EPA to complain of noise from onsite PA system.	EPA contacted site owner to discuss use of PA. Necessity for safety was discussed and reaffirmed commitment to minimise use of PA system to essential application. Complaint made anonymously, no response could be provided to complainant.
9/4/2024 CTC-1882	Noise	Resident of Lutana contacted EPA to complain of venting noise.	Source of noise investigated, no venting at the time, concrete crushing was taking place at the western side of the work site and may have contributed to the noise at the time, venting

			was scheduled in the upcoming period, specific times were provided to the EPA. As complaint was directed to EPA, no additional feedback was provided to complainant.
17/4/2024 CTC-1884	Air Quality	Resident of Lutana contacted EPA on 17/4/2024 and 29/04/2024 to complain of "acidic fall-out", claiming that Nyrstar Hobart and/or a neighbouring industrial site are performing some action every Saturday resulting in the aforementioned fall-out.	EPA requested weather data for evening of 16/4/2024 and 27/4/2024, all requested data was provided to support their investigation. As complaint was directed to EPA, no additional feedback was provided to complainant.
8/06/2024 CTC-1892	Noise	Resident of East Risdon site owner to complain of loud squeal/screech.	Noise investigated and found to be result of running C4 conveyor belt empty. Feed was put into C4 and the noise was resolved. However, complaint was repeated 4 days later (12/06/2024). It was found C4 had been allowed to run empty on and off several times in this period. Request made to production team to not run conveyor empty, issue reported that C4 conveyor tends to become bogged if stopped. Future noise can be mitigated by adding feed to empty belt.
10/10/2024 CTC-1924	Noise	Resident of Lutana contacted EPA to complain of venting noise and alarm going off in early morning.	Investigation revealed there was an incident in Roast resulting in elevated SO_2 emissions, triggering the alarm between approximately 3am to 3:42am. Alarm confirmed to be a necessary safety system for onsite personnel. No venting was occurring at the time of the complaint, but several actions that may have caused a comparable noise were investigated. Noise detection data was sent to the EPA to assist in their investigation. As complaint was directed to EPA, no additional feedback was provided to complainant.
17/10/2024 CTC-1923	Noise	Resident of Lutana contacted both site owner and EPA to complain of steam venting noise.	Information provided to the EPA as requested. Investigation indicated that noise was due to testing #6 steam safety valves on the day, resulting in 5 separate 1-2 minute events between 10:08am - 11:19am. Information was provided to complainant.
23/10/2024 CTC-1918	Air Quality	Resident of Lutana contacted site owner via website contact portal to complain of dust accumulation along north facing windows and intermittent noise, particularly at night.	Dialogue entered into with complainant, discussed possible causes and likelihood of repeat. Complainant advised satisfied with the response.
17/11/2024 CTC-1919	Air Quality	EPA representative contacted site owner on behalf of Lutana resident to complain of sulphur smell.	Investigation revealed that SO_2 emissions from site may have been elevated due to wind direction from #5 roaster through the start-up scrubber. Peak of 15 ppb SO_2 was detected at Tennis Courts monitor between 11:30am and 1:30pm. Site instrumentation team requested to bump check and calibrate SO_2 monitors to confirm accuracy. Further information provided to EPA as requested.

6.2 Appendix 2 – Notifiable and Reportable Environmental Incidents 2022 – 2024

RIMS No. & Date	Incident summary	Cause(s)	Summary of corrective actions
HEN-665727 22/01/2022	During a start-up of #6 Fluidised Bed Roaster, elevated concentrations of SO_2 were emitted from the Foreshore Stack. At 5:10pm on 22 January 2022, the concentration of SO_2, calculated as a 60 minute rolling average at the Technopark community monitor exceeded the maximum ground level concentration (0.020 ppm), specified within Condition A2 of The Permit as varied	The failure of one of the two primary saltwater pumps, and the failure of one of the two booster pumps resulted in insufficient scrubbing capacity to adequately strip SO_2 from the gas stream, resulting in an increase in SO_2 exiting from the foreshore stack. The scrubbing capacity through the tail gas scrubbers has declined due to biofouling, primarily from mussels. This has reduced the flow rate through the scrubbing system, reducing the capability of the system in scrubbing SO_2 from the gas stream.	Repair #2 Saltwater Pump. Repair #2 Booster Pump. Implement systems to confirm the availability of salt water supply pumps. Return saltwater supply system to design specification.
HEN-666130 23/01/2022	The High-Volume Air Sampler which measures total suspended particulate matter at 'Risdon Road North' was scheduled to run between 7 am Sunday 23/01/22 and 7 am Monday 24/01/22 for the regulatory 24 hour period that occurs once every six days as stipulated in Condition A8 of The Permit as varied. Laboratory staff were to collect the sample on 24/01/22 however the instrument displayed a fault and had a total run time of 4 minutes.	An instrument error occurred due to either the blower not working properly, or an issue with power supply to the instrument (either high or low voltage).	Investigate options for online alarm system across all four monitors to detect voltage upsets, operational capacity or failures and if feasible, implement. Implement power safeguard option to prevent failures to monitors based on power supply.

HEN-670113 06/03/2022	On 06/03/2022 a GLC of lead in air of 0.00202 mg/m^3 was recorded at the RRN monitoring site. This value increased the RRN 90 day average lead GLC to 0.00156 mg/m^3, exceeding the emission limit of 0.0015 mg/m^3 set out in The Permit as varied	Increased lead in feed materials has resulted in an increase in lead in by-products produced and moved around the site. The storage, processing and handling of these lead bearing materials results in fugitive emissions.	Increase monitoring at RRN. Increased plant inspections looking for leaks and dusting. Repair infrastructure where required and improved cleaning and housekeeping in the plant. Improve moisture control on PG. Investigate dust suppression systems, such as application of chemical suppressants to roadways and fog cannons to be used during out loading of by-products.
HEN-675893 05/05/2022 – 06/05/2022 **This incident was reportable under the conditions of The Permit as varied, however was not a non-compliance**	Over a 16 hour and 50 minute period starting at 3:20pm on 05/05/2022, 100mm of rain was recorded at NH. As a result 2,191.2 m^3 of untreated stormwater overflowed into the Derwent Estuary for a period of 8 hours commencing at 7:00am 06/06/2022. Analysis of rainfall data showed a greater than 20% Annual Exceedance Probability (AEP) rain event occurred during the incident period.	The infrastructure was not sufficient to deal with the amount of water which was generated during the recorded 20% AEP rainfall event. These heightened conditions in the catchment overwhelmed multiple sections of the plant. The contaminated water pond is operating at reduced capacity due to the build-up of sludge in the pond. The B3 sump pump worked well until the peak of the rainfall event, when the water level increased to 100% the pump motor was flooded. The two pumps (#5 and #6) within A drain had been pumping throughout the whole rainfall event and had no issues reported. It was considered that the pumps were unable to keep up with the volume of water generated. The wharf ponds were overwhelmed by the volume of water despite significant actions to reduce this volume. A recently installed pipe on the river side of the pond blocked water from flowing over the spillway. Water flowed onto the road before entering the river at the northern corner of the wharf ponds.	Investigate the purchase of additional portable petrol pumps which could be deployed during future significant rainfall events. Complete the design of the project for CWP sludge removal. Investigate if pumping the wharf ponds to Lake Loogana during a significant rain event is feasible. Currently the wharf ponds are pumped to the CWP only. Clear the wharf ponds spillway to re-instate that overflow point.
HEN-696369 18/12/2022	Routine mixing zone monitoring was taking place on 18 December 2022. At monitoring location OF42, at a depth of 4.5m, a pH reading of 6.5 was recorded. The contractor operating the equipment continued to lower the instrument, recording readings of less than pH 7 until a depth of 8m where the	The low pH conditions recorded on 18 December 2022 were due to the shutdown of the #5 Fluid Bed Roaster (FBR) and the #5 acid plant. The shutdown was a planned event in order to repair a leaking pump in the #5 acid plant. It is common for the pH in outfall to be lower than usual for short periods of time during the shut-down (and the subsequent start-up) of the roasters. Feed was ceased to #5 FBR and commenced blow down during this time the acid plant is shut down and as residual sulphur burns out of the roaster bed material the untreated gas is sent to the foreshore scrubbers. Though when a roaster is holding at 500^{o}C during a cool down a bump is required every 12 hours. Bumping involves an injection of 25,000 m^3 of air every 12 hours for a 2 minute period. This process stops the roaster bed from fusing requiring a manual dig out, however	Cease the practice of bumping #5 FBR to the foreshore whilst #6 FBR is online. Alter shut-down and start-up procedures for #5 FBR and #5 acid plant. Investigate options for managing excess gas from #6 FBR/acid plant shut downs. Review data and collect additional data to assess tidal conditions during which

	pH increased to above 7. The lowest pH recorded was 6.4 at a depth of 5.6-6.5m. The Hydrolab was recalibrated and monitored location OF47. All pH readings at monitoring locations OF40, OF41 and OF 47 were above a pH of 7.	generates SO_2. At 8:34am #5 FBR was bumped, and the pH of the outfall ranged from 1.87 to 3.39 for a 15 minute period with a median of 1.93. Monitoring of OF42 was completed between 8:45 – 9:00am and the pH of less than 7 was recorded.	optimal mixing of the outfall occurs within the estuary.
HEN-725080 21/10/2023– 22/10/2023 **This incident was reportable under the conditions of The Permit, however was not a non-compliance**	Over a 5 hour period starting at 11:30 pm on 21/10/2023, 30.3 mm of rain was recorded at NH. As a result 9 m^3 of untreated stormwater overflowed into the Derwent Estuary from the B3 sump. Analysis of rainfall data showed a greater than 20% Annual Exceedance Probability (AEP) rain event occurred during the incident period.	The pumping infrastructure in the B3 sump was insufficient to deal with the amount of water which was generated during the recorded 20% AEP rainfall event. The B3 sump pump operated as designed until the peak of the rainfall event, when the water level increased to 100% the pump motor was flooded. A supplementary petrol powered pump was deployed and ran throughout the overflow period. This reduced the volume that overflowed to the estuary.	Assess options for preventing B3 sump trips due to motor being submerged
HEN-729181 13/12/2023- 14/12/2023	Over a 9 hour period starting at 8 pm on 13/12/2023, 19.5 mm of rain was recorded at NH. As a result 7.5 m^3 of untreated stormwater overflowed into the Derwent Estuary from the B3 sump.	The pumping infrastructure in the B3 sump was insufficient to deal with the amount of water generated during the rainfall event. The rate of flow of stormwater into the B3 Sump exceeded the pumping capacity of the duty and supplementary petrol pump which was deployed and ran throughout the overflow period.	Replace cap on B2 Drain line. Clean B2 Drain between Risdon Road and B2 Sump pit via high pressure water blasting. Review B2 Catchment and make recommendations for improvement. Rectify overflow points on A1 Drain line.
HEN-740812 29/07/2024	Stack testing reports identified that during the previous 6 month testing window, concentration of cadmium exiting the stack exceeded emission limit specified in The Permit	Testing was conducted on the morning of 3/6/2024 and concentration of cadmium emitted during stack test window found to be 1.2 mg/m^3, exceeding A1 emission limit. An investigation was undertaken, finding that the cause of the high emission event was insufficient scrubbing efficiency owing to several contributing factors: • Scrubber filter is too small for the housing. • Scrubber filter was found to be badly damaged and full of holes. • The rubber water hose is worn out and degrading	Spare filter requisitioned. Stack internals and fins inspected for blockages or damage. Verified correct parts used per design of scrubber, and that capacity of scrubber is fit for purpose. Replaced/repaired scrubber tank drain valve solenoid.

		• The Scrubber tank drain system was found to be blocked	Flocculant trailed to determine if it can be used to improve scrubbing efficiency. Regular cleaning schedule for scrubber tank and pigtails developed.
HEN-751742 13/11/224	Cadmium stack testing revealed elevated cadmium result in the exhaust fumes	Testing was conducted on 13/11/2024 and concentration of cadmium emitted during stack test window was found to be 2.2 mg/m^3, exceeding A1 emission limit. An investigation was undertaken, finding that the previous contributing factors had been addressed, the following potential causes were put forward: • Over Fluxing during stack testing • Scrubber Efficiency. • Scrubber fins blocked	Scrubber internals have been inspected and found to be clear of buildup or restrictions. Investigations into the Cadmium scrubber efficiency and the sufficient amount of flux to be used in the pot are ongoing.
HEN-748103 08/12/2024	Over a 4 hour period starting at 10 am on 07/12/2024 48.8 mm of rain was recorded at NH, as a result 1.44 m^3 of untreated stormwater overflowed into the Derwent Estuary from the Wharf Area Catchment, from a location that was not a nominated overflow point. Analysis of rainfall data showed a greater than 20% Annual Exceedance Probability (AEP) rain event occurred during the incident period	During the recorded 20% AEP rainfall event, it was found that an open spoon drain intended to channel water to the southern of the two stormwater ponds was partially obstructed with solids, causing a diversion of some of the drain flow across open ground and into the Wharf Roadway Catchment. The infrastructure in this area was overwhelmed, resulting in an overflow into the estuary from a location that was not a nominated overflow point. This was considered by the regulator to be non-compliant with condition SW2 of The Permit.	Obstruction within open spoon drain was excavated on 16/12/2024.

6.3 Appendix 3 – The Permit as Varied

PERMIT AS VARIED

Activity name: **HOBART ZINC SMELTER**

Environmentally Relevant Activity: **The operation of a zinc smelter (ACTIVITY TYPE: Metallurgical Works)**
HOBART ZINC SMELTER, 300 RISDON ROAD LUTANA TAS 7010

Permit No.	Date Granted	Granted by
3314	28 June 1996	Director of Environmental Management

Varied by Environment Protection Notice No.	Issued Date	Issued to
7043/5	11 April 2019	Nyrstar Hobart Pty Ltd ACN 124 818 113
7043/6	05 February 2024	Nyrstar Hobart Pty Ltd ACN 124 818 113

PURPOSE OF THIS DOCUMENT

This “Permit as varied” document contains a consolidated list of all Permit conditions including variations to the Permit or Permits that have been caused by the issuing of an environment protection notice or notices referred to above.

DEFINITIONS

Unless the contrary appears, words and expressions used in this document have the meaning given to them in Schedule 1 of this document and in the *Environmental Management and Pollution Control Act 1994* (EMPCA). If there is any inconsistency between a definition in the EMPCA and a definition in this document, the EMPCA prevails to the extent of the inconsistency.

REQUIREMENTS

The person responsible for the activity must comply with the varied permit conditions as set out in Schedule 2 of this document.

INFORMATION

Attention is drawn to Schedule 3 of this document, which contains important additional information.

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Attachments

Schedule 1: Definitions

Activity means any environmentally relevant activity (as defined in Section 3 of EMPCA) to which this document relates, and includes more than one such activity.

Annual Exceedance Probability means the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year, as defined by the Bureau of Meteorology's latest design rainfall statistical dataset.

Authorized Officer means an authorized officer under section 20 of EMPCA.

Background Noise Level is the level that exceed 90% of the time of each measurement interval and is measured in the absence of the subject site noise.

Control Location (Noise) means a location chosen to represent the general ambient sound without contribution from noise sources at the activity.

Controlled Waste has the meaning described in Section 3(1) of EMPCA.

Decommissioning means the dismantling and removal of structures and equipment and the removal or control of pollutants or processes that may cause environmental harm undertaken subsequent to the cessation of the activity or part thereof.

Decommissioning and Rehabilitation Scope of Works or **DRSW** means the document titled *Decommissioning and* Rehabilitation - *Scope of Works*, by Nyrstar Hobart Pty Ltd, dated 26 July 2022 and includes any amendment to or substitution of this document approved in writing by the Director.

Derwent Estuary Mixing Zone is the area which extends 200 metres upstream, 200 metres downstream and 200 metres northeasterly into the Derwent Estuary from the activity's Foreshore (Tail Gas Scrubber) Stack Outfall diffuser; and is the area as shown in Attachment 6 of this Notice.

Director means the Director, Environment Protection Authority holding office under Section 18 of EMPCA and includes a delegate or person authorised in writing by the Director to exercise a power or function on the Director's behalf.

Dominant or Intrusive Noise Characteristics means any noise characteristic that contributes to a noise being considered louder than would be indicated by the A-weighted sound pressure level measured, or that exacerbates nuisance or harm caused by the noise.

DRP means Decommissioning and Rehabilitation Plan

Dust Management Plan means the document tiled Nyrstar Hobart Dust Management Plan 2022 (Nyrstar Hobart Doc No. HM-824-02569) and includes any amendment to or substitution of this document approved in writing by the Director.

East Risdon Community Area is the area as shown in Attachment 7 of this Notice.

EMPCA means the *Environmental Management and Pollution Control Act 1994*.

Environmental Harm and **Material Environmental Harm** and **Serious Environmental Harm** each have the meanings ascribed to them in Section 5 of EMPCA.

Environmental Nuisance has the meaning ascribed to it in Section 3 of EMPCA.

Environmentally Hazardous Material means any substance or mixture of substances of a nature or held in quantities which present a reasonably foreseeable risk of causing serious or material environmental harm if released to the environment and includes fuels, oils, waste and chemicals but excludes sewage.

EPA Board means the Board of the Environment Protection Authority established under section 13 of EMPCA and includes a delegate or person authorised in writing by the EPA Board to exercise a power or function on the EPA Board's behalf.

Fuel Burning Emission Source means an emission point that exhausts atmospheric emissions from a boiler that has a heating capacity of 100 megajoules (27.7 Kw) per hour or more.

GLC means Ground Level Concentration.

Groundwater Management Plan or **(GMP)** means the document titled *2022-2025 Groundwater Management Plan*, by Nyrstar Hobart Pty Ltd, dated January 2022 and includes any amendment to or substitution of this document and approved in writing by the Director.

In-Stack Concentration has the meaning ascribed to it in the *Environment Protection Policy (Air Quality) 2004*.

Leachate means any liquid that is either released by or has percolated through jarosite in the temporary secure landfill cell located on The Land.

Noise Measurement Procedures Manual means the document titled *Noise Measurement Procedures Manual*, by the Department of Environment, Parks, Heritage and the Arts, dated July 2008, and any amendment to or substitution of this document.

Noise Sensitive Premises means residences and residential zones (whether occupied or not), schools, hospitals, caravan parks and similar land uses involving the presence of individual people for extended periods, except in the course of their employment or for recreation.

Nominated Ambient TSPM Locations means the following locations: Risdon Road North (42°49'43.05"S, 147°18'48.83"E), at the activity's northern exit; Tennis Courts, Risdon Road (42°50'32.76"S, 147°19'1.17"E); and Birch Road (42°50'9.29"S, 147°18'45.54"E), as depicted in Attachment 3 of this Notice.

Nominated Community GLC SO_2 Monitoring Locations means the following locations: Technopark, Dowsings Point (42°49'23.87"S, 147°18'12.51"E), Goodwood; Tennis Courts, Risdon Road (42°50'32.76"S, 147°19'1.17"E); and Birch Road (42°50'9.30"S, 147°18'45.57"E), as depicted in Attachment 4 of this Notice.

Nominated Community Noise Monitoring Locations means Birch Road (42°50'7.61"S, 147°18'43.77"E) and Delwood Drive (42°50'21.06"S, 147°18'46.79"E), Lutana, and Saundersons Road, East Risdon (42°49'33.69"S, 147°19'11.78"E), as depicted in Attachment 8 of this Notice.

Nominated Discharge Point means the Foreshore (Tail Gas Scrubber) Outfall (42°49'43.67"S, 147°18'59.94"E) to the Derwent Estuary from the effluent treatment plant located on The Land, depicted as TGS Foreshore Outfall in Attachment 9 of this Notice.

Nominated Exhaust Points means the following emission point sources: Anode Casting Plant Exhaust Stack, Cadmium Smelter Plant Stack, Copper Sulphate Crystalliser Plant Vent Stack, Foreshore (Tail Gas Scrubber) Stack, Paragoethite (PG) Dryer Stack, Roaster Baghouse Stack, V1 Furnace Stack, V2 Furnace Stack, Zinc Dust Plant 1 (ZP1) Stack, Zinc Dust Plant 3 (ZP3) Stack, MZR Furnace Stack and MZR Dross Stack; as depicted in Attachment 2 of this Notice.

Nominated Groundwater Monitoring Bores means unless otherwise specified in writing by the Director, the groundwater monitoring bores as depicted in Attachment 5 of this Notice.

Nominated Stormwater Discharge Points means the following points: No. 2 Contaminated Water Pond Outfall (42°49'47.61"S, 147°19'9.84"E), New Town Bay Outfall (42°50'22.69"S, 147°19'7.16"E), B Drain Outfall (42°49'46.09"S, 147°19'5.07"E), C Drain Outfall (42°49'49.41"S, 147°19'12.53"E), Wharf Stormwater Pond Overflow (42°49'58.46"S, 147°19'23.17"E) and Loogana Overflow (42°50'23.18"S, 147°19'18.53"E), as depicted in Attachment 9 of this Notice.

Non-process Waste Management Plan means the document titled *Non-process Waste Management Plan*, by Nyrstar Hobart Pty Ltd, dated May 2017, and any amendment to or substitution of this document and approved in writing by the Director.

Normal Ambient Noise refers to the ambient noise of the receiver location in the absence of the subject site noise. Ambient noise level is measured in L_{Aeq}.

Nyrstar Hobart Procedure: Estuarine Water, Sediment and Biota Sampling means the document titled *Nyrstar Hobart Procedure: Estuarine Water, Sediment and Biota Sampling*, by Nyrstar Hobart Pty Ltd, Document Version: 07, Document No. HP-826-00731, and any amendment to or substitution of this document and approved in writing by the Director.

Person Responsible is any person who is or was responsible for the environmentally relevant activity to which this document relates and includes the officers, employees, contractors, joint venture partners and agents of that person, and includes a body corporate.

Planning Authority means the Council(s) for the municipal area(s) in which The Land is situated.

PM_{10} means particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less.

Pollutant has the meaning ascribed to it in Section 3 of EMPCA.

Procedure For: Environmental Monitoring in the Loogana-Inshallah Area means the document titled *Procedure For: Environmental Monitoring in the Loogana-Inshallah Area*, by Nyrstar Hobart Pty Ltd, Document Version: 03 Identifying Number HP-826-03536, and any amendment to or substitution of this document and approved in writing by the Director.

Raw Materials means zinc concentrate ores and zinc oxides or calcines.

Reporting Period means the 12 months ending on 31 December of each year.

Review of the Storage and Handling of Environmentally Hazardous Materials or **RSHEHM** means document titled *Review of the Storage and Handling of Environmentally Hazardous Materials*, version 2, by Nyrstar Hobart Pty Ltd, dated 19 February 2021, and includes any amendment to or substitution of this document and approved in writing by the Director.

Stack Test means the taking of measurements and the collection of samples for analysis from within a chimney, stack or flue.

Stormwater means water runoff as a consequence of a rainfall event, whether surface flow, piped flow, or flow within conduits, including any contaminants collected by the water during its passage.

Stormwater Strategy Report means the document titled *Stormwater Strategy Report*, by Nyrstar Hobart Pty Ltd, dated September 2010 and includes any amendment to or substitution of this document and approved in writing by the Director.

Strainer Backwash Outfall means the wastewater discharge point located at approximately 42°49'46.14"S, 147°18'57.56"E, as depicted in Attachment 9 of this Notice.

The Land means the land on which the activity to which this document relates may be carried out, and includes: buildings and other structures permanently fixed to the land, any part of the land covered with water, and any water covering the land. The Land falls within the area defined by:

1 the map shown in Attachment 1 of this Notice; and

2 is part of the land covered by Property ID: 7855159.

TSPM means Total Suspended Particulate Monitoring.

Waste has the meaning ascribed to it in Section 3 of EMPCA.

Wastewater means spent or used water (whether from industrial or domestic sources) containing a pollutant and includes leachate and stormwater that is contaminated or potentially contaminated with pollutants or which becomes mixed with wastewater.

Schedule 2: Conditions

Maximum Quantities

Q1 Regulatory limits

1 The activity must not exceed the following limits :

1.1 600,000 tonnes per year of raw materials processed.

General

G1 Access to and awareness of conditions and associated documents

A copy of these conditions and any associated documents referred to in these conditions must be held in a location that is known to and accessible to the person responsible for the activity. The person responsible for the activity must ensure that all persons who are responsible for undertaking work on The Land, including contractors and sub-contractors, are familiar with these conditions to the extent relevant to their work.

G2 Incident response

If an incident causing or threatening environmental nuisance, serious environmental harm or material environmental harm from pollution occurs in the course of the activity, then the person responsible for the activity must immediately take all reasonable and practicable action to minimise any adverse environmental effects from the incident.

G3 Proposed change to activity

1 The person responsible must notify the Director in writing prior to implementing any change to the activity authorised by this document that may cause or increase the emission of a pollutant or which may result in environmental harm or environmental nuisance (even temporarily). A change includes, but is not limited to, any of the following:

1.1 an increase in the discharge of a pollutant, or the location of its discharge.

1.2 the construction, installation, alteration or removal of any structure or equipment used in the course of carrying out the activity.

1.3 any clearance of native vegetation or earthworks.

1.4 a change in the quantity or characteristics of materials used in carrying out the activity.

2 The notification must be in an approved form and include the following:

2.1 details of the proposed change;

2.2 an assessment of the environmental impacts that may result from the change;

2.3 any relevant approvals held by the person responsible; and

2.4 any advice from the relevant planning authority to the effect that approval is not required.

3 The person responsible must provide additional information as requested by an Authorized Officer.

4 The proposed change must not be implemented until the Director has confirmed in writing that they are satisfied that no other approval or variation of this document is required.

5 For the avoidance of doubt, a notification of a proposed change under this provision is not required if the proposed change is part of a referral to the EPA Board for assessment under sections 24, 25 or 27 of EMPCA.

G4 Change of ownership

If the owner of The Land upon which the activity is carried out changes or is to change, then, as soon as reasonably practicable but no later than 30 days after becoming aware of the change or intended change in the ownership of The Land, the person responsible must notify the Director in writing of the change or intended change of ownership.

G5 Change of responsibility

If the person responsible for the activity intends to cease to be responsible for the activity, that person must notify the Director in writing of the full particulars of any person succeeding him or her as the person responsible for the activity, before such cessation.

G6 Complaints register

1 A public complaints register must be maintained. The public complaints register must, as a minimum, record the following detail in relation to each complaint received in which it is alleged that environmental harm (including an environmental nuisance) has been caused by the activity:

1.1 the date and time at which the complaint was received;

1.2 contact details for the complainant (where provided);

1.3 the subject-matter of the complaint;

1.4 any investigations undertaken with regard to the complaint; and

1.5 the manner in which the complaint was resolved, including any mitigation measures implemented.

2 Complaint records must be maintained for a period of at least 3 years.

G7 Annual Environmental Review

1 Unless otherwise specified in writing by the Director, a publicly available Annual Environmental Review for the activity must be submitted to the Director each year within three months of the end of the reporting period.

2 Without limitation, each Annual Environmental Review must include the following information:

2.1 a statement by the General Manager, Chief Executive Officer or equivalent for the activity acknowledging the contents of the Annual Environmental Review;

2.2 subject to the *Personal Information Protection Act 2004*, a list of all complaints received from the public during the reporting period concerning actual or potential environmental harm caused by the activity and a description of any actions taken as a result of those complaints;

2.3 details of environment-related procedural or process changes that have been implemented during the reporting period;

2.4 a summary of the amounts (tonnes or litres) of both solid and liquid wastes produced and treatment methods implemented during the reporting period. Initiatives or programs planned to avoid, minimise, re-use, or recycle such wastes over the next reporting period should be detailed;

2.5 a summary of the quantities of controlled wastes being held on The Land;

2.6 details of all non-trivial environmental incidents and/or incidents of non compliance with permit or environment protection notice conditions that occurred during the reporting period, and any mitigative or preventative actions that have resulted from such incidents;

2.7 a summary of the monitoring data and record keeping required by these conditions. This information should be presented in graphical form where possible, including comparison with the results of at least the preceding reporting period. Special causes and system changes that have impacted on the parameters monitored must be noted. Explanation of significant deviations between actual results and any predictions made in previous reports must be provided;

2.8 identification of breaches of limits specified in these conditions and significant variations from predicted results contained in any relevant management plan, an explanation of why each identified breach of specified limits or variation from predictions occurred and details of the actions taken in response to each identified breach of limits or variance from predictions;

2.9 a list of any issues, not discussed elsewhere in the report, that must be addressed to improve compliance with these conditions, and the actions that are proposed to address any such issues;

2.10 a summary of fulfilment of environmental commitments made for the reporting period. This summary must include indication of results of the actions implemented and explanation of any failures to achieve such commitments; and

2.11 a summary of any community consultation and communication undertaken during the reporting period.

G8 Additional annual reporting requirements

1 Annual Environmental Reviews submitted in accordance with these conditions must include the following additional information:

1.1 Reporting on the progress of *implementing* the actions detailed in the *Review of the Storage and Handling of Environmentally Hazardous Materials.*

G9 Amendment of required plans and reports

1 The plans and reports required by these conditions must be amended to address any matter required by the Director, as advised by notice in writing.

2 Amended plans and reports must be resubmitted within the timeframe that the Director specifies.

Atmospheric

A1 Stack emission limits

1 The in-stack concentrations in emissions from all nominated exhaust points of substances listed in Column 1 of table A1 below must not exceed the limits specified in Column 4 when measured in the units specified in Column 2 and adjusted to the reference gas value specified in Column 3.

2 Table A1: Atmospheric Emission Limits

Column 1: Substance	Column 2 : Unit of Measure	Column 3: Reference Gas Value	Column 4: Emission Limit
Metals - antimony (Sb),arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), selenium (Se), tin (Sn), vanadium (V). or any compound thereof.	mg/m^3		5 for combined total, 1 for Cd or Hg
Oxides of nitrogen (NO_x)	g/m^3	7% oxygen by volume for fuel burning emission sources	2 (as NO_2)
Particulate matter	mg/m^3 dry gas at 0^oC and 101.325 kPa	7% oxygen by volume for fuel burning emission sources	100
Sulphur dioxide (SO_2)	g/m^3 dry gas at 0^oC and 101.325 kPa		7.2
Sulphur trioxide (SO_3)	mg/m^3		100

3 Notwithstanding the above, the limit for SO_2, when measured by the Continuous (air) Emission Monitoring device, is not considered breached unless the limit is exceeded continuously for greater than 15 minutes.

A2 Maximum ground level concentrations

1 Unless otherwise specified in writing by the Director, from 12 months after the date of issue of EPN 7043/6 the maximum ground level concentration (GLC) of the substances listed in Column 1 of Table A2 below must not exceed the GLC specified in Column 2 or Column 3, under the conditions specified in Column 4, beyond the boundary of The Land.

2 Table A2: Maximum Ground Level Concentrations

Column 1: Substance	Column 2: Ground Level Concentration in ppm	Column 3: Ground Level Concentration in mg/m^3 at 25°C, 1 atm	Column 4: Averaging period
Lead (Pb)		0.0015	90 day average
Sulphur Dioxide (SO_2)	0.10		1 hour average
Sulphur Dioxide (SO_2)	0.020		24 hour average

A3 Stack testing facilities

1 The following stack testing facilities must be available at all nominated exhaust points when undertaking stack testing required by these conditions:

1.1 sampling positions must be in accordance with Australian Standard AS 4323.1 (*Stationary source emissions - selection of sampling positions*), or as approved in writing by the Director;

1.2 safe sampling platforms must be located to allow access to the sampling positions and safe access to these sampling platforms must be provided; and

1.3 all necessary services required for the test method prescribed must be provided.

A4 Stack monitoring requirements

1 Unless otherwise specified in writing by the Director, stack tests must be undertaken in accordance with table A4:

1.1 Table A4: Emission Point Source Monitoring

Nominated Exhaust Point	Monitoring Parameters	Monitoring Frequency
Foreshore (Tail Gas Scrubber) Stack	SO_3, NOx, Particulates	6 monthly
Anode Casting Plant Exhaust Stack	Metals and Particulates	6 monthly
Cadmium Smelter Plant Stack	Metals and Particulates	6 monthly
Copper Sulphate Crystalliser Plant Vent Stack	Metals and Particulates	6 monthly
Paragoethite Dryer Stack	Metals and Particulates	6 monthly
Roaster Baghouse Stack	Metals and Particulates	6 monthly
V1 and V2 Furnace Stacks	Metals and Particulates	6 monthly
Zinc Dust Plant 1 Stack	Metals and Particulates	6 monthly
Zinc Dust Plant 3 Stack	Metals and Particulates	6 monthly
MZR Furnace Stack	Metals and Particulates	6 monthly
MZR Dross Stack	Metals and Particulates	6 monthly

1.2 Monitoring for all parameters in the above table must be determined in g/min and mg/m^3 and for fuel burning emission sources particulates and NOx must be adjusted to 7% O_2 level.

1.3 Metals means the parameters listed in Table 2 - In-stack concentrations of the *Environment Protection Policy (Air Quality) 2004*.

2 Stack tests must be carried out while the activity is operating under normal conditions.

A5 Stack monitoring reports

1 A Stack Monitoring Report(s) must be provided as part of the Annual Environmental Review required by these conditions.

2 Each report must include:

2.1 the results of the stack test;

2.2 the date on which the stack test was conducted;

2.3 weather information at the time the stack test was conducted;

2.4 relevant operating conditions including the fuel feed rate at the time the stack test was conducted;

2.5 the stack test methods employed; and

2.6 identification of breaches of limits specified in these conditions, an explanation of why each breach of specified limits occurred and details of actions that have or will be taken in response to each identified breach of limits.

3 Where total particulate matter testing is carried out reporting must be done in accordance with Section 9 of Australian Standard AS 4323.2.2023 Stationary source emissions - Determination of total particulate matter - Isokinetic manual sampling - Gravimetric method, and any subsequent version of the standard.

A6 Continuous Emission Monitoring

A Continuous (air) Emission Monitoring (CEM) device must be installed and maintained in the Foreshore (Tail Gas Scrubber) Stack to continuously record the in-stack concentration of sulphur dioxide (SO_2) at the frequency of at least one reading recorded per minute.

A7 Maintain an atmospheric model

1 Unless otherwise approved in writing by the Director, an atmospheric model for the activity must be maintained.

2 The model must be updated upon replacement, repair or addition of equipment that is a significant source of atmospheric emissions and where replacement, repair or addition of equipment may increase or adversely alter the level or character of the atmospheric emissions from the activity.

3 It is not necessary to re-measure atmospheric emissions unless emission characteristics have changed since a previous measurement accepted by the Director. New or modified atmospheric emission sources must be measured within 6 months of commissioning or re-commissioning the emission sources.

A8 Ambient particulate monitoring

1 Unless otherwise approved in writing by the Director, ambient air quality Total Suspended Particulate Monitoring (TSPM) stations must be maintained at the nominated ambient TSPM locations.

1.1 The TSPM stations may be temporarily removed from operations for maintenance and/or calibration purposes. The Director must be advised of the need to temporarily remove the TSPM stations for a time period that is greater than eight (8) hours.

2 The TSPM stations must monitor and sample for Total Suspended Particulate and Lead (Pb), at a frequency of a continuous 24 hour period once every six (6) days.

A9 Community sulphur dioxide monitoring

1 Unless otherwise approved in writing by the Director, community Ground Level Concentration (GLC) of sulphur dioxide (SO_2) monitoring stations must be maintained at the nominated community GLC SO_2 monitoring locations.

1.1 The community GLC SO_2 monitors may be temporarily removed from operations for maintenance and/or calibration purposes. The Director must be advised of the need to temporarily remove the community GLC SO_2 monitors for a time period that is greater than eight (8) hours.

2 The GLC SO_2 monitoring stations must continuously monitor for SO_2 and must be able to produce results that are able to be used to determine one (1) day and one (1) hour averages of SO_2 GLC.

A10 Odour management

The person responsible must institute such odour management measures as are necessary to prevent odours causing environmental nuisance beyond the boundary of The Land.

A11 Control of dust emissions

1 The activity must be undertaken in accordance with the Dust Management Plan.

2 Notwithstanding the above, dust emissions from The Land must be controlled to the extent necessary to prevent environmental harm and/or environmental nuisance.

3 The person responsible may apply to the Director to vary or substitute the Dust Management Plan. Any variation or substitution of the plan approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice.

A12 Lead Emissions Control Plan

1 Unless otherwise approved by the Director in writing, within 12 months of the date of issue of the issue of EPN 7043/6 and at three (3) yearly intervals a Lead Emissions Control Plan must be submitted to the Director for approval. The plan is to have the aim reducing ground level concentrations for lead for the activity, by the extent that is reasonable and practical. This requirement will be deemed to be satisfied only when the Director indicates in writing that the submitted document adequately addresses the requirements of this condition.

2 The plan must be prepared in accordance with any reasonable guidelines provided by the Director.

3 Without limitation, the plan must include details of the following:

3.1 Expected reduction in ground level concentrations for lead;

3.2 Prioritised (net environmental benefit analysis) actions for the management and/or monitoring of sources of lead emissions;

3.3 A timetable for implementation and completion of actions;

3.4 Measures for determining the success of the completed actions; and

3.5 A reporting program to regularly advise the Director of the results of the plan.

4 Once approved the person responsible must act in accordance with the approved plan.

5 The person responsible may apply to the Director to vary or substitute the Lead Emissions Control Plan. Any variation or substitution of the plan approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice.

A13 Interim maximum ground level concentrations

1 Unless otherwise specified in writing by the Director, for the period of 12 months from the date of issue of EPN 7043/6 the maximum ground level concentration (GLC) for the substances listed in Column 1 of the table A13 below must not exceed the GLC specified in Column 2 , under the conditions specified in Column 3 beyond the boundary of The Land.

2 **Table A13: Interim Maximum Ground Level Concentrations**

Column 1: Substance	Column 2: Ground Level Concentration	Column 4: Averaging period
Lead (Pb)	0.0015 mg/m^3	90 day average
Sulphur Dioxide (SO_2)	0.20 ppm	1 hour average
Sulphur Dioxide (SO_2)	0.080 ppm	24 hour average

Decommissioning And Rehabilitation

DC1 Assessment of Site Contamination

1 Unless otherwise specified in writing by the Director, an evaluation of changes in the extent or degree of contamination of The Land or caused by the activity must be undertaken and a revised Assessment of Site Contamination Report (ASCR) based on the evaluation must be submitted to the Director by 31 October 2021 and at three (3) yearly intervals thereafter.

2 The ASCR must include a statement by the General Manager, Chief Executive Officer or equivalent for the activity acknowledging the contents of the ASCR.

3 The evaluation of contamination must be done in accordance with the NEPM.

4 The revised ASCR must clearly demonstrate whether or not there has been a change in contamination between each evaluation of contamination undertaken.

5 A revised ASCR may be submitted in the form of changes to the previous such document or as a substitute ASCR.

DC2 Decommissioning and Rehabilitation Scope of Works

1 Unless otherwise specified in writing by the Director, a review of the Decommissioning and Rehabilitation Scope of Works (DRSW) for the activity must be undertaken and a revised DRSW must be submitted to the Director within six (6) months of the Director having approved a revised ASCR required by these conditions.

2 The DRSW must include a statement by the General Manager, Chief Executive Officer or equivalent for the activity acknowledging the contents of the DRSW.

3 The DRSW must address the contamination identified in the ASCR most recently approved by the Director.

4 The DRSW must address any changes to the activity that have the potential to alter the liabilities for the decommissioning of the activity and the rehabilitation of The Land.

5 The DRSW must provide details on the progress of any decommissioning or rehabilitation that has taken place.

6 The DRSW must provide details of resources, both physical and financial, required for the decommissioning of the activity and rehabilitation of The Land.

7 A revised DRSW may be submitted in the form of changes to the previous such document or as a substitute DRSW.

DC3 Notification of cessation

Within 30 days of becoming aware of any event or decision which is likely to give rise to the permanent cessation of the activity, the person responsible for the activity must notify the Director in writing of that event or decision. The notice must specify the date upon which the activity is expected to cease or has ceased.

DC4 Decommissioning and Rehabilitation Plan

1 Unless otherwise approved in writing by the Director, a Decommissioning and Rehabilitation Plan (DRP) must be submitted to the Director within 180 days of the notification of permanent cessation of the activity.

2 The DRP must:

2.1 be written in accordance with any guidelines provided by the Director; and

2.2 include details of contamination from the most recently approved ASCR, action proposed by the most recently approved DRSW.

DC5 Implementation of the DRP

1 Following permanent cessation of the activity, the decommissioning of the activity and the rehabilitation of The Land must be carried out in accordance with the most recent Decommissioning and Rehabilitation Plan (DRP) approved by the Director.

2 The person responsible may apply to the Director to vary or substitute the DRP. Any variation or substitution of the DRP approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice.

DC6 Temporary suspension of activity

1 Within 30 days of becoming aware of any event or decision which is likely to give rise to the temporary suspension of the activity, the person responsible for the activity must notify the Director in writing of that event or decision. The notice must specify the date upon which the activity is expected to suspend or has suspended.

2 During temporary suspension of the activity The Land must be managed and monitored by the person responsible for the activity to ensure that emissions from The Land do not cause serious environmental harm, material environmental harm or environmental nuisance.

3 If required by the Director, a Care and Maintenance Plan for the activity must be submitted to the Director for approval, by a date specified in writing by the Director. This requirement will be deemed to be satisfied only when the Director indicates in writing that the submitted document adequately addresses the requirements of this condition.

3.1 The plan must be prepared in accordance with any reasonable guidelines provided by the Director.

3.2 Once approved the person responsible must act in accordance with the approved Care and Maintenance Plan.

3.3 The person responsible may apply to the Director to vary or substitute the Care and Maintenance Plan. Any variation or substitution of the plan approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice.

4 Unless otherwise approved in writing by the Director, if the activity on The Land has substantially ceased for 2 years or more, rehabilitation of The Land must be carried out in accordance with the requirements of these conditions as if the activity has permanently ceased.

Groundwater

GW1 Groundwater Management Plan

1 Unless otherwise specified by these conditions, or in writing by the Director, the activity must operate in accordance with the approved Groundwater Management Plan (GMP).

2 Unless otherwise specified in writing by the Director, a review of the GMP must be undertaken with the aim to reduce groundwater contamination and hydrogeologically isolate The Land from the River Derwent, and a revised GMP must be submitted to the Director for approval by 31 October 2025 and at three (3) yearly intervals thereafter.

3 The GMP must contain:

3.1 Prioritised (net environmental benefit analysis) actions for monitoring, management and/or remediation of groundwater;

3.2 Objectives of the prioritised actions;

3.3 Timeframes for the actions to be undertaken and completed;

3.4 Measures for determining the success of the completed actions; and

3.5 Reporting frequency of any monitoring.

4 Once approved the person responsible must act in accordance with the approved plan.

5 The person responsible may apply to the Director to vary or substitute the GMP. Any variation or substitution of the plan approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice

GW2 Groundwater Monitoring Bores

1 Unless otherwise specified in writing by the Director, all new groundwater bores must have an installation and development record, which includes, but is not limited to the following:

1.1 a description of the materials used for construction;

1.2 initial field measurements of the groundwater for conductivity, pH and temperature;

1.3 details of slot screens installed, and the depth to which they were installed;

1.4 depth of gravel packing;

1.5 depth of the bentonite cap;

1.6 details of bore development during pumping (removal of drilling contamination);

1.7 aquifer levels; and

1.8 a detailed geological log.

2 The following details must be recorded when sampling groundwater bores:

2.1 standing water level;

2.2 bore volume;

2.3 time of purging;

2.4 sampling time and number; and

2.5 field water quality parameters (including conductivity, pH and water temperature).

3 Bore and piezometer placement must be carried out in consultation with and under supervision of a suitably qualified person.

GW3 Groundwater monitoring bores

1 Unless otherwise approved in writing by the Director, all nominated groundwater monitoring bores on The Land must be maintained and refurbished where necessary to ensure that they are suitable for continued use.

1.1 In the event a bore is damaged in such a manner that it cannot be refurbished to be made suitable for use, the Director must be notified of the removal of the bore from use and provided of details of any replacement bore.

2 Each monitoring bore must be clearly identifiable with an intact surface seal and stable well casing.

GW4 Groundwater Monitoring

1 Unless otherwise specified in writing by the Director, monitoring and the frequency of monitoring, must be undertaken in accordance with Table 4 below. The nominated groundwater monitoring bores must be monitored for the parameters listed in Column 1 (by field measurement or by representative sampling followed by analysis), at the frequencies listed in Column 3 and the results must be reported in the units in Column 2.

2 Table 4: Groundwater Monitoring Requirements

Column 1 - Parameter	Column 2 - Units	Column 3 - Sampling Frequency
Water Depth	m	six (6) monthly
Zinc (Zn)	mg/L	once every two (2) years
Cadmium (Cd)	mg/L	once every two (2) years
Lead (Pb)	mg/L	once every two (2) years
Mercury (Hg)	mg/L	once every two (2) years
Copper (Cu)	mg/L	once every two (2) years
Manganese (Mn)	mg/L	once every two (2) years
Sulphate (SO_4)	mg/L	once every two (2) years
pH	pH units	once every two (2) years
conductivity	µS/cm	once every two (2) years

Hazardous Substances

H1 Storage and handling of hazardous materials

1 Unless otherwise approved in writing by the Director, environmentally hazardous materials held on The Land must be:

1.1 located within impervious bunded areas, spill trays or other containment systems; and

1.2 managed to prevent unauthorised discharge, emission or deposition of pollutants:

1.2.1 to soils within the boundary of The Land in a manner that is likely to cause serious environmental harm;

1.2.2 to groundwater;

1.2.3 to waterways; or

1.2.4 beyond the boundary of The Land.

H2 Spill kits

Spill kits appropriate for the types and volumes of materials handled on The Land must be kept in appropriate locations to assist with the containment of spilt environmentally hazardous materials.

H3 Inventory of hazardous materials

An inventory must be kept of all environmentally hazardous materials stored and handled on The Land. The inventory must specify the location of storage facilities and the maximum quantities of each environmentally hazardous material likely to be kept in storage and must include material safety data sheets for those environmentally hazardous materials.

H4 Progressive improvement of storage and handling of hazardous materials

1 Unless otherwise specified in writing by the Director, a review of the *Review of the Storage and Handling of Environmentally Hazardous Materials* (RSHEHM) must be undertaken with the aim to progressively improve the storage and handling of environmentally hazardous materials to ensure compliance with these conditions, and a revised RSHEHM must be submitted to the Director for approval within one (1) year of the issue of EPN 7043/6 and at three (3) yearly intervals thereafter.

2 The RSHEHM must contain:

2.1 General description of hazardous materials storage and handling areas which details the location, purpose, condition and photograph;

2.2 Risk assessment of the abovementioned areas; and

2.3 List of actions, with timeframes to improve and/or maintain the condition of the bunding.

3 Once approved the person responsible must act in accordance with the approved RSHEHM.

4 The person responsible may apply to the Director to vary or substitute the RSHEHM. Any variation or substitution of the plan approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice.

Monitoring

M1 Samples and measurements for monitoring purposes

1 Any sample or measurement required under these conditions must be taken and processed in accordance with the following:

1.1 sampling and measuring must be undertaken by a person with training, experience, and knowledge of the appropriate procedure;

1.2 the integrity of samples must be maintained prior to delivery to a testing facility;

1.3 sample analysis must be conducted by a testing facility accredited by the National Association of Testing Authorities (NATA), or a testing facility approved in writing by the Director, for the specified test;

1.4 details of methods employed in taking samples and measurements and results of sample analysis, and measurements must be retained for at least three (3) years after the date of collection; and

1.5 sampling and measurement equipment must be maintained and operated in accordance with manufacturer's specifications and records of maintenance must be retained for at least three (3) years.

M2 Nominated Discharge Point monitoring

1 Unless otherwise specified in writing by the Director, monitoring and the frequency of monitoring, must be undertaken in accordance with table 5 below. The Nominated Discharge Point must be monitored for the parameters listed in Column 1 (by field measurement or by representative sampling followed by analysis), at the frequencies listed in Column 3 and must be reported in the units in Column 2.

2 Table 5: Nominated Discharge Point Monitoring Requirements

Column 1 - Parameter	Column 2 - Units	Column 3 - Sampling Frequency
Volume of flow (L/h)	L/h	Daily 24 hour composite
Zinc (Zn)	mg/L	Daily 24 hour composite
Cadmium (Cd)	mg/L	Daily 24 hour composite
Lead (Pb)	mg/L	Daily 24 hour composite
Mercury (Hg)	mg/L	Daily 24 hour composite
Arsenic (As)	mg/L	Six (6) Monthly
Copper (Cu)	mg/L	Six (6) Monthly
Iron (Fe)	mg/L	Six (6) Monthly
Manganese (Mn)	mg/L	Six (6) Monthly
Nitrogen (N) as ammonia	mg/L	Six (6) Monthly
Fluoride (F^-)	mg/L	Six (6) Monthly
Total Suspended Solids (TSS)	mg/L	Six (6) Monthly

M3 Exceedance of emission limits

1 In the event that any of the emission limits specified in these conditions are exceeded:

1.1 The Director must be notified within 24 hours of the person responsible becoming aware of the exceedance;

1.2 A report must be forwarded to the Director within 30 days of becoming aware of the exceedance. The report must include, but not necessarily be limited to, the following:

1.2.1 the reported concentration;

1.2.2 an explanation as whether the exceedance is likely to have caused or threatens environmental harm and or nuisance;

1.2.3 an explanation as to why the emission limit was exceeded;

1.2.4 prompt actions that were undertaken to control the exceedance;

1.2.5 the results of re-sampling of the monitoring point/s at which the exceedance was recorded;

1.2.6 proposed actions to limit the likelihood of a recurrence of the exceedance; and

1.2.7 any other information that would assist the Director to understand the exceedance.

1.3 Unless otherwise approved in writing by the Director, the proposed actions to limit the likelihood of a recurrence must be implemented once approved by the Director. These actions may be amended from time to time with the written approval of the Director.

M4 Derwent Estuary Mixing Zone Monitoring

1 Unless otherwise approved in writing by the Director, the Derwent Estuary mixing zone must be monitored monthly for pH at a minimum of 4 sampling locations on the boundary of the mixing zone that are likely to be impacted by the mixing plume; and

2 The tidal flow and conditions at the time of sampling must be recorded.

M5 Estuarine water, sediment and biota monitoring

1 Estuarine water, sediment and biota monitoring must be undertaken in accordance with the *Nyrstar Hobart Procedure: Estuarine Water, Sediment and Biota Sampling* (EWS&B Sampling).

2 The person responsible may apply to the Director to vary or substitute the EWS&B Sampling. Any variation or substitution of the plan approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice.

Noise Control

N1 Noise emission limits

1 Noise emissions from the activity when measured at any noise sensitive premises in other ownership not located in the East Risdon Community area and expressed as the equivalent continuous A-weighted sound pressure level must not exceed 52 dB(A).

2 Noise emissions from the activity when measured at any noise sensitive premises in other ownership located in the East Risdon Community area and expressed as the equivalent continuous A-weighted sound pressure level must not exceed 56 dB(A).

3 Noise emissions from the activity when measured at any neighbouring industrial or commercial activity in other ownership and expressed as the equivalent continuous A-weighted sound pressure level must not exceed 65 dB(A).

4 Where the combined level of noise from the activity and the normal ambient noise exceeds the noise levels stated above, this condition will not be considered to be breached unless the noise emissions from the activity are audible and exceed the background noise level by at least 5 dB(A).

5 The time interval over which noise levels are averaged must be 10 minutes or an alternative time interval specified in writing by the Director.

6 Noise emissions from the site should not contain any dominant or intrusive noise characteristics when measured or observed at any noise sensitive premises as assessed in accordance with the *Noise Measurement Procedures Manual*. Where noise emissions from the site contain any dominant or intrusive noise characteristics at any noise sensitive premises, measured noise levels must be adjusted for tonality, impulsiveness, modulation and low frequency in accordance with the *Noise Measurement Procedures Manual*.

7 All methods of measurement must be in accordance with the *Noise Measurement Procedures Manual*.

N2 Community monitoring of noise emissions

1 Unless otherwise approved in writing by the Director, the person responsible must maintain three continuous community noise monitors at the nominated community noise monitoring locations.

1.1 The community noise monitors may be temporarily removed from operations for maintenance and/or calibration purposes. The Director must be advised of the need to temporarily remove the community noise monitors for a time period that is greater than eight (8) hours.

2 The continuous community noise monitors must be able to create an uninterrupted (to the extent reasonable and practicable) record of the results of community noise.

3 Noise emissions from the activity measured by the continuous community noise monitors, when expressed as a monthly median A-weighted L_{90} sound pressure level must not exceed:

3.1 52 dB(A) at the Birch Road location;

3.2 52 dB(A) at the Delwood Drive location; and

3.3 56 dB(A) at the Saundersons Road location.

N3 Noise survey requirements

1 Unless otherwise approved by the Director, a noise survey must be carried out:

1.1 within three (3) years since the previous noise survey;

1.2 within six (6) months from the date of any change to the activity which is likely to substantially alter the character or increase the volume of the noise emitted from The Land; and

1.3 at such other times as may reasonably be required by the Director.

N4 Noise survey method and reporting requirements

1 Noise surveys must be undertaken in accordance with a survey method approved in writing by the Director, as may be amended from time to time with written approval of the Director.

