

RICHBAY CHEMICALS (PTY) LTD

VOSLOORUS CHEMICAL FILLING PLANT

AIR QUALITY IMPACT ASSESSMENT

01 SEPTEMBER 2020





VOSLOORUS CHEMICAL FILLING PLANT

AIR QUALITY IMPACT ASSESSMENT

RICHBAY CHEMICALS (PTY) LTD

PROJECT NO.: 41101911
DATE: SEPTEMBER 2020

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1 INTRODUCTION

Richbay Chemicals (Pty) Ltd (Richbay) is a chemical manufacturer and international distributor of various speciality cleaning, maintenance, and water treatment chemical products, and is a major exporter of hydrochloric acid (HCl) and sulphuric acid (H₂SO₄) in packed form.

The company operates several manufacturing and distribution plants located in Richards Bay, Pietermaritzburg and Gauteng, and is looking to expand its business operations by establishing a filling and acid regeneration plant in Vosloorus, 26 km southeast of Johannesburg.

Primary business operations at the proposed plant will include:

- A filling plant for the decanting of chemicals from bulk storage into smaller packages for distribution; and
- An acid regeneration plant for the reprocessing waste HCl.

1.1 PURPOSE AND OBJECTIVES

Richbay have initiated the Environmental Impact Assessment (EIA) required for environmental authorisation of the proposed Vosloorus facility. The proposed activity falls under *Category 6: Organic Chemicals Industry*, and *Subcategory 7.2: Production of Acids* of Government Notice Regulation 893 of 2013¹, promulgated in line with Section 21 of the National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA)². As such, an Air Quality Impact Assessment (AQIA) is required as part of the EIA process to support the application for an Atmospheric Emissions License (AEL).

1.2 SCOPE OF WORKS

The scope of work for this AQIA is summarised as follows:

- Undertake a baseline assessment to contextualise the area, including:
 - Review of applicable air quality legislation;
 - Identification of neighbouring sensitive receptors;
 - Identification of neighbouring air pollution sources;
 - Assessment of prevailing meteorological conditions; and
 - Assessment of existing ambient air quality conditions.
- Develop an emissions inventory using internationally accepted emission factors and the available activity data and design information provided by Richbay for the operational phase of the proposed Vosloorus facility.
- Simulate the dispersion of atmospheric pollutants from the proposed facility using a Level 2 (AERMOD) dispersion model. Modelling scenarios for assessment include:
 - 1 Impacts associated with facility operations; and
 - 2 Cumulative impacts using background ambient air quality monitoring data (if available).

Pollutants of focus include those regulated by National Ambient Air Quality Standards (NAAQS) as well as pollutants regulated by applicable Minimum Emission Standards (MES). In this case, these include:

- sulphur dioxide (SO₂);
- nitrogen dioxide (NO₂);
- carbon monoxide (CO);
- particulate matter (PM₁₀ and PM_{2.5});
- lead (Pb);

¹ Department of Environmental Affairs: (2013): List of Activities which result in Atmospheric Emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage (No. R. 893), Government Gazette, 22 November 2013, (No. 37054), as amended by GN 551 in 2015 and GN 1207 in 2018.

² South Africa (2005): *National Environmental Management: Air Quality Act* (No. R. 39 of 2004) Government Gazette, 24 February 2005 (No. 27318)

- Benzene (C₆H₆); and
- Hydrogen chloride (HCl).
- Assess the associated air quality impacts by comparing predicted ground-level pollutant concentrations with relevant NAAQS;
- Compile a specialist air quality assessment detailing all findings and providing recommendations on mitigation measures to limit impacts (where applicable); and
- Compile and submit an AEL application to the relevant authority.

1.3 ENTERPRISE DETAILS

Primary project information is provided in **Table 1-1**, with the details of the responsible contact person presented in **Table 1-2**.

Table 1-1: Enterprise details

Enterprise Name	Richbay Chemicals (Pty) Ltd
Trading as	Richbay Chemicals (Pty) Ltd
Type of Enterprise, e.g. Company/Close Corporation/Trust	Private Company
Registered Address	63/65 Ceramic Curve, Alton, Richards Bay, 3900
Postal Address	P.O. Box 368, Richards Bay, 3900
Telephone Number (General)	033 386 0500
Fax Number (General)	033 386 0510
Industry Type/Nature of Trade	Dangerous goods filling plant
Land Use Zoning as per Town Planning Scheme	Industrial
Land Use Rights if outside Town Planning Scheme	N/A

Table 1-2: Contact details

Responsible Person	Martin Klopper
Emission Control Officer	Martin Klopper
Telephone Number	033 386 0500
Cell Phone Number	083 659 7775
Fax Number	033 386 0510
E-mail Address	martink@richbay.co.za
After Hours Contact Details	083 659 7775

2 REGULATORY FRAMEWORK

Until 2004, South Africa's approach to air pollution control was driven by the Atmospheric Pollution Prevention Act 45 of 1965 (APPA) which was repealed with the promulgation of National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA)³. NEM:AQA represents a shift in South Africa's approach to air quality management, from source-based control to integrated effects-based management. The objectives of NEM:AQA are to:

- Protect the environment by providing reasonable measures for:
 - The protection and enhancement of air quality;
 - The prevention of air pollution and ecological degradation;
 - Securing ecologically sustainable development while promoting justifiable economic and social development; and
 - Give effect to everyone's right "*to an environment that is not harmful to their health and well-being*"⁴

Significant functions detailed in NEM:AQA include:

- The National Framework for Air Quality Management⁵;
- Institutional planning matters, including:
 - The establishment of a National Air Quality Advisory Committee;
 - The appointment of Air Quality Officers (AQOs) at each level of government; and
 - The development, implementation and reporting of Air Quality Management Plans (AQMP) at national, provincial and municipal levels;
- Air quality management measures including:
 - The declaration of Priority Areas where ambient air quality standards are being, or may be, exceeded;
 - The listing of activities that result in atmospheric emissions and which have the potential to impact negatively on the environment and the licensing thereof through an Atmospheric Emissions License (AEL);
 - The declaration of Controlled Emitters;
 - The declaration of Controlled Fuels;
 - Procedures to enforce Pollution Prevention Plans or Atmospheric Impact Reporting for the control and inventory of atmospheric pollutants of concern; and
 - Requirements for addressing dust and offensive odours.

³ South Africa (2005): *National Environmental Management: Air Quality Act* (No. R. 39 of 2004) Government Gazette, 24 February 2005 (No. 27318)

⁴ South Africa (1996): *Constitution of the Republic of South Africa* (No. 108 of 1996)

⁵ Department of Environmental Affairs (2018): *The 2017 National Framework for Air Quality Management in the Republic of South Africa* (No.R.1144 of 2018) Government Gazette, 26 October 2018 (No. 41996)

2.1 MINIMUM EMISSION STANDARDS

Richbay's proposed Vosloorus facility triggers the following (**Table 2-1**) Listed Activities under Government Notice 893 of 2013⁶ with associated Minimum Emission Standards (MES) presented in **Table 2-2** and **Table 2-3**.

Table 2-1: Applicable Section 21 categories

Section 21 category	Subcategory	Process trigger
6: Organic Chemicals Industry	N/A	The use of organic chemicals including 300 tonnes per annum of Formalin (formaldehyde)
7: Inorganic Chemicals Industry	7.2: Production of Acids	Secondary production of hydrochloric acid through regeneration.

Table 2-2: Minimum Emission Standards for Category 6 - Organic Chemicals Industry

Description	The production, or use in production, of organic chemicals not specified elsewhere, including acetylene, acetic, maleic or phthalic anhydride or their acids, carbon disulphide, pyridine, formaldehyde, acetaldehyde, acrolein and its derivatives, acrylonitrile, amines and synthetic rubber. The production of organometallic compounds, organic dyes and pigments, surface active agents. The polymerisation or co-polymerisation of any unsaturated hydrocarbons, substituted hydrocarbon (including vinyl chloride). The manufacture, recovery or purification of acrylic acid or any ester of acrylic acid. The use of toluene di-isocyanate or other di-isocyanate of comparable volatility; or recovery of pyridine.		
Applications	All installations producing or using more than 100 tons per annum of any of the listed compounds.		
Substance or mixture of substances		Plant status	mg/Nm³ under normal conditions of 10% O₂, 273 Kelvin and 101.3 kPa
Common name	Chemical symbol		
Sulphur trioxide (from sulphonation processes)	SO ₃	New	30
		Existing	100
Acrylonitrile (from processes producing and/or using acrylonitrile)	CH ₂ CHCN	New	5
		Existing	5
Methylamines (from nitrogen – containing organic chemicals)	CH ₅ N	New	10
		Existing	10
Total volatile organic compounds (thermal)	N/A	New	150
		Existing	150
Total volatile organic compounds (non-thermal)	N/A	New	40,000
		Existing	40,000

- (a) The following transitional arrangement shall apply for the storage and handling of raw materials, intermediate and final products with a vapour pressure greater than 14 kPa at operating temperature: -
Leak detection and repair (LDAR) program approved by licensing authority to be instituted, by 01 January 2014.
- (b) The following special arrangements shall apply for control of TVOCs from the storage of raw materials, intermediate and final products with a vapour pressure of up to 14 kPa at operating temperature, except during loading and offloading. (Alternative control measures that can achieve the same or better results may be used) –
- (i) Storage vessels for liquids shall be of the following type:

Application	All permanent immobile liquid storage facilities at a single site with a combined storage capacity of greater than 1000 cubic metres.
True vapour pressure of contents at product storage temperature	Type of tank or vessel
Type 1: Up to 14 kPa	Fixed-roof tank vented to atmosphere, or as Type 2 and 3
Type 2: Above 14 kPa	Fixed-roof tank with Pressure Vacuum Vents fitted as a minimum, to prevent "breathing" losses, or as Type 3
Type 3: Above 14 kPa and up to 91 kPa with a throughput greater than 50 000 m ³ per annum	external floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20 m or fixed-roof tank with internal floating deck/roof fitted with primary seal, or fixed-roof tank with vapour recovery system.

⁶ Department of Environmental Affairs: (2013): List of Activities which result in Atmospheric Emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage (No. R. 893), Government Gazette, 22 November 2013, (No. 37054), as amended by GN 551 in 2015 and GN 1207 in 2018.

Application	All permanent immobile liquid storage facilities at a single site with a combined storage capacity of greater than 1000 cubic metres.
True vapour pressure of contents at product storage temperature	Type of tank or vessel
Type 4: Above 91 kPa	Pressure vessel

- (ii) The roof legs, slotted pipes and/or dipping well on floating roof tanks (except for domed floating roof tanks or internal floating roof tanks) shall have sleeves fitted to minimise emissions.
- (iii) Relief valves on pressurised storage should undergo periodic checks for internal leaks. This can be carried out using portable acoustic monitors or if venting to atmosphere with an accessible open end, tested with a hydrocarbon analyser as part of an LDAR programme.
- (c) The following special arrangements shall apply for control of TVOCs from the loading and unloading (excluding ships) of raw materials, intermediate and final products with a vapour pressure of greater than 14 kPa at handling temperature. Alternative control measures that can achieve the same or better results may be used:
- (i) All installations with a throughput of greater than 50 000m³ per annum of products with a vapour pressure greater than 14 kPa, must be fitted with vapour recovery destruction units. Emission limits are set out in the table below -

Description	Vapour Recovery Units		
Application	All loading/offloading facilities with a throughput greater than 50 000 m ³		
Substance or mixture of substances		Plant status	mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa.
Common name	Chemical symbol		
Total volatile organic compounds from vapour recovery/destruction units using thermal treatment.	N/A	New	150
		Existing	150
Total volatile organic compounds from vapour recovery/destruction units using non thermal treatment	N/A	New	40 000
		Existing	40 000

- (ii) For road tanker and rail car loading/offloading facilities where the throughput is less than 50 000 m³ per annum, and where ambient air quality is, or is likely to be impacted, all liquid products shall be located using bottom loading, or equivalent, with the venting pipe connected to a vapour balancing system. Where vapour balancing and/or bottom loading is not possible, a recovery system utilizing adsorption, condensation or incineration of the remaining VOCs, with a collection efficiency of at least 95%, shall be fitted.