2 Without limitation, the survey method must address the following:

2.1 measurements must be carried out at day, evening and night times (where applicable) at each location; and

2.2 measurement locations, and the number thereof, must be specified, with one location established as a control location (noise).

3 Measurements and data recorded during the survey must include:

3.1 operational status of noise producing equipment and throughput of the activity;

3.2 subjective descriptions of the sound at each location;

3.3 details of meteorological conditions relevant to the propagation of noise;

3.4 the equivalent continuous (L_{eq}) and L_1, L_{10}, L_{50}, L_{90} and L_{99} A-weighted sound pressure levels measured over a period of 10 minutes or an alternative time interval approved by the Director;

3.5 one-third octave spectra over suitably representative periods of not less than 1 minute; and

3.6 narrow-band spectra over suitably representative periods of not less than 1 minute.

4 A noise survey report must be forwarded to the Director within 30 days from the date on which the noise survey is completed.

5 The noise survey report must include the following:

5.1 the results and interpretation of the measurements required by these conditions;

5.2 a map of the area surrounding the activity with the boundary of The Land, measurement locations, and noise sensitive premises clearly marked on the map;

5.3 any other information that will assist with interpreting the results and whether the activity is in compliance with these conditions and EMPCA; and

5.4 recommendations of appropriate mitigation measures to manage any noise problems identified by the noise survey.

N5 Maintain a noise model

1 Unless otherwise approved by the Director in writing, the noise model for the activity must be maintained.

2 The model must be updated upon replacement, repair or addition of equipment that is a significant source of noise and where replacement, repair or addition of equipment may increase or adversely alter the level or character of the noise emitted from the activity.

3 It is not necessary to re-measure noise sources unless their noise output has changed since a previous measurement accepted by the Director. New or modified noise sources must be measured within 6 months of commissioning or re-commissioning the sources.

Stormwater Management

SW1 Stormwater management

1 Unless otherwise approved in writing by the Director, the activity must operate in accordance with the approved *Stormwater Strategy Report*.

2 The person responsible may apply to the Director to vary or substitute the *Stormwater Strategy Report*. Any variation or substitution of the plan approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice.

SW2 Storm event discharges

1 Contaminated or potentially contaminated stormwater must only be discharged from The Land without treatment at the Effluent Treatment Plant where the stormwater arises from a critical duration storm event with 0.2 Annual Exceedance Probability and where the capacity of the stormwater infrastructure is exceeded.

2 In the event of the above:

2.1 the Director must be notified within 24 hours of the event;

2.2 as far as reasonably practicable stormwater must only be discharged from the Land from the nominated stormwater discharge points;

2.3 the flow rate in litres per hour (L/h) must be measured or a reasonable estimate of the flow must be calculated; and

2.4 a representative grab sample, or in the likely event of variable mass loading a composite sample or multiple grab samples, of the stormwater discharged from The Land must be analysed for the following:

2.4.1 Table SW2: Storm Event Monitoring Parameters

Parameter	Unit of Measure
Total Suspended Solids (TSS)	mg/L
Total Petroleum Hydrocarbons (TPH)	mg/L
Total Zinc (Zn)	mg/L
Total Cadmium (Cd)	mg/L
Total Copper (Cu)	mg/L
Total Lead (Pb)	mg/L

3 Within 30 days of the storm event the Director must be provided with a report on the storm event containing, at least, the following information:

3.1 A summary of the storm event, including a comparison of the intensity and duration of the event against the Annual Exceedance Probability;

3.2 Details of the actions undertaken to control the overflow;

3.3 Details of the investigations into contributing causes to the overflow;

3.4 Recommended actions to prevent a recurrence of the overflow; and

3.5 Any other information that would assist the Director to understand the event.

Waste Management

WM1 Non-process Waste Management Plan

1 Unless specified in these conditions, or approved in writing by the Director, the activity must operate in accordance with the approved *Non-process Waste Management Plan*.

2 The person responsible may apply to the Director to vary or substitute the *Non-process Waste Management Plan*. Any variation or substitution of the plan approved by the Director, by notice in writing, replaces the earlier approval with affect from the date specified in the notice.

WM2 Temporary Stockpiling of Jarosite

1 All leachate from the temporary secure jarosite landfill cell located on The Land must be collected and treated as wastewater for the purposes of these conditions.

2 Unless otherwise approved in writing by the Director, monitoring of the temporary secure jarosite landfill cell located on The Land must be undertaken in accordance with *Procedure For: Environmental Monitoring in the Loogana-Inshallah Area*, as may be amended from time to time with written approval of the Director.

3 Details of investigations into the options for treatment, reuse and/or disposal of the jarosite in the temporary secure jarosite landfill cell must be provided in each Annual Environmental Review required under these conditions.

4 If required by the Director in writing, the jarosite in the temporary secure jarosite landfill cell must be removed and reused or disposed in a manner approved by the Director.

WM3 Reprocessing of waste materials

1 Unless otherwise specified in writing by the Director, only the waste materials produced on The Land listed below can be reprocessed via the Roasters:

1.1 Solids collected from screens throughout the leach process;

1.2 Contaminated soils; and

1.3 Storage and process tanks sludges, flake linings and garnet mixtures.

2 Unless otherwise specified in writing by the Director, only solid material produced by the effluent treatment plant located on The Land and spent acid plant catalyst can be mixed with Lead Sulphate Leach Concentrate or Paragoethite for removal from The Land.

WM4 Treatment of mercury filter cake for disposal

The person responsible may treat mercury filter cake and other mercury contaminated waste materials for the purpose of making the waste materials suitable for disposal at a facility approved to receive such material. The treatment must take place in a bunded area.

Wastewater Management

WW1 Management of wastewater

1 Unless otherwise specified in these conditions all wastewater and contaminated or potentially contaminated stormwater must be directed to the Effluent Treatment Plant, located on The Land, for treatment prior to discharge via the nominated discharge point.

2 Notwithstanding the above, the following exceptions are permitted:

2.1 Tail Gas Scrubber Water directed to the Foreshore (Tail Gas Scrubber) Outfall; and

2.2 Back-flushing water from the saltwater strainers which is discharged via the Strainer Backwash Outfall.

WW2 Discharge of sewage

Sewage generated on The Land must not be combined with wastewater or stormwater from the activity, and must be directed to an approved external sewage system.

WW3 Discharge limits

1 The maximum concentration of each parameter specified in Column 1 of Table WW3 below, in water discharged from The Land to the Derwent Estuary, must not exceed the limit specified in Column 2.

2 Table WW3: Discharge Limits

Column 1 - Parameter	Column 2 - Maximum Concentration
Total Suspended Solids (TSS)	60 mg/L
Ammonia as Nitrogen	1.50 mg/L
Total Fluoride (F^-)	10.00 mg/L
Total Arsenic (As)	0.25 mg/L
Total Cadmium (Cd)	0.03 mg/L
Total Copper (Cu)	1.00 mg/L
Total Iron (Fe)	5.00 mg/L
Total Lead (Pb)	0.20 mg/L
Total Manganese (Mn)	5.00 mg/L
Total Mercury (Hg)	0.01 mg/L
Total Zinc (Zn)	5.00 mg/L

3 These limits do no not apply to stormwater discharged under a critical duration storm event with 0.2 Annual Exceedance Probability and where the capacity of the stormwater infrastructure is exceeded, provided that stormwater generated during such an event is managed in accordance with the requirements of these conditions.

4 The pH at the boundary of the Derwent Estuary Mixing Zone, must not be less than pH 7.

4.1 The above is not considered breached if investigations demonstrate that the pH is a result of conditions in the surrounding estuary, and not a result of discharge from the nominated discharge point.

Schedule 3: Information

Legal Obligations

LO1 EMPCA

The activity must be conducted in accordance with both the conditions in this document and the obligations of the *Environmental Management and Pollution Control Act 1994* (EMPCA) and subordinate regulations. The conditions of this document do not replicate legislated obligations; therefore, you should ensure you are aware of your obligations under EMPCA and subordinate regulations.

Other Information

OI1 Notification of incidents under section 32 of EMPCA

Where a person is required by section 32 of EMPCA to notify the Director of the release of a pollutant, the Director can be notified by telephoning 1800 005 171 (a 24-hour emergency telephone number).

OI2 Release of Relevant Information

Under the provisions of Section 23AA of EMPCA relevant information relating to monitoring of environmental impacts required under these conditions may be subject to publishing or public release by the Director.

OI3 Waste management hierarchy

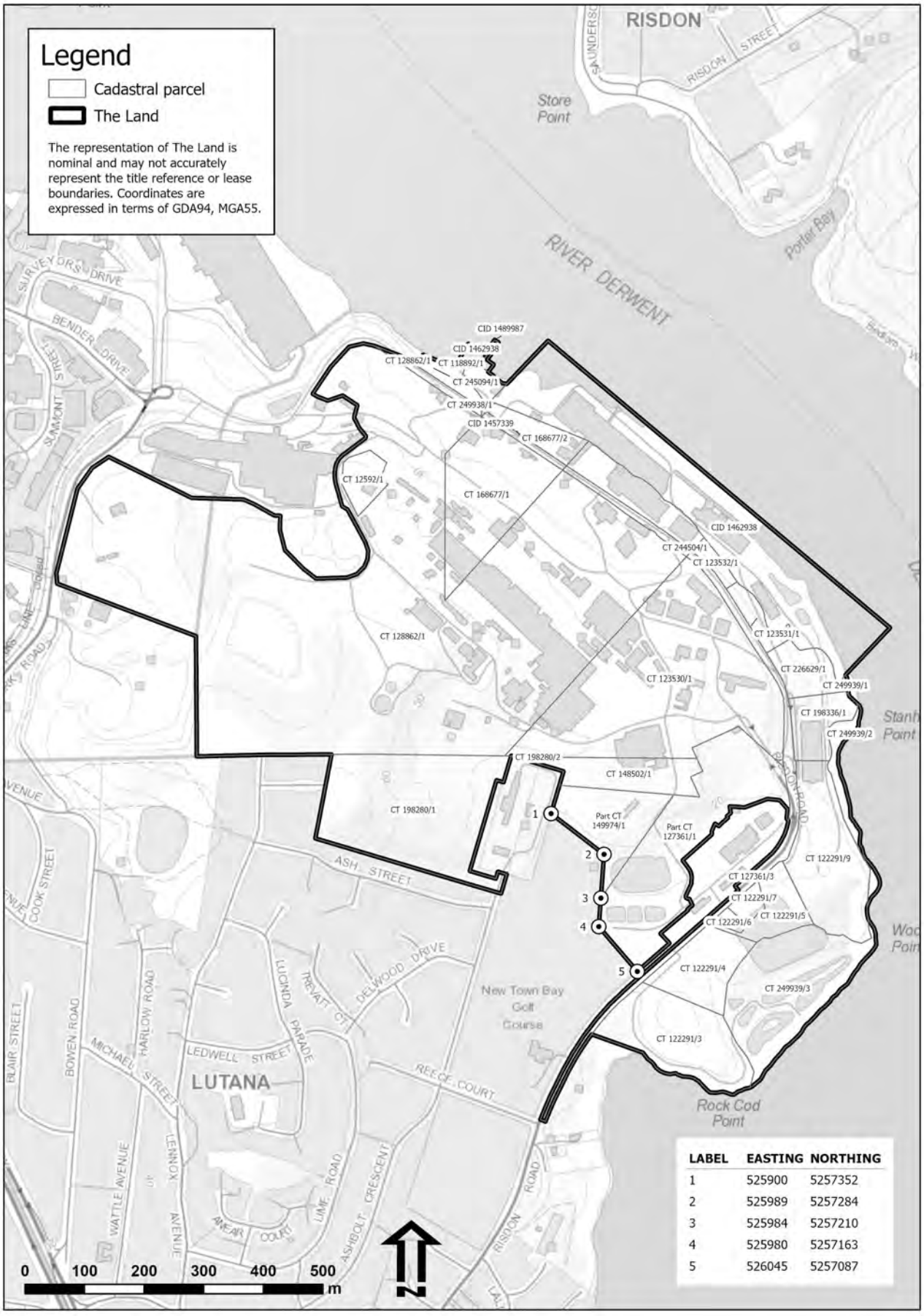
1 Wastes should be managed in accordance with the following hierarchy of waste management:

1.1 waste should be minimised, that is, the generation of waste must be reduced to the maximum extent that is reasonable and practicable, having regard to best practice environmental management;

1.2 waste should be re-used or recycled to the maximum extent that is practicable; and

1.3 waste that cannot be re-used or recycled must be disposed of at a waste depot site or treatment facility that has been approved in writing by the relevant planning authority or the Director to receive such waste, or otherwise in a manner approved in writing by the Director.

Attachment 1: The Land



Attachment 2: Nominated Exhaust Points (Source Nyrstar Hobart Pty Ltd)

Attachment 3: Nominated Ambient TSPM Locations

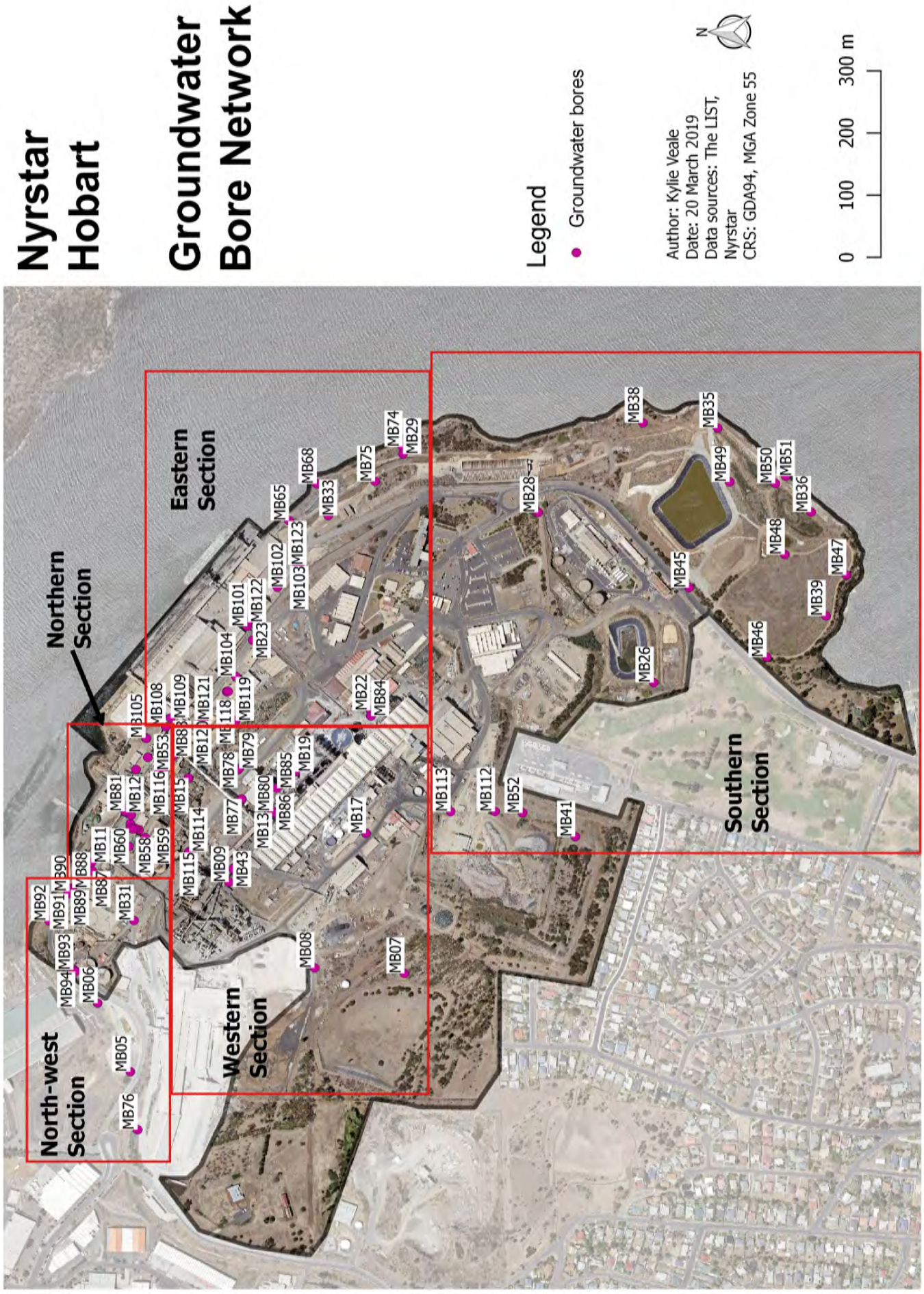
Orientation	Scale	Coordinates (SE corner) (WGS84)	Date	Author
N	0 m — 710 m	42° 50' 48.4146" S 147° 17' 51.4536" E	13/06/13	nyrstar

Source: Nyrstar Hobart Pty Ltd

Attachment 4: Nominated Community GLC SO2 Monitoring Locations

Source: Nyrstar Hobart Pty Ltd

Attachment 5: Groundwater Monitoring Bores (Source: Nyrstar Hobart Pty Ltd)



Nyrstar Hobart

Groundwater Bore Network

Northern Section

Legend

- Groundwater bores

Author: Kylie Veale
Date: 20 March 2019
Data sources: The LIST, Nyrstar
CRS: GDA94, MGA Zone 55

N

0 25 50 m

Nyrstar Hobart

Groundwater Bore Network

North West Section

Legend

- Groundwater bores

Author: Kylie Veale
Date: 20 March 2019
Data sources: The LIST, Nyrstar
CRS: GDA94, MGA Zone 55

N

0 25 50 m

Nyrstar Hobart

Groundwater Bore Network

Eastern Section

Legend

- Groundwater bores

Author: Kylie Veale
Date: 20 March 2019
Data sources: The LIST, Nyrstar
CRS: GDA94, MGA Zone 55

N

0 25 50 75 100 m

Nyrstar Hobart

Groundwater Bore Network

Western Section

Legend

- Groundwater bores

Author: Kylie Veale
Date: 20 March 2019
Data sources: The LIST, Nyrstar
CRS: GDA94, MGA Zone 55

N

0 25 50 75 100

Permit as varied: Hobart Zinc Smelter

Nyrstar Hobart

Groundwater Bore Network

Southern Section

Legend

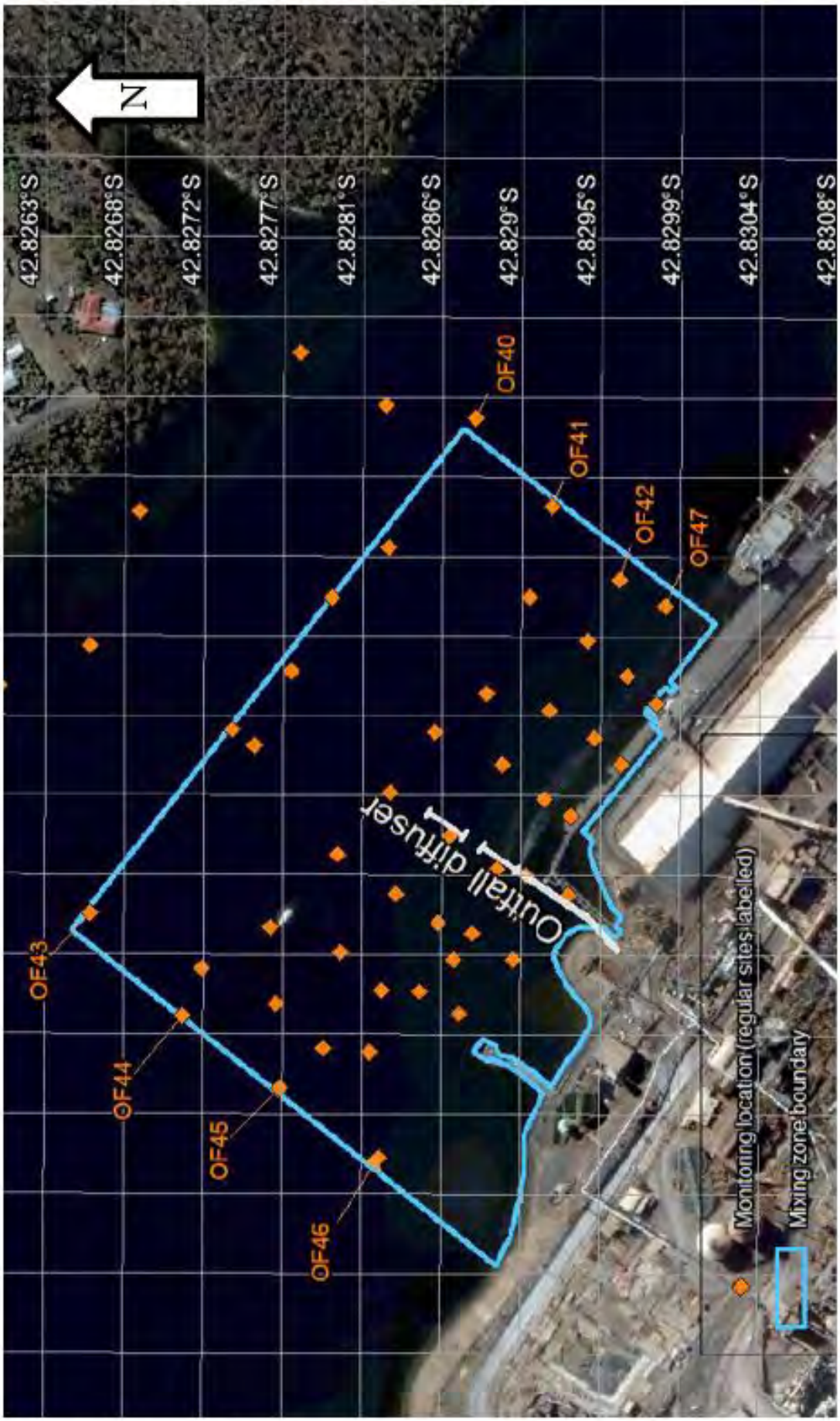
- Groundwater bores

Author: Kylie Veale
Date: 20 March 2019
Data sources: The LIST, Nyrstar
CRS: GDA94, MGA Zone 55

N

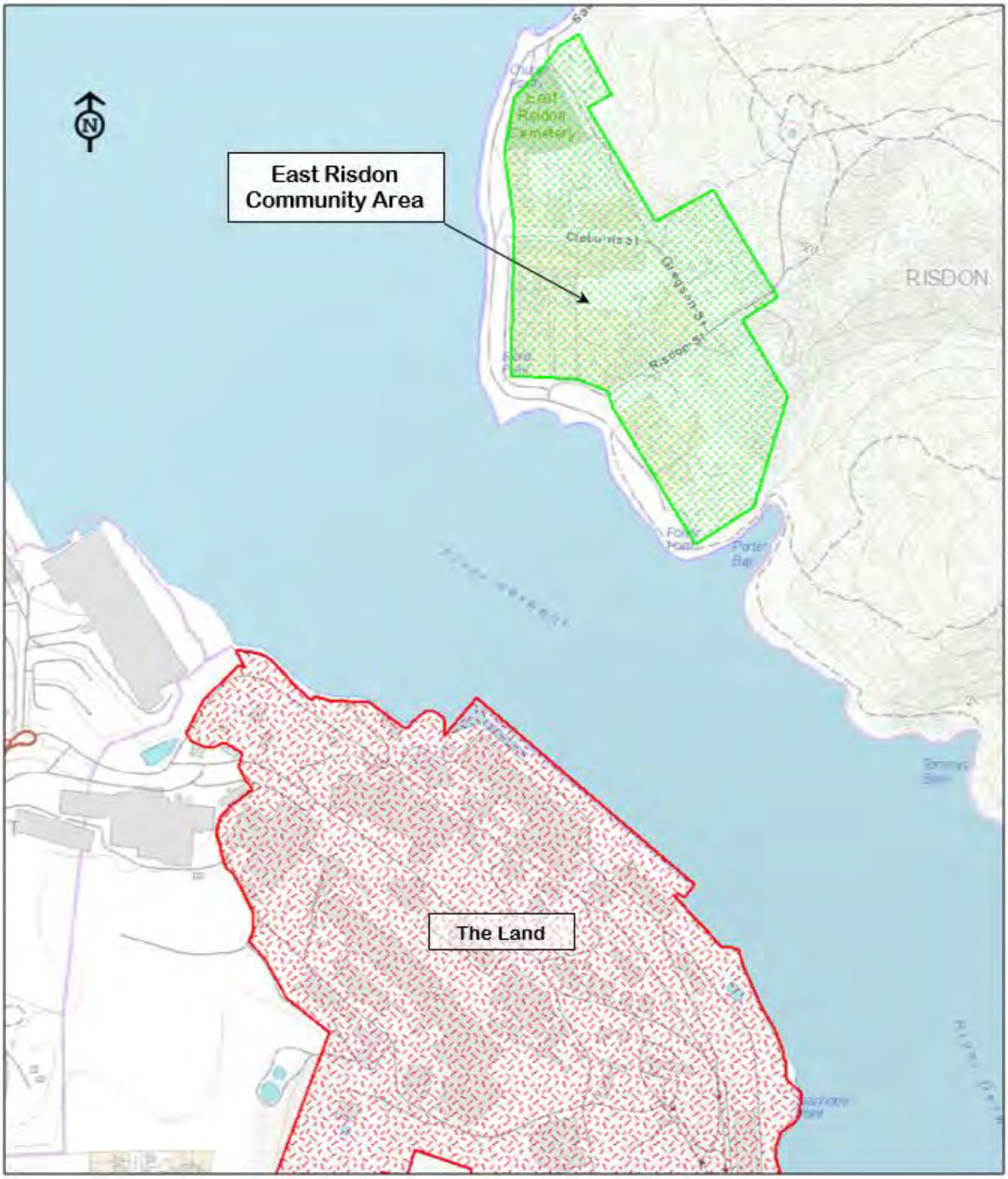
0 25 50 75 100 m

Attachment 6: Derwent Estuary Mixing Zone



Source: Nyrstar Hobart Pty Ltd

Attachment 7: East Risdon Community Area



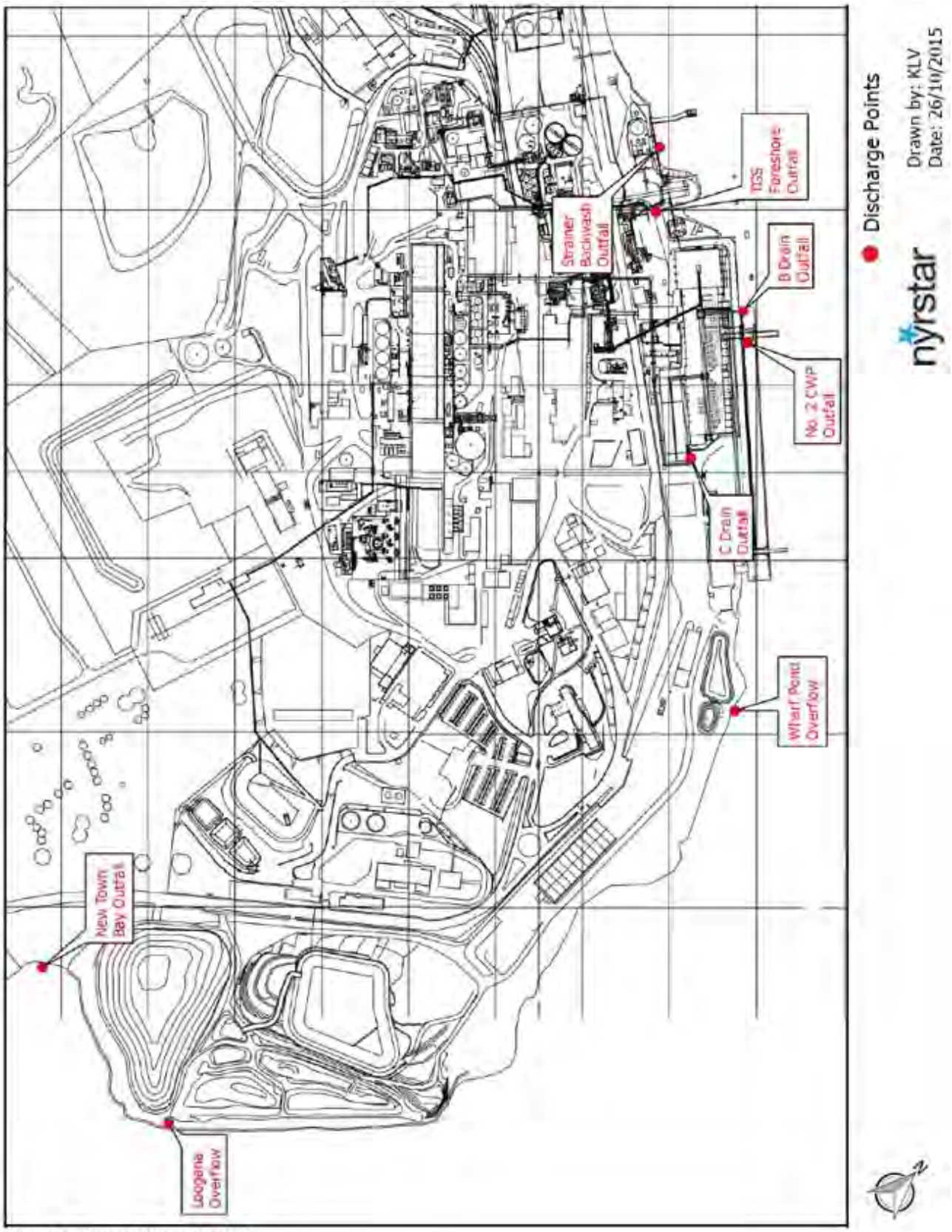
Source: Nyrstar Hobart Pty Ltd

Attachment 8: Nominated Community Noise Monitoring Locations

Orientation	Scale	Coordinates (SE corner) (WGS84)	Date	Author
N	0 m 300 m 600 m	42° 50' 34.4646" S 147° 17' 58.2612" E	28/06/13	nyrstar

Source: Nyrstar Hobart Pty Ltd

Attachment 9: Discharge Points to the Derwent Estuary



Source: Nyrstar Hobart Pty Ltd

6.4 Appendix 4 – 2022 - 2024 Stack Emission Reports

Ektimo

Nyrstar Hobart, Lutana

Emission Testing Report

Round 1 - June 2022

Report Number R011346a

Document Information

Template Version 300522

Client Name:	Nyrstar Hobart
Report Number:	R011346a
Date of Issue:	3 August 2022
Attention:	Kylie Veale
Address:	Risdon Road Lutana TAS 7009
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Amendment Record

Original Document Number	Initiator	Original Report Date	Section (s)	Reason for revision
R011346	Client (KVe)	8 July 2022	2.9 Zinc Oxide Debagging Station	Incorrect results pasted on page 55.

Report Authorisation

Glenn Trenear
Senior Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration, and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged by Nyrstar Hobart to perform emission testing at their Lutana plant. Testing was carried out in accordance with Environmental Licence 7043/5.

1.2 Project Objective

The objective of the project was to conduct a monitoring programme to quantify emissions from **14** discharge points to determine compliance with Nyrstar Hobart 's Environmental Licence and meet NPI reporting requirements.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Foreshore A	18 May 2022	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Sulfur dioxide, sulfur trioxide Total fluoride Nitrogen oxides, nitrous oxide, carbon monoxide, carbon dioxide, oxygen Total & speciated volatile organic compounds (VOCs)
Foreshore B		
Parageothite Dryer	16 May 2022	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Total fluoride Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen, sulfur dioxide Total & speciated volatile organic compounds (VOCs)
Cadmium Smelter Plant Scrubber Stack	12 May 2022	
Copper Sulphate Crystalliser Plant Vent Stack	10 May 2022	
Casting Ventilation 1 – V1	9 May 2022	
Casting Ventilation 2 – V2		
Roaster Baghouse	17 May 2022	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Sulfur dioxide, sulfur trioxide Total fluoride Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen Total & speciated volatile organic compounds (VOCs)
Zinc Oxide Debagging Station	13 May 2022	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Total fluoride Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen, sulfur dioxide Total & speciated volatile organic compounds (VOCs)
Anode Casting	12 May 2022	
Zinc Plant 1 Baghouse – ZP1	11 May 2022	
Zinc Plant 3 Baghouse – ZP3		
MZR Furnace Baghouse	10 May 2022	
MZR Dross Stack	17 May 2022	

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP. Plant operating conditions have been noted in the report.

PM_{10} and $PM_{2.5}$ results determined as sample fractions from particle size analysis (PSA), are calculated based on the assumption that the density of the sample material is 1 g/cm^3, i.e., no corrections have been made for sample density.

1.3 Licence Comparison

The following licence comparison table shows that all analytes highlighted in green are within the licence limit set by the Tasmanian Environmental Protection Notice (EPN) 7043/5.

Emission Point / Monitoring Location	Parameter	Units	Licence limit	Detected values
Foreshore A (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	0.26
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.033
	Particulates	mg/m^3	100	<1
	Sulphur dioxide	g/m^3	7.2	0.0092
Foreshore B (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	0.33
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.049
	Particulates	mg/m^3	100	1.4
	Sulphur dioxide	g/m^3	7.2	0.015
Anode Casting Plant Exhaust	Particulates	mg/m^3	100	11
V1 Furnace Stack				<4
V2 Furnace Stack				<3
Zinc Dust Plant Baghouse 1 Stack				2.4
Zinc Dust Plant Bagouse 3 Stack				27
Cadmium Smelter Plant Scrubber Stack				<3
Copper Sulphate Crystalliser Plant				<3
Roaster Baghouse				52
Paragoethite Dryer Baghouse				4.7
Anode Casting Plant Exhaust	Metals - Pb, As, Sb, Cd, Hg [(1)]	mg/m^3	5	≤0.33
V1 Furnace Stack				≤0.061
V2 Furnace Stack				≤0.048
Zinc Dust Plant Baghouse 1 Stack				≤0.081
Zinc Dust Plant Baghouse 3 Stack				≤0.36
Cadmium Smelter Plant Scrubber Stack				≤0.12
Copper Sulphate Crystalliser Plant				≤1.2
Roaster Baghouse				4.8
Paragoethite Dryer Baghouse				≤0.12
Anode Casting Plant Exhaust	Metals - Hg	mg/m^3	1	<0.0008
V1 Furnace Stack				<0.0009
V2 Furnace Stack				<0.0005
Zinc Dust Plant Baghouse 1 Stack				<0.0007
Zinc Dust Plant Baghouse 3 Stack				<0.0006
Cadmium Smelter Plant Scrubber Stack				<0.0006
Copper Sulphate Crystalliser Plant				0.012
Roaster Baghouse				0.0021
Paragoethite Dryer Baghouse				<0.001
Anode Casting Plant Exhaust	Metals - Cd	mg/m^3	1	0.013
V1 Furnace Stack				0.003
V2 Furnace Stack				0.0013
Zinc Dust Plant Baghouse 1 Stack				0.017
Zinc Dust Plant Baghouse 3 Stack				0.011
Cadmium Smelter Plant Scrubber Stack				0.016
Copper Sulphate Crystalliser Plant				0.85
Roaster Baghouse				0.32
Paragoethite Dryer Baghouse				0.0043

(1) Total concentration of metals combined.

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 Foreshore A

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		*220429*

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Access & height of ports	Stairs 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0820 & 1029	
Temperature, °C	16	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1800	
Volumetric flow rate (wet STP), m³/min	1700	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	130000	

Gas Analyser Results	Average	
Sampling time	0900 - 0959	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	33	55
Carbon monoxide	<6	<10
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	11.4	
Sampling time	0900 - 0959	
	Concentration mg/m³	Mass Rate g/min
Nitrous oxide		
Nitrous oxide	<0.004	<0.006

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

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Isokinetic Results		Results	
	Sampling time	0840-1022	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<1	<2
PM10	(PSA)	<0.6	<1
PM2.5	(PSA)	<0.2	<0.3
Sulfur dioxide		9.2	16
Sulfur trioxide		0.26	0.43
Isokinetic Sampling Parameters			
Sampling time, min		100	
Isokinetic rate, %		100	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.4

VOC's C5-C20		Results	
	Sampling time	1130-1150	
		Concentration mg/m³	Mass Rate g/min
Detection limit(1)		<0.3	<0.4

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, Toluene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

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Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Access & height of ports	Stairs 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1415 & 1614	
Temperature, °C	18	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1800	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	140000	

Isokinetic Results	Results	
Sampling time	1420-1602	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.01	<0.02
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	99	

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

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Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Access & height of ports	Stairs 4 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1230 & 1415	
Temperature, °C	17	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1800	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	140000	

Isokinetic Results	Results	
Sampling time	1230-1412	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.003**	**<0.006**
Arsenic	**0.0045**	**0.0079**
Beryllium	<0.0004	<0.0007
Cadmium	**0.031**	**0.054**
Chromium	0.0016	0.0028
Cobalt	<0.0008	<0.001
Copper	0.029	0.051
Lead	**0.46**	**0.8**
Manganese	0.026	0.046
Mercury	**0.00084**	**0.0015**
Nickel	0.002	0.0035
Phosphorus	<0.01	<0.02
Selenium	<0.003	<0.005
Zinc	4.3	7.5
Total of Sb, As, Cd, Pb, Hg	**≤0.5**	**≤0.87**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	94	

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

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Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Access & height of ports	Stairs 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1029 & 1230	
Temperature, °C	17	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1700	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	130000	

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

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Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1040 - 1222	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		1600	2700000
2-Methylnaphthalene		<700	<1000000
Acenaphthylene		<10	<20000
Acenaphthene		<10	<20000
Fluorene		<10	<20000
Phenanthrene		150	250000
Anthracene		20	34000
Fluoranthene		110	180000
Pyrene		57	97000
Benz(a)anthracene		<10	<20000
Chrysene		<10	<20000
Benzo(b)fluoranthene		<10	<20000
Benzo(k)fluoranthene		<10	<20000
Benzo(e)pyrene		<30	<50000
Benzo(a)pyrene		<10	<20000
Perylene		<10	<20000
Indeno(1,2,3-cd)pyrene		<20	<30000
Dibenz(ah)anthracene		<20	<30000
Benzo(ghi)perylene		<30	<40000
Total 16 PAHs		1900	3300000
Total 19 PAHs		1900	3300000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		12	20000
Upper Bound		24	40000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	100
Isokinetic rate, %	97

2.2 Foreshore B

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		*220429*

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Access & height of ports	Stairs 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.7 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1031 & 1228	
Temperature, °C	17	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1700	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	130000	

Gas Analyser Results	Average	
Sampling time	1013 - 1112	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	49	82
Carbon monoxide	<6	<10
	Concentration %v/v	
Carbon dioxide	0.6	
Oxygen	11.5	
Sampling time	1013 - 1112	
	Concentration mg/m³	Mass Rate g/min
Nitrous oxide		
Nitrous oxide	<0.004	<0.006

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

220429

Isokinetic Results		Results	
	Sampling time	1040-1222	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		1.4	2.4
PM10	(PSA)	0.67	1.1
PM2.5	(PSA)	0.18	0.31
Sulfur dioxide		15	25
Sulfur trioxide		0.33	0.56
Isokinetic Sampling Parameters			
Sampling time, min		100	
Isokinetic rate, %		105	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.4

VOC's C5-C20	Results	
Sampling time	1100-1120	
	Concentration mg/m³	Mass Rate g/min
Detection limit(1)	<0.3	<0.4

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, Toluene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

220429

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Access & height of ports	Stairs 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1228 & 1416	
Temperature, °C	17	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1800	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	130000	

Isokinetic Results	Results	
Sampling time	1230-1412	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.02	<0.03
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	103	

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

220429

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Access & height of ports	Stairs 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0825 & 1031	
Temperature, °C	17	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1800	
Volumetric flow rate (wet STP), m³/min	1700	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	130000	

Isokinetic Results	Results	
Sampling time	0840-1022	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.003**	**<0.005**
Arsenic	**<0.002**	**<0.004**
Beryllium	<0.0004	<0.0006
Cadmium	**0.003**	**0.005**
Chromium	<0.0005	<0.0008
Cobalt	<0.0005	<0.0008
Copper	0.0065	0.011
Lead	**0.05**	**0.084**
Manganese	0.018	0.03
Mercury	**0.00091**	**0.0015**
Nickel	0.0012	0.002
Phosphorus	0.013	0.022
Selenium	<0.003	<0.005
Zinc	0.46	0.78
Total of Sb, As, Cd, Pb, Hg	**≤0.059**	**≤0.099**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	99	

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

220429

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Access & height of ports	Stairs 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1416 & 1609	
Temperature, °C	18	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1800	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	140000	

Date	18/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 63000 m3/hr & Unit 6 producing 1020000 m3/hr of gas through the acid stream.		

220429

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1420 - 1602 Concentration ng/m³	Mass Rate ng/min
Naphthalene		1800	3200000
2-Methylnaphthalene		<600	<1000000
Acenaphthylene		<10	<20000
Acenaphthene		<10	<20000
Fluorene		<10	<20000
Phenanthrene		210	360000
Anthracene		370	640000
Fluoranthene		92	160000
Pyrene		43	74000
Benz(a)anthracene		<10	<20000
Chrysene		<10	<20000
Benzo(b)fluoranthene		<10	<20000
Benzo(k)fluoranthene		<10	<20000
Benzo(e)pyrene		<30	<50000
Benzo(a)pyrene		<10	<20000
Perylene		<10	<20000
Indeno(1,2,3-cd)pyrene		<20	<30000
Dibenz(ah)anthracene		<20	<30000
Benzo(ghi)perylene		<20	<40000
Total 16 PAHs		2500	4400000
Total 19 PAHs		2500	4400000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		11	20000
Upper Bound		23	39000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	100
Isokinetic rate, %	98

2.3 Parageothite Dryer

Date	16/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	6.5 m3/hr of dirt and 2.5 m3/hr of bypass flow into the drum.		*220429*

Sampling Plane Details		
Sampling plane dimensions	950 mm	
Sampling plane area	0.709 m²	
Sampling port size, number & depth	4" Flange (x2), 50 mm	
Access & height of ports	Stairs 15 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	32	
Gas molecular weight, g/g mole	25.7 (wet)	29.3 (dry)
Gas density at STP, kg/m³	1.15 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.82	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1152 & 1309	
Temperature, °C	108	
Velocity at sampling plane, m/s	9.7	
Volumetric flow rate, actual, m³/min	410	
Volumetric flow rate (wet STP), m³/min	290	
Volumetric flow rate (dry STP), m³/min	200	
Mass flow rate (wet basis), kg/hour	20000	

Gas Analyser Results	Average	
Sampling time	1203 - 1302	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	55	11
Sulfur dioxide	<6	<1
Carbon monoxide	<6	<1
	Concentration %v/v	
Carbon dioxide	3.4	
Oxygen	14.9	

Date	16/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	6.5 m3/hr of dirt and 2.5 m3/hr of bypass flow into the drum.		220429

Isokinetic Results		Results	
	Sampling time	1200-1303	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		4.7	0.95
PM10	(PSA)	2.3	0.46
PM2.5	(PSA)	0.59	0.12
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		107	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	0.22	0.044

VOC's C5-C20		Results	
	Sampling time	1210-1300	
		Concentration mg/m³	Mass Rate g/min
Detection limit[(1)]		<0.1	<0.02
Toluene		0.22	0.044
Acetone		<0.1	<0.02

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	16/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	6.5 m3/hr of dirt and 2.5 m3/hr of bypass flow into the drum.		220429

Sampling Plane Details		
Sampling plane dimensions	950 mm	
Sampling plane area	0.709 m²	
Sampling port size, number & depth	4" Flange (x2), 50 mm	
Access & height of ports	Stairs 15 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	25	
Gas molecular weight, g/g mole	26.4 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.18 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.83	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1309 & 1436	
Temperature, °C	109	
Velocity at sampling plane, m/s	9.5	
Volumetric flow rate, actual, m³/min	410	
Volumetric flow rate (wet STP), m³/min	290	
Volumetric flow rate (dry STP), m³/min	210	
Mass flow rate (wet basis), kg/hour	20000	

Isokinetic Results	Results	
Sampling time	1325-1428	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.07	<0.02
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	106	

Date	16/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	6.5 m3/hr of dirt and 2.5 m3/hr of bypass flow into the drum.		*220429*

Sampling Plane Details	
Sampling plane dimensions	950 mm
Sampling plane area	0.709 m²
Sampling port size, number & depth	4" Flange (x2), 50 mm
Access & height of ports	Stairs 15 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	24	
Gas molecular weight, g/g mole	26.6 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.18 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.84	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1152 & 1309	
Temperature, °C	108	
Velocity at sampling plane, m/s	9.6	
Volumetric flow rate, actual, m³/min	410	
Volumetric flow rate (wet STP), m³/min	290	
Volumetric flow rate (dry STP), m³/min	220	
Mass flow rate (wet basis), kg/hour	20000	

Isokinetic Results	Results	
Sampling time	1200-1303	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.001**
Arsenic	**0.0038**	**0.00084**
Beryllium	<0.0008	<0.0002
Cadmium	**0.0043**	**0.00094**
Chromium	0.003	0.00066
Cobalt	<0.001	<0.0002
Copper	0.013	0.0027
Lead	**0.11**	**0.023**
Manganese	0.051	0.011
Mercury	**<0.001**	**<0.0002**
Nickel	0.0088	0.0019
Phosphorus	<0.03	<0.007
Selenium	<0.008	<0.002
Zinc	0.48	0.11
Total of Sb, As, Cd, Pb, Hg	**≤0.12**	**≤0.027**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	98	

Date	16/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	6.5 m3/hr of dirt and 2.5 m3/hr of bypass flow into the drum.		*220429*

Sampling Plane Details		
Sampling plane dimensions	950 mm	
Sampling plane area	0.709 m²	
Sampling port size, number & depth	4" Flange (x2), 50 mm	
Access & height of ports	Stairs 15 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	27	
Gas molecular weight, g/g mole	26.2 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.17 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.83	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1309 & 1436	
Temperature, °C	109	
Velocity at sampling plane, m/s	9.7	
Volumetric flow rate, actual, m³/min	410	
Volumetric flow rate (wet STP), m³/min	290	
Volumetric flow rate (dry STP), m³/min	210	
Mass flow rate (wet basis), kg/hour	21000	

Date	16/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	6.5 m3/hr of dirt and 2.5 m3/hr of bypass flow into the drum.		*220429*

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1325 - 1428	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		<3000	<600000
2-Methylnaphthalene		<1000	<300000
Acenaphthylene		<20	<4000
Acenaphthene		<20	<4000
Fluorene		<20	<4000
Phenanthrene		640	140000
Anthracene		150	31000
Fluoranthene		440	94000
Pyrene		190	40000
Benz(a)anthracene		34	7200
Chrysene		100	22000
Benzo(b)fluoranthene		43	9200
Benzo(k)fluoranthene		<20	<4000
Benzo(e)pyrene		<50	<10000
Benzo(a)pyrene		<20	<4000
Perylene		<20	<4000
Indeno(1,2,3-cd)pyrene		<40	<8000
Dibenz(ah)anthracene		<30	<7000
Benzo(ghi)perylene		<50	<10000
Total 16 PAHs		1600	340000
Total 19 PAHs		1600	340000
BaP-TEQ			
Lower Bound		8.7	1900
Middle Bound		28	6100
Upper Bound		48	10000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	104

2.4 Cadmium Smelter Plant Scrubber Stack

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	470 mm
Sampling plane area	0.173 m²
Sampling port size, number & depth	4" BSP (x2), 85 mm
Access & height of ports	Scissor lift 4 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Change in diameter 2 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1210 & 1327	
Temperature, °C	22	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	11000	

Gas Analyser Results	Average	
Sampling time	1238 - 1337	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.6
Sulfur dioxide	<6	<0.9
Carbon monoxide	<6	<0.9
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.8	

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		220429

Isokinetic Results		Results	
	Sampling time	1220-1322	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<3	<0.5
PM10	(PSA)	<3	<0.4
PM2.5	(PSA)	<2	<0.3
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		99	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.04

VOC's C5-C20		Results	
	Sampling time	1400-1420	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.3	<0.04

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, Toluene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	470 mm	
Sampling plane area	0.173 m²	
Sampling port size, number & depth	4" BSP (x2), 85 mm	
Access & height of ports	Scissor lift 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Change in diameter 2 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1327 & 1448	
Temperature, °C	22	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	11000	

Isokinetic Results	Results	
Sampling time	1340-1442	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.004
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	470 mm	
Sampling plane area	0.173 m²	
Sampling port size, number & depth	4" BSP (x2), 85 mm	
Access & height of ports	Scissor lift 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Change in diameter 2 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1210 & 1327	
Temperature, °C	22	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	11000	

Isokinetic Results	Results	
Sampling time	1220-1322	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.005**	**<0.0008**
Arsenic	**<0.002**	**<0.0003**
Beryllium	<0.0007	<0.0001
Cadmium	**0.016**	**0.0024**
Chromium	0.002	0.0003
Cobalt	<0.0009	<0.0001
Copper	0.0066	0.00096
Lead	**0.091**	**0.013**
Manganese	0.056	0.0082
Mercury	**<0.0006**	**<0.00009**
Nickel	0.0045	0.00066
Phosphorus	<0.02	<0.003
Selenium	<0.005	<0.0008
Zinc	0.5	0.074
Total of Sb, As, Cd, Pb, Hg	**≤0.12**	**≤0.017**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	470 mm	
Sampling plane area	0.173 m²	
Sampling port size, number & depth	4" BSP (x2), 85 mm	
Access & height of ports	Scissor lift 4 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Change in diameter 2 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1327 & 1448	
Temperature, °C	22	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	11000	

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*220429*

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1340 - 1442	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		3200	470000
2-Methylnaphthalene		<1000	<200000
Acenaphthylene		<20	<3000
Acenaphthene		<20	<3000
Fluorene		<20	<3000
Phenanthrene		500	74000
Anthracene		25000	3700000
Fluoranthene		270	40000
Pyrene		120	18000
Benz(a)anthracene		21	3100
Chrysene		60	8700
Benzo(b)fluoranthene		<20	<3000
Benzo(k)fluoranthene		<20	<3000
Benzo(e)pyrene		<50	<7000
Benzo(a)pyrene		<20	<3000
Perylene		<20	<3000
Indeno(1,2,3-cd)pyrene		<40	<5000
Dibenz(ah)anthracene		<30	<4000
Benzo(ghi)perylene		<50	<7000
Total 16 PAHs		29000	4300000
Total 19 PAHs		29000	4300000
BaP-TEQ			
Lower Bound		2.7	400
Middle Bound		23	3300
Upper Bound		43	6200

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	99

2.5 Copper Sulphate Crystalliser Plant Vent Stack

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 6 tonnes/day, Dryer Outlet Temperature - 50.9 deg C, Feed rate into Dryer - 45%		

220429

Sampling Plane Details		
Sampling plane dimensions	500 mm	
Sampling plane area	0.196 m²	
Sampling port size, number & depth	4" Flange (x2), 100 mm	
Access & height of ports	Truck mounted boom 35 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit 2 D	
Upstream disturbance	Bend 4 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	9.8	
Gas molecular weight, g/g mole	27.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.08	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1056 & 1236	
Temperature, °C	48	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/hour	11000	

Gas Analyser Results	Average	
Sampling time	1002 - 1101	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.6
Sulfur dioxide	<6	<0.8
Carbon monoxide	<6	<0.8
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.8	

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 6 tonnes/day, Dryer Outlet Temperature - 50.9 deg C, Feed rate into Dryer - 45%		

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Isokinetic Results		Results	
	Sampling time	1130-1232	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<3	<0.4
PM10	(PSA)	<1	<0.2
PM2.5	(PSA)	<0.3	<0.04
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		97	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.5	<0.07

VOC's C5-C20		Results	
	Sampling time	1140-1200	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.5	<0.07

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, Toluene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 6 tonnes/day, Dryer Outlet Temperature - 50.9 deg C, Feed rate into Dryer - 45%		

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Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Access & height of ports	Truck mounted boom 35 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	8.2	
Gas molecular weight, g/g mole	28.1 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.08	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0930 & 1056	
Temperature, °C	47	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	190	
Volumetric flow rate (wet STP), m³/min	160	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	12000	

Isokinetic Results	Results	
Sampling time	0950-1052	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.04	<0.006
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	94	

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 6 tonnes/day, Dryer Outlet Temperature - 50.9 deg C, Feed rate into Dryer - 45%		

220429

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Access & height of ports	Truck mounted boom 35 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	5.2	
Gas molecular weight, g/g mole	28.4 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.10	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0930 & 1056	
Temperature, °C	47	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	190	
Volumetric flow rate (wet STP), m³/min	160	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	12000	

Isokinetic Results	Results	
Sampling time	0950-1052	
	Concentration mg/m³	Mass Rate g/min
Antimony	**0.0071**	**0.0011**
Arsenic	**<0.004**	**<0.0006**
Beryllium	<0.0008	<0.0001
Cadmium	**0.85**	**0.13**
Chromium	0.016	0.0024
Cobalt	0.053	0.0081
Copper	0.86	0.13
Lead	**0.33**	**0.05**
Manganese	0.075	0.011
Mercury	**0.012**	**0.0019**
Nickel	0.048	0.0073
Phosphorus	<0.02	<0.004
Selenium	<0.01	<0.002
Zinc	2.4	0.37
Total of Sb, As, Cd, Pb, Hg	**≤1.2**	**≤0.18**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	95	

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 6 tonnes/day, Dryer Outlet Temperature - 50.9 deg C, Feed rate into Dryer - 45%		