Table 2-3: Minimum Emission Standards for Subcategory 7.2 - Production of Acids

Description	The production, bulk handling and or use of hydrofluoric, hydrochloric, nitric and sulphuric acid (including oleum) in concentration exceeding 10%. Processes in which oxides of sulphur are emitted through the production of acid sulphites of alkalis or alkaline earths or through the production of liquid sulphur or sulphurous acid. Secondary production of hydrochloric acid through regeneration.		
Applications	All installations producing, handling and or using more than 100 tons per annum of any of the listed compounds. (Excluding metallurgical processes – related activities regulated under category 4).		
Substance or mixture of substances		Plant status	mg/Nm³ under normal conditions of 10% O₂, 273 Kelvin and 101.3 kPa
Common name	Chemical symbol		
Total fluoride measured as hydrogen fluoride (from processes in which HF is evolved)	F as HF	New	5
		Existing	30
Hydrogen chloride (from primary production of hydrochloric acid)	HCl	New	15
		Existing	25
Hydrogen chloride (from secondary production of hydrochloric acid)	HCl	New	30
		Existing	100
Sulphur dioxide	SO ₂	New	350
		Existing	2800
Sulphuric acid mist and sulphur trioxide expressed as SO ₃ (from processes in which SO ₃ is evolved)	SO ₃	New	25
		Existing	100
Oxides of nitrogen expressed as NO _x	NO _x	New	350
		Existing	2000

2.2 NATIONAL AMBIENT AIR QUALITY STANDARDS

Ambient air quality standards are defined as “*targets for air quality management which establish the permissible concentration of a particular substance in, or property of, discharges to air, based on what a particular receiving environment can tolerate without significant deterioration*”⁷. The aim of these standards is to provide a benchmark for air quality management and governance. South Africa’s National Ambient Air Quality Standards (NAAQS) are based primarily on guidance offered by two standards set by the South African National Standards (SANS):

- SANS 69:2004 Framework for implementing National ambient air quality standards; and
- SANS 1929:2005 Ambient air quality – Limits for common pollutants.

SANS 69:2004 makes provision for the establishment of air quality objectives for the protection of human health and the environment as a whole. Such air quality objectives include limit values, alert thresholds and target values.

SANS 1929:2005 uses the provisions in SANS 69:2004 to establish air quality objectives for the protection of human health and the environment, and stipulates that limit values are initially set to protect human health. The setting of such limit values represents the first step in a process to manage air quality and initiate a process to ultimately achieve acceptable air quality nationally.

The NAAQS presented in **Table 2-4** became applicable for air quality management from their promulgation in 2009⁸ and 2012⁹. The NAAQS generally have specific averaging periods, compliance timeframes, permissible frequencies of exceedance and measurement reference methods.

Table 2-4: South African National Ambient Air Quality Standards

Pollutant	Averaging Period	Concentration	Permissible Frequency of Exceedance
		µg/m ³	
Particulate Matter (PM ₁₀)	24 hours	75	4
	1 year	40	0
Particulate Matter (PM _{2.5})	24 hour	40	4
		25 ^a	4
	1 year	20	0
		15 ^a	0
Benzene (C ₆ H ₆)	1 year	5	0
Sulphur Dioxide (SO ₂)	10 minutes	500	526
	1 hour	350	88
	24 hours	125	4
	1 year	50	0
Nitrogen Dioxide (NO ₂)	1 hour	200	88
	1 year	40	0
Carbon Monoxide (CO)	1 hour	30000	88
	8 hour	10000	11
Ozone (O ₃)	8 hour	120	11
Lead (Pb)	1 year	0.5	0

a: Effective date is 01 January 2030

⁷ Department of Environmental Affairs (2000): *Integrated Pollution and Waste Management Policy for South Africa*. Government Gazette (No. R 227 of 2000), 17 March 2000 (No. 20978)

⁸ Department of Environmental Affairs (2009): National Ambient Air Quality Standards. Government Gazette (No. R 1210 of 2009), 24 December 2009 (No. 32816)

⁹ Department of Environmental Affairs (2012): National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Micro Metres (PM_{2.5}). Government Gazette (No. R 486 of 2012), 29 June 2012 (No. 35463)

2.3 CRITERIA FOR HYDROCARBON EXPOSURE

TVOCs is the term used for a class of several hundred carbon based chemical compounds that evaporate easily into air. Some VOCs have no known human health effects while the toxicity and carcinogenicity of others is well established. Little is known about how VOCs combine in the atmosphere or what the potential cumulative impacts might be on the human body, making analysis, risk assessment and guideline setting difficult. Benzene is the only VOC with an established NAAQS in South Africa and therefore this NAAQS is used in this study as a conservative reference threshold for assessing the degree of impact from exposure to ambient TVOC.

2.4 CRITERIA FOR HYDROGEN CHLORIDE EXPOSURE

In the absence of local standards for HCl, international guidance from the Texas Commission on Environmental Quality (TCEQ) was applied. TCEQ is the environmental agency for the state of Texas in the United States. TCEQ have developed Effects Screening Levels (ESLs) to evaluate impacts from pollutant concentrations predicted by dispersion modelling simulations. ESLs, which include both short- (1-hour) and long-term (annual) limit values, are chemical-specific concentration limits set to protect human health and welfare. They are not ambient air quality standards but rather a guideline as to whether airborne contaminants present adverse risk. Short-term ESLs are based on data concerning acute health effects, the potential for nuisance odour and effects on vegetation, while long-term ESLs are based on data concerning chronic health and vegetation effects. Welfare ESLs (i.e. odour and vegetation effects) are based on effect thresholds while health ESLs are based on toxicity factors and dose responses relevant to humans¹⁰. TCEQ threshold limits for health impact from exposure to ambient HCl are provided in **Table 2-5**.

Table 2-5: TCEQ guidelines for HCl

Pollutant	Averaging Period	Concentration
		$\mu\text{g}/\text{m}^3$
Hydrogen chloride (HCl)	1-hour	190
	1 year	7.9

2.5 GREENHOUSE GASES AND CLIMATE CHANGE

The United Nations Framework Convention on Climate Change (UNFCCC) recognises that anthropogenic climate change is a global issue requiring cohesive commitment from the international community. The level of responsibility varies between ‘developed’ (Annex 1) and ‘developing’ (Non-Annex 1) countries. The framework convention is expanded on through protocols and agreements, of which the Kyoto Protocol and Paris Agreement are the most recent and well recognised.

In terms of the provisions made under UNFCCC, South Africa has prepared and periodically updates a national inventory of greenhouse gas (GHG) emissions and has published a National Climate Change Response White Paper (October 2011)¹¹. South Africa’s approach to climate change is to implement mitigation and adaption measures that contribute to a fair and effective global solution, while simultaneously building and maintaining South Africa’s international competitiveness and achieving sustainable development goals.

Although the UNFCCC has categorised South Africa as a Non-Annex 1 party and therefore not bound by a commitment to cap or reduce GHG emissions, Government has proceeded to develop strategic policy with the aim of peaking national GHG emissions between 2020 and 2025 and reducing GHG emissions from 2036 onwards. In support of this goal, the following GHGs were declared as priority air pollutants in July 2017¹²:

- carbon dioxide (CO₂);

¹⁰ TCEQ (2006): Guidelines to Develop Effects Screening Levels, Reference Values and Unit Risk Factors. RG-442

¹¹ Department of Environmental Affairs (2001): *National Climate Change Response White Paper*. www.environment.gov.za

¹² Department of Environmental Affairs (2017): *Declaration of Greenhouse Gases as Priority Air Pollutants* (No. R. 710 of 2017) Government Gazette, 21 July 2017 (No. 40996)

- methane (CH₄);
- nitrous oxide (N₂O);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs); and
- sulphur hexafluoride (SF₆).

Polluters emitting GHGs in excess of 0.1 Megatonnes (Mt) per annum (measured as CO₂-eq) are required to develop a Pollution Prevention Plan.

The National Greenhouse Gas Emission Reporting Regulations¹³ were gazetted on 3 April 2017. This presents a single national GHG reporting system that will inform policy development and maintain the national GHG inventory as part of South Africa's obligations under the UNFCCC.

¹³ Department of Environmental Affairs (2017): *National Greenhouse Gas Emission Reporting Regulations* (No. R. 275 of 2017) Government Gazette, 03 April 2017 (No. 40762)

3 BASELINE ASSESSMENT

3.1 LOCATION AND EXTENT OF THE PLANT

Richbay has existing chemical filling plants in South Africa. A station is required closer to markets in the northern parts of the country. The proposed site is centrally located in the Gauteng province and in close proximity to major transport routes. The proposed site is located approximately 26 km southeast of Johannesburg, between the N3 and the R103 routes, and can be accessed using the Waterlands Road, which connects to the R103. The site is zoned as industrial. Plant location details are provided in **Table 3-1**. Neighbouring industrial activity includes:

- A truck and heavy equipment business 300 m to the north of the site; and
- A corrosion coating (painting, lining, coating etc.) business adjacent to the east of the site.

Open grassland is located south of the site, and the township of Vosloorus is located approximately 150 m west of the site, across the N3 highway.

Table 3-1: Plant location details

Physical Address of the Premises	Portion 107 of Farm Klippoortjie, Calcium Road, Wadeville, Germiston.
Description of Site (Where No Street Address)	N/A
Coordinates of Approximate Centre of Operations	26°21'31.15"S ; 28°14'10.43"E
Extent (km ²)	0.1
Elevation Above Mean Sea Level (m)	1551
Province	Gauteng
Metropolitan/District Municipality	Ekurhuleni Municipality
Local Municipality	N/A
Designated Priority Area	Highveld Priority Area

3.2 SENSITIVE RECEPTORS

The west and northwestern portion of the study area is characterised by high density housing, both formal and informal, interspersed by road networks. Numerous schools and medical facilities are located west of the proposed site. Open fields and smallholdings dominate the north, eastern and southern parts of the study area. Ten sensitive receptors (i.e. places where sensitive individuals may be impacted, such as residences, schools and medical facilities) were selected for evaluation, providing for a range of activities and distances from the source along key wind trajectories¹⁴ (**Table 3-2** and **Figure 3-1**).

¹⁴ Residential receptors were restricted to the three areas closest to the proposed site. Schools and medical facilities were selected across the study area.