220429

Sampling Plane Details		
Sampling plane dimensions	500 mm	
Sampling plane area	0.196 m²	
Sampling port size, number & depth	4" Flange (x2), 100 mm	
Access & height of ports	Truck mounted boom 35 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit 2 D	
Upstream disturbance	Bend 4 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	9.8	
Gas molecular weight, g/g mole	27.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.24 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1056 & 1236	
Temperature, °C	48	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	160	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/hour	12000	

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 6 tonnes/day, Dryer Outlet Temperature - 50.9 deg C, Feed rate into Dryer - 45%		

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Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1130 - 1232	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	7600	1100000
2-Methylnaphthalene	<1000	<200000
Acenaphthylene	<500	<70000
Acenaphthene	5900	860000
Fluorene	1500	210000
Phenanthrene	1200	180000
Anthracene	260	37000
Fluoranthene	300	43000
Pyrene	140	20000
Benz(a)anthracene	<60	<9000
Chrysene	140	20000
Benzo(b)fluoranthene	<20	<4000
Benzo(k)fluoranthene	<20	<4000
Benzo(e)pyrene	<20	<4000
Benzo(a)pyrene	<20	<4000
Perylene	<20	<4000
Indeno(1,2,3-cd)pyrene	<100	<20000
Dibenz(ah)anthracene	<100	<20000
Benzo(ghi)perylene	<60	<9000
Total 16 PAHs	17000	2500000
Total 19 PAHs	17000	2500000
BaP-TEQ		
Lower Bound	1.4	200
Middle Bound	52	7500
Upper Bound	100	15000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	92

2.6 Casting Ventilation 1 – V1

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Access & height of ports	Stairs 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS4323.1 (2021)	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1250 & 1415	
Temperature, °C	24	
Velocity at sampling plane, m/s	25	
Volumetric flow rate, actual, m³/min	470	
Volumetric flow rate (wet STP), m³/min	430	
Volumetric flow rate (dry STP), m³/min	420	
Mass flow rate (wet basis), kg/hour	33000	

Gas Analyser Results	Average
Sampling time	1320 - 1419
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <2
Sulfur dioxide	<6 / <3
Carbon monoxide	<6 / <3
	Concentration %v/v
Carbon dioxide	<0.4
Oxygen	20.9

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Isokinetic Results		Results	
	Sampling time	1300-1400	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<4	<2
PM10	(PSA)	<2	<0.8
PM2.5	(PSA)	<0.6	<0.2
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		100	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.5	<0.2

VOC's C5-C20		Results	
	Sampling time	1330-1350	
		Concentration mg/m³	Mass Rate g/min
Detection limit[(1)]		<0.3	<0.1

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, Toluene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Access & height of ports	Stairs 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS4323.1 (2021)	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1642 & 1755	
Temperature, °C	23	
Velocity at sampling plane, m/s	23	
Volumetric flow rate, actual, m³/min	430	
Volumetric flow rate (wet STP), m³/min	400	
Volumetric flow rate (dry STP), m³/min	400	
Mass flow rate (wet basis), kg/hour	31000	

Isokinetic Results	Results	
Sampling time	1645-1745	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.01
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	109	

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Access & height of ports	Stairs 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS4323.1 (2021)	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.4	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1538 & 1648	
Temperature, °C	24	
Velocity at sampling plane, m/s	23	
Volumetric flow rate, actual, m³/min	440	
Volumetric flow rate (wet STP), m³/min	410	
Volumetric flow rate (dry STP), m³/min	400	
Mass flow rate (wet basis), kg/hour	31000	

Isokinetic Results	Results	
Sampling time	1540-1640	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.009**	**<0.004**
Arsenic	**<0.005**	**<0.002**
Beryllium	<0.001	<0.0005
Cadmium	**0.003**	**0.0012**
Chromium	0.019	0.0078
Cobalt	<0.002	<0.0008
Copper	0.012	0.0046
Lead	**0.043**	**0.017**
Manganese	0.1	0.041
Mercury	**<0.0009**	**<0.0004**
Nickel	0.039	0.016
Phosphorus	<0.03	<0.01
Selenium	<0.01	<0.004
Zinc	2.1	0.83
Total of Sb, As, Cd, Pb, Hg	**≤0.061**	**≤0.025**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	91	

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	635 mm	
Sampling plane area	0.317 m²	
Sampling port size, number & depth	4" Flange (x1), 245 mm	
Access & height of ports	Stairs 2 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit 2 D	
Upstream disturbance	Centrifugal fan 2 D	
No. traverses & points sampled	1 6	
Sample plane conformance to AS4323.1 (2021)	Non-conforming	

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.4	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1415 & 1538	
Temperature, °C	24	
Velocity at sampling plane, m/s	24	
Volumetric flow rate, actual, m³/min	450	
Volumetric flow rate (wet STP), m³/min	420	
Volumetric flow rate (dry STP), m³/min	410	
Mass flow rate (wet basis), kg/hour	32000	

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		220429

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1430 - 1530	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		12000	4900000
2-Methylnaphthalene		<2000	<800000
Acenaphthylene		<600	<300000
Acenaphthene		1200	490000
Fluorene		420	170000
Phenanthrene		1100	450000
Anthracene		160	65000
Fluoranthene		650	270000
Pyrene		370	150000
Benz(a)anthracene		120	50000
Chrysene		260	110000
Benzo(b)fluoranthene		96	40000
Benzo(k)fluoranthene		80	33000
Benzo(e)pyrene		<30	<10000
Benzo(a)pyrene		<30	<10000
Perylene		<30	<10000
Indeno(1,2,3-cd)pyrene		300	130000
Dibenz(ah)anthracene		<200	<70000
Benzo(ghi)perylene		<80	<30000
Total 16 PAHs		17000	6800000
Total 19 PAHs		17000	6800000
BaP-TEQ			
Lower Bound		63	26000
Middle Bound		110	47000
Upper Bound		160	68000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	97

2.7 Casting Ventilation 2 – V2

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		220429

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Access & height of ports	Stairs 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS4323.1 (2021)	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1535 & 1646	
Temperature, °C	45	
Velocity at sampling plane, m/s	19	
Volumetric flow rate, actual, m³/min	310	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	260	
Mass flow rate (wet basis), kg/hour	21000	

Gas Analyser Results	Average	
Sampling time	1437 - 1548	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<1
Sulfur dioxide	7.6	2
Carbon monoxide	<6	<2
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Isokinetic Results		Results	
	Sampling time	1540-1640	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<3	<0.8
PM10	(PSA)	<2	<0.4
PM2.5	(PSA)	<0.4	<0.1
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		94	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	0.15	0.041

VOC's C5-C20		Results	
	Sampling time	1520-1620	
		Concentration mg/m³	Mass Rate g/min
Detection limit[(1)]		<0.09	<0.02
Benzene		0.15	0.041

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Access & height of ports	Stairs 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS4323.1 (2021)	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1646 & 1755	
Temperature, °C	44	
Velocity at sampling plane, m/s	18	
Volumetric flow rate, actual, m³/min	310	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	260	
Mass flow rate (wet basis), kg/hour	21000	

Isokinetic Results	Results	
Sampling time	1649-1749	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.007
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	95	

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		220429

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Access & height of ports	Stairs 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS4323.1 (2021)	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1420 & 1535	
Temperature, °C	46	
Velocity at sampling plane, m/s	19	
Volumetric flow rate, actual, m³/min	320	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	270	
Mass flow rate (wet basis), kg/hour	21000	

Isokinetic Results	Results	
Sampling time	1430-1530	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.005**	**<0.001**
Arsenic	**0.017**	**0.0045**
Beryllium	<0.0006	<0.0002
Cadmium	**0.0013**	**0.00034**
Chromium	0.018	0.0048
Cobalt	0.00082	0.00022
Copper	0.012	0.0033
Lead	**0.025**	**0.0066**
Manganese	0.06	0.016
Mercury	**<0.0005**	**<0.0001**
Nickel	0.033	0.0087
Phosphorus	<0.02	<0.004
Selenium	0.009	0.0024
Zinc	1.7	0.45
Total of Sb, As, Cd, Pb, Hg	**≤0.048**	**≤0.013**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	96	

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	595 mm	
Sampling plane area	0.278 m²	
Sampling port size, number & depth	4" Flange (x1), 245 mm	
Access & height of ports	Stairs 2 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit 2 D	
Upstream disturbance	Centrifugal fan 2 D	
No. traverses & points sampled	1 6	
Sample plane conformance to AS4323.1 (2021)	Non-conforming	

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1254 & 1420	
Temperature, °C	46	
Velocity at sampling plane, m/s	21	
Volumetric flow rate, actual, m³/min	350	
Volumetric flow rate (wet STP), m³/min	300	
Volumetric flow rate (dry STP), m³/min	300	
Mass flow rate (wet basis), kg/hour	23000	
Velocity difference, %	-7	

Date	9/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		220429

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1300 - 1400	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		41000	12000000
2-Methylnaphthalene		5000	1500000
Acenaphthylene		1100	340000
Acenaphthene		840	250000
Fluorene		1400	420000
Phenanthrene		5500	1600000
Anthracene		1500	450000
Fluoranthene		1200	370000
Pyrene		790	230000
Benz(a)anthracene		<90	<30000
Chrysene		140	41000
Benzo(b)fluoranthene		<30	<10000
Benzo(k)fluoranthene		<30	<10000
Benzo(e)pyrene		<30	<10000
Benzo(a)pyrene		<30	<10000
Perylene		<30	<10000
Indeno(1,2,3-cd)pyrene		<200	<50000
Dibenz(ah)anthracene		<200	<60000
Benzo(ghi)perylene		<90	<30000
Total 16 PAHs		54000	16000000
Total 19 PAHs		59000	17000000
BaP-TEQ			
Lower Bound		1.4	410
Middle Bound		72	21000
Upper Bound		140	42000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	108
Velocity difference, %	-7

2.8 Roaster Baghouse

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*220429*

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Access & height of ports	Stairs	15 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	>2 D
Upstream disturbance	Centrifugal fan	>6 D
No. traverses & points sampled	2	8
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	2.5	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1440 & 1601	
Temperature, °C	40	
Velocity at sampling plane, m/s	6.3	
Volumetric flow rate, actual, m³/min	44	
Volumetric flow rate (wet STP), m³/min	38	
Volumetric flow rate (dry STP), m³/min	37	
Mass flow rate (wet basis), kg/hour	2900	

Gas Analyser Results	Average	
Sampling time	1321 - 1420	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Carbon monoxide	<6	<0.2
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.4	

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*220429*

Isokinetic Results		Results	
	Sampling time	1450-1556	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		52	1.9
PM10	(PSA)	37	1.4
PM2.5	(PSA)	8	0.29
Sulfur dioxide		2800	100
Sulfur trioxide		0.68	0.025
Isokinetic Sampling Parameters			
Sampling time, min		64	
Isokinetic rate, %		99	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.01

VOC's C5-C20		Results	
	Sampling time	1340-1400	
		Concentration mg/m³	Mass Rate g/min
Detection limit[(1)]		<0.3	<0.01

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, Toluene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*220429*

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Access & height of ports	Stairs 15 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	
Comments		
The discharge is assumed to be composed of dry air and moisture		

Stack Parameters		
Moisture content, %v/v	2.3	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1300 & 1440	
Temperature, °C	40	
Velocity at sampling plane, m/s	6.3	
Volumetric flow rate, actual, m³/min	44	
Volumetric flow rate (wet STP), m³/min	38	
Volumetric flow rate (dry STP), m³/min	37	
Mass flow rate (wet basis), kg/hour	2900	

Isokinetic Results	Results	
Sampling time	1320-1426	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.001
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	99	

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*220429*

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Access & height of ports	Stairs 15 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.3	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1300 & 1440	
Temperature, °C	40	
Velocity at sampling plane, m/s	6.3	
Volumetric flow rate, actual, m³/min	44	
Volumetric flow rate (wet STP), m³/min	38	
Volumetric flow rate (dry STP), m³/min	37	
Mass flow rate (wet basis), kg/hour	2900	

Isokinetic Results	Results	
Sampling time	1320-1426	
	Concentration mg/m³	Mass Rate g/min
Antimony	**0.0072**	**0.00027**
Arsenic	**0.022**	**0.00082**
Beryllium	<0.0007	<0.00002
Cadmium	**0.32**	**0.012**
Chromium	0.0038	0.00014
Cobalt	0.0039	0.00015
Copper	0.29	0.011
Lead	**4.5**	**0.17**
Manganese	0.16	0.006
Mercury	**0.0021**	**0.000077**
Nickel	0.0061	0.00023
Phosphorus	<0.03	<0.001
Selenium	<0.005	<0.0002
Zinc	30	1.1
Total of Sb, AS, Cd, Pb, Hg	**4.8**	**0.18**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	99	

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*220429*

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Access & height of ports	Stairs 15 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.5	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.10	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1440 & 1601	
Temperature, °C	40	
Velocity at sampling plane, m/s	6.3	
Volumetric flow rate, actual, m³/min	44	
Volumetric flow rate (wet STP), m³/min	38	
Volumetric flow rate (dry STP), m³/min	37	
Mass flow rate (wet basis), kg/hour	2900	

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*220429*

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1450 - 1556	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		8900	330000
2-Methylnaphthalene		<1000	<40000
Acenaphthylene		410	15000
Acenaphthene		460	17000
Fluorene		120	4300
Phenanthrene		250	9400
Anthracene		51	1900
Fluoranthene		220	8300
Pyrene		160	5800
Benz(a)anthracene		<50	<2000
Chrysene		<40	<1000
Benzo(b)fluoranthene		<20	<700
Benzo(k)fluoranthene		<20	<700
Benzo(e)pyrene		<20	<700
Benzo(a)pyrene		<20	<700
Perylene		<20	<700
Indeno(1,2,3-cd)pyrene		<90	<3000
Dibenz(ah)anthracene		<100	<4000
Benzo(ghi)perylene		<50	<2000
Total 16 PAHs		11000	390000
Total 19 PAHs		11000	390000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		40	1500
Upper Bound		80	3000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	64
Isokinetic rate, %	99

2.9 Zinc Oxide Debagging Station

Date	13/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zink Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*220429*

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Access & height of ports	Fixed ladder
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0910	
Temperature, °C	24	
Velocity at sampling plane, m/s	4.9	
Volumetric flow rate, actual, m³/min	14	
Volumetric flow rate (wet STP), m³/min	13	
Volumetric flow rate (dry STP), m³/min	13	
Mass flow rate (wet basis), kg/hour	1000	

Gas Analyser Results	Average	
Sampling time	0908 - 0935	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.06
Sulfur dioxide	<6	<0.08
Carbon monoxide	<6	<0.08
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	13/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zink Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*220429*

Isokinetic Results		Results	
	Sampling time	0908-0936	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<5	<0.07
PM10	(PSA)	<3	<0.04
PM2.5	(PSA)	<0.8	<0.01
Isokinetic Sampling Parameters			
Sampling time, min		28	
Isokinetic rate, %		110	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	0.22	0.0029

VOC's C5-C20		Results	
	Sampling time	1130-1210	
		Concentration mg/m³	Mass Rate g/min
Detection limit[(1)]		<0.1	<0.002
Toluene		0.22	0.0029

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	13/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*220429*

Sampling Plane Details		
Sampling plane dimensions	250 mm	
Sampling plane area	0.0491 m²	
Sampling port size, number	3" Flange (x4)	
Access & height of ports	Fixed ladder	
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Cowl	>2 D
Upstream disturbance	Bend	>6 D
No. traverses & points sampled	2	4
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1031	
Temperature, °C	18	
Velocity at sampling plane, m/s	5.9	
Volumetric flow rate, actual, m³/min	17	
Volumetric flow rate (wet STP), m³/min	16	
Volumetric flow rate (dry STP), m³/min	16	
Mass flow rate (wet basis), kg/hour	1300	

Isokinetic Results	Results	
Sampling time	1030-1058	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.05	<0.0008
Isokinetic Sampling Parameters		
Sampling time, min	28	
Isokinetic rate, %	98	

Date	13/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*220429*

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Access & height of ports	Fixed ladder
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1031	
Temperature, °C	18	
Velocity at sampling plane, m/s	5.9	
Volumetric flow rate, actual, m³/min	17	
Volumetric flow rate (wet STP), m³/min	16	
Volumetric flow rate (dry STP), m³/min	16	
Mass flow rate (wet basis), kg/hour	1300	

Isokinetic Results	Results	
Sampling time	1030-1058	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.01**	**<0.0002**
Arsenic	**<0.005**	**<0.00008**
Beryllium	<0.001	<0.00002
Cadmium	**0.0082**	**0.00013**
Chromium	<0.002	<0.00003
Cobalt	<0.002	<0.00003
Copper	0.006	0.000097
Lead	**0.063**	**0.001**
Manganese	0.048	0.00077
Mercury	**<0.001**	**<0.00002**
Nickel	<0.003	<0.00005
Phosphorus	<0.03	<0.0005
Selenium	<0.01	<0.0002
Zinc	0.52	0.0085
Total of Sb, As, Cd, Pb, Hg	**≤0.088**	**≤0.0014**
Isokinetic Sampling Parameters		
Sampling time, min	28	
Isokinetic rate, %	103	

Date	13/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*220429*

Sampling Plane Details		
Sampling plane dimensions	250 mm	
Sampling plane area	0.0491 m²	
Sampling port size, number	3" Flange (x4)	
Access & height of ports	Fixed ladder	
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Cowl	>2 D
Upstream disturbance	Bend	>6 D
No. traverses & points sampled	2	4
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0910	
Temperature, °C	24	
Velocity at sampling plane, m/s	4.9	
Volumetric flow rate, actual, m³/min	14	
Volumetric flow rate (wet STP), m³/min	13	
Volumetric flow rate (dry STP), m³/min	13	
Mass flow rate (wet basis), kg/hour	1000	

Date	13/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*220429*

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 0908 - 0936 Concentration ng/m³	Mass Rate ng/min
Naphthalene	<5000	<70000
2-Methylnaphthalene	<2000	<30000
Acenaphthylene	<40	<500
Acenaphthene	<40	<500
Fluorene	260	3400
Phenanthrene	1300	17000
Anthracene	440	5800
Fluoranthene	990	13000
Pyrene	380	5000
Benz(a)anthracene	42	550
Chrysene	110	1400
Benzo(b)fluoranthene	<40	<500
Benzo(k)fluoranthene	<40	<500
Benzo(e)pyrene	<100	<1000
Benzo(a)pyrene	<40	<500
Perylene	<40	<500
Indeno(1,2,3-cd)pyrene	<70	<900
Dibenz(ah)anthracene	<60	<800
Benzo(ghi)perylene	<90	<1000
Total 16 PAHs	3500	46000
Total 19 PAHs	3500	46000
BaP-TEQ		
Lower Bound	5.3	70
Middle Bound	45	590
Upper Bound	85	1100

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	28
Isokinetic rate, %	90

2.10 Anode Casting

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		220429

Sampling Plane Details		
Sampling plane dimensions	450 mm	
Sampling plane area	0.159 m²	
Sampling port size, number	4" Flange (x1)	
Access & height of ports	Stairs & fixed ladder	3 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Centrifugal fan	2 D
No. traverses & points sampled	1	6
Sample plane conformance to AS4323.1 (2021)	Non-conforming	

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0751 & 0905	
Temperature, °C	18	
Velocity at sampling plane, m/s	5.8	
Volumetric flow rate, actual, m³/min	55	
Volumetric flow rate (wet STP), m³/min	52	
Volumetric flow rate (dry STP), m³/min	52	
Mass flow rate (wet basis), kg/hour	4000	

Gas Analyser Results	Average	
Sampling time	0807 - 0906	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Sulfur dioxide	<6	<0.3
Carbon monoxide	<6	<0.3
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Isokinetic Results		Results	
	Sampling time	0800-0900	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		11	0.55
PM10	(PSA)	5.4	0.28
PM2.5	(PSA)	1.5	0.08
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		100	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.2	<0.009

VOC's C5-C20		Results	
	Sampling time	0845-0915	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.2	<0.009

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	450 mm	
Sampling plane area	0.159 m²	
Sampling port size, number	4" Flange (x1)	
Access & height of ports	Stairs & fixed ladder	3 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Centrifugal fan	2 D
No. traverses & points sampled	1	6
Sample plane conformance to AS4323.1 (2021)	Non-conforming	

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0905 & 1016	
Temperature, °C	19	
Velocity at sampling plane, m/s	5.6	
Volumetric flow rate, actual, m³/min	54	
Volumetric flow rate (wet STP), m³/min	51	
Volumetric flow rate (dry STP), m³/min	50	
Mass flow rate (wet basis), kg/hour	3900	

Isokinetic Results	Results	
Sampling time	0911-1011	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.001
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m²
Sampling port size, number	4" Flange (x1)
Access & height of ports	Stairs & fixed ladder 3 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS4323.1 (2021)	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0751 & 0905	
Temperature, °C	18	
Velocity at sampling plane, m/s	5.8	
Volumetric flow rate, actual, m³/min	55	
Volumetric flow rate (wet STP), m³/min	52	
Volumetric flow rate (dry STP), m³/min	52	
Mass flow rate (wet basis), kg/hour	4000	

Isokinetic Results	Results	
Sampling time	0800-0900	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.005**	**<0.0003**
Arsenic	**<0.002**	**<0.0001**
Beryllium	<0.0007	<0.00004
Cadmium	**0.013**	**0.00067**
Chromium	0.0026	0.00014
Cobalt	<0.001	<0.00006
Copper	0.014	0.0007
Lead	0.31	0.016
Manganese	0.18	0.0094
Mercury	**<0.0008**	**<0.00004**
Nickel	0.0038	0.00019
Phosphorus	0.034	0.0018
Selenium	<0.005	<0.0003
Zinc	9.1	0.47
Total of Sb, As, Cd, Pb, Hg	**≤0.33**	**≤0.017**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	450 mm	
Sampling plane area	0.159 m²	
Sampling port size, number	4" Flange (x1)	
Access & height of ports	Stairs & fixed ladder	3 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Centrifugal fan	2 D
No. traverses & points sampled	1	6
Sample plane conformance to AS4323.1 (2021)	Non-conforming	

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0905 & 1016	
Temperature, °C	19	
Velocity at sampling plane, m/s	5.6	
Volumetric flow rate, actual, m³/min	54	
Volumetric flow rate (wet STP), m³/min	51	
Volumetric flow rate (dry STP), m³/min	50	
Mass flow rate (wet basis), kg/hour	3900	

Date	12/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		220429

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 0911 - 1011	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	<3000	<100000
2-Methylnaphthalene	<1000	<60000
Acenaphthylene	<400	<20000
Acenaphthene	100	5100
Fluorene	97	4800
Phenanthrene	890	45000
Anthracene	37	1900
Fluoranthene	520	26000
Pyrene	260	13000
Benz(a)anthracene	61	3100
Chrysene	200	9900
Benzo(b)fluoranthene	59	3000
Benzo(k)fluoranthene	<20	<1000
Benzo(e)pyrene	<20	<1000
Benzo(a)pyrene	<20	<1000
Perylene	<20	<1000
Indeno(1,2,3-cd)pyrene	<90	<5000
Dibenz(ah)anthracene	<100	<6000
Benzo(ghi)perylene	<50	<3000
Total 16 PAHs	2200	110000
Total 19 PAHs	2200	110000
BaP-TEQ		
Lower Bound	14	700
Middle Bound	53	2700
Upper Bound	92	4600

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	100

2.11 Zinc Plant 1 Baghouse – ZP1

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*220429*

Sampling Plane Details		
Sampling plane dimensions	390 x 500 mm	
Sampling plane area	0.195 m²	
Sampling port size, number	1" Holes (x3)	
Access & height of ports	Scissor lift 4 m	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Bend >2 D	
Upstream disturbance	Bend >6 D	
No. traverses & points sampled	3 6	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	2.9	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.03	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0920 & 1045	
Temperature, °C	73	
Velocity at sampling plane, m/s	6.6	
Volumetric flow rate, actual, m³/min	77	
Volumetric flow rate (wet STP), m³/min	62	
Volumetric flow rate (dry STP), m³/min	60	
Mass flow rate (wet basis), kg/hour	4800	

Gas Analyser Results	Average	
Sampling time	1000 - 1059	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.3
Sulfur dioxide	<6	<0.4
Carbon monoxide	<6	<0.4
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		220429

Isokinetic Results		Results	
	Sampling time	0940-1040	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		2.4	0.14
PM10	(PSA)	1.1	0.067
PM2.5	(PSA)	0.3	0.018
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		99	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.02

VOC's C5-C20		Results	
	Sampling time	1115-1135	
		Concentration mg/m³	Mass Rate g/min
Detection limit[(1)]		<0.3	<0.02

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*220429*

Sampling Plane Details		
Sampling plane dimensions	390 x 500 mm	
Sampling plane area	0.195 m²	
Sampling port size, number	1" Holes (x3)	
Access & height of ports	Scissor lift 4 m	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Bend >2 D	
Upstream disturbance	Bend >6 D	
No. traverses & points sampled	3 6	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.7	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.03	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1045 & 1155	
Temperature, °C	74	
Velocity at sampling plane, m/s	6.6	
Volumetric flow rate, actual, m³/min	78	
Volumetric flow rate (wet STP), m³/min	62	
Volumetric flow rate (dry STP), m³/min	61	
Mass flow rate (wet basis), kg/hour	4800	

Isokinetic Results	Results	
Sampling time	1050-1150	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.002
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*220429*

Sampling Plane Details	
Sampling plane dimensions	390 x 500 mm
Sampling plane area	0.195 m²
Sampling port size, number	1" Holes (x3)
Access & height of ports	Scissor lift 4 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	3 6
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.03	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0920 & 1045	
Temperature, °C	73	
Velocity at sampling plane, m/s	6.6	
Volumetric flow rate, actual, m³/min	77	
Volumetric flow rate (wet STP), m³/min	62	
Volumetric flow rate (dry STP), m³/min	61	
Mass flow rate (wet basis), kg/hour	4800	

Isokinetic Results	Results	
Sampling time	0940-1040	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0003**
Arsenic	**<0.002**	**<0.0002**
Beryllium	<0.0007	<0.00004
Cadmium	**0.017**	**0.001**
Chromium	0.0056	0.00034
Cobalt	0.0015	0.000089
Copper	0.024	0.0014
Lead	**0.055**	**0.0033**
Manganese	0.074	0.0045
Mercury	**<0.0007**	**<0.00004**
Nickel	0.035	0.0021
Phosphorus	<0.02	<0.001
Selenium	<0.006	<0.0003
Zinc	2.4	0.14
Total of Sb, As, Cd, Pb, Hg	**≤0.081**	**≤0.0049**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*220429*

Sampling Plane Details		
Sampling plane dimensions	390 x 500 mm	
Sampling plane area	0.195 m²	
Sampling port size, number	1" Holes (x3)	
Access & height of ports	Scissor lift 4 m	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Bend >2 D	
Upstream disturbance	Bend >6 D	
No. traverses & points sampled	3 6	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.3	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.03	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1045 & 1155	
Temperature, °C	74	
Velocity at sampling plane, m/s	6.6	
Volumetric flow rate, actual, m³/min	77	
Volumetric flow rate (wet STP), m³/min	62	
Volumetric flow rate (dry STP), m³/min	61	
Mass flow rate (wet basis), kg/hour	4800	

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*220429*

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1050 - 1150	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		7400	450000
2-Methylnaphthalene		<1000	<80000
Acenaphthylene		<400	<20000
Acenaphthene		740	45000
Fluorene		340	21000
Phenanthrene		2200	130000
Anthracene		410	25000
Fluoranthene		1600	95000
Pyrene		750	45000
Benz(a)anthracene		<50	<3000
Chrysene		230	14000
Benzo(b)fluoranthene		<20	<1000
Benzo(k)fluoranthene		<20	<1000
Benzo(e)pyrene		<20	<1000
Benzo(a)pyrene		<20	<1000
Perylene		<20	<1000
Indeno(1,2,3-cd)pyrene		<90	<6000
Dibenz(ah)anthracene		<100	<7000
Benzo(ghi)perylene		<70	<4000
Total 16 PAHs		14000	820000
Total 19 PAHs		14000	820000
BaP-TEQ			
Lower Bound		2.3	140
Middle Bound		45	2700
Upper Bound		87	5300

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	101

2.12 Zinc Plant 3 Baghouse – ZP3

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*220429*

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Access & height of ports	Stairs 15 m
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	3.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.02	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1309 & 1419	
Temperature, °C	76	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	60	
Volumetric flow rate (wet STP), m³/min	47	
Volumetric flow rate (dry STP), m³/min	46	
Mass flow rate (wet basis), kg/hour	3600	

Gas Analyser Results	Average
Sampling time	1329 - 1428
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.2
Sulfur dioxide	<6 / <0.3
Carbon monoxide	<6 / <0.3
	Concentration %v/v
Carbon dioxide	<0.4
Oxygen	20.9

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*220429*

Isokinetic Results		Results	
	Sampling time	1313-1417	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		27	1.2
PM10	(PSA)	16	0.71
PM2.5	(PSA)	4.7	0.22
Isokinetic Sampling Parameters			
Sampling time, min		64	
Isokinetic rate, %		105	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.01

VOC's C5-C20		Results	
	Sampling time	1450-1510	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.3	<0.01

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*220429*

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Access & height of ports	Stairs 15 m
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.3	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.02	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1419 & 1530	
Temperature, °C	75	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	59	
Volumetric flow rate (wet STP), m³/min	47	
Volumetric flow rate (dry STP), m³/min	46	
Mass flow rate (wet basis), kg/hour	3600	

Isokinetic Results	Results	
Sampling time	1423-1527	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.04	<0.002
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	100	

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*220429*

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Access & height of ports	Stairs 15 m
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.02	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1309 & 1419	
Temperature, °C	76	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	60	
Volumetric flow rate (wet STP), m³/min	47	
Volumetric flow rate (dry STP), m³/min	46	
Mass flow rate (wet basis), kg/hour	3600	

Isokinetic Results	Results	
Sampling time	1313-1417	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0003**
Arsenic	**<0.002**	**<0.0001**
Beryllium	<0.0007	<0.00003
Cadmium	**0.011**	**0.00052**
Chromium	<0.0009	<0.00004
Cobalt	<0.001	<0.00005
Copper	0.013	0.0006
Lead	**0.34**	**0.016**
Manganese	0.049	0.0023
Mercury	**<0.0006**	**<0.00003**
Nickel	0.0016	0.000074
Phosphorus	<0.02	<0.0008
Selenium	<0.006	<0.0003
Zinc	27	1.2
Total of Sb, As, Cd, Pb, Hg	**≤0.36**	**≤0.017**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	98	

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*220429*

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Access & height of ports	Stairs 15 m
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	3.3	
Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1419 & 1530	
Temperature, °C	75	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	59	
Volumetric flow rate (wet STP), m³/min	47	
Volumetric flow rate (dry STP), m³/min	45	
Mass flow rate (wet basis), kg/hour	3600	

Date	11/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*220429*

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1423 - 1527	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	<3000	<100000
2-Methylnaphthalene	<1000	<60000
Acenaphthylene	<400	<20000
Acenaphthene	87	3900
Fluorene	59	2700
Phenanthrene	160	7400
Anthracene	<20	<1000
Fluoranthene	79	3600
Pyrene	<40	<2000
Benz(a)anthracene	<50	<2000
Chrysene	<40	<2000
Benzo(b)fluoranthene	<20	<1000
Benzo(k)fluoranthene	<20	<1000
Benzo(e)pyrene	<20	<1000
Benzo(a)pyrene	<20	<1000
Perylene	<20	<1000
Indeno(1,2,3-cd)pyrene	<100	<4000
Dibenz(ah)anthracene	<100	<5000
Benzo(ghi)perylene	<50	<2000
Total 16 PAHs	390	18000
Total 19 PAHs	390	18000
BaP-TEQ		
Lower Bound	0	0
Middle Bound	45	2000
Upper Bound	90	4100

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	64
Isokinetic rate, %	101

2.13 MZR Furnace Baghouse

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Access & height of ports	Scaffold 5 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1540 & 1655	
Temperature, °C	73	
Velocity at sampling plane, m/s	5.2	
Volumetric flow rate, actual, m³/min	61	
Volumetric flow rate (wet STP), m³/min	48	
Volumetric flow rate (dry STP), m³/min	47	
Mass flow rate (wet basis), kg/hour	3700	

Gas Analyser Results	Average	
Sampling time	1436 - 1535	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Sulfur dioxide	<6	<0.3
Carbon monoxide	<6	<0.3
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.6	

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		220429

Isokinetic Results		Results	
	Sampling time	1540-1646	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		4.2	0.19
PM10	(PSA)	2.7	0.13
PM2.5	(PSA)	0.58	0.027
Isokinetic Sampling Parameters			
Sampling time, min		80	
Isokinetic rate, %		94	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.6	<0.03

VOC's C5-C20		Results	
	Sampling time	1512-1530	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.6	<0.03

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, Toluene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Access & height of ports	Scaffold 5 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1420 & 1540	
Temperature, °C	73	
Velocity at sampling plane, m/s	5.2	
Volumetric flow rate, actual, m³/min	61	
Volumetric flow rate (wet STP), m³/min	48	
Volumetric flow rate (dry STP), m³/min	47	
Mass flow rate (wet basis), kg/hour	3700	

Isokinetic Results	Results	
Sampling time	1430-1536	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.02	<0.001
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	92	

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Access & height of ports	Scaffold 5 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1420 & 1540	
Temperature, °C	73	
Velocity at sampling plane, m/s	5	
Volumetric flow rate, actual, m³/min	59	
Volumetric flow rate (wet STP), m³/min	46	
Volumetric flow rate (dry STP), m³/min	45	
Mass flow rate (wet basis), kg/hour	3500	

Isokinetic Results	Results	
Sampling time	1430-1536	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.005**	**<0.0002**
Arsenic	**<0.002**	**<0.0001**
Beryllium	<0.0006	<0.00003
Cadmium	**0.032**	**0.0014**
Chromium	0.0028	0.00012
Cobalt	0.0021	0.000096
Copper	0.037	0.0017
Lead	**0.034**	**0.0015**
Manganese	0.061	0.0027
Mercury	**0.00086**	**0.000039**
Nickel	0.0089	0.0004
Phosphorus	<0.02	<0.0009
Selenium	<0.005	<0.0002
Zinc	4.1	0.18
Total of Sb, As, Cd, Pb, Hg	**≤0.075**	**≤0.0034**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	97	

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	500 mm	
Sampling plane area	0.196 m²	
Sampling port size, number & depth	4" BSP (x2), 80 mm	
Access & height of ports	Scaffold 5 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 2 D	
Upstream disturbance	Bend 6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS4323.1 (2021)	Conforming but non-ideal	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1540 & 1655	
Temperature, °C	73	
Velocity at sampling plane, m/s	5.2	
Volumetric flow rate, actual, m³/min	61	
Volumetric flow rate (wet STP), m³/min	48	
Volumetric flow rate (dry STP), m³/min	47	
Mass flow rate (wet basis), kg/hour	3700	

Date	10/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1540 - 1646	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	2000	92000
2-Methylnaphthalene	<900	<40000
Acenaphthylene	<10	<700
Acenaphthene	130	6200
Fluorene	110	5100
Phenanthrene	880	41000
Anthracene	66	3100
Fluoranthene	460	22000
Pyrene	170	7900
Benz(a)anthracene	<10	<700
Chrysene	95	4400
Benzo(b)fluoranthene	<10	<700
Benzo(k)fluoranthene	<10	<700
Benzo(e)pyrene	<40	<2000
Benzo(a)pyrene	<10	<700
Perylene	<10	<700
Indeno(1,2,3-cd)pyrene	<30	<1000
Dibenz(ah)anthracene	<20	<1000
Benzo(ghi)perylene	<30	<2000
Total 16 PAHs	3900	180000
Total 19 PAHs	3900	180000
BaP-TEQ		
Lower Bound	0.95	44
Middle Bound	16	750
Upper Bound	31	1500

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	80
Isokinetic rate, %	95

2.14 MZR Dross Stack

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		220429

Sampling Plane Details		
Sampling plane dimensions	500 mm	
Sampling plane area	0.196 m²	
Sampling port size, number	4" BSP (x2)	
Access & height of ports	Stairs 6 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend >2 D	
Upstream disturbance	Junction >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	
Comments		
No afterflows were recorded as this a batch process		

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0850	
Temperature, °C	22	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/min	230	
Volumetric flow rate (wet STP), m³/min	210	
Volumetric flow rate (dry STP), m³/min	210	
Mass flow rate (wet basis), kg/hour	16000	

Gas Analyser Results	Average	
Sampling time	0908 - 1000	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.9
Sulfur dioxide	<6	<1
Carbon monoxide	<6	<1
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		220429

Isokinetic Results		Results	
	Sampling time	0908-0959	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<2	<0.4
PM10	(PSA)	<1	<0.2
PM2.5	(PSA)	<0.3	<0.05
Isokinetic Sampling Parameters			
Sampling time, min		56	
Isokinetic rate, %		103	
Gravimetric analysis date (total particulate)		30-05-2022	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.05

VOC's C5-C20		Results	
	Sampling time	0920-0940	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.3	<0.05

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	500 mm	
Sampling plane area	0.196 m²	
Sampling port size, number	4" BSP (x2)	
Access & height of ports	Stairs 6 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend >2 D	
Upstream disturbance	Junction >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
No afterflows were recorded as this a batch process
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	29.8 (wet)	30.0 (dry)
Gas density at STP, kg/m³	1.33 (wet)	1.34 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1014	
Temperature, °C	23	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/min	230	
Volumetric flow rate (wet STP), m³/min	210	
Volumetric flow rate (dry STP), m³/min	200	
Mass flow rate (wet basis), kg/hour	17000	

Isokinetic Results	Results	
Sampling time	1011-1108	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.02	<0.005
Isokinetic Sampling Parameters		
Sampling time, min	56	
Isokinetic rate, %	106	

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number	4" BSP (x2)
Access & height of ports	Stairs 6 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Comments
No afterflows were recorded as this a batch process
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.9 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1009	
Temperature, °C	23	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/min	240	
Volumetric flow rate (wet STP), m³/min	210	
Volumetric flow rate (dry STP), m³/min	210	
Mass flow rate (wet basis), kg/hour	16000	

Isokinetic Results	Results	
Sampling time	1011-1108	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.005**	**<0.0009**
Arsenic	**0.0037**	**0.00077**
Beryllium	<0.0005	<0.0001
Cadmium	**0.003**	**0.00063**
Chromium	<0.0009	<0.0002
Cobalt	<0.0007	<0.0001
Copper	0.014	0.003
Lead	**0.14**	**0.028**
Manganese	0.025	0.0053
Mercury	**<0.0005**	**<0.0001**
Nickel	0.0031	0.00065
Phosphorus	<0.02	<0.003
Selenium	<0.004	<0.0009
Zinc	1.3	0.28
Total of Sb, As, Cd, Pb, Hg	**≤0.15**	**≤0.031**
Isokinetic Sampling Parameters		
Sampling time, min	56	
Isokinetic rate, %	107	

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Sampling Plane Details		
Sampling plane dimensions	500 mm	
Sampling plane area	0.196 m²	
Sampling port size, number	4" BSP (x2)	
Access & height of ports	Stairs 6 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend >2 D	
Upstream disturbance	Junction >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane	

Comments
No afterflows were recorded as this a batch process
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.9 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0850	
Temperature, °C	22	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/min	230	
Volumetric flow rate (wet STP), m³/min	210	
Volumetric flow rate (dry STP), m³/min	210	
Mass flow rate (wet basis), kg/hour	16000	

Date	17/05/2022	**Client**	Nyrstar Hobart
Report	R011346	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*220429*

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 0908 - 0959	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	2500	510000
2-Methylnaphthalene	<1000	<200000
Acenaphthylene	<20	<3000
Acenaphthene	<20	<3000
Fluorene	<20	<3000
Phenanthrene	120	25000
Anthracene	<20	<3000
Fluoranthene	35	7100
Pyrene	<20	<3000
Benz(a)anthracene	<20	<3000
Chrysene	33	6800
Benzo(b)fluoranthene	<20	<3000
Benzo(k)fluoranthene	<20	<3000
Benzo(e)pyrene	<40	<8000
Benzo(a)pyrene	<20	<3000
Perylene	<20	<3000
Indeno(1,2,3-cd)pyrene	<30	<6000
Dibenz(ah)anthracene	<20	<5000
Benzo(ghi)perylene	<40	<8000
Total 16 PAHs	2700	550000
Total 19 PAHs	2700	550000
BaP-TEQ		
Lower Bound	0.33	68
Middle Bound	17	3600
Upper Bound	34	7100

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	56
Isokinetic rate, %	104

3 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate and velocity	AS 4323.1	AS 4323.1	8%, 7%	✓	✓
Moisture	USEPA Method 4	USEPA Method 4	8%	✓	✓
Moisture (stacks <60°C)	Ektimo 050	Ektimo 050	not specified	✓	✓
Molecular weight	NA	USEPA Method 3	not specified	NA	✓
Carbon dioxide and oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Carbon monoxide	USEPA Method 10	USEPA Method 10	12%	✓	✓
Nitrogen oxides	USEPA Method 7E	USEPA Method 7E	12%	✓	✓
Nitrous oxide	NA	gas analyser	12%	NA	×[h]
Sulfur dioxide	USEPA Method 6C	USEPA Method 6C	12%	✓	✓
Speciated volatile organic compounds (VOCs)	Ektimo 344	Ektimo 344	19%	✓	✓[†]
Total particulate matter	AS 4323.2	AS 4323.2	7%	✓	✓[††]
Particulate matter (PM_{10} and $PM_{2.5}$) by particle size analysis	AS 4323.2	HRL in-house method using Malvern Mastersizer 2000	not specified	×	×[**]
Total (gasesous & particulate) metals (Ag, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mn, Ni, P, Pb, Sb, Se, Tl, Zn)	USEPA Method 29	Envirolab in-house methods Metals-006, Metals-022, Metals-021	15%	✓	✓[‡]
Total fluoride	USEPA Method 13B	ALS in-house method EA144C & Ektimo 235	17%	✓	✓[#,†]
Polycyclic aromatic hydrocarbons (PAHs)	USEPA SW-846 0010	NMI in-house method NGCMS 11.27	21%	✓	✓[¶]
Sulfuric acid mist and/or sulfur oxides	USEPA Method 8	Ektimo 235	16%	✓	✓[†]

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* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

† Analysis conducted at the Ektimo Mitcham, VIC laboratory, NATA accreditation number 14601. Results were reported on:
2 June 2022 in report LV-002895.
2 June 2022 in report LV-002905.
9 June 2022 in report LV-002934.

†† Gravimetric analysis conducted at the Ektimo Mitcham, VIC laboratory, NATA accreditation number 14601.

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 3 June 2022 in report 296549.

¶ Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on:
16 June 2022 in report ORG22_038.
16 June 2022 in report ORG22_039.

** Analysis performed by HRL Technology using a laser-diffraction particle size analyser. NATA accreditation does not cover the performance of this service. Results were reported to Ektimo on 6 June 2022 in report 220633.

Analysis (solid fluoride only) performed by Australian Laboratory Services Pty Ltd, NATA accreditation number 825. Results were reported to Ektimo on 3 June 2022 in report EN2205024.

4 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

5 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
AS	Australian Standard
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
USEPA	United States Environmental Protection Agency
Velocity difference	The percentage difference between the average of initial flows and after flows.
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

6 Appendix 1: Site Photos

Foreshore A

Foreshore B

Parageothite Dryer

Cadmium Smelter Plant Scrubber Stack

Copper Sulphate Crystalliser Plant Vent Stack

Casting Ventilation 1 – V1

Casting Ventilation 2 – V2

Roaster Baghouse

Anode Casting

Zinc Plant 1 Baghouse – ZP1

Zinc Plant 3 Baghouse – ZP3

MZR Dross Stack

7 Appendix 2: Weather Observations

Hobart – May 2022

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	8th		km/h	hPa	°C	%	8th		km/h	hPa
1	Su	11.8	18.8	1	4.2		WNW	52	16:44	15.4	49	4	NNW	19	1011.9	18	64	7	NW	20	1009.9
2	Mo	13.2	21.7	0	2.6		NW	50	13:16	16.4	66	6	N	22	1014.5	20	51	7	NW	26	1012.9
3	Tu	14.2	21.4	0	4		NNW	54	11:36	17.3	59	7	N	15	1011.5	20.7	41	7	NNW	24	1008.4
4	We	12.8	14.4	3.2	2.8		NNW	43	0:17	13	81	7	N	11	1008.4	12.6	73	7	SSE	9	1009.0
5	Th	4.7	14.4	0.8	1.8		S	54	22:25	6.4	88	2	NNW	15	1017.5	12.5	72	8	SSW	26	1016.8
6	Fr	6.4	13.5	85.2			S	87	2:52	9.4	91	7	SSW	17	1009.1	13.3	63	7	NNW	24	1005.5
7	Sa	9.4	12.2	5	1.8		SSW	63	14:56	11.1	82	7	SW	19	999.6	11	85	8	SSW	33	1003.4
8	Su	9.6	16.6	19.8			SW	54	0:17	12.1	75	3	N	4	1019.7	14.9	52	2	SSW	17	1021.3
9	Mo	4.6	16.1	0.2	1.8		NNW	26	10:36	7.6	79	1	NNW	15	1029.1	15.8	47	1	N	9	1027.3
10	Tu	5.8	18	0	1.2		NW	35	4:46	8.4	81	1	N	13	1031.0	16.4	51	1	NE	9	1029.4
11	We	6.1	15.1	0	2		NW	33	4:57	9.3	73	3	N	15	1031.2	14.1	62	7	NNW	15	1028.2
12	Th	9.3	14.3	0	0.4		NW	35	10:32	10.7	82	7	N	15	1024.9	14.2	72	8	NNW	7	1020.4
13	Fr	7.4	16.7	0	0.4		NNW	26	4:31	9.8	90	3	NNW	13	1017.9	15.5	69	7	ESE	13	1016.7
14	Sa	9.8	17.7	3.2	0.6		NW	46	21:52	12.4	94	7	N	7	1009.3	16.8	79	3	NW	7	1002.5
15	Su	12.3	19.9	0.2	1.2		NW	50	11:48	16	63	5	NNW	15	1004.2	18.3	51	7	WNW	17	998.2
16	Mo	7.3	12.5	8.4	2.2		WNW	72	0:46	9.7	72	2	NNW	20	1001.1	9.9	64	2	NNW	28	1001.6
17	Tu	6.1	14.2	5.8	1.8		W	59	12:22	9.7	68	6	N	20	1005.4	13.2	50	7	NNW	28	1004.1
18	We	7.1	12.5	1	1.8		W	67	12:40	9	72	7	NNW	22	1002.9	11.4	55	4	SW	30	1007.2
19	Th	9.0	13.6	0.8	1.2		WSW	57	9:26	11	65	4	SW	37	1019.6	12	50	2	SW	22	1024.3
20	Fr	5.0	13.1	0	2		WSW	50	0:17	7.7	78	7	WNW	11	1034.1	12	66	6	E	9	1033.8
21	Sa	4.1	13	0	0.8		NNW	28	10:25	6.2	88	7	NNW	9	1036.9	12.6	59	2	N	7	1034.0
22	Su	4.0	11.5	0	1.2		NNW	33	7:42	6.7	83	7	NW	17	1032.9	11.2	65	7	NNW	15	1031.0
23	Mo	6.1	15.3	0	0.8		NNW	28	1:58	7.1	86	1	NNW	15	1032.0	15	56	1	NNW	9	1029.6
24	Tu	6.8	14.8	0	1.6		NNW	26	10:42	7.5	84	6	NNW	19	1031.4	12.7	62	2	ESE	11	1028.8
25	We	3.0	15.4	0	0.8		NNW	43	9:53	4.2	93	1	NW	26	1026.6	13.9	62	1	NE	11	1023.2
26	Th	3.7	14.8	0	1		NNW	31	1:50	4.8	95	3	NNW	20	1019.4	12.8	70	7	N	15	1014.6
27	Fr	4.7	16	0	0.6		NNW	33	4:41	12.4	69	7	WNW	9	1014.5	14.6	46	7	NW	20	1014.6
28	Sa	4.6	15.6	0	1.4		NW	37	7:29	5.6	82	6	NNW	17	1011.8	14.6	55	3	N	2	1009.0
29	Su	3.5	11.9	0	1		NNW	22	9:48	5.3	91	7	NNW	7	1010.3	10.6	76	3	Calm		1006.1
30	Mo	4.2	13.4	0	0.6		NNW	28	9:32	7.4	87	1	NNW	13	996.0	11.9	61	5	NE	9	989.9
31	Tu	4.0	10.2	0	0.8		NNW	28	5:31	5.1	87	7	NNW	9	983.9	10.1	64	7	NNW	17	983.4
Statistics for May 2022																					
	Mean	7.1	15.1		1.5					9.5	79	4		15	1016.1	14	61	4		15	1014.4
	Lowest	3	10.2	0	0.4					4.2	49	1	N	4	983.9	9.9	41	1	Calm		983.4
	Highest	14.2	21.7	85.2	4.2		S	87		17.3	95	7	SW	37	1036.9	20.7	85	8	SSW	33	1034
	Total			134.6	44.4																

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Nyrstar Hobart , Lutana
Emission Testing Report
Round 2 – October 2022
Report Number R012792

Document Information

Template Version 190722

Client Name:	Nyrstar Hobart
Report Number:	R012792
Date of Issue:	21 November 2022
Attention:	Kylie Veale
Address:	Risdon Road Lutana TAS 7009
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Glenn Trenear
Senior Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged by Nyrstar Hobart to perform emission testing at their Lutana plant. Testing was carried out in accordance with Environmental Licence 7043/5.

1.2 Project Objective & Overview

The objective of the project was to conduct a monitoring programme to quantify emissions from 14 discharge points to determine compliance with Nyrstar Hobart 's Environmental Licence and meet EPN reporting requirements.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Foreshore A	13 October 2022	Total particulate matter Metals Sulfur dioxide, sulfur trioxide Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Foreshore B		
Parageothite Dryer	11 October 2022	Total particulate matter Metals Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Cadmium Smelter Plant Scrubber Stack		
Copper Sulphate Crystalliser Plant Vent Stack		
Casting Ventilation 1 – V1	10 October 2022	
Casting Ventilation 2 – V2		
Roaster Baghouse	12 October 2022	Total particulate matter Metals Nitrogen oxides, sulfur dioxide, carbon monoxide, carbon dioxide, oxygen
Zinc Oxide Fume Debagging Station		Total particulate matter Metals Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Anode Casting		
Zinc Plant 1 Baghouse – ZP1	11 October 2022	
Zinc Plant 3 Baghouse – ZP3	10 October 2022	
MZR Furnace Baghouse	12 October 2022	
MZR Dross Stack		

* Flow rate, velocity, temperature and moisture were also determined.

All results are reported on a dry basis at STP.

Plant operating conditions have been noted in the report.

1.3 Licence Comparison

The following licence comparison table shows that all analytes highlighted in green are within the licence limit set by the Tasmanian Environmental Protection Notice (EPN) 7043/5.

Emission Point / Monitoring Location	Parameter	Units	Licence limit	Detected values
Foreshore A (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	0.56
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.036
	Particulates	mg/m^3	100	<1
	Sulphur dioxide	g/m^3	7.2	0.0013
Foreshore B (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	1.4
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.044
	Particulates	mg/m^3	100	3.1
	Sulphur dioxide	g/m^3	7.2	0.0012
Anode Casting Plant Exhaust	Particulates	mg/m^3	100	4.7
V1 Furnace Stack				<3
V2 Furnace Stack				11
Zinc Dust Plant Baghouse 1 Stack				<3
Zinc Dust Plant Bagouse 3 Stack				12
Cadmium Smelter Plant Scrubber Stack				<2
Copper Sulphate Crystalliser Plant				5.8
Roaster Baghouse				<2
Paragoethite Dryer Baghouse				5.2
Anode Casting Plant Exhaust	Metals - Pb, As, Sb, Cd, Hg [(1)]	mg/m^3	5	≤0.17
V1 Furnace Stack				≤0.068
V2 Furnace Stack				≤0.091
Zinc Dust Plant Baghouse 1 Stack				≤0.056
Zinc Dust Plant Baghouse 3 Stack				≤0.16
Cadmium Smelter Plant Scrubber Stack				≤0.47
Copper Sulphate Crystalliser Plant				≤0.10
Roaster Baghouse				≤0.085
Paragoethite Dryer Baghouse				≤0.42
Anode Casting Plant Exhaust	Metals - Hg	mg/m^3	1	0.0022
V1 Furnace Stack				<0.001
V2 Furnace Stack				0.0012
Zinc Dust Plant Baghouse 1 Stack				<0.0008
Zinc Dust Plant Baghouse 3 Stack				<0.001
Cadmium Smelter Plant Scrubber Stack				<0.002
Copper Sulphate Crystalliser Plant				0.0051
Roaster Baghouse				0.018
Paragoethite Dryer Baghouse				<0.001
Anode Casting Plant Exhaust	Metals - Cd	mg/m^3	1	0.0084
V1 Furnace Stack				0.0019
V2 Furnace Stack				0.0013
Zinc Dust Plant Baghouse 1 Stack				0.0073
Zinc Dust Plant Baghouse 3 Stack				0.0011
Cadmium Smelter Plant Scrubber Stack				0.011
Copper Sulphate Crystalliser Plant				0.028
Roaster Baghouse				0.0046
Paragoethite Dryer Baghouse				0.0097

(1) Total concentration of metals combined.

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 Foreshore A

Date	13/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 53000 m3/hr & Unit 6 producing 101000 m3/hr of gas through the acid stream.		*221003*

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0826 & 1029	
Temperature, °C	17	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1800	
Volumetric flow rate (dry STP), m³/min	1800	
Mass flow rate (wet basis), kg/hour	140000	

Gas Analyser Results	Average	
Sampling time	0855 - 0954	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	36	63
Carbon monoxide	<6	<10
	Concentration %v/v	
Carbon dioxide	0.5	
Oxygen	10.6	

Date	13/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 53000 m3/hr & Unit 6 producing 101000 m3/hr of gas through the acid stream.		*221003*

Isokinetic Results	Results	
Sampling time	0840-1022	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<1	<3
Antimony	<0.003	<0.006
Arsenic	<0.002	<0.003
Beryllium	<0.0004	<0.0007
Cadmium	**0.0027**	**0.0048**
Chromium	**0.0017**	**0.003**
Cobalt	<0.0005	<0.0009
Copper	**0.0037**	**0.0066**
Lead	**0.029**	**0.052**
Manganese	**0.048**	**0.084**
Mercury	**0.0031**	**0.0055**
Nickel	**0.0054**	**0.0096**
Phosphorus	<0.01	<0.02
Selenium	<0.003	<0.006
Zinc	**0.38**	**0.68**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	21-10-2022	

Date	13/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 53000 m3/hr & Unit 6 producing 101000 m3/hr of gas through the acid stream.		*221003*

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1030 & 1233	
Temperature, °C	17	
Velocity at sampling plane, m/s	18	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1800	
Volumetric flow rate (dry STP), m³/min	1800	
Mass flow rate (wet basis), kg/hour	140000	

Isokinetic Results	Results	
Sampling time	1040-1222	
	Concentration mg/m³	Mass Rate g/min
Sulfur dioxide	1.3	2.4
Sulfur trioxide	0.56	1
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	98	

2.2 Foreshore B

Date	13/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 53000 m3/hr & Unit 6 producing 101000 m3/hr of gas through the acid stream.		*221003*

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.5 (wet)	28.7 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0830 & 1027	
Temperature, °C	17	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1800	
Volumetric flow rate (wet STP), m³/min	1700	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	130000	

Gas Analyser Results	Average	
Sampling time	1034 - 1133	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	44	74
Carbon monoxide	<6	<10
	Concentration %v/v	
Carbon dioxide	0.6	
Oxygen	10.7	

Date	13/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 53000 m3/hr & Unit 6 producing 101000 m3/hr of gas through the acid stream.		221003

Isokinetic Results	Results	
Sampling time	0840-1022	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	3.1	5.3
Antimony	<0.004	<0.007
Arsenic	<0.002	<0.004
Beryllium	<0.0005	<0.0008
Cadmium	**0.0043**	**0.0072**
Chromium	**0.0046**	**0.0077**
Cobalt	<0.0009	<0.002
Copper	**0.0069**	**0.012**
Lead	**0.034**	**0.058**
Manganese	**0.064**	**0.11**
Mercury	**0.0058**	**0.0098**
Nickel	**0.031**	**0.053**
Phosphorus	<0.02	<0.03
Selenium	<0.004	<0.007
Zinc	**0.78**	**1.3**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	94	
Gravimetric analysis date (total particulate)	21-10-2022	

Date	13/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 53000 m3/hr & Unit 6 producing 101000 m3/hr of gas through the acid stream.		221003

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1033 & 1230	
Temperature, °C	17	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1800	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/hour	130000	

Isokinetic Results	Results	
Sampling time	1040-1222	
	Concentration mg/m³	Mass Rate g/min
Sulfur dioxide	1.2	2.1
Sulfur trioxide	1.4	2.3
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	97	

2.3 Parageothite Dryer

Date	11/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7.1 m3/hr of dirt and 1.89 m3/hr of bypass flow into the drum.		221003

Sampling Plane Details		
Sampling plane dimensions	950 mm	
Sampling plane area	0.709 m²	
Sampling port size, number & depth	4" Flange (x2), 50 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	28	
Gas molecular weight, g/g mole	26.2 (wet)	29.3 (dry)
Gas density at STP, kg/m³	1.17 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.88	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1550 & 1711	
Temperature, °C	94	
Velocity at sampling plane, m/s	9.9	
Volumetric flow rate, actual, m³/min	420	
Volumetric flow rate (wet STP), m³/min	310	
Volumetric flow rate (dry STP), m³/min	230	
Mass flow rate (wet basis), kg/hour	22000	

Gas Analyser Results	Average	
Sampling time	1605 - 1704	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	50	11
Carbon monoxide	<6	<1
	Concentration %v/v	
Carbon dioxide	3.6	
Oxygen	15.5	

Date	11/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7.1 m3/hr of dirt and 1.89 m3/hr of bypass flow into the drum.		221003

Isokinetic Results	Results	
Sampling time	1605-1705	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	5.2	1.2
Antimony	<0.006	<0.001
Arsenic	**0.011**	**0.0025**
Beryllium	<0.0009	<0.0002
Cadmium	**0.0097**	**0.0022**
Chromium	**0.017**	**0.0038**
Cobalt	**0.0015**	**0.00034**
Copper	**0.047**	**0.011**
Lead	**0.4**	**0.09**
Manganese	**0.24**	**0.053**
Mercury	<0.001	<0.0003
Nickel	**0.039**	**0.0088**
Phosphorus	<0.04	<0.01
Selenium	<0.008	<0.002
Zinc	**0.82**	**0.19**
Total of Sb, As, Cd, Pb, Hg	**≤0.42**	**≤0.096**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	94	
Gravimetric analysis date (total particulate)	21-10-2022	

2.4 Cadmium Smelter Plant Scrubber Stack

Date	11/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		221003

Sampling Plane Details	
Sampling plane dimensions	470 mm
Sampling plane area	0.173 m²
Sampling port size, number & depth	4" BSP (x2), 85 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Change in diameter 2 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1400 & 1514	
Temperature, °C	23	
Velocity at sampling plane, m/s	11	
Volumetric flow rate, actual, m³/min	120	
Volumetric flow rate (wet STP), m³/min	110	
Volumetric flow rate (dry STP), m³/min	110	
Mass flow rate (wet basis), kg/hour	8400	

Gas Analyser Results	Average	
Sampling time	1411 - 1510	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.5
Carbon monoxide	<6	<0.6
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.8	

Date	11/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		221003

Isokinetic Results	Results	
Sampling time	1410-1510	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.3
Antimony	<0.007	<0.0007
Arsenic	**0.012**	**0.0013**
Beryllium	<0.001	<0.0001
Cadmium	**0.011**	**0.0011**
Chromium	**0.019**	**0.002**
Cobalt	**0.0017**	**0.00018**
Copper	**0.052**	**0.0055**
Lead	**0.44**	**0.046**
Manganese	**0.26**	**0.028**
Mercury	<0.002	<0.0002
Nickel	**0.043**	**0.0046**
Phosphorus	<0.05	<0.005
Selenium	<0.008	<0.0009
Zinc	0.91	0.097
Total of Sb, As, Cd, Pb, Hg	**≤0.47**	**≤0.05**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	21-10-2022	

2.5 Copper Sulphate Crystalliser Plant Vent Stack

Date	11/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 10.6 tonnes/day, Dryer Outlet Temperature - 48.5 deg C, Feed rate into Dryer - 20%		

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	8.8	
Gas molecular weight, g/g mole	28.1 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1000 & 1115	
Temperature, °C	48	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/hour	12000	

Gas Analyser Results	Average	
Sampling time	1011 - 1110	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.6
Carbon monoxide	<6	<0.8
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.8	

Date	11/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 10.6 tonnes/day, Dryer Outlet Temperature - 48.5 deg C, Feed rate into Dryer - 20%		221003

Isokinetic Results	Results	
Sampling time	1010-1112	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	5.8	0.81
Antimony	<0.007	<0.0009
Arsenic	<0.004	<0.0005
Beryllium	<0.0009	<0.0001
Cadmium	**0.028**	**0.004**
Chromium	**0.01**	**0.0015**
Cobalt	**0.0023**	**0.00032**
Copper	**0.035**	**0.005**
Lead	**0.06**	**0.0084**
Manganese	**0.28**	**0.039**
Mercury	**0.0051**	**0.00071**
Nickel	**0.083**	**0.012**
Phosphorus	<0.03	<0.004
Selenium	<0.007	<0.001
Zinc	**1.2**	**0.17**
Total of Sb, As, Cd, Pb, Hg	**≤0.1**	**≤0.014**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	95	
Gravimetric analysis date (total particulate)	21-10-2022	

2.6 Casting Ventilation 1 – V1

Date	10/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		221003

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1320 & 1440	
Temperature, °C	31	
Velocity at sampling plane, m/s	23	
Volumetric flow rate, actual, m³/min	430	
Volumetric flow rate (wet STP), m³/min	390	
Volumetric flow rate (dry STP), m³/min	390	
Mass flow rate (wet basis), kg/hour	30000	

Gas Analyser Results	Average	
Sampling time	1331 - 1430	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<2
Carbon monoxide	<6	<2
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	10/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		221003

Isokinetic Results	Results	
Sampling time	1330-1430	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<3	<1
Antimony	<0.009	<0.003
Arsenic	<0.006	<0.002
Beryllium	<0.001	<0.0004
Cadmium	**0.0019**	**0.00074**
Chromium	**0.0023**	**0.0009**
Cobalt	<0.001	<0.0005
Copper	**0.0062**	**0.0024**
Lead	**0.051**	**0.02**
Manganese	**0.14**	**0.054**
Mercury	<0.001	<0.0005
Nickel	**0.003**	**0.0012**
Phosphorus	<0.03	<0.01
Selenium	<0.009	<0.003
Zinc	**1.1**	**0.44**
Total of Sb, As, Cd, Pb, Hg	**≤0.068**	**≤0.026**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	104	
Gravimetric analysis date (total particulate)	21-10-2022	

2.7 Casting Ventilation 2 – V2

Date	10/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		221003

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1350 & 1508	
Temperature, °C	46	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/min	330	
Volumetric flow rate (wet STP), m³/min	280	
Volumetric flow rate (dry STP), m³/min	280	
Mass flow rate (wet basis), kg/hour	22000	

Gas Analyser Results	Average	
Sampling time	1400 - 1459	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<1
Carbon monoxide	<6	<2
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	10/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		221003

Isokinetic Results	Results	
Sampling time	1400-1500	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	11	3.1
Antimony	<0.005	<0.001
Arsenic	**0.01**	**0.0028**
Beryllium	<0.0006	<0.0002
Cadmium	**0.0013**	**0.00036**
Chromium	**0.012**	**0.0033**
Cobalt	<0.0008	<0.0002
Copper	**0.0052**	**0.0014**
Lead	**0.074**	**0.02**
Manganese	**0.19**	**0.054**
Mercury	**0.0012**	**0.00035**
Nickel	**0.014**	**0.0039**
Phosphorus	<0.02	<0.007
Selenium	<0.005	<0.001
Zinc	**4.6**	**1.3**
Total of Sb, As, Cd, Pb, Hg	**≤0.091**	**≤0.025**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	91	
Gravimetric analysis date (total particulate)	21-10-2022	

2.8 Roaster Baghouse

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 40 t/hr, Roaster 5 - 21 t/hr (Conveyor all in operation), fumes were off.		*221003*

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.13	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0950 & 1109	
Temperature, °C	42	
Velocity at sampling plane, m/s	4.1	
Volumetric flow rate, actual, m³/min	29	
Volumetric flow rate (wet STP), m³/min	25	
Volumetric flow rate (dry STP), m³/min	25	
Mass flow rate (wet basis), kg/hour	1900	

Gas Analyser Results	Average	
Sampling time	0955 - 1054	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.1
Sulfur dioxide	3400	84
Carbon monoxide	<6	<0.1
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.4	

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 40 t/hr, Roaster 5 - 21 t/hr (Conveyor all in operation), fumes were off.		221003

Isokinetic Results	Results	
Sampling time	0955-1103	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.05
Antimony	<0.005	<0.0001
Arsenic	<0.003	<0.00007
Beryllium	<0.0007	<0.00002
Cadmium	**0.0046**	**0.00011**
Chromium	**0.0013**	**0.000033**
Cobalt	<0.0008	<0.00002
Copper	**0.0088**	**0.00022**
Lead	**0.054**	**0.0013**
Manganese	**0.054**	**0.0013**
Mercury	**0.018**	**0.00044**
Nickel	**0.0039**	**0.000096**
Phosphorus	<0.02	<0.0005
Selenium	<0.005	<0.0001
Zinc	**0.68**	**0.017**
Total of Sb, As, Cd, Pb, Hg	**≤0.085**	**≤0.0021**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	100	
Gravimetric analysis date (total particulate)	21-10-2022	

2.9 Zinc Oxide Fume Debagging Station

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		221003

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.17	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1305	
Temperature, °C	29	
Velocity at sampling plane, m/s	12	
Volumetric flow rate, actual, m³/min	35	
Volumetric flow rate (wet STP), m³/min	32	
Volumetric flow rate (dry STP), m³/min	31	
Mass flow rate (wet basis), kg/hour	2500	

Gas Analyser Results	Average
Sampling time	1306 - 1339
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.1
Carbon monoxide	<6 / <0.2
	Concentration %v/v
Carbon dioxide	<0.4
Oxygen	20.9

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		221003

Isokinetic Results	Results	
Sampling time	1305-1341	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<4	<0.1
Antimony	<0.009	<0.0003
Arsenic	<0.005	<0.0001
Beryllium	<0.001	<0.00004
Cadmium	**0.0044**	**0.00014**
Chromium	**0.0031**	**0.000099**
Cobalt	<0.001	<0.00004
Copper	**0.0088**	**0.00028**
Lead	**0.085**	**0.0027**
Manganese	**0.089**	**0.0028**
Mercury	<0.001	<0.00003
Nickel	**0.01**	**0.00032**
Phosphorus	<0.03	<0.0009
Selenium	<0.009	<0.0003
Zinc	**0.9**	**0.028**
Isokinetic Sampling Parameters		
Sampling time, min	28	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	21-10-2022	

2.10 Anode Casting

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		221003

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m²
Sampling port size, number	4" Flange (x1)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0742 & 0855	
Temperature, °C	26	
Velocity at sampling plane, m/s	7.1	
Volumetric flow rate, actual, m³/min	68	
Volumetric flow rate (wet STP), m³/min	62	
Volumetric flow rate (dry STP), m³/min	61	
Mass flow rate (wet basis), kg/hour	4800	

Gas Analyser Results	Average	
Sampling time	0750 - 0849	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.3
Carbon monoxide	<6	<0.4
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*221003*

Isokinetic Results	Results	
Sampling time	0750-0850	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	4.7	0.29
Antimony	<0.008	<0.0005
Arsenic	<0.004	<0.0003
Beryllium	<0.001	<0.00006
Cadmium	**0.0084**	**0.00051**
Chromium	**0.015**	**0.0009**
Cobalt	<0.001	<0.00007
Copper	**0.018**	**0.0011**
Lead	**0.15**	**0.0089**
Manganese	**0.21**	**0.013**
Mercury	**0.0022**	**0.00013**
Nickel	**0.0096**	**0.00058**
Phosphorus	<0.03	<0.002
Selenium	<0.008	<0.0005
Zinc	**0.48**	**0.029**
Total of Sb, As, Cd, Pb, Hg	**≤0.17**	**≤0.01**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	97	
Gravimetric analysis date (total particulate)	21-10-2022	

2.11 Zinc Plant 1 Baghouse – ZP1

Date	11/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area		221003

Sampling Plane Details		
Sampling plane dimensions	390 x 500 mm	
Sampling plane area	0.195 m²	
Sampling port size, number	1" Holes (x3)	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Bend >2 D	
Upstream disturbance	Bend >6 D	
No. traverses & points sampled	3 6	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	1.2	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1155 & 1309	
Temperature, °C	23	
Velocity at sampling plane, m/s	7.1	
Volumetric flow rate, actual, m³/min	83	
Volumetric flow rate (wet STP), m³/min	78	
Volumetric flow rate (dry STP), m³/min	77	
Mass flow rate (wet basis), kg/hour	6000	

Gas Analyser Results	Average	
Sampling time	1205 - 1304	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.3
Carbon monoxide	<6	<0.5
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	11/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area		*221003*

Isokinetic Results	Results	
Sampling time	1200-1303	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<3	<0.2
Antimony	<0.007	<0.0005
Arsenic	<0.003	<0.0002
Beryllium	<0.0009	<0.00007
Cadmium	**0.0073**	**0.00056**
Chromium	<0.002	<0.0001
Cobalt	<0.001	<0.00009
Copper	**0.01**	**0.00079**
Lead	**0.037**	**0.0029**
Manganese	**0.089**	**0.0069**
Mercury	<0.0008	<0.00006
Nickel	**0.002**	**0.00015**
Phosphorus	<0.03	<0.002
Selenium	<0.007	<0.0005
Zinc	**0.33**	**0.026**
Total of Sb, As, Cd, Pb, Hg	**≤0.056**	**≤0.0043**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	102	
Gravimetric analysis date (total particulate)	21-10-2022	

2.12 Zinc Plant 3 Baghouse – ZP3

Date	10/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		221003

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1450 & 1615	
Temperature, °C	78	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	57	
Volumetric flow rate (wet STP), m³/min	45	
Volumetric flow rate (dry STP), m³/min	44	
Mass flow rate (wet basis), kg/hour	3500	

Gas Analyser Results	Average	
Sampling time	1507 - 1606	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Carbon monoxide	<6	<0.3
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	10/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		221003

Isokinetic Results	Results	
Sampling time	1500-1607	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	12	0.53
Antimony	<0.007	<0.0003
Arsenic	<0.003	<0.0001
Beryllium	<0.0009	<0.00004
Cadmium	**0.0011**	**0.000047**
Chromium	**0.0017**	**0.000075**
Cobalt	<0.001	<0.00005
Copper	**0.0039**	**0.00017**
Lead	**0.15**	**0.0065**
Manganese	**0.12**	**0.0054**
Mercury	<0.001	<0.00004
Nickel	0.003	0.00013
Phosphorus	<0.03	<0.001
Selenium	<0.007	<0.0003
Zinc	**8.8**	**0.39**
Total of Sb, As, Cd, Pb, Hg	**≤0.16**	**≤0.007**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	99	
Velocity difference, %	-4	
Gravimetric analysis date (total particulate)	21-10-2022	

2.13 MZR Furnace Baghouse

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		221003

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.7	
Gas molecular weight, g/g mole	28.9 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.00	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1500 & 1621	
Temperature, °C	72	
Velocity at sampling plane, m/s	5.1	
Volumetric flow rate, actual, m³/min	60	
Volumetric flow rate (wet STP), m³/min	46	
Volumetric flow rate (dry STP), m³/min	45	
Mass flow rate (wet basis), kg/hour	3600	

Gas Analyser Results	Average
Sampling time	1509 - 1546
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	16 / 0.7
Carbon monoxide	24 / 1.1
	Concentration %v/v
Carbon dioxide	2.6
Oxygen	17.4

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		221003

Isokinetic Results	Results	
Sampling time	1505-1611	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.1
Antimony	<0.005	<0.0002
Arsenic	**0.003**	**0.00014**
Beryllium	<0.0007	<0.00003
Cadmium	**0.0076**	**0.00034**
Chromium	**0.034**	**0.0015**
Cobalt	**0.0022**	**0.0001**
Copper	**0.015**	**0.00068**
Lead	**0.082**	**0.0037**
Manganese	**0.1**	**0.0047**
Mercury	**0.0014**	**0.000064**
Nickel	**0.11**	**0.0049**
Phosphorus	<0.02	<0.0009
Selenium	<0.007	<0.0003
Zinc	**1.8**	**0.082**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	21-10-2022	

2.14 MZR Dross Stack

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		221003

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number	4" BSP (x2)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
No afterflows were recorded as this a batch process

Stack Parameters		
Moisture content, %v/v	1.4	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1530	
Temperature, °C	23	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	160	
Volumetric flow rate (dry STP), m³/min	160	
Mass flow rate (wet basis), kg/hour	12000	

Gas Analyser Results	Average	
Sampling time	1548 - 1621	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.7
Carbon monoxide	<6	<1
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	12/10/2022	**Client**	Nyrstar Hobart
Report	R012792	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		221003

Isokinetic Results	Results	
Sampling time	1531-1628	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.3
Antimony	<0.005	<0.0008
Arsenic	<0.003	<0.0005
Beryllium	<0.0006	<0.0001
Cadmium	**0.0084**	**0.0013**
Chromium	**0.0019**	**0.00029**
Cobalt	<0.001	<0.0002
Copper	**0.0094**	**0.0015**
Lead	**0.081**	**0.013**
Manganese	**0.27**	**0.043**
Mercury	<0.0006	<0.0001
Nickel	**0.033**	**0.0053**
Phosphorus	<0.02	<0.003
Selenium	<0.005	<0.0008
Zinc	**0.81**	**0.13**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	102	
Gravimetric analysis date (total particulate)	21-10-2022	

3 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	Sampling	Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate & velocity	AS 4323.1	AS 4323.1	8%, 7%	✓	✓
Moisture	USEPA Method 4	USEPA Method 4	8%	✓	✓
Moisture (stacks <60°C)	Ektimo 050	Ektimo 050	not specified	✓	✓
Molecular weight	NA	USEPA Method 3	not specified	NA	✓
Carbon dioxide & oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Carbon monoxide	USEPA Method 10	USEPA Method 10	12%	✓	✓
Nitrogen oxides	USEPA Method 7E	USEPA Method 7E	12%	✓	✓
Sulfur dioxide	USEPA Method 6C	USEPA Method 6C	12%	✓	✓
Total particulate matter	AS 4323.2	AS 4323.2	7%	✓	✓††
Total (gaseous & particulate) metals (Ag, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mn, Ni, P, Pb, Sb, Se, Tl, Zn)	USEPA Method 29	Envirolab in-house methods Metals-006, Metals-020, Metals-021 & Metals-022	15%	✓	✓‡
Sulfuric acid mist and/or sulfur oxides	USEPA Method 8	Ektimo 235	16%	✓	✓†

221025

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

† Analysis conducted at the Ektimo Mitcham, VIC laboratory, NATA accreditation number 14601.
Results were reported to Ektimo on 28 October 2022 in report LV-003477

†† Gravimetric analysis conducted at the Ektimo Mitcham, VIC laboratory NATA accreditation number 14601.

‡ Analysis performed by Envirolab, NATA accreditation number 2901.
Results were reported to Ektimo on 1 November 2022 in report 308762

4 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

5 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM/CEMS	Continuous emission monitoring/Continuous emission monitoring system
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
TOC	Total organic carbon. This is the sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

6 Appendix 1: Site Photos

Foreshore A

Foreshore B

Parageothite Dryer

Cadmium Smelter Plant Scrubber Stack

Copper Sulphate Crystalliser Plant Vent Stack

Casting Ventilation 1 – V1

Casting Ventilation 2 – V2

Roaster Baghouse

Anode Casting

Zinc Plant 1 Baghouse – ZP1

Zinc Plant 3 Baghouse – ZP3

MZR Furnace Stack

7 Appendix 2. Weather Observations

Hobart - October 2022

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	8th		km/h	hPa	°C	%	8th		km/h	hPa
10	Mo	5.1	18.7	0			NE	33	0.471	11.3	63		ESE	4	1022	16.2	52		NNE	13	1022
11	Tu	7.9	19.8	0.4			NE	37	15:57	12.4	71		NNW	13	1025	17.6	53		E	13	1021
12	We	10.5	18.8	0			NNE	44	18:36	15.3	69		NNE	7	1022	18.3	65		NNE	22	1019
13	Th	14.3	17.7	0.6			N	56	19:29	16.3	75		NNE	17	1012	16.9	76		NE	19	1008
Statistics for October 2022																					
Mean		8.7	16.9							12.3	70			14	1014	15.4	60			18	1013
Lowest		3.1	12.3	0						8.2	48		Calm		978.6	10.6	38		SSW	9	979
Highest		14.3	24.3	18.6			WNW	91		18.1	98		S	35	1036	23.2	94		WNW	39	1033
Total				90.2																	

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Ektimo

Nyrstar Hobart , Lutana

Triennial testing of Start-up Scrubber - 2022

Report Number R013215

Document Information

Template Version 190722

Client Name:	Nyrstar Hobart
Report Number:	R013215
Date of Issue:	16 September 2022
Attention:	Kylie Veale
Address:	Risdon Road Lutana TAS 7009
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Mathew Hutton
Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Glenn Trenear
Ektimo Signatory

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration, and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged by Nyrstar Hobart to perform emission testing at their Lutana plant. Testing was carried out in accordance with Tasmanian EPN notice 7043/5.

1.2 Project Objective & Overview

The objectives of the project were to conduct a monitoring programme to quantify emissions from one discharge point to determine compliance with Nyrstar Hobart 's Tasmanian EPN notice 7043/5.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Start Up Scrubber	3 August 2022	Total particulate matter Metals Sulfur dioxide, nitrogen oxides, carbon monoxide, carbon dioxide, oxygen

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP.

Plant operating conditions have been noted in the report.

1.3 Licence Comparison

The following licence comparison table shows that all analytes highlighted in green are withing the licence limit set by the Tasmanian Environmental Protection Notice (EPN) 7043/5 (last amended on 11 April 2019).

Emission Point / Monitoring Location	Parameter	Units	Licence limit	Detected values
Start Up Scrubber Stack	Sulfur dioxide	g/m^3	7.2	0.037
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.0058
	Particulates	mg/m^3	100	7.3

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Method table for the measurement uncertainty.

2 Results

2.1 Start Up Scrubber Stack

Date	3/08/2022	**Client**	Nyrstar Hobart
Report	R013215	**Stack ID**	Startup Scrubber Stack
Licence No.	7043/5	**Location**	Hobart
Ektimo Staff	Mathew Hutton, Tony Bakas	**State**	TAS
Process Conditions	Start-up Scrubber running under load during testing		*220701*

Sampling Plane Details		
Sampling plane dimensions	990 mm	
Sampling plane area	0.77 m²	
Sampling port size, number & depth	4" Flange (x2), 90 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	2.9	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0550 & 0710	
Temperature, °C	34	
Velocity at sampling plane, m/s	27	
Volumetric flow rate, actual, m³/min	1200	
Volumetric flow rate (wet STP), m³/min	1100	
Volumetric flow rate (dry STP), m³/min	1100	
Mass flow rate (wet basis), kg/hour	84000	

Gas Analyser Results	Average	
Sampling time	0614 - 0713	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	5.8	6.1
Sulfur dioxide	37	39
Carbon monoxide	320	340
	Concentration % v/v	
Carbon dioxide	0.7	
Oxygen	19.8	

Ektimo

Date	3/08/2022	**Client**	Nyrstar Hobart
Report	R013215	**Stack ID**	Startup Scrubber Stack
Licence No.	7043/5	**Location**	Hobart
Ektimo Staff	Mathew Hutton, Tony Bakas	**State**	TAS
Process Conditions	Please refer to client records.		*220701*

Isokinetic Results	Results	
Sampling time	0600-0705	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	7.3	7.7
Antimony	<0.008	<0.009
Arsenic	<0.006	<0.006
Beryllium	<0.001	<0.001
Cadmium	**0.013**	**0.014**
Chromium	**0.002**	**0.0021**
Cobalt	<0.001	<0.002
Lead	**0.18**	**0.2**
Manganese	**0.051**	**0.054**
Mercury	**0.0021**	**0.0023**
Nickel	**0.0029**	**0.0031**
Selenium	**0.012**	**0.013**
Tin	<0.004	<0.004
Vanadium	<0.002	<0.002
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	17-08-2022	

3 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate, temperature & velocity	ISO 10780	ISO 10780	8%, 2%, 7%	NA	✓
Moisture (stacks <60°C)	Ektimo 050	Ektimo 050	not specified	✓	✓
Molecular weight	NA	USEPA Method 3	not specified	NA	✓
Carbon dioxide & oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Carbon monoxide	USEPA Method 10	USEPA Method 10	12%	✓	✓
Nitrogen oxides	USEPA Method 7E	USEPA Method 7E	12%	✓	✓
Sulfur dioxide	USEPA Method 6C	USEPA Method 6C	12%	✓	✓
Total particulate matter	AS 4323.2	AS 4323.2	7%	✓	✓††
Total metals (Non-USEPA 29) (Al, Ca, Fe, K, Li, Mg, Mo, Na, Sn, V)	USEPA Method 29£	Envirolab in-house methods Metals-006, Metals-020, Metals-021 & Metals-022	15%	✗‡‡	✓‡
Total (gaseous & particulate) metals (Ag, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mn, Ni, P, Pb, Sb, Se, Tl, Zn)	USEPA Method 29	Envirolab in-house methods Metals-006, Metals-020, Metals-021 & Metals-022	15%	✓	✓‡

220908

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

†† Gravimetric analysis conducted at the Ektimo Mitcham, VIC laboratory, NATA accreditation number 14601.

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Result was reported to Ektimo on 26 August 2022 in report 303458.

4 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

5 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM/CEMS	Continuous emission monitoring/Continuous emission monitoring system
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
TOC	Total organic carbon. This is the sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

6 Appendix 1: Site Photo

Figure 1. Start Up Scrubber

7 Appendix 2: Weather Observations

Hobart – 3 August 2022

Date	Day	Temps		Rain	Max wind gust			9:00 AM						3:00 PM					
		Min	Max		Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm		km/h	local	°C	%	8th		km/h	hPa	°C	%	8th		km/h	hPa
3	We	8.5	16.5	0	NW	59	0:56	11.7	66	7	N	13	993.5	15.1	52		NNW	20	992.4
Statistics for August 2022																			
Mean		6.1	14.6					9	77	4		15	1012	13.1	60	7		17	1010.5
Lowest		0.9	9.9	0				3	57	1	Calm		987.9	7.8	38	7	#	6	988.9
Highest		10.3	21.1	19	#	81		14.8	97	7	S	46	1029.8	19.7	89	7	NW	37	1027.5
Total				67															

IDCJDW7021.202208 Prepared at 13:03 UTC on Wednesday 7 September 2022

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Ektimo

Nyrstar Hobart , Lutana

Emission Testing Report

Round 1 – May 2023

Report Number R014539

Document Information

Template Version 130223

Client Name:	Nyrstar Hobart
Report Number:	R014539
Date of Issue:	11 July 2023
Attention:	Kylie Veale
Address:	Risdon Road Lutana TAS 7009
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Glenn Trenear
Client Manager

NATA Accredited Laboratory
No. 14601

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration, and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged by Nyrstar Hobart to perform emission testing at their Lutana plant. Testing was carried out in accordance with Environmental Licence 7043/5.

1.2 Project Objective

The objective of the project was to conduct a monitoring programme to quantify emissions from **15** discharge points to determine compliance with Nyrstar Hobart 's Environmental Licence and meet NPI reporting requirements.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Foreshore A	11 May 2023	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Sulfur dioxide, sulfur trioxide Total fluoride Nitrogen oxides, nitrous oxide, carbon monoxide, carbon dioxide, oxygen Total & speciated volatile organic compounds (VOCs)
Foreshore B		
Parageothite Dryer	9 May 2023	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Total fluoride Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen, Sulfur dioxide Total & speciated volatile organic compounds (VOCs)
Cadmium Smelter Plant Scrubber Stack	16 May 2023	
Copper Sulphate Stack Crystalliser Plant Vent Stack	9 May 2023	
Casting Ventilation 1 – V1	8 May 2023	
Casting Ventilation 2 – V2	8 May 2023	
Roaster Baghouse	16 May 2023	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Sulfur dioxide, sulfur trioxide Total fluoride Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen Total & speciated volatile organic compounds (VOCs)
Zinc Oxide Debagging Station	12 May 2023	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Total fluoride Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen, Sulfur dioxide Total & speciated volatile organic compounds (VOCs)
Anode Casting	10 May 2023	
Zinc Plant 1 Baghouse – ZP1	10 May 2023	
Zinc Plant 3 Baghouse – ZP3	10 May 2023	
MZR Furnace Baghouse	15 May 2023	
MZR Dross Stack	15 May 2023	
Start-up Scrubber	16 May 2023	Total particulate matter Metals Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen, Sulfur dioxide

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP. Plant operating conditions have been noted in the report.

There was insufficient particulate matter collected on the total particulate matter tests that recorded below detection results, subsequently not enough dust was collected to perform accurate particle size analysis. In these instances, the PM_{10} and $PM_{2.5}$ are assumed to be less than the reported detection limit result for the total particulate matter test.

1.3 Licence Comparison

The following licence comparison table shows that all analytes highlighted in green are within the licence limit set by the Tasmanian Environmental Protection Notice (EPN) 7043/5.

Emission Point / Monitoring Location	Parameter	Units	Licence limit	Detected values
Foreshore A (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	0.31
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.031
	Particulates	mg/m^3	100	<1
	Sulphur dioxide	g/m^3	7.2	0.13
Foreshore B (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	0.33
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.039
	Particulates	mg/m^3	100	<2
	Sulphur dioxide	g/m^3	7.2	0.039
Anode Casting Plant Exhaust	Particulates	mg/m^3	100	<2
V1 Furnace Stack				<3
V2 Furnace Stack				<4
Zinc Dust Plant Baghouse 1 Stack				<3
Zinc Dust Plant Bagouse 3 Stack				<2
Cadmium Smelter Plant Scrubber Stack				<3
Copper Sulphate Crystalliser Plant				66
Roaster Baghouse				3.5
Paragoethite Dryer Baghouse				24
Anode Casting Plant Exhaust	Metals - Pb, As, Sb, Cd, Hg [1]	mg/m^3	5	≤1.72
V1 Furnace Stack				≤0.021
V2 Furnace Stack				≤0.053
Zinc Dust Plant Baghouse 1 Stack				≤0.137
Zinc Dust Plant Baghouse 3 Stack				≤0.071
Cadmium Smelter Plant Scrubber Stack				≤0.09
Copper Sulphate Crystalliser Plant				≤0.15
Roaster Baghouse				≤0.358
Paragoethite Dryer Baghouse				≤0.13
Anode Casting Plant Exhaust	Metals - Hg	mg/m^3	1	<0.0008
V1 Furnace Stack				<0.0009
V2 Furnace Stack				<0.001
Zinc Dust Plant Baghouse 1 Stack				<0.0007
Zinc Dust Plant Baghouse 3 Stack				<0.0005
Cadmium Smelter Plant Scrubber Stack				0.0021
Copper Sulphate Crystalliser Plant				0.012
Roaster Baghouse				0.0014
Paragoethite Dryer Baghouse				0.0063
Anode Casting Plant Exhaust	Metals - Cd	mg/m^3	1	0.014
V1 Furnace Stack				<0.0008
V2 Furnace Stack				<0.001
Zinc Dust Plant Baghouse 1 Stack				0.0063
Zinc Dust Plant Baghouse 3 Stack				0.0071
Cadmium Smelter Plant Scrubber Stack				0.034
Copper Sulphate Crystalliser Plant				0.1
Roaster Baghouse				0.026
Paragoethite Dryer Baghouse				0.054
Start Up Scrubber Stack	Sulfur dioxide	g/m^3	7.2	<0.006
	Oxides of nitrogen (as NO2)	g/m^3	2	0.0058
	Particulates	mg/m^3	100	17

[1] *Total concentration of metals combined.*

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 Foreshore A

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.7 (saturated)	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1037 & 1235	
Temperature, °C	16	
Velocity at sampling plane, m/s	12	
Volumetric flow rate, actual, m³/min	1400	
Volumetric flow rate (wet STP), m³/min	1300	
Volumetric flow rate (dry STP), m³/min	1300	
Mass flow rate (wet basis), kg/hour	99000	

Gas Analyser Results	Average	
Sampling time	1018 - 1117	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	31	39
Carbon monoxide	<6	<8
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	11.3	
Sampling time	1018 - 1117	
	Concentration mg/m³	Mass Rate g/min
Nitrous oxide		
Nitrous oxide	<0.004	<0.005

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Isokinetic Results		Results	
	Sampling time	1050-1232	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<1	<1
PM10	(PSA)	<1	<1
PM2.5	(PSA)	<1	<1
Sulfur dioxide		130	170
Sulfur trioxide		0.31	0.4
Isokinetic Sampling Parameters			
Sampling time, min		100	
Isokinetic rate, %		97	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.5

VOC's C5-C20		Results	
	Sampling time	1310-1330	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.5

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Please note, toluene results not reported due to suspected contamination.

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6 (saturated)	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0842 & 1037	
Temperature, °C	15	
Velocity at sampling plane, m/s	12	
Volumetric flow rate, actual, m³/min	1300	
Volumetric flow rate (wet STP), m³/min	1300	
Volumetric flow rate (dry STP), m³/min	1300	
Mass flow rate (wet basis), kg/hour	99000	

Isokinetic Results	Results	
Sampling time	0850-1032	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.029	0.038
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	97	

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1235 & 1430	
Temperature, °C	17	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1400	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/hour	100000	

Isokinetic Results	Results	
Sampling time	1245-1427	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.004**	**<0.005**
Arsenic	**<0.002**	**<0.002**
Beryllium	<0.0005	<0.0006
Cadmium	**0.002**	**0.0026**
Chromium	0.0022	0.0029
Cobalt	<0.0006	<0.0008
Copper	<0.0007	<0.001
Lead	**0.019**	**0.026**
Manganese	0.017	0.023
Mercury	**0.00046**	**0.00063**
Nickel	0.0069	0.0093
Phosphorus	<0.01	<0.02
Selenium	<0.004	<0.005
Zinc	0.09	0.12
Total of Sb, As, Cd, Pb, Hg	**≤0.027**	**≤0.036**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	110	

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1430 & 1613	
Temperature, °C	17	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1400	
Volumetric flow rate (wet STP), m³/min	1300	
Volumetric flow rate (dry STP), m³/min	1300	
Mass flow rate (wet basis), kg/hour	100000	

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1435 - 1617	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		64000	84000000
2-Methylnaphthalene		440	580000
Acenaphthylene		<20	<20000
Acenaphthene		41	54000
Fluorene		<20	<20000
Phenanthrene		260	340000
Anthracene		<20	<20000
Fluoranthene		140	190000
Pyrene		100	130000
Benz(a)anthracene		<20	<20000
Chrysene		48	63000
Benzo(b)fluoranthene		24	31000
Benzo(k)fluoranthene		<20	<20000
Benzo(e)pyrene		<20	<20000
Benzo(a)pyrene		<20	<20000
Perylene		<20	<20000
Indeno(1,2,3-cd)pyrene		<20	<20000
Dibenz(ah)anthracene		<20	<20000
Benzo(ghi)perylene		<20	<20000
Total 16 PAHs		64000	85000000
Total 19 PAHs		65000	85000000
BaP-TEQ			
Lower Bound		2.8	3700
Middle Bound		16	21000
Upper Bound		30	39000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	100
Isokinetic rate, %	100

2.2 Foreshore B

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.5 (wet)	28.7 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1237 & 1432	
Temperature, °C	17	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1400	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1300	
Mass flow rate (wet basis), kg/hour	100000	

Gas Analyser Results	Average	
Sampling time	1203 - 1302	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	39	52
Carbon monoxide	<6	<8
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	11.9	
Sampling time	1203 - 1302	
	Concentration mg/m³	Mass Rate g/min
Nitrous oxide		
Nitrous oxide	<0.004	<0.005

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Isokinetic Results		Results	
	Sampling time	1245-1427	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<2	<2
PM10	(PSA)	<2	<2
PM2.5	(PSA)	<2	<2
Sulfur dioxide		39	52
Sulfur trioxide		0.33	0.44
Isokinetic Sampling Parameters			
Sampling time, min		100	
Isokinetic rate, %		99	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.6

VOC's C5-C20		Results	
	Sampling time	1335-1355	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.6

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1432 & 1623	
Temperature, °C	17	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1400	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/hour	100000	

Isokinetic Results	Results	
Sampling time	1435-1617	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.04
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	100	

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.7 (saturated)	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1037 & 1237	
Temperature, °C	16	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1400	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1300	
Mass flow rate (wet basis), kg/hour	100000	

Isokinetic Results	Results	
Sampling time	1050-1232	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.004**	**<0.005**
Arsenic	**<0.002**	**<0.002**
Beryllium	<0.0005	<0.0007
Cadmium	**0.004**	**0.0054**
Chromium	0.023	0.031
Cobalt	0.0008	0.0011
Copper	<0.0009	<0.001
Lead	**0.033**	**0.044**
Manganese	0.045	0.061
Mercury	**<0.0008**	**<0.001**
Nickel	0.083	0.11
Phosphorus	<0.02	<0.02
Selenium	<0.004	<0.005
Zinc	0.18	0.25
Total of Sb, As, Cd, Pb, Hg	**≤0.044**	**≤0.059**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	101	

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

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Sampling Plane Details		
Sampling plane dimensions	1530 mm	
Sampling plane area	1.84 m²	
Sampling port size, number & depth	4" Flange (x2), 150 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Centrifugal fan 3 D	
No. traverses & points sampled	2 20	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments

The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6 (saturated)	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0840 & 1037	
Temperature, °C	15	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1500	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/hour	110000	

Date	11/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 101,000 m3/hr of gas through the acid stream. Number 1 salt water pump was fault finding (stop/starting) throughout the day.		

230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 0850 - 1032	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		8700	12000000
2-Methylnaphthalene		150	210000
Acenaphthylene		<10	<20000
Acenaphthene		100	140000
Fluorene		68	94000
Phenanthrene		390	540000
Anthracene		<10	<20000
Fluoranthene		55	77000
Pyrene		58	80000
Benz(a)anthracene		<10	<20000
Chrysene		<10	<20000
Benzo(b)fluoranthene		<10	<20000
Benzo(k)fluoranthene		<10	<20000
Benzo(e)pyrene		<10	<20000
Benzo(a)pyrene		<10	<20000
Perylene		<10	<20000
Indeno(1,2,3-cd)pyrene		<10	<20000
Dibenz(ah)anthracene		<10	<20000
Benzo(ghi)perylene		<10	<20000
Total 16 PAHs		9400	13000000
Total 19 PAHs		9600	13000000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		13	18000
Upper Bound		26	37000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	100
Isokinetic rate, %	98

2.3 Parageothite Dryer

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7 m3/hr of dirt and 1.75 m3/hr of bypass flow into the drum.		230328

Sampling Plane Details		
Sampling plane dimensions	950 mm	
Sampling plane area	0.709 m²	
Sampling port size, number & depth	4" Flange (x2), 50 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	28	
Gas molecular weight, g/g mole	26.2 (wet)	29.3 (dry)
Gas density at STP, kg/m³	1.17 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.89	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1527 & 1635	
Temperature, °C	86	
Velocity at sampling plane, m/s	8.5	
Volumetric flow rate, actual, m³/min	360	
Volumetric flow rate (wet STP), m³/min	280	
Volumetric flow rate (dry STP), m³/min	200	
Mass flow rate (wet basis), kg/hour	19000	

Gas Analyser Results	Average	
Sampling time	1319 - 1334	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	55	11
Sulfur dioxide	<6	<1
Carbon monoxide	<6	<1
	Concentration % v/v	
Carbon dioxide	3.7	
Oxygen	14.2	

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7 m3/hr of dirt and 1.75 m3/hr of bypass flow into the drum.		*230328*

Isokinetic Results		Results	
	Sampling time	1530-1632	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		24	4.7
PM10	(PSA)	10	2.1
PM2.5	(PSA)	2.3	0.46
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		102	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.09

VOC's C5-C20		Results	
	Sampling time	1535-1555	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.09

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Please note, toluene results not reported due to suspected contamination.

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7 m3/hr of dirt and 1.75 m3/hr of bypass flow into the drum.		*230328*

Sampling Plane Details	
Sampling plane dimensions	950 mm
Sampling plane area	0.709 m²
Sampling port size, number & depth	4" Flange (x2), 50 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
Test stopped at 1344 due to a process issue which caused the dryer to shut down.
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	26	
Gas molecular weight, g/g mole	26.3 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.17 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.88	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1309	
Temperature, °C	93	
Velocity at sampling plane, m/s	8.4	
Volumetric flow rate, actual, m³/min	360	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	200	
Mass flow rate (wet basis), kg/hour	19000	

Isokinetic Results	Results	
Sampling time	1320-1344	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	13	2.5
Isokinetic Sampling Parameters		
Sampling time, min	25	
Isokinetic rate, %	102	

Please note: *Test stopped at 1344 due to a process issue which caused the dryer to shut down.*

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7 m3/hr of dirt and 1.75 m3/hr of bypass flow into the drum.		*230328*

Sampling Plane Details	
Sampling plane dimensions	950 mm
Sampling plane area	0.709 m²
Sampling port size, number & depth	4" Flange (x2), 50 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	19	
Gas molecular weight, g/g mole	27.1 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.21 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.92	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1527 & 1635	
Temperature, °C	86	
Velocity at sampling plane, m/s	8.3	
Volumetric flow rate, actual, m³/min	350	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	220	
Mass flow rate (wet basis), kg/hour	20000	

Isokinetic Results	Results	
Sampling time	1530-1632	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.007**	**<0.001**
Arsenic	**<0.004**	**<0.0008**
Beryllium	<0.001	<0.0002
Cadmium	**0.054**	**0.012**
Chromium	0.061	0.013
Cobalt	0.0061	0.0013
Copper	0.0047	0.001
Lead	**0.064**	**0.014**
Manganese	0.15	0.034
Mercury	**0.0063**	**0.0014**
Nickel	0.36	0.08
Phosphorus	<0.05	<0.01
Selenium	<0.007	<0.001
Zinc	0.61	0.13
Total of Sb, As, Cd, Pb, Hg	**≤0.13**	**≤0.029**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	94	

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7 m3/hr of dirt and 1.75 m3/hr of bypass flow into the drum.		230328

Sampling Plane Details		
Sampling plane dimensions	950 mm	
Sampling plane area	0.709 m^2	
Sampling port size, number & depth	4" Flange (x2), 50 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Comments
Test stopped at 1344 due to a process issue which caused the dryer to shut down.
Isokinetic rate for one or more tests is outside the criteria (90-110%)
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	28	
Gas molecular weight, g/g mole	26.1 (wet)	29.2 (dry)
Gas density at STP, kg/m^3	1.17 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m^3	0.87	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1309	
Temperature, °C	93	
Velocity at sampling plane, m/s	8.3	
Volumetric flow rate, actual, m^3/min	360	
Volumetric flow rate (wet STP), m^3/min	270	
Volumetric flow rate (dry STP), m^3/min	190	
Mass flow rate (wet basis), kg/hour	19000	

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7 m3/hr of dirt and 1.75 m3/hr of bypass flow into the drum.		*230328*

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1320 - 1344	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		160000	30000000
2-Methylnaphthalene		1000	200000
Acenaphthylene		<60	<10000
Acenaphthene		<60	<10000
Fluorene		80	15000
Phenanthrene		1800	350000
Anthracene		290	57000
Fluoranthene		2700	520000
Pyrene		730	140000
Benz(a)anthracene		89	17000
Chrysene		460	89000
Benzo(b)fluoranthene		<60	<10000
Benzo(k)fluoranthene		<60	<10000
Benzo(e)pyrene		<60	<10000
Benzo(a)pyrene		<60	<10000
Perylene		<60	<10000
Indeno(1,2,3-cd)pyrene		<60	<10000
Dibenz(ah)anthracene		<60	<10000
Benzo(ghi)perylene		<60	<10000
Total 16 PAHs		160000	32000000
Total 19 PAHs		160000	32000000
BaP-TEQ			
Lower Bound		13	2600
Middle Bound		65	13000
Upper Bound		120	23000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	25
Isokinetic rate, %	97

Please note: *Test stopped at 1344 due to a process issue which caused the dryer to shut down.*

2.4 Cadmium Smelter Plant Scrubber Stack

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*230328*

Sampling Plane Details		
Sampling plane dimensions	470 mm	
Sampling plane area	0.173 m²	
Sampling port size, number & depth	4" BSP (x2), 85 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Change in diameter 2 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1535 & 1650	
Temperature, °C	22	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	150	
Volumetric flow rate (wet STP), m³/min	140	
Volumetric flow rate (dry STP), m³/min	130	
Mass flow rate (wet basis), kg/hour	11000	

Gas Analyser Results	Average	
Sampling time	1454 - 1553	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.6
Sulfur dioxide	<6	<0.8
Carbon monoxide	<6	<0.8
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.8	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*230328*

Isokinetic Results		Results	
	Sampling time	1540-1642	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<3	<0.4
PM10	(PSA)	<3	<0.4
PM2.5	(PSA)	<3	<0.4
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		95	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.06

VOC's C5-C20	Results	
Sampling time	1550-1610	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.4	<0.06

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Please note, toluene results not reported due to suspected contamination.