Table 3-2: Sensitive receptors

ID	Receptor Name	Approx. distance from site (km)	Direction	X – Coordinate (m)	Y – Coordinate (m)
1	Umdlebe Road	0.2	W	622948.13	7084035.66
2	Pelsers Road	0.78	NNW	623064.56	7084862.84
3	Corner of Diana and Boundary road	1.07	NE	624354.30	7084785.31
4	Corner of Whipp and Boundary road	0.82	E	624340.21	7083946.63
5	Corner of R103 and Waterlands Road	1.11	SSE	623924.39	7082882.42
6	Vosloorus	3.01	WWN	620163.57	7084638.14
7	Corner of Flanagan and Vredeplaas Road	4.20	NW	620645.57	7087553.09
8	Villa Lisa	3.5	NE	624398.29	7087518.66
9	Farmstead off Diana Road	3.43	SE	626693.53	7082606.85
10	Zonkizizwe	4.77	SW	619520.91	7080885.42

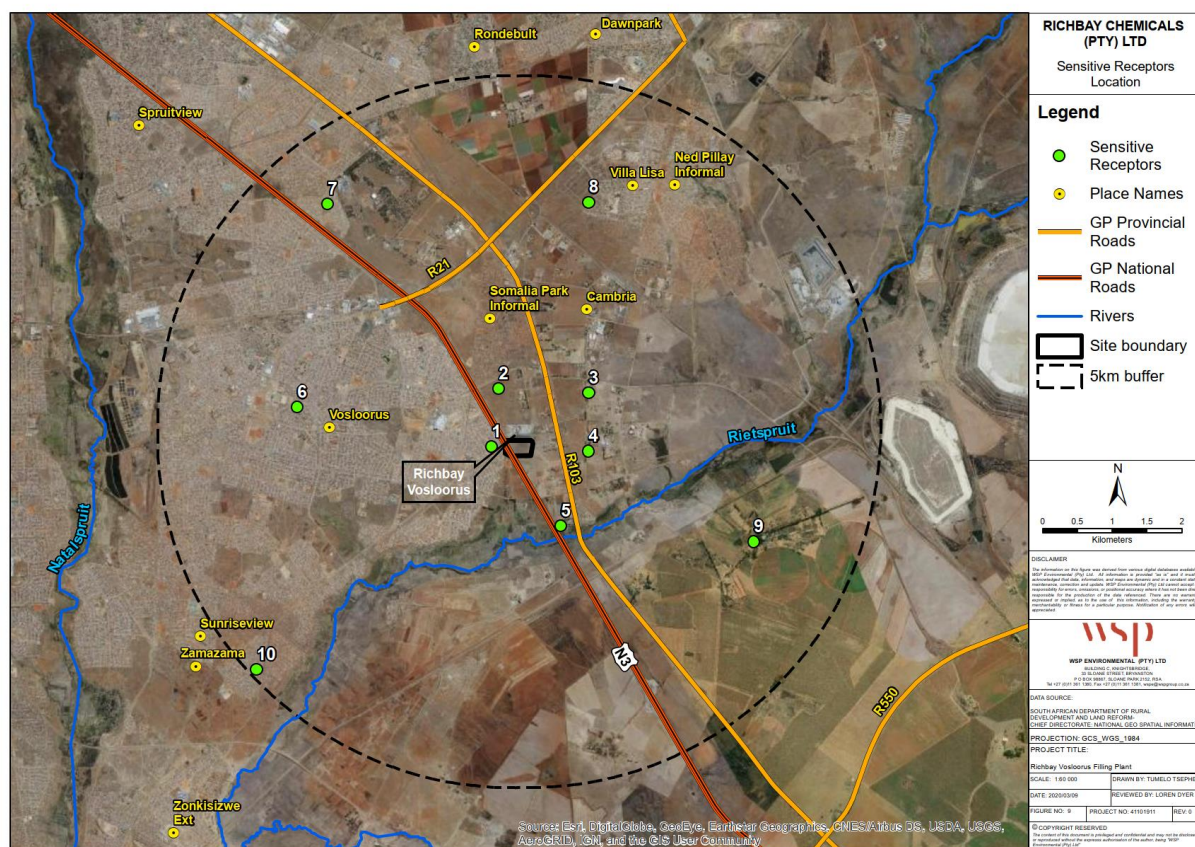


Figure 3-1: Sensitive receptors

3.3 PROCESS DESCRIPTION

Ferric chloride (FeCl_3) is used in a wide range of applications in the industrial sector including surface water clarification, heavy metal precipitation, industrial effluent treatment and phosphate precipitation in sewage treatment. At present, Richbay is the only producer and supplier of FeCl_3 to South Africa and neighbouring countries. By establishing a facility in Gauteng and increasing overall production, Richbay can meet supply demands and cost-effectively distribute their product to the northern regions of the country and neighbouring international markets.

It is intended that the proposed plant will be commissioned in three phases as outlined in **Sections 3.3.1, 3.3.2 and 3.3.3**. The proposed plant layout is provided in **Figure 3-2**.