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*230328*

Sampling Plane Details		
Sampling plane dimensions	470 mm	
Sampling plane area	0.173 m²	
Sampling port size, number & depth	4" BSP (x2), 85 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Change in diameter 2 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1422 & 1535	
Temperature, °C	23	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	150	
Volumetric flow rate (wet STP), m³/min	140	
Volumetric flow rate (dry STP), m³/min	130	
Mass flow rate (wet basis), kg/hour	10000	

Isokinetic Results	Results	
Sampling time	1430-1532	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.083	0.011
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	98	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		230328

Sampling Plane Details		
Sampling plane dimensions	470 mm	
Sampling plane area	0.173 m²	
Sampling port size, number & depth	4" BSP (x2), 85 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Change in diameter 2 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1422 & 1535	
Temperature, °C	23	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	150	
Volumetric flow rate (wet STP), m³/min	140	
Volumetric flow rate (dry STP), m³/min	130	
Mass flow rate (wet basis), kg/hour	10000	

Isokinetic Results	Results	
Sampling time	1430-1532	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.007**	**<0.0009**
Arsenic	**<0.003**	**<0.0004**
Beryllium	<0.0009	<0.0001
Cadmium	**0.034**	**0.0045**
Chromium	<0.001	<0.0001
Cobalt	<0.001	<0.0002
Copper	0.0013	0.00017
Lead	**0.047**	**0.0062**
Manganese	0.0038	0.0005
Mercury	**0.0021**	**0.00027**
Nickel	<0.002	<0.0002
Phosphorus	<0.03	<0.004
Selenium	<0.007	<0.0009
Zinc	0.64	0.085
Total of Sb, As, Cd, Pb, Hg	**≤0.093**	**≤0.012**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	98	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		*230328*

Sampling Plane Details		
Sampling plane dimensions	470 mm	
Sampling plane area	0.173 m^2	
Sampling port size, number & depth	4" BSP (x2), 85 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 1 D	
Upstream disturbance	Change in diameter 2 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Conforming but non-ideal	

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m^3	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m^3	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1535 & 1650	
Temperature, °C	22	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m^3/min	150	
Volumetric flow rate (wet STP), m^3/min	140	
Volumetric flow rate (dry STP), m^3/min	130	
Mass flow rate (wet basis), kg/hour	11000	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation.		230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1540 - 1642	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		6700	900000
2-Methylnaphthalene		130	17000
Acenaphthylene		<20	<3000
Acenaphthene		44	5900
Fluorene		<20	<3000
Phenanthrene		150	21000
Anthracene		7100	950000
Fluoranthene		120	16000
Pyrene		68	9200
Benz(a)anthracene		<20	<3000
Chrysene		<20	<3000
Benzo(b)fluoranthene		<20	<3000
Benzo(k)fluoranthene		<20	<3000
Benzo(e)pyrene		<20	<3000
Benzo(a)pyrene		<20	<3000
Perylene		<20	<3000
Indeno(1,2,3-cd)pyrene		<20	<3000
Dibenz(ah)anthracene		<20	<3000
Benzo(ghi)perylene		<20	<3000
Total 16 PAHs		14000	1900000
Total 19 PAHs		14000	1900000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		21	2900
Upper Bound		43	5700

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	101

2.5 Copper Sulphate Crystalliser Plant Vent Stack

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 10 tonnes/day, Dryer Outlet Temperature - 111 deg C, Feed rate into Dryer - 40%		

230328

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	8.1 (saturated)	
Gas molecular weight, g/g mole	28.1 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.06	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1006 & 1127	
Temperature, °C	50	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	190	
Volumetric flow rate (wet STP), m³/min	160	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	12000	

Gas Analyser Results	Average	
Sampling time	1011 - 1110	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.6
Sulfur dioxide	<6	<0.8
Carbon monoxide	<6	<0.9
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 10 tonnes/day, Dryer Outlet Temperature - 111 deg C, Feed rate into Dryer - 40%		

230328

Isokinetic Results		Results	
	Sampling time	1020-1122	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		66	9.9
PM10	(PSA)	8.2	1.2
PM2.5	(PSA)	1.7	0.25
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		100	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.06

VOC's C5-C20		Results	
	Sampling time	1040-1100	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.06

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 10 tonnes/day, Dryer Outlet Temperature - 111 deg C, Feed rate into Dryer - 40%		

230328

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	10 (saturated)	
Gas molecular weight, g/g mole	27.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.24 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.06	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0842 & 1006	
Temperature, °C	48	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	200	
Volumetric flow rate (wet STP), m³/min	170	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	13000	

Isokinetic Results	Results	
Sampling time	0900-1002	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	4.9	0.73
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 10 tonnes/day, Dryer Outlet Temperature - 111 deg C, Feed rate into Dryer - 40%		

230328

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	8.1 (saturated)	
Gas molecular weight, g/g mole	28.1 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.06	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1006 & 1127	
Temperature, °C	50	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	190	
Volumetric flow rate (wet STP), m³/min	160	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	12000	

Isokinetic Results	Results	
Sampling time	1020-1122	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.007**	**<0.001**
Arsenic	**<0.003**	**<0.0005**
Beryllium	<0.0009	<0.0001
Cadmium	**0.1**	**0.015**
Chromium	0.056	0.0084
Cobalt	0.007	0.001
Copper	0.029	0.0043
Lead	**0.032**	**0.0047**
Manganese	0.17	0.025
Mercury	**0.012**	**0.0018**
Nickel	0.15	0.022
Phosphorus	0.11	0.016
Selenium	0.011	0.0016
Zinc	1.5	0.22
Total of Sb, As, Cd, Pb, Hg	**≤0.16**	**≤0.023**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	96	

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 10 tonnes/day, Dryer Outlet Temperature - 111 deg C, Feed rate into Dryer - 40%		

230328

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	8.1 (saturated)	
Gas molecular weight, g/g mole	28.1 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0842 & 1006	
Temperature, °C	48	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	200	
Volumetric flow rate (wet STP), m³/min	170	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/hour	13000	

Date	9/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 10 tonnes/day, Dryer Outlet Temperature - 111 deg C, Feed rate into Dryer - 40%		

230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 0900 - 1002	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		11000	1700000
2-Methylnaphthalene		260	41000
Acenaphthylene		<20	<4000
Acenaphthene		440	67000
Fluorene		460	70000
Phenanthrene		3700	560000
Anthracene		880	140000
Fluoranthene		1700	260000
Pyrene		730	110000
Benz(a)anthracene		31	4800
Chrysene		320	49000
Benzo(b)fluoranthene		95	15000
Benzo(k)fluoranthene		<20	<4000
Benzo(e)pyrene		<20	<4000
Benzo(a)pyrene		<20	<4000
Perylene		<20	<4000
Indeno(1,2,3-cd)pyrene		<20	<4000
Dibenz(ah)anthracene		<20	<4000
Benzo(ghi)perylene		<20	<4000
Total 16 PAHs		19000	3000000
Total 19 PAHs		20000	3000000
BaP-TEQ			
Lower Bound		16	2400
Middle Bound		34	5300
Upper Bound		53	8100

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	101

2.6 Casting Ventilation 1 – V1

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.17	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1153 & 1304	
Temperature, °C	26	
Velocity at sampling plane, m/s	26	
Volumetric flow rate, actual, m³/min	500	
Volumetric flow rate (wet STP), m³/min	460	
Volumetric flow rate (dry STP), m³/min	450	
Mass flow rate (wet basis), kg/hour	35000	

Gas Analyser Results	Average	
Sampling time	1342 - 1441	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<2
Sulfur dioxide	<6	<3
Carbon monoxide	<6	<3
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Isokinetic Results		Results	
	Sampling time	1200-1300	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<3	<2
PM10	(PSA)	<3	<2
PM2.5	(PSA)	<3	<2
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		108	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.2

VOC's C5-C20		Results	
	Sampling time	1410-1430	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.2

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.17	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1523 & 1627	
Temperature, °C	26	
Velocity at sampling plane, m/s	26	
Volumetric flow rate, actual, m³/min	490	
Volumetric flow rate (wet STP), m³/min	450	
Volumetric flow rate (dry STP), m³/min	440	
Mass flow rate (wet basis), kg/hour	35000	

Isokinetic Results	Results	
Sampling time	1525-1625	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	4.9	2.2
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	109	

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1414 & 1523	
Temperature, °C	26	
Velocity at sampling plane, m/s	26	
Volumetric flow rate, actual, m³/min	500	
Volumetric flow rate (wet STP), m³/min	450	
Volumetric flow rate (dry STP), m³/min	440	
Mass flow rate (wet basis), kg/hour	35000	

Isokinetic Results	Results	
Sampling time	1418-1518	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.008**	**<0.004**
Arsenic	**<0.004**	**<0.002**
Beryllium	<0.001	<0.0005
Cadmium	**<0.0008**	**<0.0004**
Chromium	0.079	0.035
Cobalt	0.0016	0.00072
Copper	<0.002	<0.0007
Lead	**0.0078**	**0.0034**
Manganese	0.012	0.0051
Mercury	**<0.0009**	**<0.0004**
Nickel	0.091	0.04
Phosphorus	0.041	0.018
Selenium	<0.008	<0.004
Zinc	1.8	0.79
Total of Sb, As, Cd, Pb, Hg	**≤0.022**	**≤0.0095**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Sampling Plane Details		
Sampling plane dimensions	635 mm	
Sampling plane area	0.317 m^2	
Sampling port size, number & depth	4" Flange (x1), 245 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit 2 D	
Upstream disturbance	Centrifugal fan 2 D	
No. traverses & points sampled	1 6	
Sample plane conformance to AS 4323.1	Non-conforming	

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m^3	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m^3	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1304 & 1414	
Temperature, °C	26	
Velocity at sampling plane, m/s	26	
Volumetric flow rate, actual, m^3/min	500	
Volumetric flow rate (wet STP), m^3/min	450	
Volumetric flow rate (dry STP), m^3/min	440	
Mass flow rate (wet basis), kg/hour	35000	

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1310 - 1410	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		11000	4800000
2-Methylnaphthalene		240	110000
Acenaphthylene		<30	<10000
Acenaphthene		670	300000
Fluorene		560	250000
Phenanthrene		2700	1200000
Anthracene		4600	2100000
Fluoranthene		720	320000
Pyrene		590	260000
Benz(a)anthracene		300	140000
Chrysene		1200	530000
Benzo(b)fluoranthene		150	65000
Benzo(k)fluoranthene		82	36000
Benzo(e)pyrene		100	46000
Benzo(a)pyrene		<30	<10000
Perylene		<30	<10000
Indeno(1,2,3-cd)pyrene		<30	<10000
Dibenz(ah)anthracene		<30	<10000
Benzo(ghi)perylene		<30	<10000
Total 16 PAHs		23000	10000000
Total 19 PAHs		23000	10000000
BaP-TEQ			
Lower Bound		65	29000
Middle Bound		89	40000
Upper Bound		110	50000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	98

2.7 Casting Ventilation 2 – V2

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	3.2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.10	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1305 & 1413	
Temperature, °C	42	
Velocity at sampling plane, m/s	28	
Volumetric flow rate, actual, m³/min	470	
Volumetric flow rate (wet STP), m³/min	400	
Volumetric flow rate (dry STP), m³/min	390	
Mass flow rate (wet basis), kg/hour	31000	

Gas Analyser Results	Average	
Sampling time	1452 - 1551	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<2
Sulfur dioxide	<6	<2
Carbon monoxide	<6	<2
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Isokinetic Results		Results	
	Sampling time	1310-1410	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<4	<1
PM10	(PSA)	<4	<1
PM2.5	(PSA)	<4	<1
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		104	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	0.3	0.12

VOC's C5-C20		Results	
	Sampling time	1434-1501	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.3	<0.1
Residuals as Toluene		0.3	0.12

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane

Please note, toluene results not reported due to suspected contamination.

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1521 & 1629	
Temperature, °C	41	
Velocity at sampling plane, m/s	28	
Volumetric flow rate, actual, m³/min	460	
Volumetric flow rate (wet STP), m³/min	400	
Volumetric flow rate (dry STP), m³/min	390	
Mass flow rate (wet basis), kg/hour	31000	

Isokinetic Results	Results	
Sampling time	1525-1625	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.29	0.11
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	105	

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	3	
Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1152 & 1303	
Temperature, °C	41	
Velocity at sampling plane, m/s	28	
Volumetric flow rate, actual, m³/min	470	
Volumetric flow rate (wet STP), m³/min	410	
Volumetric flow rate (dry STP), m³/min	400	
Mass flow rate (wet basis), kg/hour	31000	

Isokinetic Results	Results	
Sampling time	1200-1300	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.008**	**<0.003**
Arsenic	**<0.004**	**<0.001**
Beryllium	<0.001	<0.0004
Cadmium	**<0.001**	**<0.0005**
Chromium	0.0021	0.00082
Cobalt	<0.001	<0.0005
Copper	<0.001	<0.0005
Lead	**0.039**	**0.015**
Manganese	0.051	0.02
Mercury	**<0.001**	**<0.0004**
Nickel	0.01	0.0041
Phosphorus	0.067	0.027
Selenium	<0.008	<0.003
Zinc	0.91	0.36
Total of Sb, As, Cd, Pb, Hg	**≤0.053**	**≤0.021**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Sampling Plane Details		
Sampling plane dimensions	595 mm	
Sampling plane area	0.278 m^2	
Sampling port size, number & depth	4" Flange (x1), 245 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit 2 D	
Upstream disturbance	Centrifugal fan 2 D	
No. traverses & points sampled	1 6	
Sample plane conformance to AS 4323.1	Non-conforming	

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.9	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m^3	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m^3	1.10	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1415 & 1522	
Temperature, °C	42	
Velocity at sampling plane, m/s	28	
Volumetric flow rate, actual, m^3/min	470	
Volumetric flow rate (wet STP), m^3/min	400	
Volumetric flow rate (dry STP), m^3/min	390	
Mass flow rate (wet basis), kg/hour	31000	

Date	8/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1418 - 1518	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		38000	15000000
2-Methylnaphthalene		3000	1200000
Acenaphthylene		460	180000
Acenaphthene		760	300000
Fluorene		910	350000
Phenanthrene		4900	1900000
Anthracene		590	230000
Fluoranthene		1000	400000
Pyrene		730	290000
Benz(a)anthracene		140	56000
Chrysene		530	210000
Benzo(b)fluoranthene		100	39000
Benzo(k)fluoranthene		54	21000
Benzo(e)pyrene		91	35000
Benzo(a)pyrene		<30	<10000
Perylene		<30	<10000
Indeno(1,2,3-cd)pyrene		<30	<10000
Dibenz(ah)anthracene		<30	<10000
Benzo(ghi)perylene		<30	<10000
Total 16 PAHs		48000	19000000
Total 19 PAHs		52000	20000000
BaP-TEQ			
Lower Bound		35	14000
Middle Bound		59	23000
Upper Bound		83	32000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	102

2.8 Roaster Baghouse

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 0 t/hr (Conveyor all in operation), no fumes were on.		230328

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	0.9	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1215 & 1341	
Temperature, °C	23	
Velocity at sampling plane, m/s	5.7	
Volumetric flow rate, actual, m³/min	40	
Volumetric flow rate (wet STP), m³/min	37	
Volumetric flow rate (dry STP), m³/min	36	
Mass flow rate (wet basis), kg/hour	2900	

Gas Analyser Results	Average	
Sampling time	1112 - 1211	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.1
Carbon monoxide	<6	<0.2
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 0 t/hr (Conveyor all in operation), no fumes were on.		230328

Isokinetic Results		Results	
	Sampling time	1230-1336	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		3.5	0.13
PM10	(PSA)	2.1	0.076
PM2.5	(PSA)	0.6	0.022
Sulfur dioxide		7.2	0.26
Sulfur trioxide		0.93	0.034
Isokinetic Sampling Parameters			
Sampling time, min		64	
Isokinetic rate, %		96	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.02

VOC's C5-C20		Results	
	Sampling time	1240-1300	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.02

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Please note, toluene results not reported due to suspected contamination.

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 0 t/hr (Conveyor all in operation), no fumes were on.		*230328*

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS 4323.1	Ideal sampling plane	
Comments		
The discharge is assumed to be composed of dry air and moisture		

Stack Parameters		
Moisture content, %v/v	0.8	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1101 & 1215	
Temperature, °C	22	
Velocity at sampling plane, m/s	5.3	
Volumetric flow rate, actual, m³/min	37	
Volumetric flow rate (wet STP), m³/min	34	
Volumetric flow rate (dry STP), m³/min	34	
Mass flow rate (wet basis), kg/hour	2700	

Isokinetic Results	Results	
Sampling time	1105-1211	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.05	<0.002
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	101	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 0 t/hr (Conveyor all in operation), no fumes were on.		*230328*

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS 4323.1	Ideal sampling plane	
Comments		
The discharge is assumed to be composed of dry air and moisture		

Stack Parameters		
Moisture content, %v/v	0.8	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1101 & 1215	
Temperature, °C	22	
Velocity at sampling plane, m/s	5.3	
Volumetric flow rate, actual, m³/min	37	
Volumetric flow rate (wet STP), m³/min	34	
Volumetric flow rate (dry STP), m³/min	34	
Mass flow rate (wet basis), kg/hour	2700	

Isokinetic Results	Results	
Sampling time	1105-1211	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0002**
Arsenic	**0.0049**	**0.00017**
Beryllium	<0.0008	<0.00003
Cadmium	**0.026**	**0.00087**
Chromium	<0.001	<0.00003
Cobalt	<0.001	<0.00003
Copper	0.021	0.00071
Lead	**0.32**	**0.011**
Manganese	0.038	0.0013
Mercury	**0.0014**	**0.000046**
Nickel	0.0018	0.000062
Phosphorus	<0.02	<0.0008
Selenium	<0.006	<0.0002
Zinc	4.4	0.15
Total of Sb, As, Cd, Pb, Hg	**≤0.36**	**≤0.012**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	98	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 0 t/hr (Conveyor all in operation), no fumes were on.		*230328*

Sampling Plane Details		
Sampling plane dimensions	385 mm	
Sampling plane area	0.116 m²	
Sampling port size, number & depth	4" BSP (x2), 105 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 8	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	0.9	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1215 & 1341	
Temperature, °C	23	
Velocity at sampling plane, m/s	5.7	
Volumetric flow rate, actual, m³/min	40	
Volumetric flow rate (wet STP), m³/min	37	
Volumetric flow rate (dry STP), m³/min	37	
Mass flow rate (wet basis), kg/hour	2800	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 48 t/hr, Roaster 5 - 0 t/hr (Conveyor all in operation), no fumes were on.		230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1230 - 1336	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		5500	200000
2-Methylnaphthalene		190	6800
Acenaphthylene		<20	<800
Acenaphthene		150	5600
Fluorene		64	2300
Phenanthrene		230	8400
Anthracene		<20	<800
Fluoranthene		160	6000
Pyrene		94	3400
Benz(a)anthracene		<20	<800
Chrysene		<20	<800
Benzo(b)fluoranthene		<20	<800
Benzo(k)fluoranthene		<20	<800
Benzo(e)pyrene		58	2100
Benzo(a)pyrene		<20	<800
Perylene		<20	<800
Indeno(1,2,3-cd)pyrene		<20	<800
Dibenz(ah)anthracene		<20	<800
Benzo(ghi)perylene		<20	<800
Total 16 PAHs		6200	230000
Total 19 PAHs		6400	240000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		20	730
Upper Bound		40	1500

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	64
Isokinetic rate, %	95

2.9 Zinc Oxide Debagging Station

Date	12/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		230328

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0945	
Temperature, °C	21	
Velocity at sampling plane, m/s	8.6	
Volumetric flow rate, actual, m³/min	25	
Volumetric flow rate (wet STP), m³/min	24	
Volumetric flow rate (dry STP), m³/min	23	
Mass flow rate (wet basis), kg/hour	1800	

Gas Analyser Results	Average	
Sampling time	0942 - 1021	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.1
Carbon monoxide	<6	<0.1
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	12/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*230328*

Isokinetic Results		Results	
	Sampling time	0945-1026	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<4	<0.08
PM10	(PSA)	<4	<0.08
PM2.5	(PSA)	<4	<0.08
Sulfur dioxide		1.8	0.043
Sulfur trioxide		0.12	0.0028
Isokinetic Sampling Parameters			
Sampling time, min		40	
Isokinetic rate, %		110	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.2	<0.005

VOC's C5-C20		Results	
	Sampling time	0950-1026	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.2	<0.005

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	12/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*230328*

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.9 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0820	
Temperature, °C	21	
Velocity at sampling plane, m/s	8.6	
Volumetric flow rate, actual, m³/min	25	
Volumetric flow rate (wet STP), m³/min	24	
Volumetric flow rate (dry STP), m³/min	23	
Mass flow rate (wet basis), kg/hour	1800	

Isokinetic Results	Results	
Sampling time	0820-0847	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.08	<0.002
Isokinetic Sampling Parameters		
Sampling time, min	28	
Isokinetic rate, %	94	

Date	12/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		230328

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.9 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0820	
Temperature, °C	21	
Velocity at sampling plane, m/s	8.6	
Volumetric flow rate, actual, m³/min	25	
Volumetric flow rate (wet STP), m³/min	24	
Volumetric flow rate (dry STP), m³/min	23	
Mass flow rate (wet basis), kg/hour	1800	

Isokinetic Results	Results	
Sampling time	0820-0847	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.01**	**<0.0003**
Arsenic	**<0.006**	**<0.0001**
Beryllium	<0.002	<0.00004
Cadmium	**0.0095**	**0.00022**
Chromium	<0.003	<0.00006
Cobalt	<0.002	<0.00005
Copper	<0.002	<0.00005
Lead	**0.099**	**0.0023**
Manganese	0.096	0.0023
Mercury	**<0.001**	**<0.00003**
Nickel	0.013	0.0003
Phosphorus	<0.05	<0.001
Selenium	<0.01	<0.0003
Zinc	0.58	0.014
Total of Sb, As, Cd, Pb, Hg	**≤0.13**	**≤0.003**
Isokinetic Sampling Parameters		
Sampling time, min	28	
Isokinetic rate, %	94	

Date	12/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zink Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*230328*

Sampling Plane Details		
Sampling plane dimensions	250 mm	
Sampling plane area	0.0491 m²	
Sampling port size, number	3" Flange (x4)	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Cowl >2 D	
Upstream disturbance	Bend >6 D	
No. traverses & points sampled	2 4	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.9 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0945	
Temperature, °C	21	
Velocity at sampling plane, m/s	8.6	
Volumetric flow rate, actual, m³/min	25	
Volumetric flow rate (wet STP), m³/min	24	
Volumetric flow rate (dry STP), m³/min	23	
Mass flow rate (wet basis), kg/hour	1800	

Date	12/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zink Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 0945 - 1026	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		8400	200000
2-Methylnaphthalene		170	3900
Acenaphthylene		<30	<700
Acenaphthene		55	1300
Fluorene		<30	<700
Phenanthrene		150	3400
Anthracene		<30	<700
Fluoranthene		88	2100
Pyrene		50	1200
Benz(a)anthracene		<30	<700
Chrysene		<30	<700
Benzo(b)fluoranthene		<30	<700
Benzo(k)fluoranthene		<30	<700
Benzo(e)pyrene		<30	<700
Benzo(a)pyrene		<30	<700
Perylene		<30	<700
Indeno(1,2,3-cd)pyrene		<30	<700
Dibenz(ah)anthracene		<30	<700
Benzo(ghi)perylene		<30	<700
Total 16 PAHs		8700	200000
Total 19 PAHs		8900	210000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		28	640
Upper Bound		55	1300

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	40
Isokinetic rate, %	107

2.10 Anode Casting

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m²
Sampling port size, number	4" Flange (x1)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0933 & 1042	
Temperature, °C	20	
Velocity at sampling plane, m/s	6	
Volumetric flow rate, actual, m³/min	57	
Volumetric flow rate (wet STP), m³/min	53	
Volumetric flow rate (dry STP), m³/min	52	
Mass flow rate (wet basis), kg/hour	4100	

Gas Analyser Results	Average	
Sampling time	0940 - 1039	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Sulfur dioxide	<6	<0.3
Carbon monoxide	<6	<0.3
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		230328

Isokinetic Results		Results	
	Sampling time	0940-1040	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<2	<0.1
PM10	(PSA)	<2	<0.1
PM2.5	(PSA)	<2	<0.1
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		100	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.02

VOC's C5-C20		Results	
	Sampling time	0942-1002	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.02

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m²
Sampling port size, number	4" Flange (x1)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0818 & 0933	
Temperature, °C	19	
Velocity at sampling plane, m/s	5.8	
Volumetric flow rate, actual, m³/min	55	
Volumetric flow rate (wet STP), m³/min	52	
Volumetric flow rate (dry STP), m³/min	51	
Mass flow rate (wet basis), kg/hour	4000	

Isokinetic Results	Results	
Sampling time	0830-0930	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.12	0.006
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m²
Sampling port size, number	4" Flange (x1)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0933 & 1042	
Temperature, °C	20	
Velocity at sampling plane, m/s	6	
Volumetric flow rate, actual, m³/min	57	
Volumetric flow rate (wet STP), m³/min	53	
Volumetric flow rate (dry STP), m³/min	52	
Mass flow rate (wet basis), kg/hour	4100	

Isokinetic Results	Results	
Sampling time	0940-1040	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0003**
Arsenic	**<0.003**	**<0.0001**
Beryllium	<0.0007	<0.00004
Cadmium	**0.014**	**0.00074**
Chromium	0.0041	0.00021
Cobalt	0.0012	0.000063
Copper	0.0056	0.00029
Lead	**1.7**	**0.087**
Manganese	0.14	0.0072
Mercury	**<0.0008**	**<0.00004**
Nickel	0.021	0.0011
Phosphorus	0.4	0.021
Selenium	<0.006	<0.0003
Zinc	0.32	0.017
Total of Sb, As, Cd, Pb, Hg	**≤1.7**	**≤0.088**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m^2
Sampling port size, number	4" Flange (x1)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m^3	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m^3	1.21	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0818 & 0935	
Temperature, °C	19	
Velocity at sampling plane, m/s	5.8	
Volumetric flow rate, actual, m^3/min	55	
Volumetric flow rate (wet STP), m^3/min	52	
Volumetric flow rate (dry STP), m^3/min	51	
Mass flow rate (wet basis), kg/hour	4000	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 0830 - 0930	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		4500	230000
2-Methylnaphthalene		140	7300
Acenaphthylene		<20	<1000
Acenaphthene		230	12000
Fluorene		110	5600
Phenanthrene		750	38000
Anthracene		34	1700
Fluoranthene		440	22000
Pyrene		230	12000
Benz(a)anthracene		24	1200
Chrysene		120	6200
Benzo(b)fluoranthene		<20	<1000
Benzo(k)fluoranthene		<20	<1000
Benzo(e)pyrene		<20	<1000
Benzo(a)pyrene		<20	<1000
Perylene		<20	<1000
Indeno(1,2,3-cd)pyrene		<20	<1000
Dibenz(ah)anthracene		<20	<1000
Benzo(ghi)perylene		<20	<1000
Total 16 PAHs		6400	330000
Total 19 PAHs		6600	340000
BaP-TEQ			
Lower Bound		3.6	190
Middle Bound		22	1100
Upper Bound		41	2100

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	100

2.11 Zinc Plant 1 Baghouse – ZP1

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		230328

Sampling Plane Details	
Sampling plane dimensions	390 x 500 mm
Sampling plane area	0.195 m²
Sampling port size, number	1" Holes (x3)
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	3 6
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1224 & 1339	
Temperature, °C	18	
Velocity at sampling plane, m/s	7.1	
Volumetric flow rate, actual, m³/min	83	
Volumetric flow rate (wet STP), m³/min	79	
Volumetric flow rate (dry STP), m³/min	78	
Mass flow rate (wet basis), kg/hour	6100	

Gas Analyser Results	Average	
Sampling time	1137 - 1236	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.3
Sulfur dioxide	<6	<0.4
Carbon monoxide	<6	<0.5
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		230328

Isokinetic Results		Results	
	Sampling time	1235-1336	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<3	<0.2
PM10	(PSA)	<3	<0.2
PM2.5	(PSA)	<3	<0.2
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		101	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.03

VOC's C5-C20		Results	
	Sampling time	1250-1310	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.03

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Please note, toluene results not reported due to suspected contamination.

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*230328*

Sampling Plane Details	
Sampling plane dimensions	390 x 500 mm
Sampling plane area	0.195 m²
Sampling port size, number	1" Holes (x3)
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	3 6
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1115 & 1224	
Temperature, °C	18	
Velocity at sampling plane, m/s	7.2	
Volumetric flow rate, actual, m³/min	84	
Volumetric flow rate (wet STP), m³/min	80	
Volumetric flow rate (dry STP), m³/min	79	
Mass flow rate (wet basis), kg/hour	6200	

Isokinetic Results	Results	
Sampling time	1120-1221	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.22	0.017
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		230328

Sampling Plane Details	
Sampling plane dimensions	390 x 500 mm
Sampling plane area	0.195 m²
Sampling port size, number	1" Holes (x3)
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	3 6
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1224 & 1339	
Temperature, °C	18	
Velocity at sampling plane, m/s	7.1	
Volumetric flow rate, actual, m³/min	83	
Volumetric flow rate (wet STP), m³/min	79	
Volumetric flow rate (dry STP), m³/min	78	
Mass flow rate (wet basis), kg/hour	6100	

Isokinetic Results	Results	
Sampling time	1235-1336	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.007**	**<0.0005**
Arsenic	**<0.003**	**<0.0002**
Beryllium	<0.0009	<0.00007
Cadmium	**0.0063**	**0.00049**
Chromium	<0.001	<0.00009
Cobalt	<0.001	<0.00009
Copper	<0.001	<0.00009
Lead	**0.12**	**0.009**
Manganese	0.22	0.017
Mercury	**<0.0007**	**<0.00006**
Nickel	<0.002	<0.0002
Phosphorus	<0.03	<0.002
Selenium	<0.007	<0.0005
Zinc	0.41	0.032
Total of Sb, As, Cd, Pb, Hg	**≤0.13**	**≤0.01**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	98	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*230328*

Sampling Plane Details		
Sampling plane dimensions	390 x 500 mm	
Sampling plane area	0.195 m²	
Sampling port size, number	1" Holes (x3)	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Bend >2 D	
Upstream disturbance	Bend >6 D	
No. traverses & points sampled	3 6	
Sample plane conformance to AS 4323.1	Ideal sampling plane	
Comments		
The discharge is assumed to be composed of dry air and moisture		

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.22	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1115 & 1224	
Temperature, °C	18	
Velocity at sampling plane, m/s	7.2	
Volumetric flow rate, actual, m³/min	84	
Volumetric flow rate (wet STP), m³/min	80	
Volumetric flow rate (dry STP), m³/min	79	
Mass flow rate (wet basis), kg/hour	6200	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*230328*

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1120 - 1221	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		80000	6300000
2-Methylnaphthalene		420	33000
Acenaphthylene		<30	<2000
Acenaphthene		95	7500
Fluorene		61	4800
Phenanthrene		650	51000
Anthracene		66	5200
Fluoranthene		650	51000
Pyrene		320	25000
Benz(a)anthracene		<30	<2000
Chrysene		160	12000
Benzo(b)fluoranthene		120	9300
Benzo(k)fluoranthene		32	2500
Benzo(e)pyrene		<30	<2000
Benzo(a)pyrene		<30	<2000
Perylene		<30	<2000
Indeno(1,2,3-cd)pyrene		<30	<2000
Dibenz(ah)anthracene		<30	<2000
Benzo(ghi)perylene		<30	<2000
Total 16 PAHs		83000	6500000
Total 19 PAHs		83000	6500000
BaP-TEQ			
Lower Bound		17	1300
Middle Bound		38	3000
Upper Bound		59	4600

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	98

2.12 Zinc Plant 3 Baghouse – ZP3

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		230328

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.2	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1544 & 1700	
Temperature, °C	24	
Velocity at sampling plane, m/s	19	
Volumetric flow rate, actual, m³/min	72	
Volumetric flow rate (wet STP), m³/min	67	
Volumetric flow rate (dry STP), m³/min	66	
Mass flow rate (wet basis), kg/hour	5200	

Gas Analyser Results	Average	
Sampling time	1548 - 1647	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.3
Sulfur dioxide	<6	<0.4
Carbon monoxide	<6	<0.4
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		230328

Isokinetic Results		Results	
	Sampling time	1550-1655	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<2	<0.1
PM10	(PSA)	<2	<0.1
PM2.5	(PSA)	<2	<0.1
Isokinetic Sampling Parameters			
Sampling time, min		64	
Isokinetic rate, %		91	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.03

VOC's C5-C20		Results	
	Sampling time	1606-1626	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.03

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Please note, toluene results not reported due to suspected contamination.

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		230328

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1427 & 1544	
Temperature, °C	26	
Velocity at sampling plane, m/s	18	
Volumetric flow rate, actual, m³/min	71	
Volumetric flow rate (wet STP), m³/min	65	
Volumetric flow rate (dry STP), m³/min	64	
Mass flow rate (wet basis), kg/hour	5000	

Isokinetic Results	Results	
Sampling time	1436-1541	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.02	<0.002
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	93	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.3	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1544 & 1700	
Temperature, °C	24	
Velocity at sampling plane, m/s	19	
Volumetric flow rate, actual, m³/min	72	
Volumetric flow rate (wet STP), m³/min	67	
Volumetric flow rate (dry STP), m³/min	66	
Mass flow rate (wet basis), kg/hour	5200	

Isokinetic Results	Results	
Sampling time	1550-1655	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.005**	**<0.0003**
Arsenic	**<0.002**	**<0.0001**
Beryllium	<0.0006	<0.00004
Cadmium	**0.0071**	**0.00047**
Chromium	<0.0008	<0.00005
Cobalt	<0.001	<0.00006
Copper	<0.0008	<0.00005
Lead	**0.057**	**0.0038**
Manganese	0.11	0.0076
Mercury	**<0.0005**	**<0.00004**
Nickel	<0.002	<0.0001
Phosphorus	<0.02	<0.001
Selenium	<0.005	<0.0003
Zinc	0.92	0.061
Total of Sb, As, Cd, Pb, Hg	**≤0.072**	**≤0.0047**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	96	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.3	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1427 & 1544	
Temperature, °C	26	
Velocity at sampling plane, m/s	18	
Volumetric flow rate, actual, m³/min	71	
Volumetric flow rate (wet STP), m³/min	65	
Volumetric flow rate (dry STP), m³/min	64	
Mass flow rate (wet basis), kg/hour	5000	

Date	10/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*230328*

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1436 - 1541	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		4700	300000
2-Methylnaphthalene		90	5800
Acenaphthylene		<20	<1000
Acenaphthene		<20	<1000
Fluorene		<20	<1000
Phenanthrene		120	7800
Anthracene		<20	<1000
Fluoranthene		100	6600
Pyrene		54	3500
Benz(a)anthracene		<20	<1000
Chrysene		<20	<1000
Benzo(b)fluoranthene		<20	<1000
Benzo(k)fluoranthene		<20	<1000
Benzo(e)pyrene		<20	<1000
Benzo(a)pyrene		<20	<1000
Perylene		<20	<1000
Indeno(1,2,3-cd)pyrene		<20	<1000
Dibenz(ah)anthracene		<20	<1000
Benzo(ghi)perylene		<20	<1000
Total 16 PAHs		5000	320000
Total 19 PAHs		5100	320000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		17	1100
Upper Bound		34	2200

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	64
Isokinetic rate, %	94

2.13 MZR Furnace Baghouse

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		230328

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.03	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1518 & 1631	
Temperature, °C	55	
Velocity at sampling plane, m/s	8.9	
Volumetric flow rate, actual, m³/min	100	
Volumetric flow rate (wet STP), m³/min	84	
Volumetric flow rate (dry STP), m³/min	83	
Mass flow rate (wet basis), kg/hour	6500	

Gas Analyser Results	Average	
Sampling time	1428 - 1501	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.3
Sulfur dioxide	<6	<0.5
Carbon monoxide	<6	<0.5
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*230328*

Isokinetic Results		Results	
	Sampling time	1520-1626	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<3	<0.2
PM10	(PSA)	<3	<0.2
PM2.5	(PSA)	<3	<0.2
Isokinetic Sampling Parameters			
Sampling time, min		64	
Isokinetic rate, %		102	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.04

VOC's C5-C20		Results	
	Sampling time	1530-1550	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.04

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	0.54	
Gas molecular weight, g/g mole	29.0 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.05	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1400 & 1518	
Temperature, °C	54	
Velocity at sampling plane, m/s	9	
Volumetric flow rate, actual, m³/min	110	
Volumetric flow rate (wet STP), m³/min	86	
Volumetric flow rate (dry STP), m³/min	85	
Mass flow rate (wet basis), kg/hour	6700	

Isokinetic Results	Results	
Sampling time	1410-1516	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.003
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	97	

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		230328

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	1.2	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.04	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1400 & 1518	
Temperature, °C	54	
Velocity at sampling plane, m/s	9	
Volumetric flow rate, actual, m³/min	110	
Volumetric flow rate (wet STP), m³/min	86	
Volumetric flow rate (dry STP), m³/min	85	
Mass flow rate (wet basis), kg/hour	6700	

Isokinetic Results	Results	
Sampling time	1410-1516	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0005**
Arsenic	**<0.003**	**<0.0002**
Beryllium	<0.0008	<0.00007
Cadmium	**0.0023**	**0.0002**
Chromium	<0.001	<0.00008
Cobalt	<0.001	<0.00008
Copper	0.0011	0.000097
Lead	**0.016**	**0.0014**
Manganese	0.011	0.00091
Mercury	**<0.0007**	**<0.00006**
Nickel	<0.002	<0.0002
Phosphorus	<0.02	<0.002
Selenium	<0.006	<0.0005
Zinc	0.52	0.044
Total of Sb, As, Cd, Pb, Hg	**≤0.028**	**≤0.0023**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	97	

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m^2
Sampling port size, number & depth	4" BSP (x2), 80 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m^3	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m^3	1.03	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1518 & 1631	
Temperature, °C	55	
Velocity at sampling plane, m/s	8.9	
Volumetric flow rate, actual, m^3/min	100	
Volumetric flow rate (wet STP), m^3/min	84	
Volumetric flow rate (dry STP), m^3/min	83	
Mass flow rate (wet basis), kg/hour	6500	

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1520 - 1626	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		49000	4100000
2-Methylnaphthalene		680	56000
Acenaphthylene		<20	<2000
Acenaphthene		110	8900
Fluorene		61	5000
Phenanthrene		440	37000
Anthracene		<20	<2000
Fluoranthene		220	18000
Pyrene		99	8200
Benz(a)anthracene		<20	<2000
Chrysene		<20	<2000
Benzo(b)fluoranthene		<20	<2000
Benzo(k)fluoranthene		<20	<2000
Benzo(e)pyrene		<20	<2000
Benzo(a)pyrene		<20	<2000
Perylene		<20	<2000
Indeno(1,2,3-cd)pyrene		<20	<2000
Dibenz(ah)anthracene		<20	<2000
Benzo(ghi)perylene		<20	<2000
Total 16 PAHs		50000	4100000
Total 19 PAHs		51000	4200000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		22	1800
Upper Bound		43	3600

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	64
Isokinetic rate, %	95

2.14 MZR Dross Stack

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		230328

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number	4" BSP (x2)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
No afterflows were recorded as this a batch process

Stack Parameters		
Moisture content, %v/v	0.86	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1236	
Temperature, °C	26	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	150	
Volumetric flow rate (wet STP), m³/min	130	
Volumetric flow rate (dry STP), m³/min	130	
Mass flow rate (wet basis), kg/hour	10000	

Gas Analyser Results	Average	
Sampling time	1345 - 1425	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.5
Carbon monoxide	<6	<0.8
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		230328

Isokinetic Results		Results	
	Sampling time	1240-1257	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<7	<0.9
PM10	(PSA)	<7	<0.9
PM2.5	(PSA)	<7	<0.9
Isokinetic Sampling Parameters			
Sampling time, min		16	
Isokinetic rate, %		103	
Gravimetric analysis date (total particulate)		30-05-2023	

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.4	<0.06

VOC's C5-C20		Results	
	Sampling time	1341-1501	
		Concentration mg/m³	Mass Rate g/min
Detection limit[1]		<0.4	<0.06

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene,m + p-Xylene,1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Please note, toluene results not reported due to suspected contamination.

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number	4" BSP (x2)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
No afterflows were recorded as this a batch process
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	0.86	
Gas molecular weight, g/g mole	29.0 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1236	
Temperature, °C	26	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	150	
Volumetric flow rate (wet STP), m³/min	130	
Volumetric flow rate (dry STP), m³/min	130	
Mass flow rate (wet basis), kg/hour	10000	

Isokinetic Results	Results	
Sampling time	1240-1257	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.09	<0.01
Isokinetic Sampling Parameters		
Sampling time, min	16	
Isokinetic rate, %	102	

Ektimo

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		230328

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number	4" BSP (x2)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
No afterflows were recorded as this a batch process
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	0.84	
Gas molecular weight, g/g mole	29.0 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1319	
Temperature, °C	26	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	150	
Volumetric flow rate (wet STP), m³/min	130	
Volumetric flow rate (dry STP), m³/min	130	
Mass flow rate (wet basis), kg/hour	10000	

Isokinetic Results	Results	
Sampling time	1320-1417	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.008**	**<0.001**
Arsenic	**<0.004**	**<0.0005**
Beryllium	<0.001	<0.0001
Cadmium	**0.005**	**0.00066**
Chromium	<0.001	<0.0002
Cobalt	<0.001	<0.0002
Copper	0.0031	0.0004
Lead	**0.04**	**0.0053**
Manganese	0.013	0.0017
Mercury	**<0.0009**	**<0.0001**
Nickel	0.0054	0.00071
Phosphorus	<0.03	<0.004
Selenium	<0.008	<0.001
Zinc	0.73	0.095
Total of Sb, As,Cd, Pb, Hg	**≤0.058**	**≤0.0076**
Isokinetic Sampling Parameters		
Sampling time, min	56	
Isokinetic rate, %	97	

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*230328*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m^2
Sampling port size, number	4" BSP (x2)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

Comments
No afterflows were recorded as this a batch process
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	0.86	
Gas molecular weight, g/g mole	29.0 (wet)	29.1 (dry)
Gas density at STP, kg/m^3	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m^3	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1319	
Temperature, °C	26	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m^3/min	150	
Volumetric flow rate (wet STP), m^3/min	130	
Volumetric flow rate (dry STP), m^3/min	130	
Mass flow rate (wet basis), kg/hour	10000	

Date	15/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		230328

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1320 - 1417	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		4400	570000
2-Methylnaphthalene		120	16000
Acenaphthylene		<20	<2000
Acenaphthene		<20	<2000
Fluorene		18	2400
Phenanthrene		150	19000
Anthracene		<20	<2000
Fluoranthene		100	14000
Pyrene		56	7300
Benz(a)anthracene		<20	<2000
Chrysene		<20	<2000
Benzo(b)fluoranthene		<20	<2000
Benzo(k)fluoranthene		<20	<2000
Benzo(e)pyrene		<20	<2000
Benzo(a)pyrene		<20	<2000
Perylene		<20	<2000
Indeno(1,2,3-cd)pyrene		<20	<2000
Dibenz(ah)anthracene		<20	<2000
Benzo(ghi)perylene		<20	<2000
Total 16 PAHs		4700	610000
Total 19 PAHs		4800	630000
BaP-TEQ			
Lower Bound		0	0
Middle Bound		16	2100
Upper Bound		32	4100

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	56
Isokinetic rate, %	97

2.15 Start-up Scrubber

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Start-up Scrubber
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 5 running through the scrubber, 390amps, bombay doors open 20%		230328

Sampling Plane Details		
Sampling plane dimensions	1050 mm	
Sampling plane area	0.866 m²	
Sampling port size, number & depth	4" BSP (x2), 800 mm	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Centrifugal fan >6 D	
No. traverses & points sampled	2 12	
Sample plane conformance to AS 4323.1	Ideal sampling plane	

Stack Parameters		
Moisture content, %v/v	2.6	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0828 & 0838	
Temperature, °C	38	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	780	
Volumetric flow rate (wet STP), m³/min	690	
Volumetric flow rate (dry STP), m³/min	670	
Mass flow rate (wet basis), kg/hour	53000	

Gas Analyser Results	Average	
Sampling time	0829 - 0829	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	5.8	3.9
Sulfur dioxide	<6	<4
Carbon monoxide	940	620
	Concentration % v/v	
Carbon dioxide	0.5	
Oxygen	20.2	

Date	16/05/2023	**Client**	Nyrstar Hobart
Report	R014539	**Stack ID**	Start-up Scrubber
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 5 running through the scrubber, 390amps, bombay doors open 20%		*230328*

Isokinetic Results	Results	
Sampling time	0830-0932	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	17	12
Antimony	**<0.007**	**<0.005**
Arsenic	**0.013**	**0.0089**
Beryllium	<0.0009	<0.0006
Cadmium	**0.054**	**0.036**
Chromium	<0.001	<0.0009
Cobalt	<0.001	<0.0008
Copper	0.016	0.011
Lead	**1.3**	**0.85**
Manganese	0.014	0.0095
Mercury	**<0.001**	**<0.0006**
Nickel	0.0035	0.0023
Phosphorus	<0.03	<0.02
Selenium	<0.007	<0.005
Zinc	3.5	2.4
Total of Sb, As, Cd, Pb, Hg	**≤1.3**	**≤0.9**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	107	
Gravimetric analysis date (total particulate)	26-05-2023	

3 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited	
				Sampling	Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate & velocity	AS 4323.1	AS 4323.1	8%, 7%	✓	✓
Moisture	USEPA Method 4	USEPA Method 4	8%	✓	✓
Moisture (stacks <60°C)	Ektimo 050	Ektimo 050	not specified	✓	✓[j]
Molecular weight	NA	USEPA Method 3	not specified	NA	✓
Carbon dioxide & oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Carbon monoxide	USEPA Method 10	USEPA Method 10	12%	✓	✓
Nitrogen oxides	USEPA Method 7E	USEPA Method 7E	12%	✓	✓
Nitrous oxide	NA	gas analyser	12%	NA	×[h]
Sulfur dioxide	USEPA Method 6C	USEPA Method 6C	12%	✓	✓
Speciated volatile organic compounds	Ektimo 344	Ektimo 344	19%	✓	✓[†]
Total particulate matter	AS 4323.2	AS 4323.2	7%	✓	✓[††]
Particulate matter (PM_{10} & $PM_{2.5}$) by particle size analysis	AS 4323.2	Ektimo in-house method using Malvern Mastersizer 3000	not specified	×	×[†]
Total (gaseous & particulate) metals (As, Be, Cd, Co, Cr, Cu, Hg, Mn, Ni, P, Pb, Sb, Se, Zn)	USEPA Method 29	Envirolab in-house methods Metals-020/021/022	15%	✓	✓[‡]
Total fluoride	USEPA Method 13B	Ektimo 235	17%	✓	✓[†]
Polycyclic aromatic hydrocarbons (PAHs)	USEPA SW-846 0010	NMI in-house method NGCMS 11.27	21%	✓	✓[¶]
Sulfuric acid mist and/or sulfur oxides	USEPA Method 8	Ektimo 235	16%	✓	✓[†]

030723

[*] Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

[¶] Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 14 June 2023 in report RN1395459.

[†] Analysis performed by Ektimo. Results were reported to Ektimo on.
29 May 2023 in report LV-004462.
29 May 2023 in report LV-004468.
2 June 2023 in report LV-004488.
6 June 2023 in report LV-004506.
6 June 2023 in report LV-004518.

[††] Gravimetric analysis conducted at the Ektimo VIC laboratory.

[‡] Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 6 June 2023 in report 324378.

[h] Nitrous oxide analysis performed using the instrumental technique as per USEPA Method 7E.

[j] Includes analysis of moisture content by Ektimo 050 which uses the same principle as ASTM E337.

4 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

5 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
AS	Australian Standard
BaP-TEQ	Benzo(a)pyrene toxic equivalents
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NT	Not tested or results not required
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
USEPA	United States Environmental Protection Agency
Velocity difference	The percentage difference between the average of initial flows and after flows.
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

6 Appendix 1: Site Photos

Foreshore A

Foreshore B

Parageothite Dryer

Cadmium Smelter Plant Scrubber Stack

Copper Sulphate Crystalliser Plant Vent Stack

Casting Ventilation 1 – V1

Casting Ventilation 2 – V2

Roaster Baghouse

Anode Casting

Zinc Plant 1 Baghouse – ZP1

Zinc Plant 3 Baghouse – ZP3

MZR Furnace Stack

MZR Dross

Start Up Scrubber

7 Appendix 2: Weather Observations

Hobart, Tasmania

May 2023 Daily Weather Observations

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	8th		km/h	hPa	°C	%	8th		km/h	hPa
1	Mo	8.3	11.9	0			NW	28	10:43	10	78		NNW	15	1016	11.6	83		NNW	9	1012
2	Tu	9.3	17.2	1.2			NW	31	6:00	11.9	81		NW	13	1009	15.5	69		E	11	1006
3	We	5.9	12.1	6.8			SSW	44	16:47	8.4	95		WSW	9	1003	11.5	79		SSW	17	1007
4	Th	5	15.8	1.8			N	28	14:33	7.9	84		NNW	13	1020	15	51		N	15	1017
5	Fr	6.6	17.5	0			NW	39	14:19	9.6	74		N	9	1010	14.2	71		SSE	11	1006
6	Sa	4.6	12.6	0			SSW	39	15:08	7.6	65		N	9	1018	10.8	47		SSW	17	1018
7	Su	2	11.7	0			SSW	39	13:18	4.3	77		N	13	1025	8.9	60		SW	17	1024
8	Mo	2.1	15.6	0			WSW	54	16:29	9.3	65		NW	28	1018	13.3	68		S	13	1016
9	Tu	9.1	14.2	0			SW	65	6:55	13	59		SW	26	1018	13.5	60		SW	15	1020
10	We	8.8	15.8	0			S	48	13:42	11.9	67		SE	7	1025	14	55		WSW	17	1025
11	Th	4.6	16.6	0			NNW	41	21:30	6.6	84		NW	15	1027	15.8	50		NNE	13	1023
12	Fr	6.6	18	0			NNW	43	5:09	11	64		NW	13	1024	16.6	39		WSW	15	1025
13	Sa	7.3	16.4	0			NNW	33	1:53	11	66		NW	15	1031	15.8	48		WNW	9	1029
14	Su	4.2	17.2	0			NNW	56	11:52	6.6	82		NNW	17	1028	16.9	43		NNW	9	1022
15	Mo	6.6	18.9	0			NW	67	12:53	15.2	47		NNW	20	1016	17.9	50		NNW	39	1010
16	Tu	8.4	11.6	0.4			WSW	52	7:41	8.6	63		SW	19	1017	10.7	51		SW	11	1022
17	We	3.8	14.2	0			NNW	30	3:36	5.9	80		NW	19	1029	13.8	47		NNE	11	1026
18	Th	2.9	13.7	0.2			NW	39	15:16	6.1	79		NNW	6	1023	12.7	55		NNW	22	1018
19	Fr	5.9	11.7	0.4			WSW	28	1:20	7.3	85		NNW	9	1017	10.5	57		NNW	11	1014
20	Sa	4.9	12.5	0.2			NW	50	10:23	8	70		NNW	26	1009	12.1	56		NW	24	1003
21	Su	6.5	14.7	1			SW	56	3:18	7.6	75		SSW	22	1010	11.8	48		W	24	1015
22	Mo	7.6	18.2	0.2			NNW	57	2:08	14.7	57		N	22	1016	17.2	48		NNW	22	1015
23	Tu	12.7	16.3	0			NW	57	10:51	13.5	68		NW	35	1021	15.9	57		NW	28	1018
24	We	12.8	19.5	0			NW	65	12:07	14.7	63		NNE	20	1017	19.1	47		NW	26	1012
25	Th	11.2	15.4	1.4			NW	83	5:48	11.2	82		NW	24	1001	12.5	60		NW	19	998
26	Fr	5.6	15	7			NNW	59	20:12	9.4	65		NNW	31	1006	13.9	56		NNW	19	1006
27	Sa	9.3	15.6	0			NW	69	14:34	12.3	61		NNW	20	1006	14.6	50		NNW	35	1002
28	Su	10.4	15.8	0			NW	39	16:20	11	79		NW	13	1005	15.8	46		NNW	19	1003
29	Mo	7.4	15.4	1			W	89	8:34	8.9	52		WSW	31	1005	10.4	49		W	22	1008
30	Tu	7.3	18.4	0			NW	57	22:41	15.3	62		N	20	1007	15.4	71		N	15	1005
31	We	13.1	19.5	0.6			WNW	91	15:00	14.8	72		W	6	1001	17.4	48		WNW	52	994
Statistics for May 2023																					
Mean		7.1	15.5							10.1	71			17	1015	14	55			18	1014
Lowest		2	11.6	0						4.3	47		#	6	1001	8.9	39		#	9	994
Highest		13.1	19.5	7			WNW	91		15.3	95		NW	35	1031	19.1	83		WNW	52	1029
Total				22.2																	

IDCJDW7021.202305 Prepared at 16:03 UTC on Sunday 2 July 2023

***Site name**: HOBART AIRPORT WEST* ***Site number:** 094008* ***Latitude:** 42.83 °S* ***Longitude:** 147.50 °E* ***Elevation:** 4 m*

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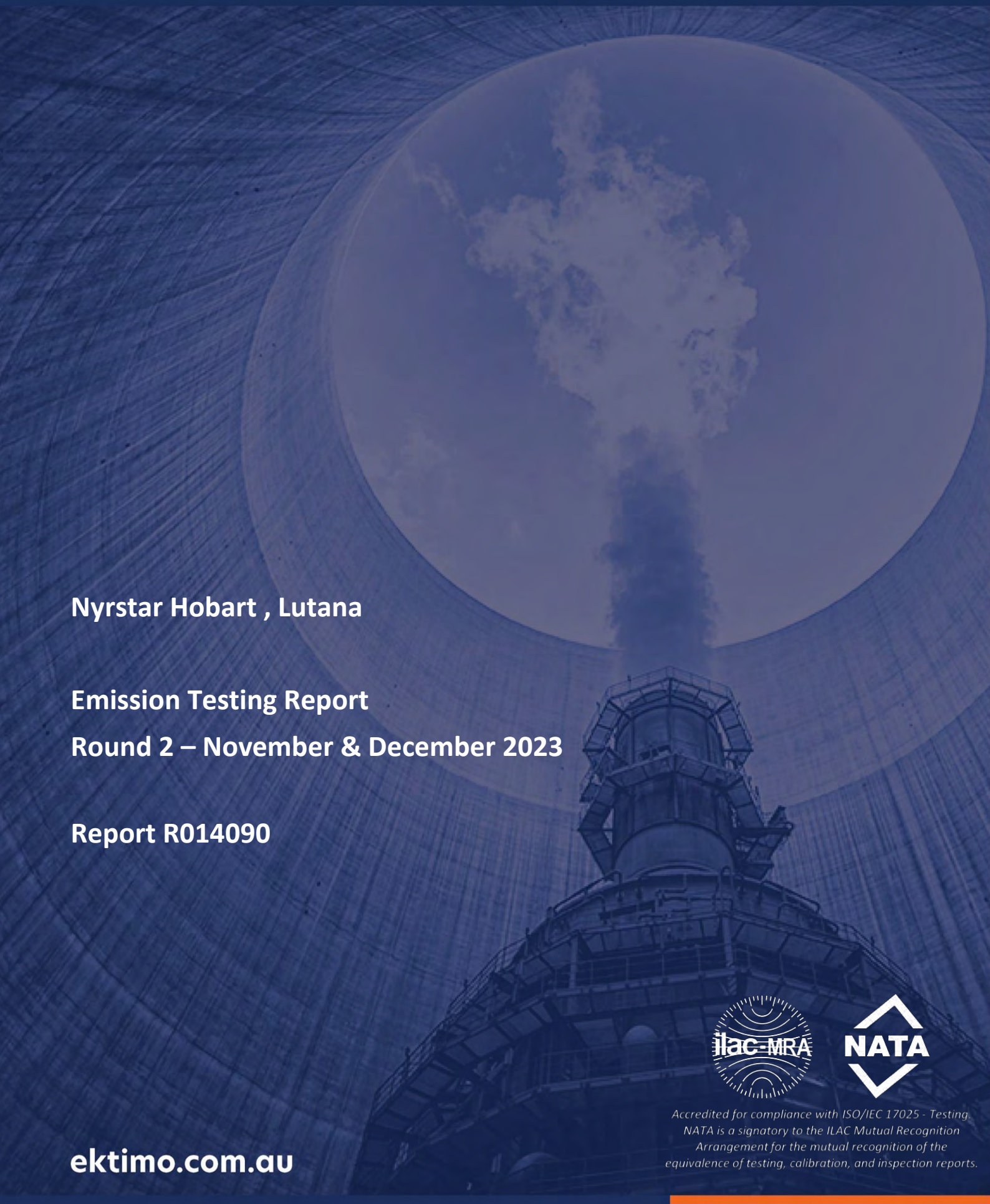
WA 6164
AUSTRALIA

BRISBANE
3/109 Riverside Place
Morningside
QLD 4170
AUSTRALIA

Ektimo



Nyrstar Hobart , Lutana

Emission Testing Report
Round 2 – November & December 2023

Report R014090

Document Information

Client Name:	Nyrstar Hobart
Report Number:	R014090
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Attention:	Kylie Veale
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Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

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NATA Accredited Laboratory
No. 14601

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1 Executive Summary

1.1 Background

Ektimo was engaged by Nyrstar Hobart to perform emission testing at their Lutana plant. Testing was carried out in accordance with Environmental Licence 7043/5.

1.2 Project Objective & Overview

The objective of the project was to quantify emissions from 14 discharge points to determine compliance with Nyrstar Hobart 's Environmental Licence and meet EPN reporting requirements.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Foreshore A	14 November 2023	Total particulate matter Metals Sulfur dioxide, sulfur trioxide Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Foreshore B		
Parageothite Dryer	16 November 2023	Total particulate matter Metals Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Cadmium Smelter	15 November 2023	
Copper Sulphate Stack	5 December 2023	
Casting Ventilation 1 – V1	15 November 2023	
Casting Ventilation 2 – V2		
Roaster Baghouse	16 November 2023	Total particulate matter Metals Nitrogen oxides, sulfur dioxide, carbon monoxide, carbon dioxide, oxygen
Zinc Oxide Fume Debagging Station	17 November 2023	Total particulate matter Metals Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Anode Casting	15 November 2023	
Zinc Plant 1 Baghouse – ZP1	14 November 2023	
Zinc Plant 3 Baghouse – ZP3		
MZR Furnace Baghouse	16 November 2023	
MZR Dross Stack		

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP.

Plant operating conditions have been noted in this report.

1.3 Licence Comparison

The following licence comparison table shows that all analytes are within the licence limit set by the Tasmanian Environmental Protection Notice (EPN) 7043/5.

Emission Point / Monitoring Location	Parameter	Units	Licence limit	Detected values
Foreshore A (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	**0.41**
	Oxides of nitrogen (as NO_2)	g/m^3	2	**0.021**
	Particulates	mg/m^3	100	**<2**
	Sulphur dioxide	g/m^3	7.2	**0.0024**
Foreshore B (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	**0.33**
	Oxides of nitrogen (as NO_2)	g/m^3	2	**0.018**
	Particulates	mg/m^3	100	**<1**
	Sulphur dioxide	g/m^3	7.2	**0.0027**
Anode Casting Plant Exhaust	Particulates	mg/m^3	100	**9.4**
V1 Furnace Stack				**<3**
V2 Furnace Stack				**<2**
Zinc Dust Plant Baghouse 1 Stack				**<2**
Zinc Dust Plant Bagouse 3 Stack				**5.8**
Cadmium Smelter Plant Scrubber Stack				**<1**
Copper Sulphate Crystalliser Plant				**<4**
Roaster Baghouse				**13**
Paragoethite Dryer Baghouse				**4.7**
Anode Casting Plant Exhaust	Metals - Pb, As, Sb, Cd, Hg [(1)]	mg/m^3	5	**≤0.16**
V1 Furnace Stack				**≤0.214**
V2 Furnace Stack				**≤0.062**
Zinc Dust Plant Baghouse 1 Stack				**≤0.048**
Zinc Dust Plant Baghouse 3 Stack				**≤0.107**
Cadmium Smelter Plant Scrubber Stack				**≤0.07**
Copper Sulphate Crystalliser Plant				**≤0.05**
Roaster Baghouse				**≤0.425**
Paragoethite Dryer Baghouse				**≤0.26**
Anode Casting Plant Exhaust	Metals - Hg	mg/m^3	1	**<0.0009**
V1 Furnace Stack				**<0.001**
V2 Furnace Stack				**<0.0005**
Zinc Dust Plant Baghouse 1 Stack				**<0.0006**
Zinc Dust Plant Baghouse 3 Stack				**0.0011**
Cadmium Smelter Plant Scrubber Stack				**<0.0005**
Copper Sulphate Crystalliser Plant				**0.00087**
Roaster Baghouse				**0.003**
Paragoethite Dryer Baghouse				**<0.002**
Anode Casting Plant Exhaust	Metals - Cd	mg/m^3	1	**0.0034**
V1 Furnace Stack				**0.031**
V2 Furnace Stack				**0.014**
Zinc Dust Plant Baghouse 1 Stack				**0.0022**
Zinc Dust Plant Baghouse 3 Stack				**0.0047**
Cadmium Smelter Plant Scrubber Stack				**0.036**
Copper Sulphate Crystalliser Plant				**0.011**
Roaster Baghouse				**0.031**
Paragoethite Dryer Baghouse				**0.014**

(1) Total concentration of metals combined.

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

2 Results

2.1 Foreshore A

Date	14/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 46 000 m3/hr & Unit 6 producing 96 000 m3/hr of gas through the acid stream.		

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.4 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0819 & 1018	
Temperature, °C	19	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	1700	
Volumetric flow rate (wet STP), m³/min	1600	
Volumetric flow rate (dry STP), m³/min	1500	
Mass flow rate (wet basis), kg/h	120000	

Gas Analyser Results	Average	
Sampling time	1000 - 1059	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	21	32
Carbon monoxide	<6	<10
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	10.3	

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Date	14/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 46 000 m3/hr & Unit 6 producing 96 000 m3/hr of gas through the acid stream.		

Isokinetic Results	Results	
Sampling time	0830-1013	
	Concentration mg/m³	Mass Rate g/min
Antimony	<0.004	<0.006
Arsenic	<0.002	<0.003
Beryllium	<0.0005	<0.0007
Cadmium	**0.00077**	**0.0012**
Chromium	**0.012**	**0.018**
Cobalt	<0.0007	<0.001
Copper	**0.0054**	**0.0082**
Lead	**0.012**	**0.018**
Manganese	**0.014**	**0.022**
Mercury	<0.0005	<0.0007
Nickel	**0.024**	**0.036**
Phosphorus	**0.02**	**0.031**
Selenium	<0.004	<0.006
Zinc	**0.048**	**0.073**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	99	

Isokinetic Results	Results	
Sampling time	1030-1213	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<2
Sulfur dioxide	2.4	3.7
Sulfur trioxide	0.41	0.63
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	24-11-2023	

2.2 Foreshore B

Date	14/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 46 000 m3/hr & Unit 6 producing 96 000 m3/hr of gas through the acid stream.		

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.4 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1019 & 1219	
Temperature, °C	20	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1900	
Volumetric flow rate (wet STP), m³/min	1700	
Volumetric flow rate (dry STP), m³/min	1700	
Mass flow rate (wet basis), kg/h	130000	

Gas Analyser Results	Average	
Sampling time	1110 - 1208	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	18	31
Carbon monoxide	<6	<10
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	9.9	

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Date	14/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 46 000 m3/hr & Unit 6 producing 96 000 m3/hr of gas through the acid stream.		

Isokinetic Results	Results	
Sampling time	1030-1213	
	Concentration mg/m³	Mass Rate g/min
Antimony	<0.003	<0.005
Arsenic	**<0.002**	**<0.003**
Beryllium	<0.0004	<0.0007
Cadmium	**0.0013**	**0.0021**
Chromium	**0.0094**	**0.016**
Cobalt	0.00063	0.0011
Copper	0.0012	0.002
Lead	**0.017**	**0.029**
Manganese	**0.014**	**0.023**
Mercury	<0.0004	<0.0006
Nickel	**0.024**	**0.04**
Phosphorus	<0.01	<0.02
Selenium	<0.003	<0.005
Zinc	**0.056**	**0.095**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	100	

Isokinetic Results	Results	
Sampling time	0830-1013	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<1	<2
Sulfur dioxide	2.7	4.6
Sulfur trioxide	0.33	0.57
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	98	
Gravimetric analysis date (total particulate)	24-11-2023	

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2.3 Parageothite Dryer

Date	16/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	8 m3/hr of dirt and 2.75 m3/hr of bypass flow into the drum.		231018

Stack Parameters		
Moisture content, %v/v	23	
Gas molecular weight, g/g mole	26.7 (wet)	29.3 (dry)
Gas density at STP, kg/m³	1.19 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.86	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1222 & 1341	
Temperature, °C	104	
Velocity at sampling plane, m/s	9.8	
Volumetric flow rate, actual, m³/min	420	
Volumetric flow rate (wet STP), m³/min	300	
Volumetric flow rate (dry STP), m³/min	230	
Mass flow rate (wet basis), kg/h	22000	

Gas Analyser Results	Average	
Sampling time	1237 - 1306	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	59	14
Carbon monoxide	<6	<1
	Concentration %v/v	
Carbon dioxide	3.7	
Oxygen	14.7	

Isokinetic Results	Results	
Sampling time	1230-1332	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	4.7	1.1
Antimony	<0.006	<0.001
Arsenic	**0.0095**	**0.0022**
Beryllium	<0.001	<0.0002
Cadmium	**0.014**	**0.0033**
Chromium	**0.0092**	**0.0021**
Cobalt	<0.001	<0.0003
Copper	**0.013**	**0.0031**
Lead	**0.23**	**0.053**
Manganese	**0.11**	**0.025**
Mercury	<0.002	<0.0004
Nickel	**0.0068**	**0.0016**
Phosphorus	<0.05	<0.01
Selenium	<0.009	<0.002
Zinc	**1.4**	**0.34**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	91	
Gravimetric analysis date (total particulate)	24-11-2023	

2.4 Cadmium Smelter Plant Scrubber Stack

Date	15/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Cadmium Smelter Outlet
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Active melting		231018

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1055 & 1209	
Temperature, °C	23	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	140	
Volumetric flow rate (wet STP), m³/min	130	
Volumetric flow rate (dry STP), m³/min	130	
Mass flow rate (wet basis), kg/h	10000	

Gas Analyser Results	Average	
Sampling time	1111 - 1210	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.5
Carbon monoxide	<6	<0.8
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.7	

Isokinetic Results	Results	
Sampling time	1105-1207	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<1	<0.2
Antimony	<0.004	<0.0005
Arsenic	<0.002	<0.0003
Beryllium	<0.0005	<0.00006
Cadmium	**0.036**	**0.0046**
Chromium	**0.0064**	**0.0008**
Cobalt	**<0.0007**	**<0.00008**
Copper	**<0.0007**	**<0.00008**
Lead	**0.03**	**0.0037**
Manganese	**0.12**	**0.015**
Mercury	<0.0005	<0.00006
Nickel	**0.014**	**0.0017**
Phosphorus	<0.02	<0.002
Selenium	<0.004	<0.0005
Zinc	**0.64**	**0.081**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	24-11-2023	

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2.5 Copper Sulphate Crystalliser Plant Vent Stack

Date	5/12/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	M Hutton & L Fry	**State**	TAS
Process Conditions	Production rate - 5.6 tonnes/day, Dryer Outlet Temperature - 50.8 deg C, Feed rate into Dryer - 30%		

231018

Stack Parameters		
Moisture content, %v/v	10	
Gas molecular weight, g/g mole	27.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.24 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.05	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1550 & 1700	
Temperature, °C	50	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	190	
Volumetric flow rate (wet STP), m³/min	160	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/h	12000	

Gas Analyser Results	Average
Sampling time	1557 - 1656
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.6
Carbon monoxide	<6 / <0.9
	Concentration %v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results	
Sampling time	1555-1656	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<4	<0.5
Antimony	<0.007	<0.001
Arsenic	<0.004	<0.0006
Beryllium	<0.0009	<0.0001
Cadmium	**0.011**	**0.0015**
Chromium	**0.012**	**0.0017**
Cobalt	<0.001	<0.0002
Copper	**0.005**	**0.00072**
Lead	**0.036**	**0.0052**
Manganese	**0.061**	**0.0087**
Mercury	**0.00087**	**0.00013**
Nickel	**0.07**	**0.01**
Phosphorus	**0.032**	**0.0046**
Selenium	<0.007	<0.001
Zinc	**0.57**	**0.082**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	12-12-2023	

2.6 Casting Ventilation 1 – V1

Date	15/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		231018

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1505 & 1621	
Temperature, °C	30	
Velocity at sampling plane, m/s	27	
Volumetric flow rate, actual, m³/min	510	
Volumetric flow rate (wet STP), m³/min	460	
Volumetric flow rate (dry STP), m³/min	450	
Mass flow rate (wet basis), kg/h	35000	

Gas Analyser Results	Average
Sampling time	1519 - 1548
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <2
Carbon monoxide	<6 / <3
	Concentration %v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results	
Sampling time	1515-1615	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<3	<1
Antimony	<0.008	<0.004
Arsenic	<0.004	<0.002
Beryllium	<0.001	<0.0005
Cadmium	**0.031**	**0.014**
Chromium	**0.0054**	**0.0024**
Cobalt	<0.001	<0.0006
Copper	<0.002	<0.0008
Lead	**0.17**	**0.077**
Manganese	**0.43**	**0.19**
Mercury	<0.001	<0.0005
Nickel	**0.0093**	**0.0042**
Phosphorus	**0.052**	**0.023**
Selenium	<0.008	<0.004
Zinc	**1.8**	**0.81**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	102	
Gravimetric analysis date (total particulate)	24-11-2023	

2.7 Casting Ventilation 2 – V2

Date	15/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		231018

Stack Parameters		
Moisture content, %v/v	1.4	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1507 & 1623	
Temperature, °C	53	
Velocity at sampling plane, m/s	25	
Volumetric flow rate, actual, m³/min	410	
Volumetric flow rate (wet STP), m³/min	340	
Volumetric flow rate (dry STP), m³/min	340	
Mass flow rate (wet basis), kg/h	27000	

Gas Analyser Results	Average	
Sampling time	1550 - 1619	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<1
Carbon monoxide	32	11
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.7	

Isokinetic Results	Results	
Sampling time	1515-1615	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.5
Antimony	<0.004	<0.001
Arsenic	<0.002	<0.0007
Beryllium	<0.0005	<0.0002
Cadmium	**0.014**	**0.0046**
Chromium	**0.0022**	**0.00075**
Cobalt	<0.0007	<0.0002
Copper	<0.0007	<0.0002
Lead	**0.042**	**0.014**
Manganese	**0.07**	**0.024**
Mercury	<0.0005	<0.0002
Nickel	0.0026	0.00087
Phosphorus	<0.02	<0.006
Selenium	<0.004	<0.001
Zinc	**0.48**	**0.16**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	24-11-2023	

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2.8 Roaster Baghouse

Date	16/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 45 t/hr, Roaster 5 - 18 t/hr (Conveyor all in operation), fumes were on.		231018

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1408 & 1531	
Temperature, °C	28	
Velocity at sampling plane, m/s	4.5	
Volumetric flow rate, actual, m³/min	32	
Volumetric flow rate (wet STP), m³/min	29	
Volumetric flow rate (dry STP), m³/min	28	
Mass flow rate (wet basis), kg/h	2200	

Gas Analyser Results	Average	
Sampling time	1422 - 1506	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.1
Sulfur dioxide	5.9	0.17
Carbon monoxide	<6	<0.2
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	1415-1521	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	13	0.37
Antimony	<0.005	<0.0001
Arsenic	**0.0069**	**0.00019**
Beryllium	<0.0007	<0.00002
Cadmium	**0.031**	**0.00086**
Chromium	**0.0069**	**0.00019**
Cobalt	**0.00087**	**0.000024**
Copper	**0.025**	**0.00071**
Lead	**0.38**	**0.011**
Manganese	**0.14**	**0.0039**
Mercury	**0.003**	**0.000083**
Nickel	**0.0076**	**0.00021**
Phosphorus	**0.03**	**0.00085**
Selenium	<0.005	<0.0001
Zinc	**5**	**0.14**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	24-11-2023	

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2.9 Zinc Oxide Fume Debagging Station

Date	17/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		231018

Comments
This is a batch process which shuts down at the end of the run. No afterflows were recorded.

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0843	
Temperature, °C	20	
Velocity at sampling plane, m/s	4.8	
Volumetric flow rate, actual, m³/min	14	
Volumetric flow rate (wet STP), m³/min	13	
Volumetric flow rate (dry STP), m³/min	13	
Mass flow rate (wet basis), kg/h	1000	

Gas Analyser Results	Average
Sampling time	0845 - 0914
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.05
Sulfur dioxide	<6 / <0.07
Carbon monoxide	<6 / <0.08
	Concentration %v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results	
Sampling time	0844-0916	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<4	<0.05
Antimony	<0.01	<0.0001
Arsenic	<0.007	<0.00009
Beryllium	<0.002	<0.00002
Cadmium	**0.0061**	**0.000078**
Chromium	**0.0024**	**0.000031**
Cobalt	<0.002	<0.00002
Copper	<0.002	<0.00002
Lead	**0.12**	**0.0016**
Manganese	**0.062**	**0.0008**
Mercury	<0.001	<0.00002
Nickel	**0.0058**	**0.000075**
Phosphorus	<0.05	<0.0006
Selenium	<0.01	<0.0001
Zinc	**1.3**	**0.016**
Isokinetic Sampling Parameters		
Sampling time, min	32	
Isokinetic rate, %	109	
Gravimetric analysis date (total particulate)	24-11-2023	

Ektimo

2.10 Anode Casting

Date	15/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		231018

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0751 & 0911	
Temperature, °C	20	
Velocity at sampling plane, m/s	6	
Volumetric flow rate, actual, m³/min	57	
Volumetric flow rate (wet STP), m³/min	53	
Volumetric flow rate (dry STP), m³/min	52	
Mass flow rate (wet basis), kg/h	4100	

Gas Analyser Results	Average	
Sampling time	0815 - 0844	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Carbon monoxide	<6	<0.3
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	0800-0900	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	9.4	0.49
Antimony	<0.005	<0.0003
Arsenic	<0.002	<0.0001
Beryllium	<0.0007	<0.00004
Cadmium	**0.0034**	**0.00018**
Chromium	**0.0095**	**0.0005**
Cobalt	<0.0009	<0.00005
Copper	**0.0051**	**0.00027**
Lead	**0.15**	**0.008**
Manganese	**0.061**	**0.0032**
Mercury	<0.0009	<0.00005
Nickel	**0.012**	**0.00065**
Phosphorus	<0.02	<0.001
Selenium	<0.005	<0.0003
Zinc	**0.34**	**0.018**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	
Gravimetric analysis date (total particulate)	24-11-2023	

Ektimo

2.11 Zinc Plant 1 Baghouse – ZP1

Date	14/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area		231018

Stack Parameters		
Moisture content, %v/v	2.3	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1420 & 1538	
Temperature, °C	42	
Velocity at sampling plane, m/s	6.7	
Volumetric flow rate, actual, m³/min	79	
Volumetric flow rate (wet STP), m³/min	69	
Volumetric flow rate (dry STP), m³/min	67	
Mass flow rate (wet basis), kg/h	5300	

Gas Analyser Results	Average
Sampling time	1508 - 1538
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.3
Carbon monoxide	<6 / <0.4
	Concentration %v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results	
Sampling time	1430-1533	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.1
Antimony	<0.005	<0.0004
Arsenic	<0.003	<0.0002
Beryllium	<0.0007	<0.00005
Cadmium	**0.0022**	**0.00014**
Chromium	**0.0018**	**0.00012**
Cobalt	<0.0009	<0.00006
Copper	<0.0009	<0.00006
Lead	**0.038**	**0.0025**
Manganese	**0.048**	**0.0032**
Mercury	<0.0006	<0.00004
Nickel	**0.0078**	**0.00052**
Phosphorus	<0.03	<0.002
Selenium	<0.005	<0.0004
Zinc	**0.72**	**0.048**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	24-11-2023	

Ektimo

2.12 Zinc Plant 3 Baghouse – ZP3

Date	14/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		231018

Stack Parameters		
Moisture content, %v/v	2.8	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.04	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1351 & 1514	
Temperature, °C	62	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	56	
Volumetric flow rate (wet STP), m³/min	45	
Volumetric flow rate (dry STP), m³/min	44	
Mass flow rate (wet basis), kg/h	3500	

Gas Analyser Results	Average	
Sampling time	1405 - 1435	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Carbon monoxide	<6	<0.3
	Concentration %v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	1400-1507	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	5.8	0.26
Antimony	<0.007	<0.0003
Arsenic	<0.003	<0.0001
Beryllium	<0.0009	<0.00004
Cadmium	**0.0047**	**0.00021**
Chromium	**0.017**	**0.00077**
Cobalt	**0.0013**	**0.000056**
Copper	**0.0025**	**0.00011**
Lead	**0.092**	**0.0041**
Manganese	**0.1**	**0.0046**
Mercury	**0.0011**	**0.000047**
Nickel	**0.048**	**0.0021**
Phosphorus	<0.03	<0.001
Selenium	<0.007	<0.0003
Zinc	**3.9**	**0.17**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	102	
Gravimetric analysis date (total particulate)	24-11-2023	

2.13 MZR Furnace Baghouse

Date	16/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		231018

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.05	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0834 & 0953	
Temperature, °C	51	
Velocity at sampling plane, m/s	5.5	
Volumetric flow rate, actual, m³/min	65	
Volumetric flow rate (wet STP), m³/min	53	
Volumetric flow rate (dry STP), m³/min	52	
Mass flow rate (wet basis), kg/h	4100	

Gas Analyser Results	Average	
Sampling time	0838 - 0907	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	8.6	0.45
Sulfur dioxide	10	0.52
Carbon monoxide	16	0.84
	Concentration %v/v	
Carbon dioxide	0.9	
Oxygen	19.5	

Isokinetic Results	Results	
Sampling time	0842-0949	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.1
Antimony	<0.007	<0.0003
Arsenic	<0.003	<0.0002
Beryllium	<0.0008	<0.00004
Cadmium	**0.011**	**0.00058**
Chromium	**0.0041**	**0.00021**
Cobalt	<0.001	<0.00006
Copper	<0.001	<0.00006
Lead	**0.095**	**0.005**
Manganese	**0.19**	**0.0099**
Mercury	<0.0009	<0.00005
Nickel	**0.0057**	**0.0003**
Phosphorus	**0.029**	**0.0015**
Selenium	<0.007	<0.0003
Zinc	**1.1**	**0.057**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	24-11-2023	

2.14 MZR Dross Stack

Date	16/11/2023	**Client**	Nyrstar Hobart
Report	R014090	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		23.10.18

Comments
No afterflows were recorded as this a batch process

Stack Parameters		
Moisture content, %v/v	2.4	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.14	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0840	
Temperature, °C	23	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/h	11000	

Gas Analyser Results	Average
Sampling time	0911 - 0939
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.6
Carbon monoxide	<6 / <0.9
	Concentration %v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results	
Sampling time	0838-0945	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.3
Antimony	<0.007	<0.0009
Arsenic	<0.003	<0.0004
Beryllium	<0.0009	<0.0001
Cadmium	**0.0099**	**0.0014**
Chromium	**0.0036**	**0.00051**
Cobalt	<0.001	<0.0002
Copper	<0.001	<0.0002
Lead	**0.037**	**0.0052**
Manganese	**0.072**	**0.01**
Mercury	<0.0008	<0.0001
Nickel	**0.0041**	**0.00059**
Phosphorus	<0.03	<0.004
Selenium	<0.007	<0.0009
Zinc	**0.83**	**0.12**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	98	
Gravimetric analysis date (total particulate)	24-11-2023	

3 Sample Plane Compliance

3.1 Foreshore A

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.2 Foreshore B

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.3 Parageothite Dryer

Sampling Plane Details	
Sampling plane dimensions	950 mm
Sampling plane area	0.709 m²
Sampling port size, number & depth	4" Flange (x2), 50 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.4 Cadmium Smelter Plant Scrubber Stack

Sampling Plane Details	
Sampling plane dimensions	470 mm
Sampling plane area	0.173 m²
Sampling port size, number & depth	4" BSP (x2), 85 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Change in diameter 2 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.5 Copper Sulphate Crystalliser Plant Vent Stack

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.6 Casting Ventilation 1 – V1

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.7 Casting Ventilation 2 – V2

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.8 Roaster Baghouse

Sampling Plane Details	
Sampling plane dimensions	385 mm
Sampling plane area	0.116 m²
Sampling port size, number & depth	4" BSP (x2), 105 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.9 Zinc Oxide Fume Debagging Station

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.10 Anode Casting

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m²
Sampling port size, number	4" Flange (x1)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.11 Zinc Plant 1 Baghouse – ZP1

Sampling Plane Details	
Sampling plane dimensions	390 x 500 mm
Sampling plane area	0.195 m²
Sampling port size, number	1" Holes (x3)
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	3 6
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.12 Zinc Plant 3 Baghouse – ZP3

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.13 MZR Furnace Baghouse

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

3.14 MZR Dross Stack

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number	4" BSP (x2)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

4 Test Methods

All sampling and analysis was performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited	
				Sampling	Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate & velocity	AS 4323.1	AS 4323.1	8%, 7%	✓	✓
Moisture	USEPA Method 4	USEPA Method 4	8%	✓	✓
Moisture (stacks <60°C)	Ektimo 050	Ektimo 050	not specified	✓	✓[j]
Molecular weight	NA	USEPA Method 3	not specified	NA	✓
Carbon dioxide & oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Carbon monoxide	USEPA Method 10	USEPA Method 10	12%	✓	✓
Nitrogen oxides	USEPA Method 7E	USEPA Method 7E	12%	✓	✓
Sulfur dioxide	USEPA Method 6C	USEPA Method 6C	12%	✓	✓
Total particulate matter	AS 4323.2	AS 4323.2	7%	✓	✓[††]
Total (gaseous & particulate) metals (As, Be, Cd, Co, Cr, Cu, Hg, Mn, Ni, P, Pb, Sb, Se, Zn)	USEPA Method 29	Envirolab in-house methods Metals-020/021/022	15%	✓	✓[‡]
Sulfuric acid mist and/or sulfur oxides	USEPA Method 8	Ektimo 235	16%	✓	✓[†]

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[*] Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

[†] Analysis performed by Ektimo. Results were reported to Ektimo on LV-005155 in report 27 November 2023.

[††] Gravimetric analysis conducted at the Ektimo VIC laboratory

[‡] Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on:
05 December 2023 in report 338843.
21 December 2023 in report 340188.

[j] Includes analysis of moisture content by Ektimo 050 which uses the same principle as ASTM E337.

5 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

Unless specifically noted, all samples were collected and handled in accordance with Ektimo's QA/QC standards.

6 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water.
AS	Australian Standard
BaP-TEQ	Benzo(a)pyrene toxic equivalents
BSP	British standard pipe
CEM/CEMS	Continuous emission monitoring/Continuous emission monitoring system
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red.
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
I-TEQ	International toxic equivalents
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required.
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
TOC	Total organic carbon. This is the sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
WHO05-TEQ	World Health Organisation toxic equivalents
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

7 Appendices

Appendix A: Site Images

Foreshore A

Foreshore B

Parageothite Dryer

Cadmium Smelter Plant Scrubber Stack

Copper Sulphate Crystalliser Plant Vent Stack

Casting Ventilation 1 – V1

Casting Ventilation 2 – V2

Roaster Baghouse

Anode Casting

Zinc Plant 1 Baghouse – ZP1

Zinc Plant 3 Baghouse – ZP3

MZR Furnace Stack

MZR Dross Stack

Appendix B: Weather Observations

Hobart – November and December 2023

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours	km/h		local	°C	%	8th	km/h		hPa	°C	%	8th	km/h		hPa
14	Tu	11.5	17.6	0.2			NNW	48	0:43	15.8	38		SSW	17	1014	15.7	51		ESE	22	1013
15	We	10.3	20.3	0			NNW	48	22:39	12	55		NE	9	1014	16.6	51		SE	28	1009
16	Th	9.8	15.9	0						12.4	46		SSW	19	1010	13.8	43		WSW	28	1011
17	Fr	6.8	22.8	0.4			NW	46	12:17	14	54		NNW	24	1016	20.6	39		NW	24	1014
Statistics for November 2023																					
	Mean	10.5	19							14.5	64			14	1019	17.1	56			22	1017
	Lowest	5.2	13.3	0						11	38		#	4	1005	11.9	29		S	6	1009
	Highest	14.8	27.2	13.8			WSW	72		19.7	91		SSE	28	1031	23	91		SE	33	1029
	Total			27.4																	

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours	km/h		local	°C	%	8th	km/h		hPa	°C	%	8th	km/h		hPa
5	Tu	13	22.3	0			WNW	74	18:40	18	67		ESE	13	1010	21	60		ESE	19	1006
Statistics for the first 8 days of December 2023																					
	Mean	11.9	22							16.5	61			12	1014	20.3	50			16	1012
	Lowest	11	19.1	0						14.9	41		W	4	1010	17.7	29		S	9	1006
	Highest	13.1	24.9	0.8			WNW	74		18	75		NNW	20	1019	22.9	62		SE	26	1018
	Total			1.4																	

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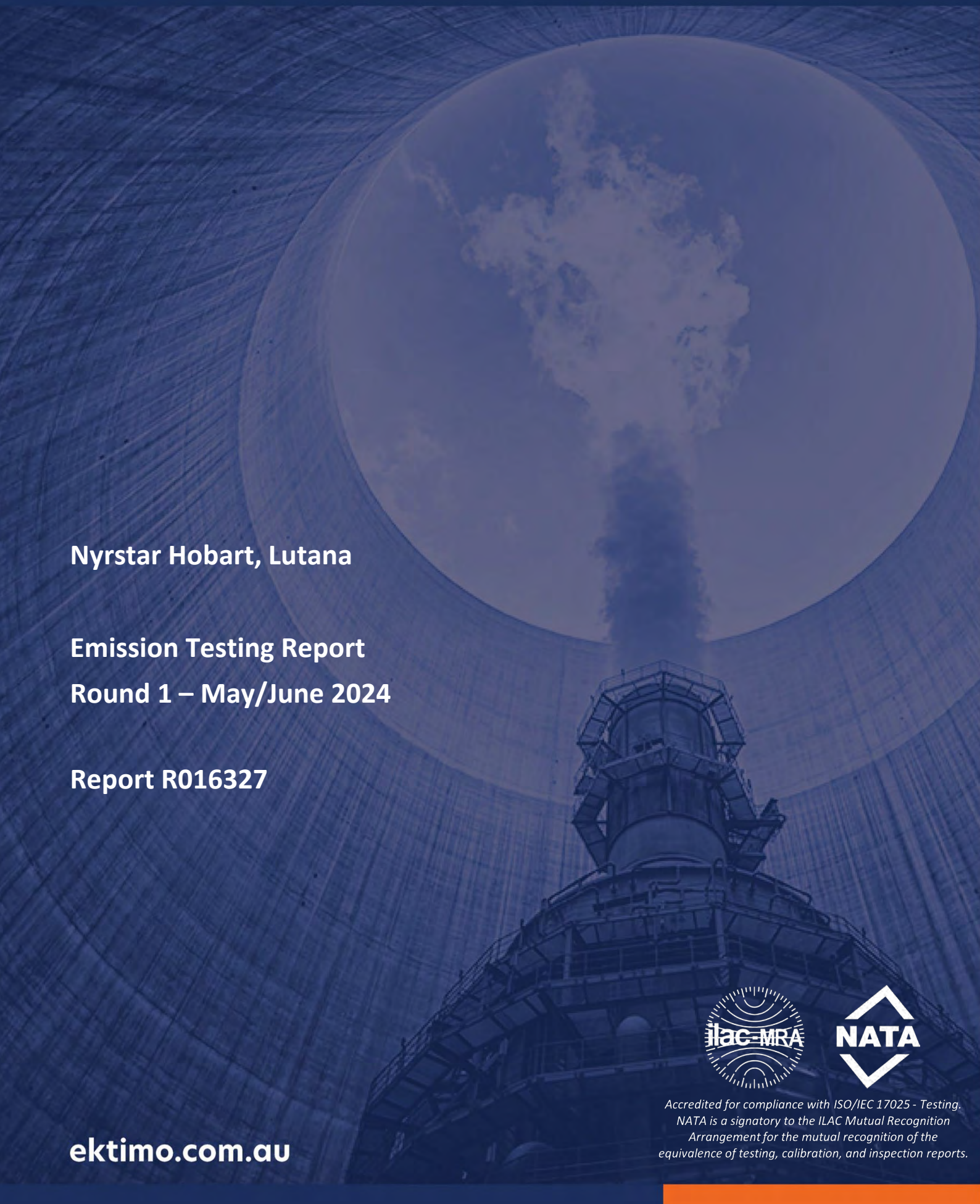

Nyrstar Hobart, Lutana

Emission Testing Report
Round 1 – May/June 2024

Report R016327

Ektimo

Document Information

Client Name:	Nyrstar Hobart
Report Number:	R016327
Date of Issue:	26 July 2024
Attention:	Kylie Veale
Address:	Risdon Road Lutana TAS 7009
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Glenn Trenear
Senior Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to Test Methods section for full details of testing covered by NATA accreditation.

Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged by Nyrstar Hobart to perform emission testing at their Lutana plant. Testing was carried out in accordance with Environmental Licence 7043/5.

1.2 Project Objective & Overview

The objective of the project was to conduct a monitoring programme to quantify emissions from **14** discharge points to determine compliance with Nyrstar Hobart 's Environmental Licence and meet NPI reporting requirements.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Foreshore A	4 June 2024	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Sulfur dioxide, sulfur trioxide Total fluoride Nitrogen oxides, nitrous oxide, carbon monoxide, carbon dioxide, oxygen Total & speciated volatile organic compounds (VOCs)
Foreshore B		
Parageothite Dryer	28 May 2024	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Total fluoride Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen, sulfur dioxide Total & speciated volatile organic compounds (VOCs)
Cadmium Smelter Plant Scrubber Stack	3 June 2024	
Copper Sulphate Stack Crystalliser Plant Vent Stack	28 May 2024	
Casting Ventilation 1 – V1	27 May 2024	
Casting Ventilation 2 – V2	27 May 2024	
Roaster Baghouse	29 May 2024	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Total fluoride Sulfur dioxide, sulfur trioxide Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen Total & speciated volatile organic compounds (VOCs)
Zinc Oxide Debagging Station	31 May 2024	Total particulate matter Fine particulate matter (PM_{10} & $PM_{2.5}$ via particle sizing analysis) Polycyclic aromatic hydrocarbons (PAHs) Metals Total fluoride Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen, sulfur dioxide Total & speciated volatile organic compounds (VOCs)
Anode Casting	29 May 2024	
Zinc Plant 1 Baghouse – ZP1	30 May 2024	
Zinc Plant 3 Baghouse – ZP3	30 May 2024	
MZR Furnace Baghouse	30 May 2024	
MZR Dross Stack	3 June 2024	

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP.

Plant operating conditions have been noted in this report. There was insufficient particulate matter collected on the total particulate matter tests that recorded below detection results, subsequently not enough dust was collected to perform accurate particle size analysis. In these instances, the PM_{10} and $PM_{2.5}$ are assumed to be less than the reported detection limit result for the total particulate matter test.

1.3 Licence Comparison

The following licence comparison table shows any analytes highlighted in orange are outside the licence limit set by the Tasmanian Environmental Protection Notice (EPN) 7043/5.

Emission Point / Monitoring Location	Parameter	Units	Licence limit	Detected values
Foreshore A (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	0.74
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.015
	Particulates	mg/m^3	100	<2
	Sulphur dioxide	g/m^3	7.2	0.057
Foreshore B (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	0.36
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.01
	Particulates	mg/m^3	100	<1
	Sulphur dioxide	g/m^3	7.2	0.055
Anode Casting Plant Exhaust	Particulates	mg/m^3	100	7.1
V1 Furnace Stack				<2
V2 Furnace Stack				<3
Zinc Dust Plant Baghouse 1 Stack				5.6
Zinc Dust Plant Bagouse 3 Stack				8.7
Cadmium Smelter Plant Scrubber Stack				5.7
Copper Sulphate Crystalliser Plant				5.8
Roaster Baghouse				<2
Paragoethite Dryer Baghouse				<3
Anode Casting Plant Exhaust	Metals - Pb, As, Sb, Cd, Hg [(1)]	mg/m^3	5	≤0.25
V1 Furnace Stack				≤0.02
V2 Furnace Stack				≤0.028
Zinc Dust Plant Baghouse 1 Stack				≤0.24
Zinc Dust Plant Baghouse 3 Stack				≤0.15
Cadmium Smelter Plant Scrubber Stack				≤1.5
Copper Sulphate Crystalliser Plant				≤0.1
Roaster Baghouse				≤0.28
Paragoethite Dryer Baghouse				≤0.29
Anode Casting Plant Exhaust	Metals - Hg	mg/m^3	1	0.0031
V1 Furnace Stack				<0.0009
V2 Furnace Stack				<0.0008
Zinc Dust Plant Baghouse 1 Stack				<0.001
Zinc Dust Plant Baghouse 3 Stack				<0.0009
Cadmium Smelter Plant Scrubber Stack				<0.0009
Copper Sulphate Crystalliser Plant				0.014
Roaster Baghouse				0.0014
Paragoethite Dryer Baghouse				<0.001
Anode Casting Plant Exhaust	Metals - Cd	mg/m^3	1	0.082
V1 Furnace Stack				0.00089
V2 Furnace Stack				0.00058
Zinc Dust Plant Baghouse 1 Stack				0.022
Zinc Dust Plant Baghouse 3 Stack				0.0056
Cadmium Smelter Plant Scrubber Stack				1.2
Copper Sulphate Crystalliser Plant				0.047
Roaster Baghouse				0.026
Paragoethite Dryer Baghouse				0.082

[1] **Total concentration of metals combined.**

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 Foreshore A

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.5 (wet)	28.7 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1146 & 1337	
Temperature, °C	19	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1500	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/h	110000	

Gas Analyser Results	Average	
Sampling time	0827 - 0926	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	15	21
Carbon monoxide	9.3	13
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	11.8	
Sampling time	0827 - 0926	
	Concentration mg/m³	Mass Rate g/min
Nitrous oxide		
Nitrous oxide	<20	<20

Isokinetic Results		Results	
Sampling time		1150-1332	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<2	<2
PM10	(PSA)	<2	<2
PM2.5	(PSA)	<2	<2
Sulfur dioxide		57	78
Sulfur trioxide		0.74	1
Isokinetic Sampling Parameters			
Sampling time, min		100	
Isokinetic rate, %		101	
Gravimetric analysis date (total particulate)		17-06-2024	

Ektimo

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.4

VOC's C5-C20	Results	
Sampling time	1230-1250	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.4
Acetone	<0.3	<0.4
Toluene	<0.3	<0.4

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0801 & 0955	
Temperature, °C	18	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1500	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1300	
Mass flow rate (wet basis), kg/h	100000	

Isokinetic Results	Results	
Sampling time	0810-0952	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.033	0.045
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	100	

Ektimo

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0955 & 1146	
Temperature, °C	18	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/min	1400	
Volumetric flow rate (wet STP), m³/min	1300	
Volumetric flow rate (dry STP), m³/min	1300	
Mass flow rate (wet basis), kg/h	100000	

Isokinetic Results	Results	
Sampling time	1000-1142	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.004**	**<0.005**
Arsenic	**<0.002**	**<0.003**
Beryllium	<0.0005	<0.0006
Cadmium	**0.041**	**0.053**
Chromium	0.0037	0.0049
Cobalt	<0.0007	<0.0009
Copper	0.0013	0.0017
Lead	**0.061**	**0.08**
Manganese	0.016	0.021
Mercury	**<0.0005**	**<0.0006**
Nickel	0.0072	0.0095
Phosphorus	<0.02	<0.02
Selenium	<0.005	<0.007
Tin	0.0042	0.0056
Vanadium	<0.0009	<0.001
Zinc	0.73	0.95
Total of Sb, As, Cd, Pb, Hg	**≤0.11**	**≤0.14**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	98	

Ektimo

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.4 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1337 & 1536	
Temperature, °C	19	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	1500	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/h	110000	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1345 - 1527	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	1300	1800000
2-Methylnaphthalene	100	140000
Acenaphthylene	<10	<20000
Acenaphthene	66	92000
Fluorene	230	330000
Phenanthrene	96	130000
Anthracene	26	36000
Fluoranthene	54	75000
Pyrene	41	57000
Benz(a)anthracene	<10	<20000
Chrysene	25	35000
Benzo(b)fluoranthene	<10	<20000
Benzo(k)fluoranthene	<10	<20000
Benzo(e)pyrene	<10	<20000
Benzo(a)pyrene	<10	<20000
Perylene	<10	<20000
Indeno(1,2,3-cd)pyrene	<10	<20000
Dibenz(ah)anthracene	<10	<20000
Benzo(ghi)perylene	<10	<20000
Total 16 PAHs	1800	2500000
Total 19 PAHs	1900	2700000
BaP-TEQ		
Lower Bound	0.25	350
Middle Bound	11	15000
Upper Bound	22	30000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	100
Isokinetic rate, %	99%

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2.2 Foreshore B

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.5 (wet)	28.7 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1335 & 1530	
Temperature, °C	19	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	1500	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/h	110000	

Gas Analyser Results	Average
Sampling time	0943 - 1042
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	10 / 14
Carbon monoxide	<6 / <9
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	11.9
Sampling time	0943 - 1042
	Concentration mg/m³ / Mass Rate g/min
Nitrous oxide	
Nitrous oxide	<20 / <20

Isokinetic Results	Results
Sampling time	1340-1522
	Concentration mg/m³ / Mass Rate g/min
Total particulate matter	<1 / <2
PM10 (PSA)	<1 / <2
PM2.5 (PSA)	<1 / <2
Sulfur dioxide	55 / 76
Sulfur trioxide	0.36 / 0.5
Isokinetic Sampling Parameters	
Sampling time, min	100
Isokinetic rate, %	102
Gravimetric analysis date (total particulate)	17-06-2024

Ektimo

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.4

VOC's C5-C20	Results	
Sampling time	1400-1420	
	Concentration mg/m³	Mass Rate g/min
Detection limit[(1)]	<0.3	<0.4
Acetone	<0.3	<0.4
Toluene	<0.3	<0.4

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0957 & 1144	
Temperature, °C	18	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	1500	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/h	110000	

Isokinetic Results	Results	
Sampling time	1000-1142	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.016	0.023
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	98	

Ektimo

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.5 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0803 & 0957	
Temperature, °C	18	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	1500	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/h	110000	

Isokinetic Results	Results	
Sampling time	0810-0952	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.003**	**<0.005**
Arsenic	**<0.003**	**<0.004**
Beryllium	<0.0004	<0.0006
Cadmium	**0.077**	**0.11**
Chromium	0.0021	0.0029
Cobalt	0.0011	0.0015
Copper	0.0095	0.013
Lead	**0.074**	**0.1**
Manganese	0.027	0.038
Mercury	**0.00033**	**0.00047**
Nickel	0.011	0.016
Phosphorus	0.017	0.024
Selenium	<0.003	<0.005
Tin	0.0014	0.002
Vanadium	<0.0008	<0.001
Zinc	1.2	1.7
Total of Sb, As, Cd, Pb, Hg	**≤0.16**	**≤0.22**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	99	

Ektimo

Date	4/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 0 m3/hr (not running) & Unit 6 producing 117,000 m3/hr of gas through the acid stream.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.4 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.28 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1144 & 1335	
Temperature, °C	19	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	1500	
Volumetric flow rate (wet STP), m³/min	1400	
Volumetric flow rate (dry STP), m³/min	1400	
Mass flow rate (wet basis), kg/h	110000	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1150 - 1332	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	770	1100000
2-Methylnaphthalene	83	110000
Acenaphthylene	<10	<20000
Acenaphthene	<10	<20000
Fluorene	<10	<20000
Phenanthrene	42	58000
Anthracene	<10	<20000
Fluoranthene	50	69000
Pyrene	57	78000
Benz(a)anthracene	17	23000
Chrysene	<10	<20000
Benzo(b)fluoranthene	17	23000
Benzo(k)fluoranthene	<10	<20000
Benzo(e)pyrene	18	25000
Benzo(a)pyrene	16	22000
Perylene	<10	<20000
Indeno(1,2,3-cd)pyrene	<10	<20000
Dibenz(ah)anthracene	<10	<20000
Benzo(ghi)perylene	30	42000
Total 16 PAHs	1000	1400000
Total 19 PAHs	1100	1500000
BaP-TEQ		
Lower Bound	19	27000
Middle Bound	23	32000
Upper Bound	27	37000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	100
Isokinetic rate, %	102%

2.3 Parageothite Dryer

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	5.9 m3/hr of dirt and 1.65 m3/hr of bypass flow into the drum.		*240524*

Stack Parameters		
Moisture content, %v/v	30	
Gas molecular weight, g/g mole	25.8 (wet)	29.3 (dry)
Gas density at STP, kg/m³	1.15 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.90	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1507 & 1620	
Temperature, °C	81	
Velocity at sampling plane, m/s	8.3	
Volumetric flow rate, actual, m³/min	350	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	190	
Mass flow rate (wet basis), kg/h	19000	

Gas Analyser Results	Average
Sampling time	1419 - 1518
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	45 / 8.6
Sulfur dioxide	<6 / <1
Carbon monoxide	<6 / <1
	Concentration % v/v
Carbon dioxide	3.3
Oxygen	15.5

Isokinetic Results		Results
Sampling time		1510-1612
		Concentration mg/m³ / Mass Rate g/min
Total particulate matter		<3 / <0.5
PM10	(PSA)	<3 / <0.5
PM2.5	(PSA)	<3 / <0.5
Isokinetic Sampling Parameters		
Sampling time, min		60
Isokinetic rate, %		106
Gravimetric analysis date (total particulate)		17-06-2024

Ektimo

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	5.9 m3/hr of dirt and 1.65 m3/hr of bypass flow into the drum.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.05

VOC's C5-C20	Results	
Sampling time	1520-1540	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.05
Acetone	<0.3	<0.05
Toluene	<0.3	<0.05

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	5.9 m3/hr of dirt and 1.65 m3/hr of bypass flow into the drum.		*240524*

Stack Parameters		
Moisture content, %v/v	25	
Gas molecular weight, g/g mole	26.4 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.18 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.91	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1335 & 1507	
Temperature, °C	81	
Velocity at sampling plane, m/s	8.1	
Volumetric flow rate, actual, m³/min	340	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	200	
Mass flow rate (wet basis), kg/h	19000	

Isokinetic Results	Results	
Sampling time	1400-1502	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.37	0.074
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	107	

Ektimo

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	5.9 m3/hr of dirt and 1.65 m3/hr of bypass flow into the drum.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	22	
Gas molecular weight, g/g mole	26.7 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.19 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.93	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1335 & 1507	
Temperature, °C	81	
Velocity at sampling plane, m/s	8.1	
Volumetric flow rate, actual, m³/min	340	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	210	
Mass flow rate (wet basis), kg/h	19000	

Isokinetic Results	Results	
Sampling time	1400-1502	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.001**
Arsenic	**0.007**	**0.0015**
Beryllium	<0.0009	<0.0002
Cadmium	**0.082**	**0.017**
Chromium	0.0091	0.0019
Cobalt	0.0045	0.00094
Copper	0.02	0.0042
Lead	**0.19**	**0.04**
Manganese	0.035	0.0072
Mercury	**<0.001**	**<0.0003**
Nickel	0.0071	0.0015
Phosphorus	0.12	0.024
Selenium	<0.007	<0.001
Tin	<0.003	<0.0006
Vanadium	<0.002	<0.0004
Zinc	0.44	0.092
Total of Sb, As, Cd, Pb, Hg	**≤0.29**	**≤0.06**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	109	

Ektimo

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	5.9 m3/hr of dirt and 1.65 m3/hr of bypass flow into the drum.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	26	
Gas molecular weight, g/g mole	26.3 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.17 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.91	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1507 & 1620	
Temperature, °C	81	
Velocity at sampling plane, m/s	8.2	
Volumetric flow rate, actual, m³/min	350	
Volumetric flow rate (wet STP), m³/min	270	
Volumetric flow rate (dry STP), m³/min	200	
Mass flow rate (wet basis), kg/h	19000	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1510 - 1612	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	90000	18000000
2-Methylnaphthalene	440	88000
Acenaphthylene	<20	<5000
Acenaphthene	82	16000
Fluorene	290	57000
Phenanthrene	990	200000
Anthracene	57	11000
Fluoranthene	1800	360000
Pyrene	220	43000
Benz(a)anthracene	49	9800
Chrysene	360	72000
Benzo(b)fluoranthene	<20	<5000
Benzo(k)fluoranthene	<20	<5000
Benzo(e)pyrene	<20	<5000
Benzo(a)pyrene	<20	<5000
Perylene	<20	<5000
Indeno(1,2,3-cd)pyrene	<20	<5000
Dibenz(ah)anthracene	<20	<5000
Benzo(ghi)perylene	<20	<5000
Total 16 PAHs	93000	19000000
Total 19 PAHs	94000	19000000
BaP-TEQ		
Lower Bound	8.5	1700
Middle Bound	29	5800
Upper Bound	49	9800

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	102%

2.4 Cadmium Smelter Plant Scrubber Stack

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation. Metal addition and drossing occurred during this test.		*240524*

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1217 & 1325	
Temperature, °C	19	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/h	11000	

Gas Analyser Results	Average	
Sampling time	1225 - 1324	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.6
Sulfur dioxide	<6	<0.8
Carbon monoxide	<6	<0.9
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.8	

Isokinetic Results	Results	
Sampling time	1220-1322	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	5.7	0.83
PM10 (PSA)	2.4	0.35
PM2.5 (PSA)	0.62	0.09
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	
Gravimetric analysis date (total particulate)	19-06-2024	

Ektimo

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation. Metal addition and drossing occurred during this test.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.04

VOC's C5-C20	Results	
Sampling time	1240-1300	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.04
Toluene	<0.3	<0.04

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation. Metal addition and drossing occurred during this test.		*240524*

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1325 & 1436	
Temperature, °C	20	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/h	12000	

Isokinetic Results	Results	
Sampling time	1327-1429	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.073	0.011
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	97	

Ektimo

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation. Metal addition and drossing occurred during this test.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1217 & 1325	
Temperature, °C	19	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/h	11000	

Isokinetic Results	Results	
Sampling time	1220-1322	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.008**	**<0.001**
Arsenic	**0.0065**	**0.00096**
Beryllium	<0.0009	<0.0001
Cadmium	**1.2**	**0.18**
Chromium	0.013	0.0019
Cobalt	0.0016	0.00023
Copper	0.022	0.0032
Lead	**0.29**	**0.042**
Manganese	0.074	0.011
Mercury	**<0.0009**	**<0.0001**
Nickel	0.022	0.0032
Phosphorus	0.087	0.013
Selenium	<0.009	<0.001
Tin	0.015	0.0022
Vanadium	<0.002	<0.0003
Zinc	4.6	0.67
Total of Sb, As, Cd, Pb, Hg	**≤1.5**	**≤0.22**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	

Ektimo

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation. Metal addition and drossing occurred during this test.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1325 & 1436	
Temperature, °C	20	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	160	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	150	
Mass flow rate (wet basis), kg/h	12000	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1327 - 1429	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	52000	7800000
2-Methylnaphthalene	380	56000
Acenaphthylene	180	27000
Acenaphthene	160	23000
Fluorene	550	82000
Phenanthrene	200	29000
Anthracene	6100	910000
Fluoranthene	350	52000
Pyrene	130	19000
Benz(a)anthracene	<30	<4000
Chrysene	38	5600
Benzo(b)fluoranthene	<30	<4000
Benzo(k)fluoranthene	<30	<4000
Benzo(e)pyrene	<30	<4000
Benzo(a)pyrene	<30	<4000
Perylene	<30	<4000
Indeno(1,2,3-cd)pyrene	<30	<4000
Dibenz(ah)anthracene	<30	<4000
Benzo(ghi)perylene	<30	<4000
Total 16 PAHs	60000	8900000
Total 19 PAHs	60000	9000000
BaP-TEQ		
Lower Bound	0.38	56
Middle Bound	24	3600
Upper Bound	47	7100

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	98%

Ektimo

2.5 Copper Sulphate Crystalliser Plant Vent Stack

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 16.1 tonnes/day, Dryer Outlet Temperature - 41.5 deg C, Feed rate into Dryer - 35%		*240524*

Stack Parameters		
Moisture content, %v/v	9.8	
Gas molecular weight, g/g mole	27.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1020 & 1135	
Temperature, °C	48	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/h	11000	

Gas Analyser Results	Average	
Sampling time	0918 - 1017	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.6
Sulfur dioxide	<6	<0.8
Carbon monoxide	<6	<0.9
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.7	

Isokinetic Results	Results	
Sampling time	1030-1132	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	5.8	0.8
PM10 (PSA)	2.4	0.33
PM2.5 (PSA)	0.55	0.077
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	
Gravimetric analysis date (total particulate)	18-06-2024	

Ektimo

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 16.1 tonnes/day, Dryer Outlet Temperature - 41.5 deg C, Feed rate into Dryer - 35%		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.03

VOC's C5-C20	Results	
Sampling time	0940-1001	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.03
Toluene	<0.3	<0.03

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 16.1 tonnes/day, Dryer Outlet Temperature - 41.5 deg C, Feed rate into Dryer - 35%		*240524*

Stack Parameters		
Moisture content, %v/v	9.4	
Gas molecular weight, g/g mole	27.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0900 & 1020	
Temperature, °C	47	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/h	11000	

Isokinetic Results	Results	
Sampling time	0915-1017	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.33	0.045
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	103	

Ektimo

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 16.1 tonnes/day, Dryer Outlet Temperature - 41.5 deg C, Feed rate into Dryer - 35%		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	9.8	
Gas molecular weight, g/g mole	27.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.24 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.06	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1020 & 1135	
Temperature, °C	48	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/h	11000	

Isokinetic Results	Results	
Sampling time	1030-1132	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0008**
Arsenic	**<0.003**	**<0.0004**
Beryllium	<0.0008	<0.0001
Cadmium	**0.047**	**0.0065**
Chromium	0.0081	0.0011
Cobalt	0.0029	0.0004
Copper	0.11	0.016
Lead	**0.034**	**0.0047**
Manganese	0.072	0.01
Mercury	**0.014**	**0.0019**
Nickel	0.027	0.0038
Phosphorus	0.13	0.017
Selenium	0.0064	0.00089
Tin	0.0035	0.00048
Vanadium	<0.002	<0.0002
Zinc	1.2	0.16
Total of Sb, As, Cd, Pb, Hg	**≤0.1**	**≤0.014**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	