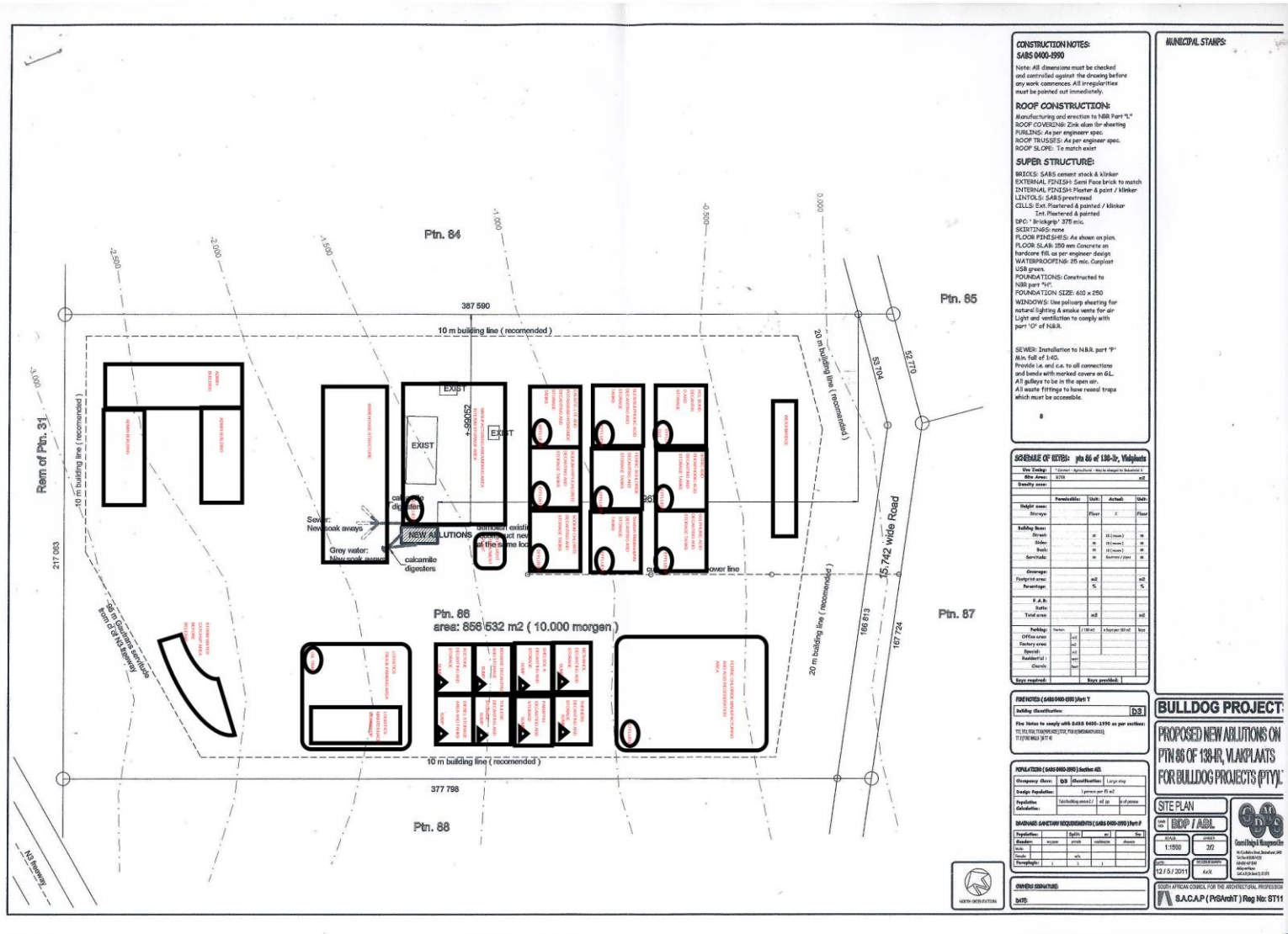


Figure 3-2: Proposed plant layout

VOSLOORUS CHEMICAL FILLING PLANT
Project No. 41101911
RICHBAY CHEMICALS (PTY) LTD

3.3.1 PHASE 1 - FILLING PLANT

Phase 1 of the development is the construction of the filling plant. No manufacturing will be undertaken during this phase. At the filling plant, various chemicals will be brought in and decanted from bulk tankers to medium sized packages. The packed products will be transferred to the warehouse in preparation for distribution to customers. Palletizing and strapping might be required. Chemicals to be decanted in the filling plant include:

- water purification chemicals: HCl, H₂SO₄, FeCl₃, sodium hypochlorite (NaOCl), caustic soda (NaOH), sodium chlorite liquid (NaClO₂) and sodium metabisulphite (Na₂S₂O₅);
- nitric acid (HNO₃);
- formalin (CH₂O);
- sodium laureth sulphate (SLES, CH₃(CH₂)₁₁(OCH₂CH₂)_nOSO₃Na) 70%;
- linear alkyl benzene sulphonic acid (LABSA, C₁₈H₃₀O₃S);
- soda ash (Na₂CO₃);
- potassium hydroxide (NaOH) liquid; and
- phosphoric acid (H₃PO₄).

It is estimated that at full operational capacity, the filling plant will have a maximum of 1,155 m³ total storage capacity. All HCl storage tanks will be ducted through the HCl scrubber located in the acid regeneration plant (Phase 2).

3.3.2 PHASE 2 - ACID REGENERATION PLANT

Phase 2 includes the construction of an acid regeneration plant for the reprocessing of waste HCl into ferric chloride and a small portion of calcium chloride. This process (**Figure 3-3**) is detailed as follows:

- Waste acid will go through an iron exchange process and strengthened with HCl (from the Phase 1 filling plant);
- The mixture will then be put through an evaporation process (with the use of a paraffin fuelled boiler) to increase the percentage of FeCl₃ from approximately 30% to 40-44%;
- FeCl₃ will be stored in bulk tanks and then decanted into smaller pack sizes or bulk road tankers for distribution; and
- Waste zinc chloride (ZnCl₂) will be sold to the market as a dust suppressor.

Exhaust emissions from the evaporator will pass through a scrubber to remove HCl from flue gases prior to release.