Ektimo

Date	28/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Production rate - 16.1 tonnes/day, Dryer Outlet Temperature - 41.5 deg C, Feed rate into Dryer - 35%		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	9.4	
Gas molecular weight, g/g mole	27.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0900 & 1020	
Temperature, °C	47	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/h	12000	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 0915 - 1017	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	110000	16000000
2-Methylnaphthalene	1700	240000
Acenaphthylene	<30	<4000
Acenaphthene	540	75000
Fluorene	1000	140000
Phenanthrene	1700	240000
Anthracene	650	91000
Fluoranthene	930	130000
Pyrene	710	99000
Benz(a)anthracene	87	12000
Chrysene	200	29000
Benzo(b)fluoranthene	130	19000
Benzo(k)fluoranthene	50	7100
Benzo(e)pyrene	77	11000
Benzo(a)pyrene	38	5300
Perylene	<30	<4000
Indeno(1,2,3-cd)pyrene	<30	<4000
Dibenz(ah)anthracene	<30	<4000
Benzo(ghi)perylene	120	17000
Total 16 PAHs	120000	17000000
Total 19 PAHs	120000	17000000
BaP-TEQ		
Lower Bound	67	9400
Middle Bound	75	10000
Upper Bound	83	12000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	98%

2.6 Casting Ventilation 1 – V1

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Stack Parameters		
Moisture content, %v/v	0.48	
Gas molecular weight, g/g mole	29.0 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1453 & 1604	
Temperature, °C	26	
Velocity at sampling plane, m/s	26	
Volumetric flow rate, actual, m³/min	500	
Volumetric flow rate (wet STP), m³/min	460	
Volumetric flow rate (dry STP), m³/min	450	
Mass flow rate (wet basis), kg/h	35000	

Gas Analyser Results	Average	
Sampling time	1301 - 1400	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<2
Sulfur dioxide	<6	<3
Carbon monoxide	<6	<3
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	1500-1600	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.9
PM10 (PSA)	<2	<0.9
PM2.5 (PSA)	<2	<0.9
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	17-06-2024	

Ektimo

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.1

VOC's C5-C20	Results	
Sampling time	1510-1530	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.1
Toluene	<0.3	<0.1

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Stack Parameters		
Moisture content, %v/v	0.49	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1604 & 1716	
Temperature, °C	26	
Velocity at sampling plane, m/s	26	
Volumetric flow rate, actual, m³/min	500	
Volumetric flow rate (wet STP), m³/min	450	
Volumetric flow rate (dry STP), m³/min	450	
Mass flow rate (wet basis), kg/h	35000	

Isokinetic Results	Results	
Sampling time	1610-1710	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.049	0.022
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	102	

Ektimo

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	0.87	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.17	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1218 & 1338	
Temperature, °C	26	
Velocity at sampling plane, m/s	27	
Volumetric flow rate, actual, m³/min	510	
Volumetric flow rate (wet STP), m³/min	470	
Volumetric flow rate (dry STP), m³/min	460	
Mass flow rate (wet basis), kg/h	36000	

Isokinetic Results	Results	
Sampling time	1235-1335	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.005**	**<0.002**
Arsenic	**<0.002**	**<0.001**
Beryllium	<0.0007	<0.0003
Cadmium	**0.00089**	**0.00041**
Chromium	0.0043	0.002
Cobalt	<0.0009	<0.0004
Copper	0.13	0.06
Lead	**0.011**	**0.005**
Manganese	0.017	0.0078
Mercury	**<0.0009**	**<0.0004**
Nickel	0.0059	0.0027
Phosphorus	0.11	0.049
Selenium	<0.006	<0.003
Tin	<0.003	<0.001
Vanadium	<0.001	<0.0007
Zinc	0.75	0.35
Total of Sb, As, Cd, Pb, Hg	**≤0.02**	**≤0.0094**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	

Ektimo

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	0.64	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.17	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1338 & 1453	
Temperature, °C	26	
Velocity at sampling plane, m/s	27	
Volumetric flow rate, actual, m³/min	510	
Volumetric flow rate (wet STP), m³/min	460	
Volumetric flow rate (dry STP), m³/min	460	
Mass flow rate (wet basis), kg/h	36000	

Polycyclic Aromatic Hydrocarbons	Results	
(PAHs) Sampling time	1350 - 1450	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	130000	60000000
2-Methylnaphthalene	550	250000
Acenaphthylene	40	18000
Acenaphthene	330	150000
Fluorene	690	320000
Phenanthrene	630	290000
Anthracene	54	25000
Fluoranthene	350	160000
Pyrene	190	87000
Benz(a)anthracene	36	17000
Chrysene	100	46000
Benzo(b)fluoranthene	<20	<9000
Benzo(k)fluoranthene	<20	<9000
Benzo(e)pyrene	<20	<9000
Benzo(a)pyrene	<20	<9000
Perylene	<20	<9000
Indeno(1,2,3-cd)pyrene	<20	<9000
Dibenz(ah)anthracene	<20	<9000
Benzo(ghi)perylene	<20	<9000
Total 16 PAHs	130000	61000000
Total 19 PAHs	130000	61000000
BaP-TEQ		
Lower Bound	4.6	2100
Middle Bound	22	9900
Upper Bound	39	18000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	99%

2.7 Casting Ventilation 2 – V2

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		240524

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1220 & 1340	
Temperature, °C	41	
Velocity at sampling plane, m/s	27	
Volumetric flow rate, actual, m³/min	450	
Volumetric flow rate (wet STP), m³/min	390	
Volumetric flow rate (dry STP), m³/min	380	
Mass flow rate (wet basis), kg/h	30000	

Gas Analyser Results	Average	
Sampling time	1427 - 1526	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<2
Sulfur dioxide	19	7.3
Carbon monoxide	<6	<2
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results		Results	
Sampling time		1235-1335	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<3	<1
PM10	(PSA)	<3	<1
PM2.5	(PSA)	<3	<1
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		99	
Gravimetric analysis date (total particulate)		17-06-2024	

Ektimo

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.2	<0.07

VOC's C5-C20	Results	
Sampling time	1310-1340	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.2	<0.07
Acetone	<0.2	<0.07
Toluene	<0.2	<0.07

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1340 & 1455	
Temperature, °C	42	
Velocity at sampling plane, m/s	26	
Volumetric flow rate, actual, m³/min	430	
Volumetric flow rate (wet STP), m³/min	370	
Volumetric flow rate (dry STP), m³/min	370	
Mass flow rate (wet basis), kg/h	29000	

Isokinetic Results	Results	
Sampling time	1350-1450	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.053	0.019
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	

Ektimo

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.3	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1455 & 1655	
Temperature, °C	42	
Velocity at sampling plane, m/s	27	
Volumetric flow rate, actual, m³/min	450	
Volumetric flow rate (wet STP), m³/min	390	
Volumetric flow rate (dry STP), m³/min	380	
Mass flow rate (wet basis), kg/h	30000	

Isokinetic Results	Results	
Sampling time	1500-1600	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.002**
Arsenic	**<0.003**	**<0.001**
Beryllium	<0.0007	<0.0003
Cadmium	**0.00058**	**0.00022**
Chromium	0.0041	0.0016
Cobalt	<0.001	<0.0004
Copper	<0.001	<0.0004
Lead	**0.019**	**0.0072**
Manganese	0.039	0.015
Mercury	**<0.0008**	**<0.0003**
Nickel	0.012	0.0047
Phosphorus	0.12	0.046
Selenium	<0.009	<0.003
Tin	<0.003	<0.001
Vanadium	<0.001	<0.0006
Zinc	0.51	0.19
Total of Sb, As, Cd, Pb, Hg	**≤0.028**	**≤0.011**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	

Ektimo

Date	27/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1605 & 1715	
Temperature, °C	41	
Velocity at sampling plane, m/s	27	
Volumetric flow rate, actual, m³/min	440	
Volumetric flow rate (wet STP), m³/min	390	
Volumetric flow rate (dry STP), m³/min	380	
Mass flow rate (wet basis), kg/h	30000	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1610 - 1710	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	100000	38000000
2-Methylnaphthalene	1400	520000
Acenaphthylene	1300	490000
Acenaphthene	1100	410000
Fluorene	1000	390000
Phenanthrene	730	280000
Anthracene	160	61000
Fluoranthene	420	160000
Pyrene	290	110000
Benz(a)anthracene	44	17000
Chrysene	120	46000
Benzo(b)fluoranthene	<30	<10000
Benzo(k)fluoranthene	<30	<10000
Benzo(e)pyrene	<30	<10000
Benzo(a)pyrene	<30	<10000
Perylene	<30	<10000
Indeno(1,2,3-cd)pyrene	<30	<10000
Dibenz(ah)anthracene	<30	<10000
Benzo(ghi)perylene	<30	<10000
Total 16 PAHs	110000	40000000
Total 19 PAHs	110000	41000000
BaP-TEQ		
Lower Bound	5.6	2100
Middle Bound	33	13000
Upper Bound	61	23000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	100%

2.8 Roaster Baghouse

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 45 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*240524*

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1410 & 1550	
Temperature, °C	34	
Velocity at sampling plane, m/s	4.2	
Volumetric flow rate, actual, m³/min	30	
Volumetric flow rate (wet STP), m³/min	26	
Volumetric flow rate (dry STP), m³/min	26	
Mass flow rate (wet basis), kg/h	2000	

Gas Analyser Results	Average	
Sampling time	1306 - 1405	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.1
Carbon monoxide	<6	<0.2
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results		Results	
Sampling time		1420-1526	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		<2	<0.05
PM10	(PSA)	<2	<0.05
PM2.5	(PSA)	<2	<0.05
Sulfur dioxide		150	4
Sulfur trioxide		1.2	0.03
Isokinetic Sampling Parameters			
Sampling time, min		64	
Isokinetic rate, %		100	
Gravimetric analysis date (total particulate)		18-06-2024	

Ektimo

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 45 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.007

VOC's C5-C20	Results	
Sampling time	1440-1460	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.007
Toluene	<0.3	<0.007

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane,1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane,2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane,Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene,beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene,D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Please note, acetone results not reported due to suspected contamination.

Ektimo

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 45 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*240524*

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1250 & 1410	
Temperature, °C	33	
Velocity at sampling plane, m/s	4	
Volumetric flow rate, actual, m³/min	28	
Volumetric flow rate (wet STP), m³/min	25	
Volumetric flow rate (dry STP), m³/min	24	
Mass flow rate (wet basis), kg/h	1900	

Isokinetic Results	Results	
Sampling time	1300-1406	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.0007
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	100	

Ektimo

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 45 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*240524*

Comments
The velocity difference for isokinetic testing is outside the criteria (±10%)
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1250 & 1410	
Temperature, °C	33	
Velocity at sampling plane, m/s	4.1	
Volumetric flow rate, actual, m³/min	28	
Volumetric flow rate (wet STP), m³/min	25	
Volumetric flow rate (dry STP), m³/min	25	
Mass flow rate (wet basis), kg/h	2000	

Isokinetic Results	Results	
Sampling time	1300-1406	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0001**
Arsenic	**0.0035**	**0.000088**
Beryllium	<0.0008	<0.00002
Cadmium	**0.026**	**0.00065**
Chromium	0.0043	0.00011
Cobalt	<0.001	<0.00004
Copper	0.016	0.00039
Lead	**0.25**	**0.0062**
Manganese	0.019	0.00049
Mercury	**0.0014**	**0.000035**
Nickel	0.0048	0.00012
Phosphorus	0.043	0.0011
Selenium	<0.006	<0.0002
Tin	<0.003	<0.00009
Vanadium	<0.002	<0.00004
Zinc	1.5	0.037
Total of Sb, As, Cd, Pb, Hg	**≤0.28**	**≤0.0071**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	98	
Velocity difference, %	10	

Ektimo

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Roaster 6 - 45 t/hr, Roaster 5 - 20 t/hr (Conveyor all in operation), fumes were on.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1410 & 1550	
Temperature, °C	34	
Velocity at sampling plane, m/s	4.2	
Volumetric flow rate, actual, m³/min	30	
Volumetric flow rate (wet STP), m³/min	26	
Volumetric flow rate (dry STP), m³/min	26	
Mass flow rate (wet basis), kg/h	2000	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1420 - 1526	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	97000	2500000
2-Methylnaphthalene	460	12000
Acenaphthylene	<20	<500
Acenaphthene	<20	<500
Fluorene	<20	<500
Phenanthrene	150	3800
Anthracene	30	780
Fluoranthene	<20	<500
Pyrene	<20	<500
Benz(a)anthracene	<20	<500
Chrysene	<20	<500
Benzo(b)fluoranthene	<20	<500
Benzo(k)fluoranthene	<20	<500
Benzo(e)pyrene	<20	<500
Benzo(a)pyrene	34	890
Perylene	<20	<500
Indeno(1,2,3-cd)pyrene	<20	<500
Dibenz(ah)anthracene	<20	<500
Benzo(ghi)perylene	<20	<500
Total 16 PAHs	97000	2500000
Total 19 PAHs	98000	2500000
BaP-TEQ		
Lower Bound	34	890
Middle Bound	42	1100
Upper Bound	50	1300

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	64
Isokinetic rate, %	101%

2.9 Zinc Oxide Debagging Station

Date	31/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*240524*

Comments
Afterflows could not be recorded as this is a batch process.

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0935	
Temperature, °C	24	
Velocity at sampling plane, m/s	4.9	
Volumetric flow rate, actual, m³/min	14	
Volumetric flow rate (wet STP), m³/min	13	
Volumetric flow rate (dry STP), m³/min	13	
Mass flow rate (wet basis), kg/h	1000	

Gas Analyser Results	Average
Sampling time	0821 - 0846
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.05
Sulfur dioxide	<6 / <0.07
Carbon monoxide	<6 / <0.08
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results
Sampling time	0936-1007
	Concentration mg/m³ / Mass Rate g/min
Total particulate matter	<6 / <0.08
PM10 (PSA)	<6 / <0.08
PM2.5 (PSA)	<6 / <0.08
Isokinetic Sampling Parameters	
Sampling time, min	32
Isokinetic rate, %	92
Gravimetric analysis date (total particulate)	19-06-2024

Ektimo

Date	31/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.2	<0.003

VOC's C5-C20	Results	
Sampling time	0820-0844	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.2	<0.003
Acetone	<0.2	<0.003
Toluene	<0.2	<0.003

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	31/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*240524*

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0816	
Temperature, °C	23	
Velocity at sampling plane, m/s	4.7	
Volumetric flow rate, actual, m³/min	14	
Volumetric flow rate (wet STP), m³/min	13	
Volumetric flow rate (dry STP), m³/min	12	
Mass flow rate (wet basis), kg/h	980	

Isokinetic Results	Results	
Sampling time	0817-0847	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.07	<0.0008
Isokinetic Sampling Parameters		
Sampling time, min	36	
Isokinetic rate, %	107	

Ektimo

Date	31/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*240524*

Comments
Afterflows could not be recorded as this is a batch process.
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0816	
Temperature, °C	23	
Velocity at sampling plane, m/s	4.7	
Volumetric flow rate, actual, m³/min	14	
Volumetric flow rate (wet STP), m³/min	13	
Volumetric flow rate (dry STP), m³/min	12	
Mass flow rate (wet basis), kg/h	980	

Isokinetic Results	Results	
Sampling time	0817-0847	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.01**	**<0.0002**
Arsenic	**<0.009**	**<0.0001**
Beryllium	<0.002	<0.00002
Cadmium	**0.024**	**0.00029**
Chromium	0.011	0.00014
Cobalt	<0.003	<0.00003
Copper	0.0096	0.00012
Lead	**0.23**	**0.0029**
Manganese	0.082	0.001
Mercury	**<0.001**	**<0.00002**
Nickel	0.02	0.00025
Phosphorus	0.084	0.001
Selenium	<0.01	<0.0001
Tin	<0.008	<0.0001
Vanadium	<0.003	<0.00004
Zinc	6.5	0.082
Total of Sb, As, Cd, Pb, Hg	**≤0.28**	**≤0.0034**
Isokinetic Sampling Parameters		
Sampling time, min	36	
Isokinetic rate, %	109	

Ektimo

Date	31/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.18	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0935	
Temperature, °C	24	
Velocity at sampling plane, m/s	4.9	
Volumetric flow rate, actual, m³/min	14	
Volumetric flow rate (wet STP), m³/min	13	
Volumetric flow rate (dry STP), m³/min	13	
Mass flow rate (wet basis), kg/h	1000	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 0936 - 1007	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	110000	1400000
2-Methylnaphthalene	630	8300
Acenaphthylene	<50	<700
Acenaphthene	240	3200
Fluorene	910	12000
Phenanthrene	300	4000
Anthracene	63	830
Fluoranthene	250	3300
Pyrene	170	2200
Benz(a)anthracene	<50	<700
Chrysene	91	1200
Benzo(b)fluoranthene	<50	<700
Benzo(k)fluoranthene	<50	<700
Benzo(e)pyrene	<50	<700
Benzo(a)pyrene	<50	<700
Perylene	<50	<700
Indeno(1,2,3-cd)pyrene	<50	<700
Dibenz(ah)anthracene	<50	<700
Benzo(ghi)perylene	<50	<700
Total 16 PAHs	110000	1400000
Total 19 PAHs	110000	1500000
BaP-TEQ		
Lower Bound	0.91	12
Middle Bound	46	610
Upper Bound	92	1200

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	32
Isokinetic rate, %	101%

2.10 Anode Casting

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		240524

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0928 & 1115	
Temperature, °C	23	
Velocity at sampling plane, m/s	5.6	
Volumetric flow rate, actual, m³/min	54	
Volumetric flow rate (wet STP), m³/min	50	
Volumetric flow rate (dry STP), m³/min	49	
Mass flow rate (wet basis), kg/h	3800	

Gas Analyser Results	Average	
Sampling time	0821 - 0920	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Sulfur dioxide	<6	<0.3
Carbon monoxide	<6	<0.3
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	1010-1110	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	7.1	0.35
PM10 (PSA)	3.4	0.17
PM2.5 (PSA)	0.8	0.039
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	17-06-2024	

Ektimo

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.01

VOC's C5-C20	Results	
Sampling time	1035-1055	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.01
Toluene	<0.3	<0.01

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Acetone, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0800 & 0928	
Temperature, °C	22	
Velocity at sampling plane, m/s	5.6	
Volumetric flow rate, actual, m³/min	54	
Volumetric flow rate (wet STP), m³/min	50	
Volumetric flow rate (dry STP), m³/min	49	
Mass flow rate (wet basis), kg/h	3800	

Isokinetic Results	Results	
Sampling time	0820-0920	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.06	0.0029
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	

Ektimo

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0800 & 0928	
Temperature, °C	22	
Velocity at sampling plane, m/s	5.6	
Volumetric flow rate, actual, m³/min	54	
Volumetric flow rate (wet STP), m³/min	50	
Volumetric flow rate (dry STP), m³/min	49	
Mass flow rate (wet basis), kg/h	3800	

Isokinetic Results	Results	
Sampling time	0820-0920	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0003**
Arsenic	**<0.004**	**<0.0002**
Beryllium	<0.0008	<0.00004
Cadmium	**0.082**	**0.004**
Chromium	0.0072	0.00035
Cobalt	0.0044	0.00021
Copper	0.021	0.001
Lead	**0.16**	**0.0077**
Manganese	0.14	0.0071
Mercury	**0.0031**	**0.00015**
Nickel	0.012	0.00059
Phosphorus	0.14	0.0067
Selenium	<0.007	<0.0004
Tin	<0.004	<0.0002
Vanadium	<0.002	<0.0001
Zinc	0.44	0.022
Total of Sb, As, Cd, Pb, Hg	**≤0.25**	**≤0.012**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	102	

Ektimo

Date	29/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1.8	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0928 & 1115	
Temperature, °C	23	
Velocity at sampling plane, m/s	5.6	
Volumetric flow rate, actual, m³/min	54	
Volumetric flow rate (wet STP), m³/min	50	
Volumetric flow rate (dry STP), m³/min	49	
Mass flow rate (wet basis), kg/h	3800	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1010 - 1110	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	57000	2800000
2-Methylnaphthalene	650	32000
Acenaphthylene	<20	<1000
Acenaphthene	<20	<1000
Fluorene	440	21000
Phenanthrene	670	33000
Anthracene	130	6500
Fluoranthene	330	16000
Pyrene	220	11000
Benz(a)anthracene	37	1800
Chrysene	120	5900
Benzo(b)fluoranthene	50	2400
Benzo(k)fluoranthene	<20	<1000
Benzo(e)pyrene	<20	<1000
Benzo(a)pyrene	<20	<1000
Perylene	<20	<1000
Indeno(1,2,3-cd)pyrene	<20	<1000
Dibenz(ah)anthracene	<20	<1000
Benzo(ghi)perylene	<20	<1000
Total 16 PAHs	59000	2900000
Total 19 PAHs	60000	2900000
BaP-TEQ		
Lower Bound	9.9	480
Middle Bound	29	1400
Upper Bound	49	2400

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	101%

2.11 Zinc Plant 1 Baghouse – ZP1

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*240524*

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.99	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0916 & 1025	
Temperature, °C	82	
Velocity at sampling plane, m/s	6.6	
Volumetric flow rate, actual, m³/min	77	
Volumetric flow rate (wet STP), m³/min	59	
Volumetric flow rate (dry STP), m³/min	58	
Mass flow rate (wet basis), kg/h	4600	

Gas Analyser Results	Average	
Sampling time	0811 - 0910	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Sulfur dioxide	<6	<0.3
Carbon monoxide	<6	<0.4
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	0920-1022	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	5.6	0.32
PM10 (PSA)	3.3	0.19
PM2.5 (PSA)	0.99	0.058
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	
Gravimetric analysis date (total particulate)	17-06-2024	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.02

VOC's C5-C20	Results	
Sampling time	0830-0850	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.02
Acetone	<0.3	<0.02
Toluene	<0.3	<0.02

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*240524*

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.99	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0800 & 0916	
Temperature, °C	81	
Velocity at sampling plane, m/s	6.5	
Volumetric flow rate, actual, m³/min	76	
Volumetric flow rate (wet STP), m³/min	59	
Volumetric flow rate (dry STP), m³/min	58	
Mass flow rate (wet basis), kg/h	4500	

Isokinetic Results	Results	
Sampling time	0810-0912	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.05	<0.003
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.99	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0800 & 0916	
Temperature, °C	81	
Velocity at sampling plane, m/s	6.5	
Volumetric flow rate, actual, m³/min	76	
Volumetric flow rate (wet STP), m³/min	59	
Volumetric flow rate (dry STP), m³/min	58	
Mass flow rate (wet basis), kg/h	4500	

Isokinetic Results	Results	
Sampling time	0810-0912	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.007**	**<0.0004**
Arsenic	**<0.004**	**<0.0002**
Beryllium	<0.0009	<0.00005
Cadmium	**0.022**	**0.0013**
Chromium	0.003	0.00018
Cobalt	0.0012	0.000069
Copper	0.049	0.0028
Lead	**0.21**	**0.012**
Manganese	0.032	0.0019
Mercury	**<0.001**	**<0.00006**
Nickel	0.013	0.00075
Phosphorus	0.077	0.0044
Selenium	<0.007	<0.0004
Tin	<0.004	<0.0002
Vanadium	<0.002	<0.0001
Zinc	9	0.52
Total of Sb, As, Cd, Pb, Hg	**≤0.24**	**≤0.014**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.99	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0916 & 1025	
Temperature, °C	82	
Velocity at sampling plane, m/s	6.6	
Volumetric flow rate, actual, m³/min	77	
Volumetric flow rate (wet STP), m³/min	59	
Volumetric flow rate (dry STP), m³/min	58	
Mass flow rate (wet basis), kg/h	4600	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 0920 - 1022 Concentration	Mass Rate
	ng/m³	ng/min
Naphthalene	5300	310000
2-Methylnaphthalene	240	14000
Acenaphthylene	<20	<1000
Acenaphthene	<20	<1000
Fluorene	430	25000
Phenanthrene	120	7100
Anthracene	26	1500
Fluoranthene	57	3300
Pyrene	39	2200
Benz(a)anthracene	<20	<1000
Chrysene	39	2200
Benzo(b)fluoranthene	<20	<1000
Benzo(k)fluoranthene	<20	<1000
Benzo(e)pyrene	<20	<1000
Benzo(a)pyrene	<20	<1000
Perylene	<20	<1000
Indeno(1,2,3-cd)pyrene	<20	<1000
Dibenz(ah)anthracene	<20	<1000
Benzo(ghi)perylene	<20	<1000
Total 16 PAHs	6100	350000
Total 19 PAHs	6300	360000
BaP-TEQ		
Lower Bound	0.39	22
Middle Bound	23	1300
Upper Bound	45	2600

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	60
Isokinetic rate, %	98%

2.12 Zinc Plant 3 Baghouse – ZP3

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*240524*

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.98	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1157 & 1315	
Temperature, °C	82	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	53	
Volumetric flow rate (wet STP), m³/min	41	
Volumetric flow rate (dry STP), m³/min	40	
Mass flow rate (wet basis), kg/h	3100	

Gas Analyser Results	Average	
Sampling time	1055 - 1154	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Sulfur dioxide	<6	<0.2
Carbon monoxide	<6	<0.3
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results		Results	
Sampling time		1205-1311	
		Concentration mg/m³	Mass Rate g/min
Total particulate matter		8.7	0.34
PM10	(PSA)	5.1	0.2
PM2.5	(PSA)	1.3	0.051
Isokinetic Sampling Parameters			
Sampling time, min		64	
Isokinetic rate, %		100	
Gravimetric analysis date (total particulate)		17-06-2024	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.01

VOC's C5-C20	Results	
Sampling time	1205-1225	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.01
Acetone	<0.3	<0.01
Toluene	<0.3	<0.01

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*240524*

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.98	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1040 & 1157	
Temperature, °C	82	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	53	
Volumetric flow rate (wet STP), m³/min	40	
Volumetric flow rate (dry STP), m³/min	40	
Mass flow rate (wet basis), kg/h	3100	

Isokinetic Results	Results	
Sampling time	1045-1153	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.028	0.0011
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	100	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.99	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1040 & 1157	
Temperature, °C	82	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	53	
Volumetric flow rate (wet STP), m³/min	40	
Volumetric flow rate (dry STP), m³/min	40	
Mass flow rate (wet basis), kg/h	3100	

Isokinetic Results	Results	
Sampling time	1045-1153	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.006**	**<0.0002**
Arsenic	**<0.003**	**<0.0001**
Beryllium	<0.0008	<0.00003
Cadmium	**0.0056**	**0.00022**
Chromium	0.003	0.00012
Cobalt	<0.001	<0.00004
Copper	<0.001	<0.00004
Lead	**0.14**	**0.0056**
Manganese	0.04	0.0016
Mercury	**<0.0009**	**<0.00003**
Nickel	0.0085	0.00034
Phosphorus	0.038	0.0015
Selenium	<0.007	<0.0003
Tin	<0.003	<0.0001
Vanadium	<0.002	<0.00006
Zinc	8.8	0.35
Total of Sb, As, Cd, Pb, Hg	**≤0.15**	**≤0.0062**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	102	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.98	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1157 & 1315	
Temperature, °C	82	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	53	
Volumetric flow rate (wet STP), m³/min	41	
Volumetric flow rate (dry STP), m³/min	40	
Mass flow rate (wet basis), kg/h	3100	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1205 - 1311	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	41000	1600000
2-Methylnaphthalene	450	18000
Acenaphthylene	<20	<900
Acenaphthene	<20	<900
Fluorene	<20	<900
Phenanthrene	450	18000
Anthracene	72	2800
Fluoranthene	320	13000
Pyrene	210	8500
Benz(a)anthracene	100	4000
Chrysene	180	7100
Benzo(b)fluoranthene	160	6200
Benzo(k)fluoranthene	70	2800
Benzo(e)pyrene	98	3900
Benzo(a)pyrene	83	3300
Perylene	<20	<900
Indeno(1,2,3-cd)pyrene	72	2800
Dibenz(ah)anthracene	<20	<900
Benzo(ghi)perylene	93	3700
Total 16 PAHs	43000	1700000
Total 19 PAHs	44000	1700000
BaP-TEQ		
Lower Bound	120	5000
Middle Bound	130	5100
Upper Bound	130	5300

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	64
Isokinetic rate, %	101%

2.13 MZR Furnace Baghouse

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Stack Parameters		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	29.0 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.06	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1606 & 1725	
Temperature, °C	52	
Velocity at sampling plane, m/s	6.1	
Volumetric flow rate, actual, m³/min	72	
Volumetric flow rate (wet STP), m³/min	59	
Volumetric flow rate (dry STP), m³/min	58	
Mass flow rate (wet basis), kg/h	4600	

Gas Analyser Results	Average	
Sampling time	1632 - 1705	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	17	0.98
Sulfur dioxide	11	0.65
Carbon monoxide	<6	<0.4
	Concentration % v/v	
Carbon dioxide	1.9	
Oxygen	17.9	

Isokinetic Results	Results	
Sampling time	1615-1721	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	15	0.88
PM10 (PSA)	12	0.67
PM2.5 (PSA)	2.7	0.15
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	103	
Gravimetric analysis date (total particulate)	19-06-2024	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.02

VOC's C5-C20	Results	
Sampling time	1530-1550	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.02
Acetone	<0.3	<0.02
Toluene	<0.3	<0.02

(1) Unless otherwise reported, the following target compounds were found to be below detection:

Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.05	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1450 & 1606	
Temperature, °C	52	
Velocity at sampling plane, m/s	5.7	
Volumetric flow rate, actual, m³/min	67	
Volumetric flow rate (wet STP), m³/min	54	
Volumetric flow rate (dry STP), m³/min	53	
Mass flow rate (wet basis), kg/h	4200	

Isokinetic Results	Results	
Sampling time	1456-1602	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	<0.03	<0.001
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	102	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.4	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.05	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1450 & 1606	
Temperature, °C	52	
Velocity at sampling plane, m/s	5.7	
Volumetric flow rate, actual, m³/min	67	
Volumetric flow rate (wet STP), m³/min	54	
Volumetric flow rate (dry STP), m³/min	53	
Mass flow rate (wet basis), kg/h	4200	

Isokinetic Results	Results	
Sampling time	1456-1602	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.007**	**<0.0004**
Arsenic	**<0.003**	**<0.0002**
Beryllium	<0.0009	<0.00005
Cadmium	**0.009**	**0.00048**
Chromium	0.0088	0.00047
Cobalt	<0.001	<0.00006
Copper	0.0087	0.00046
Lead	**0.064**	**0.0034**
Manganese	0.068	0.0036
Mercury	**<0.0009**	**<0.00005**
Nickel	0.012	0.00063
Phosphorus	0.05	0.0026
Selenium	<0.007	<0.0004
Tin	0.013	0.00068
Vanadium	<0.002	<0.0001
Zinc	13	0.69
Total of Sb, As, Cd, Pb, Hg	**≤0.084**	**≤0.0045**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	103	

Ektimo

Date	30/05/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Comments
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.05	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1606 & 1725	
Temperature, °C	52	
Velocity at sampling plane, m/s	6.1	
Volumetric flow rate, actual, m³/min	72	
Volumetric flow rate (wet STP), m³/min	59	
Volumetric flow rate (dry STP), m³/min	58	
Mass flow rate (wet basis), kg/h	4600	

Polycyclic Aromatic Hydrocarbons (PAHs) Sampling time	Results 1615 - 1721	
	Concentration ng/m³	Mass Rate ng/min
Naphthalene	48000	2800000
2-Methylnaphthalene	350	20000
Acenaphthylene	<20	<1000
Acenaphthene	99	5700
Fluorene	340	20000
Phenanthrene	410	24000
Anthracene	31	1800
Fluoranthene	1000	59000
Pyrene	340	20000
Benz(a)anthracene	28	1600
Chrysene	130	7700
Benzo(b)fluoranthene	29	1700
Benzo(k)fluoranthene	<20	<1000
Benzo(e)pyrene	<20	<1000
Benzo(a)pyrene	<20	<1000
Perylene	<20	<1000
Indeno(1,2,3-cd)pyrene	<20	<1000
Dibenz(ah)anthracene	<20	<1000
Benzo(ghi)perylene	<20	<1000
Total 16 PAHs	51000	2900000
Total 19 PAHs	51000	2900000
BaP-TEQ		
Lower Bound	7	400
Middle Bound	26	1500
Upper Bound	45	2600

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	64
Isokinetic rate, %	97%

2.14 MZR Dross Stack

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1619	
Temperature, °C	23	
Velocity at sampling plane, m/s	22	
Volumetric flow rate, actual, m³/min	260	
Volumetric flow rate (wet STP), m³/min	230	
Volumetric flow rate (dry STP), m³/min	230	
Mass flow rate (wet basis), kg/h	18000	

Gas Analyser Results	Average	
Sampling time	1520 - 1550	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.9
Sulfur dioxide	<6	<1
Carbon monoxide	<6	<1
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	1620-1708	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.5
PM10 (PSA)	<2	<0.5
PM2.5 (PSA)	<2	<0.5
Isokinetic Sampling Parameters		
Sampling time, min	48	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	19-06-2024	

Ektimo

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Total Speciated VOCs	Results	
	Concentration mg/m³	Mass Rate g/min
Total	<0.3	<0.06

VOC's C5-C20	Results	
Sampling time	1530-1550	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.3	<0.06
Acetone	<0.3	<0.06
Toluene	<0.3	<0.06

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Trichloroethylene, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

Ektimo

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1517	
Temperature, °C	23	
Velocity at sampling plane, m/s	22	
Volumetric flow rate, actual, m³/min	260	
Volumetric flow rate (wet STP), m³/min	230	
Volumetric flow rate (dry STP), m³/min	230	
Mass flow rate (wet basis), kg/h	18000	

Isokinetic Results	Results	
Sampling time	1518-1608	
	Concentration mg/m³	Mass Rate g/min
Total fluoride (as HF)	0.065	0.015
Isokinetic Sampling Parameters		
Sampling time, min	48	
Isokinetic rate, %	98	

Ektimo

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Comments
No afterflows were recorded as this a batch process
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1517	
Temperature, °C	23	
Velocity at sampling plane, m/s	22	
Volumetric flow rate, actual, m³/min	260	
Volumetric flow rate (wet STP), m³/min	230	
Volumetric flow rate (dry STP), m³/min	230	
Mass flow rate (wet basis), kg/h	18000	

Isokinetic Results	Results	
Sampling time	1518-1608	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.007**	**<0.002**
Arsenic	**0.0055**	**0.0013**
Beryllium	<0.0008	<0.0002
Cadmium	**0.2**	**0.045**
Chromium	0.007	0.0016
Cobalt	0.0023	0.00052
Copper	0.019	0.0044
Lead	**0.26**	**0.06**
Manganese	0.12	0.027
Mercury	**<0.0009**	**<0.0002**
Nickel	0.037	0.0084
Phosphorus	0.089	0.02
Selenium	<0.006	<0.001
Tin	0.0039	0.00089
Vanadium	<0.002	<0.0004
Zinc	5.7	1.3
Total of Sb, As, Cd, Pb, Hg	**≤0.48**	**≤0.11**
Isokinetic Sampling Parameters		
Sampling time, min	48	
Isokinetic rate, %	101	

Ektimo

Date	3/06/2024	**Client**	Nyrstar Hobart
Report	R016327	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*240524*

Comments
No afterflows were recorded as this a batch process
The discharge is assumed to be composed of dry air and moisture

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1619	
Temperature, °C	23	
Velocity at sampling plane, m/s	22	
Volumetric flow rate, actual, m³/min	260	
Volumetric flow rate (wet STP), m³/min	230	
Volumetric flow rate (dry STP), m³/min	230	
Mass flow rate (wet basis), kg/h	18000	

Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Results 1620 - 1708	
		Concentration ng/m³	Mass Rate ng/min
Naphthalene		13000	3000000
2-Methylnaphthalene		210	49000
Acenaphthylene		<20	<5000
Acenaphthene		<20	<5000
Fluorene		380	87000
Phenanthrene		290	65000
Anthracene		1200	260000
Fluoranthene		240	54000
Pyrene		110	25000
Benz(a)anthracene		58	13000
Chrysene		97	22000
Benzo(b)fluoranthene		93	21000
Benzo(k)fluoranthene		43	9700
Benzo(e)pyrene		70	16000
Benzo(a)pyrene		74	17000
Perylene		<20	<5000
Indeno(1,2,3-cd)pyrene		<20	<5000
Dibenz(ah)anthracene		<20	<5000
Benzo(ghi)perylene		76	17000
Total 16 PAHs		16000	3600000
Total 19 PAHs		16000	3600000
BaP-TEQ			
Lower Bound		94	21000
Middle Bound		100	23000
Upper Bound		110	24000

Abbreviations and definitions

BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.

TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency factor.

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	48
Isokinetic rate, %	99%

3 Sample Plane Compliance

3.1 Foreshore A

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.2 Foreshore B

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.3 Parageothite Dryer

Sampling Plane Details	
Sampling plane dimensions	950 mm
Sampling plane area	0.709 m²
Sampling port size, number & depth	4" Flange (x2), 50 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.4 Cadmium Smelter Plant Scrubber Stack

Sampling Plane Details	
Sampling plane dimensions	470 mm
Sampling plane area	0.173 m²
Sampling port size, number & depth	4" BSP (x2), 85 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Change in diameter 2 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.5 Copper Sulphate Crystalliser Plant Vent Stack

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.6 Casting Ventilation 1 – V1

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.7 Casting Ventilation 2 – V2

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.8 Roaster Baghouse

Sampling Plane Details	
Sampling plane dimensions	385 mm
Sampling plane area	0.116 m²
Sampling port size, number & depth	4" BSP (x2), 105 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.9 Zinc Oxide Debagging Station

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.10 Anode Casting

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m²
Sampling port size, number	4" Flange (x1)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.11 Zinc Plant 1 Baghouse – ZP1

Sampling Plane Details	
Sampling plane dimensions	390 x 500 mm
Sampling plane area	0.195 m²
Sampling port size, number	1" Holes (x3)
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	3 6
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.12 Zinc Plant 3 Baghouse – ZP3

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.13 MZR Furnace Baghouse

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal
The sampling plane is deemed to be non-ideal due to the following reasons:	
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D	

3.14 MZR Dross Stack

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number	4" BSP (x2)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

4 Plant Operating Conditions

See Nyrstar Hobart records for complete process conditions.

5 Test Methods

All sampling and analysis were performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate & velocity	AS 4323.1	AS 4323.1	8%, 7%	✓	✓
Moisture	USEPA Method 4	USEPA Method 4	8%	✓	✓
Moisture (stacks <60°C)	Ektimo 050	Ektimo 050	not specified	✓	✓[j]
Molecular weight	NA	USEPA Method 3	not specified	NA	✓
Carbon dioxide & oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Carbon monoxide	USEPA Method 10	USEPA Method 10	12%	✓	✓
Nitrogen oxides	USEPA Method 7E	USEPA Method 7E	12%	✓	✓
Nitrous oxide	NA	gas analyser	12%	NA	×[h]
Sulfur dioxide	USEPA Method 6C	USEPA Method 6C	12%	✓	✓
Speciated volatile organic compounds	Ektimo 344	Ektimo 344	19%	✓	✓[†]
Total particulate matter	AS 4323.2	AS 4323.2	7%	✓	✓[††]
Particulate matter (PM_{10} & $PM_{2.5}$) by particle size analysis	AS 4323.2	Ektimo 410 in-house method using Malvern Mastersizer 3000	not specified	×	×[†]
Total (gaseous & particulate) metals (Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mn, Hg, Ni, P, Se, Zn)	USEPA Method 29	Envirolab in-house methods Metals-020/021/022	15%	✓	✓[‡]
Total (gaseous & particulate) metals (Non-USEPA 29) (Sn, V)	USEPA Method 29	Envirolab in-house methods Metals-020/021/022	15%	×[‡‡]	✓[‡]
Total fluoride	USEPA Method 13B	Ektimo 235	17%	✓	✓[†]
Polycyclic aromatic hydrocarbons (PAHs)	USEPA SW-846 0010	NMI in-house method NGCMS 11.27	21%	✓	✓[¶]
Sulfuric acid mist and/or sulfur oxides	USEPA Method 8	Ektimo 235	16%	✓	✓[†]

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* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

¶ Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 9 July 2024 in report RN1434142.

† Analysis performed by Ektimo. Results were reported to Ektimo on:
- 21 June 2024 in report LV-005923
- 25 June 2024 in report LV-005942
- 26 June 2024 in report LV-005951
- 26 June 2024 in report LV-005957
- 26 June 2024 in report LV-005968

†† Gravimetric analysis conducted at the Ektimo VIC laboratory.

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 3 July 2024 in report 354698.

‡‡ Specified metals are not listed in USEPA Method 29 and therefore, are not covered by NATA accreditation for sampling.

h Nitrous oxide analysis performed using a real-time analyser. Ektimo is not NATA accredited for this method.

j Includes analysis of moisture content by Ektimo 050 which uses the same principle as ASTM E337.

6 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

Unless specifically noted, all samples were collected and handled in accordance with Ektimo's QA/QC standards.

Ektimo

7 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BaP-TEQ	Benzo(a)pyrene toxic equivalents
BSP	British standard pipe
CEM/CEMS	Continuous emission monitoring/Continuous emission monitoring system
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
I-TEQ	International toxic equivalents
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
TOC	Total organic carbon. This is the sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
WHO05-TEQ	World Health Organisation toxic equivalents
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

8 Appendices

Appendix A: Site Images

Foreshore A

Foreshore B

Parageothite Dryer

Cadmium Smelter Plant Scrubber Stack

Copper Sulphate Crystalliser Plant Vent Stack

Casting Ventilation 1 – V1

Casting Ventilation 2 – V2

Roaster Baghouse

Anode Casting

Zinc Plant 1 Baghouse – ZP1

Zinc Plant 3 Baghouse – ZP3

MZR Furnace Stack

MZR Dross

Appendix B: Weather Observations

Hobart, Tasmania

May 2024 Daily Weather Observations

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours	km/h		local	°C	%	8th	km/h		hPa	°C	%	8th	km/h		hPa
1	We	5.5	15.6	0			SSW	39	19:14	10	72	1	NW	17	1035	14.5	61	1	SE	15	1033
2	Th	6.6	14.3	0			S	30	15:17	10.3	68	7	NW	17	1036	12.4	77	7	SSE	19	1034
3	Fr	4.6	15.2	0			NW	24	4:06	8.5	80	3	NW	17	1035	13	76	6	SSE	15	1032
4	Sa	8.1	14	2.4			NW	17	23:39	10.7	91	4	NNE	9	1032	13.8	67	7	ENE	9	1030
5	Su	3.9	15.9	0.2			SSE	35	15:44	7.6	93	1	NW	11	1030	14.2	57	7	SSW	13	1029
6	Mo	7.6	17	0			NW	31	10:38	10.2	62	7	NW	19	1035	16.1	50	6	NNE	7	1033
7	Tu	5.2	16.8	0			SSE	24	17:29	9.3	79	7	NW	11	1035	15.1	57	6	SE	9	1033
8	We	9.2	13.9	2.2			SE	24	13:24	11.3	99	8	WNW	4	1038	12.2	95	8	SE	13	1036
9	Th	10.1	14.8	0			S	20	19:34	12.1	97	7	NNE	6	1037	14.4	86	7	SSE	11	1035
10	Fr	11.8	15.5	6.8			SE	22	12:36	13	96	7	SSW	11	1038	14.7	81	6	SSE	13	1036
11	Sa	9.5	15.1	0.8			SE	17	13:19	10.9	100	8	NW	6	1037	14.1	85	3	SSE	9	1034
12	Su	5.1	17	0.2			NNE	26	16:53	8.2	100	2	WNW	6	1030	16.8	63	3	NNE	15	1026
13	Mo	8.2	18.6	0			N	48	11:32	13.9	75	2	NNE	9	1017	15.6	67	3	W	19	1013
14	Tu	8.7	15.8	3.4			WNW	61	2:05	11.1	58	6	WSW	24	1021	14.9	43	1	WNW	26	1022
15	We	11.1	18.5	0			WNW	56	12:57	14.2	60	7	NW	28	1019	17.1	58	7	W	30	1017
16	Th	5.5	15.8	0			NW	43	14:20	11.5	63	7	NNW	19	1022	14.9	57	7	NW	28	1018
17	Fr	9.1	12.6	3			SW	56	19:43	9.2	86	5	S	13	1019	8.7	70	7	SW	30	1021
18	Sa	4	12.1	4.4			NW	50	20:00	6	72	7	NW	24	1032	10.6	57	7	NW	17	1025
19	Su	6	15.5	0.4			W	41	13:20	12	72	5	SW	19	1017	13.7	67	6	S	19	1017
20	Mo	2.5	12.5	0.2			NW	24	8:27	5.7	94	7	NW	17	1028	11.7	64	5	S	15	1027
21	Tu	4.1	12.8	0.2			NW	35	9:16	7.6	78	7	NNW	15	1030	12.4	65	8	NW	20	1027
22	We	7.5	16	3.4			WNW	30	16:28	11	94	7	NW	6	1026	14.4	68	6	NW	13	1023
23	Th	9.6	12.6	0			NW	41	6:37	12.4	72	7	NW	19	1023	10.5	89	8	S	13	1025
24	Fr	3.5	12.7	3			NW	19	8:53	7.3	97	1	NW	15	1031	10.8	73	6	SSE	9	1030
25	Sa	3	13.5	0.2			NW	24	10:13	4.8	92	5	NW	11	1031	11.7	65	7	S	13	1029
26	Su	1.9	14.7	0.2			WNW	24	10:45	5.2	93	5	NW	13	1028	12.9	68	2	SSE	9	1023
27	Mo	5.1	16.8	0			WNW	48	14:07	12.7	64	1	NNW	15	1018	16.4	46	1	WNW	28	1017
28	Tu	9.7	16.4	0.2			N	31	2:49	12.3	98	7	SSE	17	1021	14.9	83	7	S	2	1020
29	We	9.5	18.2	0.2			NNW	52	22:34	13.7	65	7	NNW	26	1019	16.8	63	7	N	17	1016
30	Th	11	19.5	0			NNW	54	1:22	15.6	55	7	NW	37	1010	18.3	58	7	N	28	1004
31	Fr	12.1	16.4	0			NW	89	11:37	15.1	46	1	NNW	26	994.8	12.1	59	2	NW	44	995.5
Statistics for May 2024																					
Mean		7.1	15.4							10.4	79	5		15	1027	13.9	66	5		17	1025
Lowest		1.9	12.1	0						4.8	46	1	WNW	4	994.8	8.7	43	1	S	2	995.5
Highest		12.1	19.5	6.8			NW	89		15.6	100	8	NW	37	1038	18.3	95	8	NW	44	1036
Total				31.4																	

IDCJDW7062.202405 Prepared at 16:03 UTC on Tuesday 16 July 2024

***Site name**: HOBART AIRPORT* ***Site number:** 0944250* ***Latitude:** 42.84 °S* ***Longitude:** 147.50 °E* ***Elevation:** 7 m*

Prepared for: Nyrstar Hobart
Report No.: R016327
Date: 26/07/2024

Ektimo

June 2024 Daily Weather Observations

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours	km/h		local	°C	%	8th	km/h		hPa	°C	%	8th	km/h		hPa
1	Sa	4.3	13.2	0			W	22	10:33	8.7	79	1	W	6	1023	11.7	53	7	SSE	9	1025
2	Su	3.9	12.4	0			NW	24	11:35	6.3	82	7	NW	9	1030	10.9	62	7	NE	9	1026
3	Mo	6.2	13.4	0.2			SSE	35	5:07	11	85	8	S	17	1018	12.7	99	8	S	22	1011
4	Tu	7.5	15.2	9			NW	26	6:47	11.2	98	1	NW	15	1011	14	82	4	SSE	6	1011
5	We	5.3	15.6	0			WSW	24	11:05	11.6	92	2	Calm		1021	14.5	58	7	NW	7	1022
6	Th	9	14.8	0			WNW	24	7:54	9.7	87	7	NW	19	1029	12.4	87	7	SSE	15	1028
7	Fr	9.7	13	0			N	20	11:43	10.6	78	7	N	6	1028	12.4	68		E	6	1024
8	Sa	1.9	12.1	0.4			NW	30	5:00	4.7	98	2	NW	6	1019	11.7	66	3	NW	13	1013
9	Su	4.6	12.8	0.8			S	35	12:14	9.4	87	7	WSW	17	1015	11.3	65	5	SSW	20	1016
10	Mo	1.6	13.2	0.2			NW	31	11:05	8.2	65	1	NNW	15	1019	11.7	50	2	NW	19	1017
11	Tu	5.7	15.4	3.4			NNW	52	11:09	11.9	86	8	WNW	31	996.9	12.9	62	5	WNW	31	991.8
12	We	5.7	10.4	1.2			WSW	61	3:06	7.3	67	6	WSW	30	1008	9.4	65	6	WSW	19	1013
13	Th	3.1	12.8	0			SW	28	12:36	6.9	85	5	NW	15	1022	11	68	7	S	13	1022
14	Fr	5.9	10.1	0.6			SSE	30	18:04	7.3	98	7	W	6	1027	9.7	69	7	SSE	9	1026
15	Sa	4.7	11.1	2			S	43	15:32	8.3	88	7	SW	15	1026	10.3	73	7	SSW	22	1024
16	Su	8.1	11.1	1.6			SSW	52	0:16	9.4	76	7	SSW	28	1021	10.7	69	7	SSW	26	1021
17	Mo	7.9	10.5	0.6			SSW	37	1:19	7.9	93	7	WSW	9	1024	10	78	2	SSW	13	1022
18	Tu	5.4	9.7	3.2			NW	28	8:43	5.9	98	6	NW	20	1021	9.3	85	7	NW	9	1019
19	We	4.9	10.4	1.4			NW	22	9:01	6	93	7	NW	17	1018	9.9	80	6	W	2	1016
20	Th	6	10.6	3.2			SW	28	12:03	8.6	99	7	SW	19	1019	10.2	86	7	S	15	1019
21	Fr	6.9	12.7	4.2			S	28	14:24	7.5	94	7	NW	13	1022	10.1	94	7	SW	20	1023
22	Sa	3.2	14	0.6			NNW	22	9:30	7.3	82	1	NNW	15	1028	13.2	63	7	SSW	4	1027
23	Su	6.4	12.7	0			NW	22	4:19	8.1	89	7	NW	13	1027	11.5	75	6	N	6	1024
24	Mo	1.3	13.6	0.2			NW	24	8:59	5	100	8	NW	19	1018	13.3	62	7	N	11	1014
25	Tu	3.8	12.9	0.2			NNW	28	22:06	7.5	90	4	WNW	2	1016	11.7	71	7	NNE	9	1014
26	We	2.3	11	2.6			WNW	54	12:10	5.2	100	7	Calm		1012	9.6	85	7	NNW	9	1009
27	Th	3.1	13.5	0.8			NNW	31	4:18	9	69	7	NW	7	1011	13.1	62	3	NW	17	1010
28	Fr	5.4	13.7	0			NNW	37	1:45	7.5	84	7	NW	13	1018	12	68	7	N	13	1014
29	Sa	7.5	15.2	0			NW	57	11:51	12.4	76	6	NW	20	1001	12.4	57	5	NW	33	1000
30	Su	5.9	9.5	4.6			SW	43	12:04	6.4	85	3	SW	26	1018	8.4	68	6	S	24	1020
Statistics for June 2024																					
Mean		5.2	12.6							8.2	86	5		14	1019	11.4	71	5		14	1017
Lowest		1.3	9.5	0						4.7	65	1	Calm		996.9	8.4	50	2	W	2	991.8
Highest		9.7	15.6	9			WSW	61		12.4	100	8	WNW	31	1030	14.5	99	8	NW	33	1028
Total				41																	

IDCJDW7062.202406 Prepared at 13:03 UTC on Sunday 14 July 2024

***Site name**: HOBART AIRPORT* ***Site number:** 0944250* ***Latitude:** 42.84 °S* ***Longitude:** 147.50 °E* ***Elevation:** 7 m*

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Ektimo

Nyrstar Hobart, Lutana

Emission Testing Report
Cadmium Smelter Re-Test – August 2024

Report R017615

Ektimo

Document Information

Client Name:	Nyrstar Hobart
Report Number:	R017615
Date of Issue:	19 September 2024
Attention:	Alex Lovibond
Address:	Risdon Road Lutana TAS 7009
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Glenn Trenear
Senior Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to Test Methods section for full details of testing covered by NATA accreditation.

Ektimo

Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged to retest emissions from the Cadmium Smelter Plant Scrubber Stack. Testing was carried out in accordance with Environmental Licence 7043/5.

1.2 Project Objective & Overview

The objective of the project was to quantify emissions from one (1) discharge point to determine compliance with Nyrstar Hobart 's Environmental Licence and meet NPI reporting requirements.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Cadmium Smelter Plant Scrubber Stack	29 August 2024	Total particulate matter Metals Carbon dioxide (CO_2) and oxygen (O_2)

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP.

1.3 Licence Comparison

The following licence comparison table shows all analytes are within the licence limit set by Tasmanian Environmental Protection Notice (EPN) 7043/5.