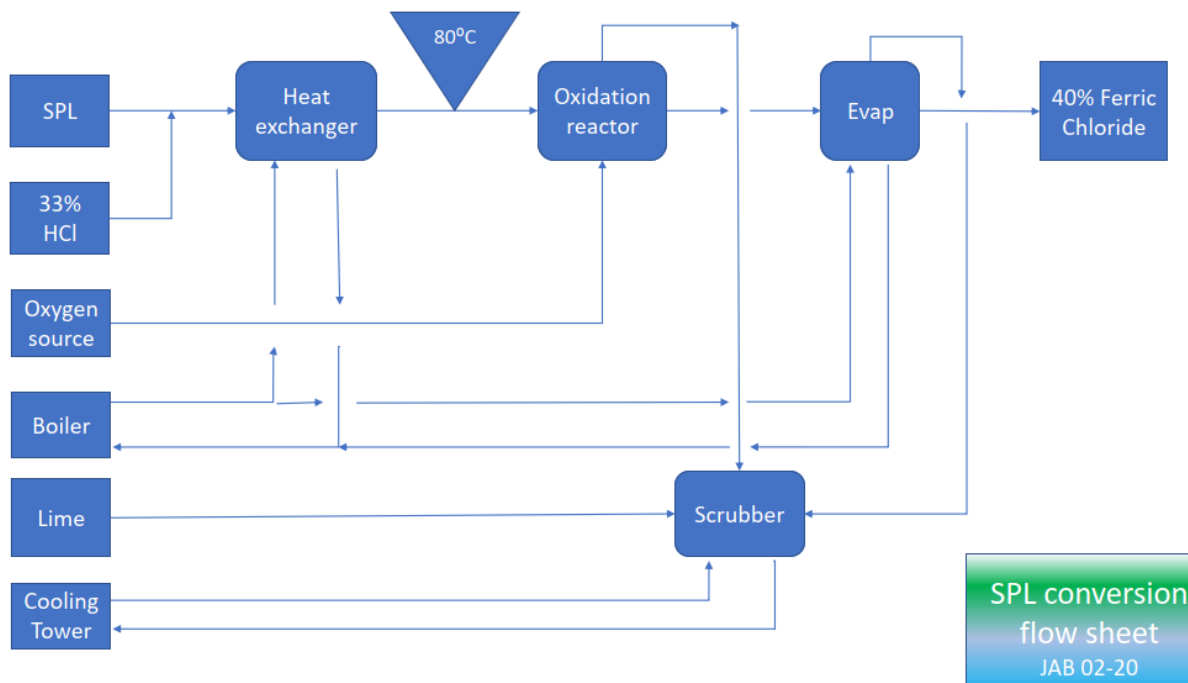


Figure 3-3: Richbay acid regeneration plant process flow diagram

3.3.3 PHASE 3 - SOLVENT FILLING PLANT

Phase 3 includes the construction of a solvent filling plant. Products will be decanted from bulk storage tanks to medium tanks and then smaller package sizes as required. The packed product is transferred to the warehouse for distribution. Palletizing and strapping might be required.

Solvent chemicals to be stored and decanted are as follows:

- methanol / ethanol;
- thinners;
- Shelsol A;
- formalin;
- paraffin;
- Benzine¹⁵;
- toluene;
- acetone; and
- diesel.

It is estimated that at full operational capacity, the solvent filling plant will have a maximum of 352 m³ total storage capacity.

3.4 METEOROLOGICAL CONTEXT

Seasonal and diurnal pollutant concentration levels fluctuate in response to the changing state of atmospheric stability, to concurrent variations in mixing depth and to the influence of mesoscale and macroscale wind systems

¹⁵ Not to be confused with benzene (a carcinogenic, organic chemical compound with the molecular formula C₆H₆), benzine is a chemical mixture that is predominantly petroleum naphtha based and commonly used as a solvent. Refer to **Section 4.1.3** for more details on mixture properties.

on the transport of atmospheric contaminants. This section provides an overview of the atmospheric circulations influencing airflow and the subsequent dispersion and dilution of pollutants in the Vosloorus area.

3.4.1 SURFACE STATION

In the absence of a suitably site representative meteorological station operated by the South African Weather Service (SAWS), modelled meteorological variables (MM5 data - Penn State/NCAR Fifth Generation Mesoscale Model), including hourly temperature, rainfall, wind speed and wind direction, purchased from Lakes Environmental has been substituted to provide a meteorological overview of the proposed development site. Data is analysed for the period January 2016 - December 2018 (i.e. three calendar years as required by the Regulations Regarding Dispersion Modelling¹⁶, hereafter referred to as the *Modelling Regulations*).

3.4.2 TEMPERATURE AND RAINFALL

Ambient air temperature influences plume buoyancy as the higher the plume temperature is above the ambient air temperature, the higher the plume will rise. Further, the rate of change of atmospheric temperature with height influences vertical stability (i.e. mixing or inversion layers). Rainfall is an effective removal mechanism of atmospheric pollutants and thus also relevant in the assessment of pollution potential.

Figure 3-4 presents average monthly temperature, rainfall and humidity. Seasonal trends of higher temperatures and rainfall during the summer months (December to February) with dry and cooler conditions during winter months (June to August) is evident. Summer temperatures for the region average at 21°C while winter temperatures average at 10°C. Vosloorus has an average humidity of 65% and is considered a high rainfall area receiving approximately 800 mm per annum. 57% of annual rainfall is received during the summer months.

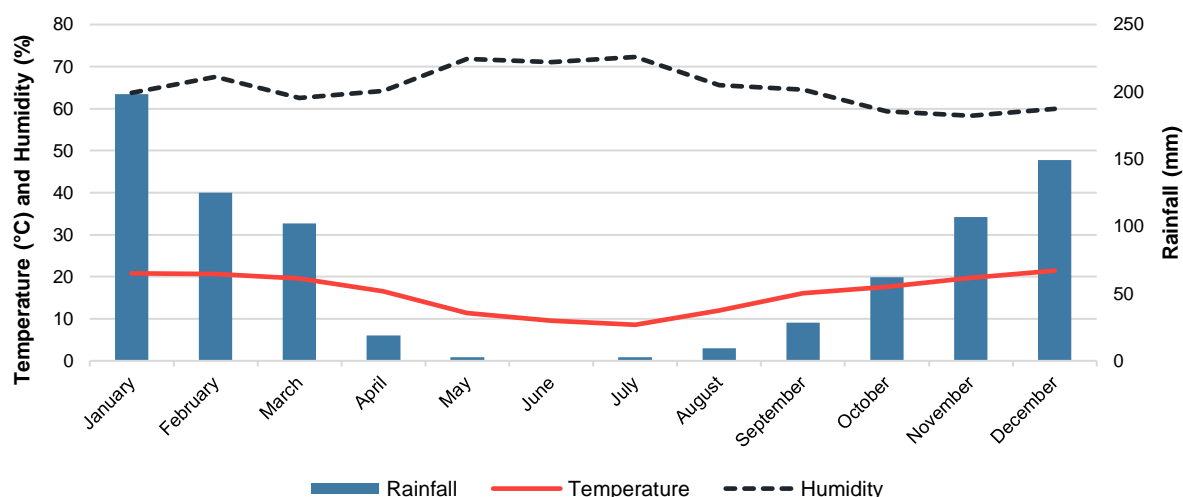


Figure 3-4: Meteorological summary

3.4.3 WIND FIELD

Wind roses (**Figure 3-5**) summarize wind speed and directional frequency at a location. Each directional branch on a wind rose represents wind originating from that direction. Each directional branch is divided into segments of colour, representative of different wind speeds.