Emission Point / Monitoring Location	Parameter	Units	Licence limit	Detected values
Cadmium Smelter Plant Scrubber Stack	Particulates	mg/m³	100	2.6
	Metals - Pb, As, Sb, Cd, Hg [(1)]	mg/m³	5	≤0.6
	Metals - Hg	mg/m³	1	0.00051
	Metals - Cd	mg/m³	1	0.56

[1] **Total concentration of metals combined.**

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

Ektimo

2 Results

2.1 Cadmium Smelter Plant Scrubber Stack

Date	29/08/2024	**Client**	Nyrstar Hobart
Report	R017615	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & V Liu	**State**	TAS
Process Conditions	Fume extraction while furnace in operation. Metal addition occurred during this test.		*240808*

Comments
The gas temperature of the sampling plane is below the dew point

Stack Parameters		
Moisture content, %v/v	1.7 (saturated)	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0605 & 0730	
Temperature, °C	13	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/min	150	
Volumetric flow rate (wet STP), m³/min	140	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/h	11000	

Gas Analyser Results	Average
Sampling time	0618 - 0717
	Concentration
	% v/v
Carbon dioxide	<0.4
Oxygen	20.7

Ektimo

Date	29/08/2024	**Client**	Nyrstar Hobart
Report	R017615	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & V Liu	**State**	TAS
Process Conditions	Fume extraction while furnace in operation. Metal addition occurred during this test.		*240808*

Isokinetic Results	Results	
Sampling time	0616-0722	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	2.6	0.36
Aluminium	0.021	0.0029
Antimony	**<0.006**	**<0.0008**
Arsenic	**<0.004**	**<0.0005**
Barium	0.0035	0.00048
Beryllium	<0.0008	<0.0001
Cadmium	**0.56**	**0.077**
Calcium	0.28	0.038
Chromium	0.0043	0.00059
Cobalt	<0.001	<0.0001
Copper	0.0053	0.00073
Iron	0.056	0.0077
Lead	**0.011**	**0.0015**
Lithium	<0.001	<0.0001
Magnesium	<0.2	<0.03
Manganese	0.034	0.0046
Mercury	**0.00051**	**0.00007**
Molybdenum	<0.002	<0.0003
Nickel	0.0037	0.0005
Phosphorus	<0.03	<0.004
Potassium	<0.2	<0.03
Selenium	<0.006	<0.0008
Silver	<0.001	<0.0002
Sodium	<0.2	<0.03
Thallium	<0.003	<0.0004
Tin	<0.003	<0.0004
Vanadium	<0.002	<0.0002
Zinc	0.11	0.015
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	107	
Gravimetric analysis date (total particulate)	04-09-2024	

3 Sample Plane Compliance

3.1 Cadmium Smelter Plant Scrubber Stack

Sampling Plane Details	
Sampling plane dimensions	470 mm
Sampling plane area	0.173 m²
Sampling port size, number & depth	4" BSP (x2), 85 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Change in diameter 2 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

4 Plant Operating Conditions

See Nyrstar Hobart records for complete process conditions.

5 Test Methods

All sampling and analysis were performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate & velocity	AS 4323.1	AS 4323.1	8%, 7%	✓	✓
Moisture (stacks <60°C)	Ektimo 050	Ektimo 050	not specified	✓	✓[j]
Molecular weight	NA	USEPA Method 3	not specified	NA	✓
Carbon dioxide & oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Total particulate matter	AS 4323.2	AS 4323.2	7%	✓	✓[††]
Total (gaseous & particulate) metals (Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Hg, Ni, P, Se, Ag, Tl, Zn)	USEPA Method 29	Envirolab in-house methods Metals-006/020/021/022	15%	✓	✓[‡]
Total (gaseous & particulate) metals (Non-USEPA 29) (Al, Ca, Fe, Li, Mg, Mo, K, Na, Sn, V)	USEPA Method 29	Envirolab in-house methods Metals-006/020/021/022	15%	✗[‡‡]	✓[‡]

290824

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor =

†† Gravimetric analysis conducted at the Ektimo VIC laboratory.

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on:

- 13 September 2024 in report 361100.

‡‡ Specified metals are not listed in USEPA Method 29 and therefore, are not covered by NATA accreditation for sampling.

[j] Includes analysis of moisture content by Ektimo 050 which uses the same principle as ASTM E337.

6 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

Unless specifically noted, all samples were collected and handled in accordance with Ektimo's QA/QC standards.

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7 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water.
AS	Australian Standard
BaP-TEQ	Benzo(a)pyrene toxic equivalents
BSP	British standard pipe
CEM/CEMS	Continuous emission monitoring/Continuous emission monitoring system
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
I-TEQ	International toxic equivalents
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
TOC	Total organic carbon. This is the sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
WHO05-TEQ	World Health Organisation toxic equivalents
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

8 Appendices

Appendix A: Site Image

Image 1. Cadmium Smelter Plant Scrubber Stack

Appendix B: Weather Observations

Hobart, Tasmania

August 2024 Daily Weather Observations

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours	km/h		local	°C	%	8th	km/h		hPa	°C	%	8th	km/h		hPa
1	Th	2.8	12.2	0.2			NW	24	9:29	6	90	7	NW	13	1038	10.8	79	6	SSE	11	1036
2	Fr	0.8	14	0.2			N	41	14:01	4.3	97	1	NNW	9	1031	13.6	51	2	N	26	1026
3	Sa	4.1	14.1	0			NW	37	12:15	9.4	76	8	NW	17	1023	13.9	47	5	WNW	17	1022
4	Su	6.3	14.4	0			WNW	46	15:33	11	61	6	N	17	1020	14.1	51	3	WNW	17	1019
5	Mo	3	15.4	0			NW	41	12:56	9.5	73	7	NW	2	1019	14.8	49	3	NW	24	1016
6	Tu	8	16	0			NW	69	14:27	10.4	64	7	NNW	15	1013	10.8	75	7	NW	31	1009
7	We	8.2	15.7	0.4			W	70	3:14	12.9	57	3	SSW	6	1016	13.5	59	7	NW	17	1018
8	Th	6.1	14.4	0			N	44	17:40	8.8	86	8	NW	11	1019	13.9	59	7	N	20	1015
9	Fr	3.9	15.8	0.2			NW	37	10:34	11.1	67	2	NNE	11	1020	15.1	45	7	NNW	19	1019
10	Sa	9.7	18.6	0			NW	54	13:05	13.1	59	3	NNW	20	1023	17.1	50	5	NW	28	1021
11	Su	12.4	18.5	0			WNW	54	6:42	14.5	61	7	NNW	20	1025	17.2	46	7	WNW	20	1025
12	Mo	6.5	17.4	0			NNW	33	5:14	9.8	75	3	NNW	24	1027	16.8	54	7	NNW	13	1023
13	Tu	7.4	18.3	0			N	37	14:24	12.1	74	7	SE	9	1021	17.2	56	7	NNW	24	1017
14	We	11.6	20.1	0			N	39	0:17	13.2	81	7	Calm	1015	17	59	7	NW	13	1013	
15	Th	5.2	14.6	0			SSE	22	14:37	9.1	98	7	W	2	1018	12.9	85	5	SSE	13	1015
16	Fr	9.1	13.5	1.4			SE	22	11:52	11.5	99	8	WNW	2	1011	13	89	8	SSE	9	1007
17	Sa	8.1	12	5.4			S	50	15:02	11.6	99	8	S	15	1007	9.8	82	8	S	35	1010
18	Su	5.8	10.2	1			SSW	37	9:06	7.7	84	7	SSW	13	1020	9.4	64	7	SSW	19	1019
19	Mo	3.2	12.3	0			NNW	31	8:44	6.6	79	2	NW	22	1025	11.8	59	2	SE	9	1023
20	Tu	1.9	13.1	0.2			NW	24	11:10	7.5	85	7	NW	9	1019	12.1	79	8	NW	15	1013
21	We	7.5	18.2	2.2			NW	41	15:00	13.1	79	7	NNW	13	1003	17	51	6	NW	30	1002
22	Th	8.2	15.9	0			NW	87	14:46	11.5	55	1	NNW	28	1007	14	48	7	NW	56	1005
23	Fr	9.3	17	0			W	50	13:53	13.8	59	1	WNW	28	1012	16.4	56	5	W	20	1013
24	Sa	8.5	12.2	3.4			NW	26	22:12	10.1	100	8	SE	7	1009	11.5	95	8	S	7	1006
25	Su	7.5	18.7	6.6			N	43	14:09	10.9	90	6	NW	15	1007	17.3	65	7	NNW	24	1001
26	Mo	10.8	16.7	1.2			WNW	74	15:32	13.3	63	6	WNW	30	999.6	16.4	52	6	WNW	41	1001
27	Tu	12.7	19.8	0			NW	91	10:58	15.4	62	7	N	15	1000	16.6	57	7	N	37	992.9
28	We	7.1	11.6	8.6			NW	76	9:17	7.3	85	6	NW	33	984.7	9.2	69	1	NNW	31	987.1
29	Th	5.9	14.8	4			NW	56	7:33	10.4	64	3	WNW	35	1000	14.1	49	6	NW	19	998.5
30	Fr	10.4	13.5	9.2			WNW	78	12:32	12.4	60	1	NW	31	981.7	12.6	63	1	NW	41	981.7
31	Sa	6.3	12.9	5.6			NW	87	19:53	7.4	66	3	WNW	37	984.4	10.2	63	7	NW	46	984.6
Statistics for August 2024																					
Mean		7	15.2							10.5	75	5		16	1013	13.9	61	5		23	1011
Lowest		0.8	10.2	0						4.3	55	1	Calm		981.7	9.2	45	1	S	7	981.7
Highest		12.7	20.1	9.2			NW	91		15.4	100	8	WNW	37	1038	17.3	95	8	NW	56	1036
Total				49.8																	

IDCJDW7062.202408 Prepared at 13:03 UTC on Saturday 14 September 2024

***Site name**: HOBART AIRPORT* ***Site number:** 0944250* ***Latitude:** 42.84 °S* ***Longitude:** 147.50 °E* ***Elevation:** 7 m*

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Experts in air quality, odour and emission monitoring.

Emission Testing Report

Round 2 - November/December 2024

Report: R016328

Nyrstar Hobart, Lutana

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, calibration, and inspection reports.

Document Information

Client Name:	Nyrstar Hobart
Report Number:	R016328
Date of Issue:	24 January 2025
Attention:	Kylie Veale
Address:	Risdon Road Lutana TAS 7009
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Glenn Trenear
Senior Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

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Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged by Nyrstar Hobart to perform emission testing at their Lutana plant. Testing was carried out in accordance with Environmental Licence 7043/5.

1.2 Project Objective & Overview

The objective of the project was to quantify emissions from fourteen (14) discharge points, to determine compliance with Nyrstar Hobart 's Environmental Licence.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Foreshore A	13 November 2024	Total particulate matter Metals Sulfur dioxide, sulfur trioxide Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Foreshore B	13 November 2024	
Parageothite Dryer	11 November 2024	Total particulate matter Metals Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Cadmium Smelter	13 November 2024	
Copper Sulphate Stack	5 December 2024	
Casting Ventilation 1 – V1	12 November 2024	
Casting Ventilation 2 – V2	12 November 2024	
Roaster Baghouse	3 December 2024	Total particulate matter Metals Nitrogen oxides, sulfur dioxide, carbon monoxide, carbon dioxide, oxygen
Zinc Oxide Debagging Station	13 November 2024	Total particulate matter Metals Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
Anode Casting	12 November 2024	
Zinc Plant 1 Baghouse – ZP1	11 November 2024	
Zinc Plant 3 Baghouse – ZP3	11 November 2024	
MZR Furnace Baghouse	12 November 2024	
MZR Dross Stack	12 November 2024	

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP.

1.3 Licence Comparison

The following licence comparison table shows any analytes highlighted in orange are outside the licence limit set by the Tasmanian Environmental Protection Notice (EPN) 7043/5.

Emission Point / Monitoring Location	Parameter	Units	Licence limit	Detected values
Foreshore A (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	2.2
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.011
	Particulates	mg/m^3	100	1.9
	Sulphur dioxide	g/m^3	7.2	0.053
Foreshore B (Tail Gas Scrubber) Stack	Sulfuric acid and Sulfur trioxide (SO_3)	mg/m^3	100	3.1
	Oxides of nitrogen (as NO_2)	g/m^3	2	0.015
	Particulates	mg/m^3	100	1.6
	Sulphur dioxide	g/m^3	7.2	0.084
Anode Casting Plant Exhaust	Particulates	mg/m^3	100	4.3
V1 Furnace Stack				<3
V2 Furnace Stack				<2
Zinc Dust Plant Baghouse 1 Stack				5
Zinc Dust Plant Bagouse 3 Stack				6.9
Cadmium Smelter Plant Scrubber Stack				8.2
Copper Sulphate Crystalliser Plant				2.6
Roaster Baghouse				6.6
Paragoethite Dryer Baghouse				<2
Anode Casting Plant Exhaust	Metals - Pb, As, Sb, Cd, Hg [(1)]	mg/m^3	5	≤0.18
V1 Furnace Stack				≤0.02
V2 Furnace Stack				≤0.042
Zinc Dust Plant Baghouse 1 Stack				≤0.04
Zinc Dust Plant Baghouse 3 Stack				≤0.07
Cadmium Smelter Plant Scrubber Stack				≤2.2
Copper Sulphate Crystalliser Plant				≤0.1
Roaster Baghouse				≤0.26
Paragoethite Dryer Baghouse				≤0.094
Anode Casting Plant Exhaust	Metals - Hg	mg/m^3	1	<0.001
V1 Furnace Stack				<0.0007
V2 Furnace Stack				<0.0008
Zinc Dust Plant Baghouse 1 Stack				<0.0007
Zinc Dust Plant Baghouse 3 Stack				<0.0008
Cadmium Smelter Plant Scrubber Stack				<0.0009
Copper Sulphate Crystalliser Plant				0.0057
Roaster Baghouse				0.0008
Paragoethite Dryer Baghouse				<0.002
Anode Casting Plant Exhaust	Metals - Cd	mg/m^3	1	0.0064
V1 Furnace Stack				0.0018
V2 Furnace Stack				0.0048
Zinc Dust Plant Baghouse 1 Stack				0.0039
Zinc Dust Plant Baghouse 3 Stack				0.0021
Cadmium Smelter Plant Scrubber Stack				**2.2**
Copper Sulphate Crystalliser Plant				0.078
Roaster Baghouse				0.026
Paragoethite Dryer Baghouse				0.0056

[1] **Total concentration of metals combined.**

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

2 Results

2.1 Foreshore A

Date	13/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 62,000 m3/hr (not running) & Unit 6 producing 106,000 m3/hr of gas through the acid stream.		

241106

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.4 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.27 (dry)
Gas density at discharge conditions, kg/m³	1.17	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0908, 1110 & 1306	
Temperature, °C	21	
Ambient pressure, kPa	101	
Stack pressure, kPa	101	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	1800	
Volumetric flow rate (wet STP), m³/min	1700	
Volumetric flow rate (dry STP), m³/min	1600	
Mass flow rate (wet basis), kg/h	130000	

Gas Analyser Results	Average	
Sampling time	0927 - 1026	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	11	18
Carbon monoxide	<6	<10
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	9.6	

Date	13/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Foreshore A
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 62,000 m3/hr (not running) & Unit 6 producing 106,000 m3/hr of gas through the acid stream.		241106

Isokinetic Results	Results	
Sampling time	0920-1102	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.003**	**<0.006**
Arsenic	**<0.002**	**<0.003**
Beryllium	<0.0004	<0.0007
Cadmium	**0.0029**	**0.0047**
Chromium	0.0039	0.0064
Cobalt	<0.0006	<0.0009
Copper	0.0011	0.0018
Lead	**0.0068**	**0.011**
Manganese	0.026	0.043
Mercury	**<0.0004**	**<0.0007**
Nickel	0.0021	0.0035
Phosphorus	<0.02	<0.03
Selenium	<0.004	<0.006
Tin	<0.002	<0.003
Vanadium	<0.0009	<0.001
Zinc	0.23	0.38
Total of Sb, As, Cd, Pb, Hg	**≤0.016**	**≤0.026**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	99	

Isokinetic Results	Results	
Sampling time	1120-1302	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	1.9	3.2
Sulfur dioxide	53	87
Sulfur trioxide	2.2	3.6
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	95	
Gravimetric analysis date (total particulate)	21-11-2024	

2.2 Foreshore B

Date	13/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 62,000 m3/hr (not running) & Unit 6 producing 106,000 m3/hr of gas through the acid stream.		241106

Stack Parameters		
Moisture content, %v/v	2	
Gas molecular weight, g/g mole	28.3 (wet)	28.6 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.27 (dry)
Gas density at discharge conditions, kg/m³	1.17	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0910, 1112 & 1308	
Temperature, °C	21	
Ambient pressure, kPa	101	
Stack pressure, kPa	101	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	1700	
Volumetric flow rate (wet STP), m³/min	1600	
Volumetric flow rate (dry STP), m³/min	1500	
Mass flow rate (wet basis), kg/h	120000	

Gas Analyser Results	Average	
Sampling time	1041 - 1140	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	15	22
Carbon monoxide	<6	<10
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	9.2	

Date	13/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Foreshore B
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Unit 5 producing 62,000 m3/hr (not running) & Unit 6 producing 106,000 m3/hr of gas through the acid stream.		

241106

Isokinetic Results	Results	
Sampling time	0920-1102	
	Concentration mg/m³	Mass Rate g/min
Antimony	**<0.003**	**<0.005**
Arsenic	**0.0046**	**0.007**
Beryllium	<0.0004	<0.0006
Cadmium	**0.26**	**0.4**
Chromium	0.012	0.018
Cobalt	0.0018	0.0028
Copper	0.0034	0.0052
Lead	**0.02**	**0.03**
Manganese	0.039	0.06
Mercury	**<0.0005**	**<0.0007**
Nickel	0.0088	0.014
Phosphorus	0.034	0.051
Selenium	<0.003	<0.005
Tin	<0.003	<0.004
Vanadium	<0.001	<0.002
Zinc	1.1	1.7
Total of Sb, As, Cd, Pb, Hg	**≤0.29**	**≤0.44**
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	94	

Isokinetic Results	Results	
Sampling time	1120-1302	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	1.6	2.5
Sulfur dioxide	84	130
Sulfur trioxide	3.1	4.8
Isokinetic Sampling Parameters		
Sampling time, min	100	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	21-11-2024	

2.3 Parageothite Dryer

Date	11/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Parageothite Dryer
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	7 m3/hr of dirt and 2 m3/hr of bypass flow into the drum.		241106

Stack Parameters		
Moisture content, %v/v	28	
Gas molecular weight, g/g mole	26.1 (wet)	29.3 (dry)
Gas density at STP, kg/m³	1.16 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.92	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1515 & 1640	
Temperature, °C	75	
Ambient pressure, kPa	102	
Stack pressure, kPa	102	
Velocity at sampling plane, m/s	8.5	
Volumetric flow rate, actual, m³/min	360	
Volumetric flow rate (wet STP), m³/min	280	
Volumetric flow rate (dry STP), m³/min	200	
Mass flow rate (wet basis), kg/h	20000	

Gas Analyser Results	Average
Sampling time	1523 - 1625
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	49 / 9.9
Carbon monoxide	<6 / <1
	Concentration % v/v
Carbon dioxide	3.6
Oxygen	15

Isokinetic Results	Results	
Sampling time	1530-1632	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.5
Antimony	**<0.007**	**<0.001**
Arsenic	**0.0078**	**0.0016**
Beryllium	<0.001	<0.0002
Cadmium	**0.0056**	**0.0011**
Chromium	0.013	0.0027
Cobalt	<0.002	<0.0005
Copper	0.013	0.0026
Lead	**0.072**	**0.015**
Manganese	0.069	0.014
Mercury	**<0.002**	**<0.0004**
Nickel	0.062	0.013
Phosphorus	<0.04	<0.009
Selenium	0.018	0.0037
Tin	<0.003	<0.0006
Vanadium	<0.002	<0.0004
Zinc	0.24	0.049
Total of Sb, As, Cd, Pb, Hg	**≤0.094**	**≤0.019**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	106	
Gravimetric analysis date (total particulate)	21-11-2024	

2.4 Cadmium Smelter Plant Scrubber Stack

Date	13/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Cadmium Smelter
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume extraction while furnace in operation. Metal addition occurred during this test.		241106

Stack Parameters		
Moisture content, %v/v	3.7	
Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.13	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0650 & 0804	
Temperature, °C	34	
Ambient pressure, kPa	101	
Stack pressure, kPa	101	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	170	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	140	
Mass flow rate (wet basis), kg/h	11000	

Gas Analyser Results	Average	
Sampling time	0652 - 0721	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	4.7	0.68
Carbon monoxide	<6	<0.9
	Concentration % v/v	
Carbon dioxide	0.4	
Oxygen	20.5	

Isokinetic Results	Results	
Sampling time	0655-0757	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	8.2	1.2
Antimony	**<0.007**	**<0.001**
Arsenic	**<0.003**	**<0.0005**
Beryllium	<0.0009	<0.0001
Cadmium	**2.2**	**0.31**
Chromium	0.0068	0.00098
Cobalt	0.0082	0.0012
Copper	0.0051	0.00074
Lead	**0.032**	**0.0046**
Manganese	0.065	0.0093
Mercury	**<0.0009**	**<0.0001**
Nickel	0.0076	0.0011
Phosphorus	<0.04	<0.006
Selenium	<0.007	<0.001
Tin	<0.003	<0.0005
Vanadium	<0.002	<0.0003
Zinc	0.85	0.12
Total of Sb, As, Cd, Pb, Hg	**≤2.2**	**≤0.32**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	
Gravimetric analysis date (total particulate)	22-11-2024	

2.5 Copper Sulphate Crystalliser Plant Vent Stack

Date	5/12/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Copper Sulphate Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	Nick Heatley, Leigh Fry	**State**	TAS
Process Conditions	Production rate - 13.1 tonnes/day, Dryer Outlet Temperature - 45 deg C, Feed rate into Dryer - 30%		241106

Stack Parameters		
Moisture content, %v/v	13	
Gas molecular weight, g/g mole	27.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.23 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.04	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0919 & 1030	
Temperature, °C	52	
Ambient pressure, kPa	101	
Stack pressure, kPa	101	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	180	
Volumetric flow rate (wet STP), m³/min	150	
Volumetric flow rate (dry STP), m³/min	130	
Mass flow rate (wet basis), kg/h	11000	

Gas Analyser Results	Average	
Sampling time	0929 - 1029	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.5
Carbon monoxide	<6	<0.8
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.5	

Isokinetic Results	Results	
Sampling time	0925-1027	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	2.6	0.35
Antimony	**<0.006**	**<0.0008**
Arsenic	**<0.003**	**<0.0004**
Beryllium	<0.0008	<0.0001
Cadmium	**0.078**	**0.01**
Chromium	0.024	0.0032
Cobalt	0.0068	0.0009
Copper	0.077	0.01
Lead	**0.035**	**0.0046**
Manganese	0.033	0.0043
Mercury	**0.0057**	**0.00076**
Nickel	0.086	0.011
Phosphorus	0.11	0.014
Selenium	<0.009	<0.001
Tin	<0.003	<0.0004
Vanadium	<0.002	<0.0002
Zinc	0.3	0.04
Total of Sb, As, Cd, Pb, Hg	**≤0.13**	**≤0.017**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	102	
Gravimetric analysis date (total particulate)	10-12-2024	

2.6 Casting Ventilation 1 – V1

Date	12/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Casting Ventilation 1 - V1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*241106*

Stack Parameters		
Moisture content, %v/v	1.4	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1315 & 1433	
Temperature, °C	29	
Ambient pressure, kPa	102	
Stack pressure, kPa	101	
Velocity at sampling plane, m/s	12	
Volumetric flow rate, actual, m³/min	230	
Volumetric flow rate (wet STP), m³/min	200	
Volumetric flow rate (dry STP), m³/min	200	
Mass flow rate (wet basis), kg/h	16000	

Gas Analyser Results	Average
Sampling time	1332 - 1400
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.8
Carbon monoxide	<6 / <1
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results	
Sampling time	1325-1425	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<3	<0.5
Antimony	**<0.006**	**<0.001**
Arsenic	**<0.003**	**<0.0006**
Beryllium	<0.0008	<0.0002
Cadmium	**0.0018**	**0.00037**
Chromium	0.0041	0.00081
Cobalt	<0.001	<0.0002
Copper	0.0032	0.00063
Lead	**0.017**	**0.0034**
Manganese	0.039	0.0078
Mercury	**<0.0007**	**<0.0001**
Nickel	<0.003	<0.0005
Phosphorus	<0.03	<0.005
Selenium	<0.006	<0.001
Tin	<0.003	<0.0006
Vanadium	<0.002	<0.0003
Zinc	0.91	0.18
Total of Sb, As, Cd, Pb, Hg	**≤0.029**	**≤0.0057**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	21-11-2024	

2.7 Casting Ventilation 2 – V2

Date	12/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Casting Ventilation 2 - V2
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		*241106*

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1320 & 1429	
Temperature, °C	29	
Ambient pressure, kPa	102	
Stack pressure, kPa	101	
Velocity at sampling plane, m/s	12	
Volumetric flow rate, actual, m³/min	200	
Volumetric flow rate (wet STP), m³/min	180	
Volumetric flow rate (dry STP), m³/min	180	
Mass flow rate (wet basis), kg/h	14000	

Gas Analyser Results	Average
Sampling time	1415 - 1444
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.7
Carbon monoxide	<6 / <1
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results	
Sampling time	1325-1425	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<2	<0.3
Antimony	**<0.005**	**<0.0008**
Arsenic	**<0.002**	**<0.0004**
Beryllium	<0.0006	<0.0001
Cadmium	**0.0048**	**0.00085**
Chromium	0.0056	0.00098
Cobalt	<0.0008	<0.0001
Copper	0.0029	0.00051
Lead	**0.03**	**0.0052**
Manganese	0.031	0.0055
Mercury	**<0.0008**	**<0.0001**
Nickel	0.0048	0.00086
Phosphorus	0.035	0.0061
Selenium	<0.005	<0.0008
Tin	<0.003	<0.0005
Vanadium	<0.001	<0.0002
Zinc	0.71	0.13
Total of Sb, As, Cd, Pb, Hg	**≤0.042**	**≤0.0074**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	100	
Gravimetric analysis date (total particulate)	21-11-2024	

2.8 Roaster Baghouse

Date	3/12/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Roaster Baghouse
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	Nick Heatley, Leigh Fry	**State**	TAS
Process Conditions	Roaster 6 - 56 t/hr, Roaster 5 - 0 t/hr (Conveyor in operation), fumes were on.		*241202*

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	1.06	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1415 & 1610	
Temperature, °C	54	
Ambient pressure, kPa	99	
Stack pressure, kPa	99	
Velocity at sampling plane, m/s	6.5	
Volumetric flow rate, actual, m³/min	45	
Volumetric flow rate (wet STP), m³/min	37	
Volumetric flow rate (dry STP), m³/min	37	
Mass flow rate (wet basis), kg/h	2900	

Gas Analyser Results	Average	
Sampling time	1507 - 1607	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Sulfur dioxide	650	24
Carbon monoxide	<6	<0.2
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	1450-1556	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	6.6	0.24
Antimony	**<0.005**	**<0.0002**
Arsenic	**0.0036**	**0.00013**
Beryllium	<0.0007	<0.00003
Cadmium	**0.026**	**0.00097**
Chromium	0.0013	0.000046
Cobalt	<0.001	<0.00004
Copper	0.021	0.00077
Lead	**0.23**	**0.0083**
Manganese	0.019	0.00069
Mercury	**0.0008**	**0.000029**
Nickel	<0.002	<0.00007
Phosphorus	<0.02	<0.0008
Selenium	<0.006	<0.0002
Tin	<0.002	<0.00009
Vanadium	<0.001	<0.00005
Zinc	2.6	0.095
Total Type 1 Substances	**≤0.26**	**≤0.0096**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	10-12-2024	

2.9 Zinc Fume Oxide Debagging Station

Date	13/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		241106

Comments
Afterflows could not be recorded as this is a batch process.

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.17	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1411	
Temperature, °C	27	
Ambient pressure, kPa	101	
Stack pressure, kPa	101	
Velocity at sampling plane, m/s	4.6	
Volumetric flow rate, actual, m³/min	14	
Volumetric flow rate (wet STP), m³/min	12	
Volumetric flow rate (dry STP), m³/min	12	
Mass flow rate (wet basis), kg/h	950	

Gas Analyser Results	Average
Sampling time	1412 - 1441
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.05
Carbon monoxide	<6 / <0.08
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.9

Date	13/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Zinc Oxide Fume Debagging Station
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Fume unloading for duration of test.		*241106*

Isokinetic Results	Results	
Sampling time	1412-1440	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<5	<0.06
Antimony	**<0.01**	**<0.0002**
Arsenic	**<0.009**	**<0.0001**
Beryllium	<0.002	<0.00002
Cadmium	**0.0075**	**0.000091**
Chromium	0.0089	0.00011
Cobalt	<0.002	<0.00003
Copper	0.0053	0.000064
Lead	**0.13**	**0.0016**
Manganese	0.02	0.00024
Mercury	**<0.002**	**<0.00002**
Nickel	0.0058	0.000069
Phosphorus	<0.08	<0.0009
Selenium	<0.01	<0.0002
Tin	<0.008	<0.00009
Vanadium	<0.004	<0.00004
Zinc	0.81	0.0097
Total of Sb, As, Cd, Pb, Hg	**≤0.17**	**≤0.002**
Isokinetic Sampling Parameters		
Sampling time, min	32	
Isokinetic rate, %	107	
Gravimetric analysis date (total particulate)	22-11-2024	

2.10 Anode Casting

Date	12/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Anode Casting
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Casting area in normal operation.		241106

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0733 & 0847	
Temperature, °C	21	
Ambient pressure, kPa	102	
Stack pressure, kPa	102	
Velocity at sampling plane, m/s	3.4	
Volumetric flow rate, actual, m³/min	33	
Volumetric flow rate (wet STP), m³/min	30	
Volumetric flow rate (dry STP), m³/min	30	
Mass flow rate (wet basis), kg/h	2300	

Gas Analyser Results	Average
Sampling time	0741 - 0810
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.1
Carbon monoxide	<6 / <0.2
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results	
Sampling time	0740-0840	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	4.3	0.13
Antimony	**<0.007**	**<0.0002**
Arsenic	**0.0038**	**0.00011**
Beryllium	<0.0009	<0.00003
Cadmium	**0.0064**	**0.00019**
Chromium	0.0048	0.00014
Cobalt	<0.001	<0.00004
Copper	0.011	0.00031
Lead	**0.17**	**0.005**
Manganese	0.13	0.0039
Mercury	**<0.001**	**<0.00003**
Nickel	0.0059	0.00018
Phosphorus	<0.03	<0.0009
Selenium	<0.008	<0.0002
Tin	<0.003	<0.0001
Vanadium	<0.002	<0.00006
Zinc	1.7	0.05
Total of Sb, As, Cd, Pb, Hg	**≤0.19**	**≤0.0055**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	21-11-2024	

2.11 Zinc Plant 1 Baghouse – ZP1

Date	11/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Zinc Plant 1 Baghouse - ZP 1
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 1 area.		*241106*

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1309 & 1425	
Temperature, °C	61	
Ambient pressure, kPa	102	
Stack pressure, kPa	102	
Velocity at sampling plane, m/s	9.8	
Volumetric flow rate, actual, m³/min	110	
Volumetric flow rate (wet STP), m³/min	94	
Volumetric flow rate (dry STP), m³/min	93	
Mass flow rate (wet basis), kg/h	7300	

Gas Analyser Results	Average	
Sampling time	1338 - 1407	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.4
Carbon monoxide	<6	<0.6
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	1315-1420	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	5	0.47
Antimony	**<0.006**	**<0.0006**
Arsenic	**<0.003**	**<0.0002**
Beryllium	<0.0008	<0.00007
Cadmium	**0.0039**	**0.00036**
Chromium	<0.002	<0.0002
Cobalt	<0.001	<0.00009
Copper	0.0021	0.00019
Lead	**0.035**	**0.0033**
Manganese	0.02	0.0018
Mercury	**<0.0007**	**<0.00007**
Nickel	0.0046	0.00043
Phosphorus	<0.03	<0.002
Selenium	<0.006	<0.0006
Tin	<0.003	<0.0002
Vanadium	<0.002	<0.0002
Zinc	2.6	0.24
Total of Sb, As, Cd, Pb, Hg	**≤0.049**	**≤0.0045**
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	21-11-2024	

2.12 Zinc Plant 3 Baghouse – ZP3

Date	11/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	Zinc Plant 3 Baghouse - ZP 3
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	Normal production in Zinc Plant 3 area.		*241106*

Stack Parameters		
Moisture content, %v/v	0.74	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.04	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1240 & 1418	
Temperature, °C	66	
Ambient pressure, kPa	102	
Stack pressure, kPa	102	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	57	
Volumetric flow rate (wet STP), m³/min	46	
Volumetric flow rate (dry STP), m³/min	46	
Mass flow rate (wet basis), kg/h	3600	

Gas Analyser Results	Average	
Sampling time	1301 - 1333	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.2
Carbon monoxide	<6	<0.3
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Isokinetic Results	Results	
Sampling time	1250-1356	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	6.9	0.32
Antimony	**<0.007**	**<0.0003**
Arsenic	**<0.003**	**<0.0001**
Beryllium	<0.0008	<0.00004
Cadmium	**0.0021**	**0.000097**
Chromium	0.0026	0.00012
Cobalt	<0.001	<0.00005
Copper	0.0028	0.00013
Lead	**0.065**	**0.003**
Manganese	0.028	0.0013
Mercury	**<0.0008**	**<0.00004**
Nickel	0.0028	0.00013
Phosphorus	<0.03	<0.001
Selenium	<0.007	<0.0003
Tin	<0.003	<0.0001
Vanadium	<0.002	<0.00008
Zinc	4.6	0.21
Total of Sb, As, Cd, Pb, Hg	**≤0.078**	**≤0.0036**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	99	
Gravimetric analysis date (total particulate)	21-11-2024	

2.13 MZR Furnace Baghouse

Date	12/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	MZR Furnace
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		241106

Stack Parameters		
Moisture content, %v/v	2.6	
Gas molecular weight, g/g mole	28.8 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.93	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1018 & 1145	
Temperature, °C	96	
Ambient pressure, kPa	102	
Stack pressure, kPa	99	
Velocity at sampling plane, m/s	6.4	
Volumetric flow rate, actual, m³/min	76	
Volumetric flow rate (wet STP), m³/min	55	
Volumetric flow rate (dry STP), m³/min	54	
Mass flow rate (wet basis), kg/h	4200	

Gas Analyser Results	Average	
Sampling time	1030 - 1059	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	12	0.64
Sulfur dioxide	<6	<0.3
Carbon monoxide	<6	<0.3
	Concentration % v/v	
Carbon dioxide	1.3	
Oxygen	18.8	

Isokinetic Results	Results	
Sampling time	1025-1131	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	23	1.2
Antimony	**<0.006**	**<0.0003**
Arsenic	**0.0037**	**0.0002**
Beryllium	<0.0008	<0.00004
Cadmium	**0.031**	**0.0017**
Chromium	0.0071	0.00038
Cobalt	<0.001	<0.00007
Copper	0.0096	0.00052
Lead	**0.051**	**0.0028**
Manganese	0.16	0.0084
Mercury	**<0.0007**	**<0.00004**
Nickel	0.0084	0.00045
Phosphorus	0.033	0.0018
Selenium	<0.009	<0.0005
Tin	<0.003	<0.0002
Vanadium	<0.002	<0.00009
Zinc	13	0.67
Total of Sb, As, Cd, Pb, Hg	**≤0.094**	**≤0.005**
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	107	
Gravimetric analysis date (total particulate)	22-11-2024	

2.14 MZR Dross Stack

Date	12/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		241106

Comments
No afterflows were recorded as this a batch process

Stack Parameters		
Moisture content, %v/v	1.7	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1055	
Temperature, °C	24	
Ambient pressure, kPa	102	
Stack pressure, kPa	98	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/min	190	
Volumetric flow rate (wet STP), m³/min	170	
Volumetric flow rate (dry STP), m³/min	170	
Mass flow rate (wet basis), kg/h	13000	

Gas Analyser Results	Average	
Sampling time	1112 - 1141	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	<4	<0.7
Carbon monoxide	<6	<1
	Concentration % v/v	
Carbon dioxide	<0.4	
Oxygen	20.9	

Date	12/11/2024	**Client**	Nyrstar Hobart
Report	R016328	**Stack ID**	MZR Dross Stack
Licence No.	7043-5	**Location**	Hobart
Ektimo Staff	G Trenear & T Bakas	**State**	TAS
Process Conditions	MZR Furnace in operation.		*241106*

Isokinetic Results	Results	
Sampling time	1055-1149	
	Concentration mg/m³	Mass Rate g/min
Total particulate matter	<3	<0.5
Antimony	**<0.008**	**<0.001**
Arsenic	**<0.003**	**<0.0006**
Beryllium	<0.001	<0.0002
Cadmium	**0.007**	**0.0012**
Chromium	0.0022	0.00036
Cobalt	<0.001	<0.0002
Copper	0.0048	0.00079
Lead	**0.027**	**0.0045**
Manganese	0.037	0.0062
Mercury	**<0.0009**	**<0.0001**
Nickel	0.0064	0.0011
Phosphorus	0.053	0.0088
Selenium	<0.008	<0.001
Tin	<0.003	<0.0006
Vanadium	<0.002	<0.0003
Zinc	0.76	0.13
Total of Sb, As, Cd, Pb, Hg	**≤0.046**	**≤0.0077**
Isokinetic Sampling Parameters		
Sampling time, min	56	
Isokinetic rate, %	98	
Gravimetric analysis date (total particulate)	21-11-2024	

3 Sample Plane Compliance

3.1 Foreshore A

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.2 Foreshore B

Sampling Plane Details	
Sampling plane dimensions	1530 mm
Sampling plane area	1.84 m²
Sampling port size, number & depth	4" Flange (x2), 150 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Centrifugal fan 3 D
No. traverses & points sampled	2 20
Sample plane conformance to AS 4323.1	Conforming but non-ideal

Comments

The number of points sampled is less than the requirement

The sampling plane is deemed to be non-ideal due to the following reasons:

The highest to lowest gas velocity ratio exceeds 1.6:1

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.3 Parageothite Dryer

Sampling Plane Details	
Sampling plane dimensions	950 mm
Sampling plane area	0.709 m²
Sampling port size, number & depth	4" Flange (x2), 50 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.4 Cadmium Smelter Plant Scrubber Stack

Sampling Plane Details	
Sampling plane dimensions	470 mm
Sampling plane area	0.173 m²
Sampling port size, number & depth	4" BSP (x2), 85 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Change in diameter 2 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.5 Copper Sulphate Crystalliser Plant Vent Stack

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" Flange (x2), 100 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest gas velocity ratio exceeds 1.6:1
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.6 Casting Ventilation 1 – V1

Sampling Plane Details	
Sampling plane dimensions	635 mm
Sampling plane area	0.317 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.7 Casting Ventilation 2 – V2

Sampling Plane Details	
Sampling plane dimensions	595 mm
Sampling plane area	0.278 m²
Sampling port size, number & depth	4" Flange (x1), 245 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.8 Roaster Baghouse

Sampling Plane Details	
Sampling plane dimensions	385 mm
Sampling plane area	0.116 m²
Sampling port size, number & depth	4" BSP (x2), 105 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.9 Zinc Oxide Fume Debagging Station

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number	3" Flange (x4)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Cowl >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.10 Anode Casting

Sampling Plane Details	
Sampling plane dimensions	450 mm
Sampling plane area	0.159 m²
Sampling port size, number	4" Flange (x1)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Centrifugal fan 2 D
No. traverses & points sampled	1 6
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.11 Zinc Plant 1 Baghouse – ZP1

Sampling Plane Details	
Sampling plane dimensions	390 x 500 mm
Sampling plane area	0.195 m²
Sampling port size, number	1" Holes (x3)
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	3 6
Sample plane conformance to AS 4323.1	Ideal sampling plane

3.12 Zinc Plant 3 Baghouse – ZP3

Sampling Plane Details	
Sampling plane dimensions	285 mm
Sampling plane area	0.0638 m²
Sampling port size, number	2" Holes (x2)
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 4 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

3.13 MZR Furnace Baghouse

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	4" BSP (x2), 80 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

3.14 MZR Dross Stack

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number	4" BSP (x2)
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend >2 D
Upstream disturbance	Junction >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

4 Plant Operating Conditions

See Nyrstar Hobart records for complete process conditions.

5 Test Methods

All sampling and analysis were performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate & velocity	AS 4323.1	AS 4323.1	8%, 7%	✓	✓
Moisture	USEPA Method 4	USEPA Method 4	8%	✓	✓
Moisture (stacks <60°C)	Ektimo 050	Ektimo 050	not specified	✓	✓[j]
Molecular weight	NA	USEPA Method 3	not specified	NA	✓
Carbon dioxide & oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Carbon monoxide	USEPA Method 10	USEPA Method 10	12%	✓	✓
Nitrogen oxides	USEPA Method 7E	USEPA Method 7E	12%	✓	✓
Sulfur dioxide	USEPA Method 6C	USEPA Method 6C	12%	✓	✓
Total particulate matter	AS 4323.2	AS 4323.2	7%	✓	✓[††]
Total (gaseous & particulate) metals (Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mn, Hg, Ni, P, Se, Zn)	USEPA Method 29	Envirolab in-house methods Metals-020/021/022	15%	✓	✓[‡]
Total (gaseous & particulate) metals (Non-USEPA 29) (Sn, V)	USEPA Method 29	Envirolab in-house methods Metals-020/021/022	15%	✗[‡‡]	✓[‡]
Sulfuric acid mist and/or sulfur oxides	USEPA Method 8	Ektimo 235	16%	✓	✓[†]

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* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

† Analysis performed by Ektimo. Results were reported to Ektimo on 21 November 2024 in report LV-006520.

†† Gravimetric analysis conducted at the Ektimo VIC laboratory.

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on:

- 3 December 2024 in report 367360.
- 20 December 2024 in report 368941.

‡‡ Specified metals are not listed in USEPA Method 29 and therefore, are not covered by NATA accreditation for sampling.

j Includes analysis of moisture content by Ektimo 050 which uses the same principle as ASTM E337.

6 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

Unless specifically noted, all samples were collected and handled in accordance with Ektimo's QA/QC standards.

7 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
AS	Australian Standard
BaP-TEQ	Benzo(a)pyrene toxic equivalents
BSP	British standard pipe
CEM/CEMS	Continuous emission monitoring/Continuous emission monitoring system
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
I-TEQ	International toxic equivalents
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
TOC	Total organic carbon. This is the sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
WHO05-TEQ	World Health Organisation toxic equivalents
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range

8 Appendices

Appendix A: Site Images

Image 1. Foreshore A

Image 2. Foreshore B

Image 3. Parageothite Dryer

Image 4. Cadmium Smelter Plant Scrubber Stack

Image 5. Copper Sulphate Crystalliser Plant Vent Stack

Image 6. Casting Ventilation 1 – V1

Image 7. Casting Ventilation 2 – V2

Image 8. Roaster Baghouse

Image 9. Anode Casting

Image 10. Zinc Plant 1 Baghouse – ZP1

Image 11. Zinc Plant 3 Baghouse – ZP3

Image 12. MZR Furnace Stack

Image 13. MZR Dross

Appendix B: Weather Observations

Hobart, Tasmania

November 2024 Daily Weather Observations

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours	km/h		local	°C	%	8th	km/h		hPa	°C	%	8th	km/h		hPa
1	Fr	7.6	15.5	0.2			WSW	54	14:45	12.2	49	8	WSW	24	1014	14.1	43	3	SW	33	1017
2	Sa	3	22.1	0.2			N	54	22:35	10.7	59		NNW	15	1020	20.5	30		N	33	1011
3	Su	10.3	20.8	0			N	76	4:24	16.6	42	2	WNW	33	998.7	19	40	8	W	33	1001
4	Mo	11.2	20.6	0			WNW	50	13:26	12.6	60	7	NW	26	1008	19.9	35	2	WNW	28	1009
5	Tu	5.6	21.1	0			SE	33	14:01	13.8	52		NW	19	1015	20.3	41		SSE	26	1011
6	We	11.1	28.7	0			N	63	13:16	17.1	52	6	NNW	20	1004	27.6	32		N	28	995.7
7	Th	10.5	20.1	0			SE	44	21:40	14.6	47		NW	19	1008	17.9	36	6	ESE	15	1005
8	Fr	8.5	18	0			NW	74	8:52	15.9	39		NW	43	997.2	15.6	37	7	WNW	39	1002
9	Sa	8.4	18.7	0			NW	50	11:42	13.5	48	4	NW	24	1013	16.5	42	8	WNW	22	1013
10	Su	9.5	16.7	0			WNW	37	1:45	12.8	55	8	WSW	17	1021	15.5	43	4	SE	22	1022
11	Mo	4.8	18.9	0			S	44	16:17	14.1	52		NW	15	1021	17.9	46		SE	24	1019
12	Tu	6.5	23.1	0			SSW	46	20:12	14	68		WNW	11	1019	21.6	46		SSE	22	1013
13	We	11.7	18.4	0.2			S	43	18:00	17.4	80		WNW	7	1007	14.9	86	8	SSE	20	1008
14	Th	8.4	19.6	2.4			WNW	46	10:29	13.7	47	1	WNW	28	1017	17.8	35	7	WSW	13	1016
15	Fr	6.5	17.3	0			NE	39	17:44	10.6	68	8	NW	4	1025	15.8	48	8	ENE	17	1023
16	Sa	10.6	24.8	0			S	54	14:23	16.4	63	1	NW	9	1017	20.8	64	8	SSE	26	1014
17	Su	14.4	25.6	0			WNW	59	13:14	20.8	66	2	N	24	998	14.6	74	7	NW	44	996.5
18	Mo	10	17.7	4.4			WSW	65	14:36	14.3	49	3	WSW	17	1006	14.3	69	8	SSW	26	1012
19	Tu	10.3	16.6	0			SSE	37	16:15	12.5	54	7	SSW	19	1024	15.4	51		SE	22	1022
20	We	8.4	17.2	0			SSE	43	10:53	14.4	52	6	NW	9	1026	14.6	59	1	SSE	30	1027
21	Th	11.3	21.7	0			SE	43	14:19	14.7	65	5	NE	9	1027	20.9	55		SE	31	1023
22	Fr	9.8	21.7	0			S	31	14:42	15.7	73	5	WSW	6	1023	21.4	57		SSE	20	1019
23	Sa	12.7	27.8	0			N	39	13:46	21.6	62	2	N	15	1015	26.9	32	4	NNW	24	1011
24	Su	13.5	16.4	0			SE	33	6:13	14.1	89	8	SSE	22	1018	15.3	75	7	S	22	1018
25	Mo	12.5	19.3	0			SSE	37	13:54	13.5	95	8	S	13	1017	16.7	70	7	SSE	30	1014
26	Tu	13.5	22.2	0			SSE	37	16:01	16.5	79	8	NW	7	1011	20.9	67		SSE	20	1008
27	We	16	19.7	0			S	30	20:48	18.5	80	8	N	11	1004	17.8	97	8	SE	11	1001
28	Th	11.7	16	7.8			S	46	0:09	12.6	88	8	S	28	1019	15.2	63	7	S	24	1023
29	Fr	11.5	18.4	2			E	33	12:13	14.9	67	8	ESE	9	1028	14.5	74	7	E	17	1027
30	Sa	10.6	19.8	0			NE	28	12:42	15.2	76	8	ESE	9	1021	17.7	76	8	NE	17	1016
Statistics for November 2024																					
Mean		10	20.1							14.8	62	5		17	1015	18.1	54	6		24	1013
Lowest		3.0	15.5	0						10.6	39	1	NW	4	997.2	14.1	30	1	SE	11	995.7
Highest		16.0	28.7	7.8			N	76		21.6	95	8	NW	43	1028	27.6	97	8	NW	44	1027
Total				17.2																	

IDCJDW7062.202411 Prepared at 16:03 UTC on Thursday 2 January 2025

***Site name**: HOBART AIRPORT* ***Site number:** 0944250* ***Latitude:** 42.84 °S* ***Longitude:** 147.50 °E* ***Elevation:** 7 m*

December 2024 Daily Weather Observations

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9:00 AM						3:00 PM					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours	km/h		local	°C	%	8th	km/h		hPa	°C	%	8th	km/h		hPa
1	Su	15.1	26.4	13			NNW	57	14:34	19.7	84	1	WNW	11	998.9	25.8	44	4	N	35	998.1
2	Mo	15.7	27.5	0.4			W	54	15:30	20.1	58	8	NW	26	998.8	25.9	39		W	26	999.4
3	Tu	13.3	26.2	3.2			W	52	18:03	16.2	95	8	NNW	6	1001	23.6	68	8	NNW	19	995.2
4	We	11.9	23.6	4.4			W	35	23:11	16.1	52		WNW	22	1014	22.7	36		SE	20	1014
5	Th	12.3	27.5	0.2			S	41	15:53	19.9	64	6	NNW	11	1018	25.2	51	8	SE	20	1014
6	Fr	12.4	20.3	0			S	39	12:24	19.1	67	8	SE	7	1015	17.8	76	5	S	28	1016
7	Sa	14	20.9	23			W	59	22:05	14.7	99	8	SW	7	1005	20.1	76	4	NNW	9	1000
8	Su	11	19	13.4			W	61	9:16	13.6	53	1	WNW	37	1003	18.8	45	8	WNW	35	1004
9	Mo	12.6	20.2	0			NW	54	15:14	15.8	56	1	NW	30	1009	18.7	43	6	NW	33	1008
10	Tu	12.8	19.5	0			NW	43	8:08	17.3	56	1	WNW	24	1008	16.6	48	8	WSW	19	1008
11	We	12.5	20.7	0			NW	65	10:26	14.8	54	6	NW	28	1003	19.5	50	3	NW	48	995.8
12	Th	14.7	20.5	0			WNW	65	1:25	17.5	51	8	WNW	17	998.9	16.4	65	8	SE	20	999.5
13	Fr	14.2	19.2	0			W	59	9:30	14.7	70	8	W	26	1001	18.1	49	8	SSW	20	1004
14	Sa	7.5	21.9	0.8			WNW	41	11:25	14.4	56	8	NW	19	1010	18.8	47	6	SE	20	1008
15	Su	9.3	22.7	0			SSE	39	12:54	16.4	60		NNE	7	1014	20.9	58		SE	28	1013
16	Mo	15.8	31.6	0			NNW	52	14:14	20.3	57	8	NNW	24	1008	30.8	38		N	28	999.9
17	Tu	14.4	21	8.6			NW	83	12:11	17.7	51		WNW	39	999.5	20.2	46	3	W	33	1000
18	We	12.1	20.6	0			SSE	44	15:58	16.1	49		WSW	17	1019	17.6	65		SSE	31	1021
19	Th	13.1	20.4	0			SSE	31	15:05	15.1	68	8	ENE	7	1023	19.3	56		SSE	24	1020
20	Fr	9.2	25.6	0			NE	31	14:33	17.4	66		NE	7	1014	25.1	46		NE	13	1008
21	Sa	14.7	19.7	3.4			S	61	16:19	18.1	56		SSW	22	1009	17.7	66	2	SSE	39	1010
22	Su	7.4	21.3	0			SW	50	17:46	13.6	62	3	NNE	9	1009	20.2	53	2	SE	26	1001
23	Mo	10.8	17.4	19			SSW	48	14:21	13.5	56	8	WSW	22	1002	17	57	1	SSW	28	1001
24	Tu	11	23.6	0.6			SW	44	6:10	15.6	48	5	SSW	15	1009	19.6	58	7	ESE	7	1008
25	We	8.2	21.7	0			NW	28	23:18	17.3	61	6	WSW	7	1013	19.6	56	5	SE	22	1013
26	Th	13.8	28.3	0.2			N	44	18:08	17.6	75	7	NNW	9	1006	25.8	50	1	S	20	998.4
27	Fr	13.3	20.5	1.4			NW	72	6:11	16.9	55	8	W	37	991.2	19	34	5	W	39	998
28	Sa	12.9	20.7	0			NW	48	1:53	15.6	61	8	NNW	17	1001	19.8	40	5	W	28	1001
29	Su	12.9	24.1	0.4			W	56	10:01	17.7	54	8	NNW	13	1006	23.1	36		W	30	1009
30	Mo	11.8	25	0			NW	30	12:05	18.1	57		N	13	1015	21.9	51	8	SE	17	1011
31	Tu	10	21.8	0			SE	37	15:03	17.3	53	1	NE	9	1016	21	44		SSE	24	1014
Statistics for December 2024																					
Mean		12.3	22.6							16.7	61	5		17	1008	20.9	51	5		25	1006
Lowest		7.4	17.4	0						13.5	48	1	NNW	6	991.2	16.4	34	1	ESE	7	995.2
Highest		15.8	31.6	23			NW	83		20.3	99	8	WNW	39	1023	30.8	76	8	NW	48	1021
Total				92.0																	

IDCJDW7062.202412 Prepared at 13:03 UTC on Tuesday 7 January 2025

Site name: *HOBART AIRPORT* ***Site number:*** *0944250* ***Latitude:*** *42.84 °S* ***Longitude:*** *147.50 °E* ***Elevation:*** *7 m*

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