Typical wind fields have been analysed using Lakes Environmental WRPlot Freeware version 7.0.0 for the full period (January 2016 – December 2018); diurnally for early morning (00h00 – 06h00), morning (06h00 – 12h00), afternoon (12h00 – 18h00) and night (18h00 – 00h00); and seasonally for summer (December, January and

¹⁶ Department of Environmental Affairs (2014): Regulations regarding dispersion modelling (GN.R. 533) Government Gazette - 11 July 2014 (No. 37804)

February), autumn (March, April and May), winter (June, July and August) and spring (September, October and November). Calm conditions were defined as wind speeds less than 1 m/s. Findings are as follows:

- Calm conditions (wind speeds <1.0 m/s) occurred 12.59% of the time; Gentle to moderate winds from the north, north-northeast and north-northwest prevailed in the region;
- Peak wind speeds occurred from the west and highest average wind speeds occurred from the north-northeast;
- Northerly winds prevailed in the morning;
- Winds prevailed from the north-northwest in the afternoon into the evening;
- Winds prevailed from the north-northeast during the early morning;
- Winds from the north and north-northeast prevailed during the spring and summer months;
- Winds from the north and north-northwest prevailed during the autumn and winter months;
- Higher directional variability in the wind field is observed during autumn and winter; and
- Highest average wind speeds occur in the morning and during spring.

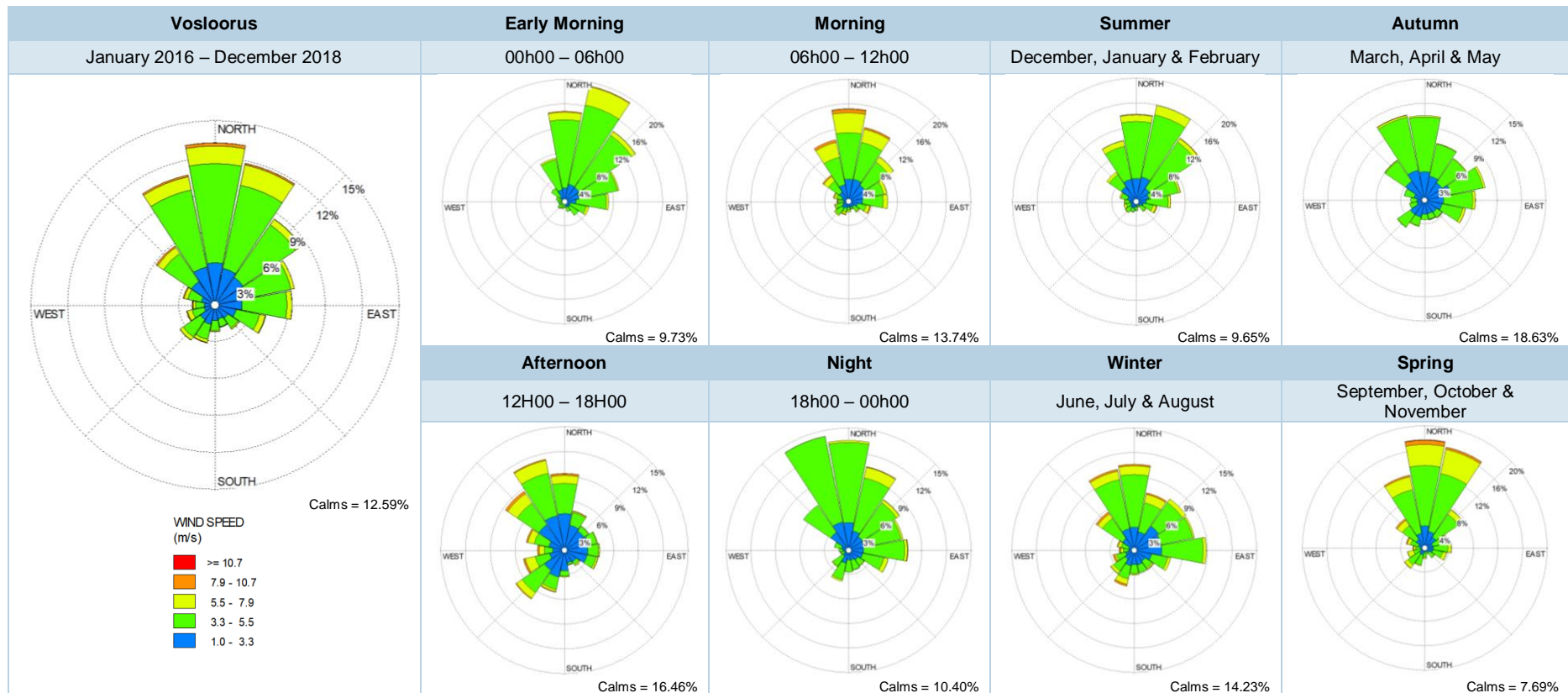


Figure 3-5: Local wind conditions at Vosloorus

3.5 AMBIENT AIR QUALITY

Ambient air quality monitoring data has been sourced from a monitoring station located approximately 9.9 km to the west-northwest of the proposed development site, namely Thokoza, located in the residential area of Thokoza. This station is owned and managed by SAWS. Data was requested for the period January 2016 – December 2018 (three calendar years) and assessed for compliance with NAAQS. Station information and data recovery is presented in **Table 3-3**.

A minimum data recovery of 90% is required for assessing compliance with national standards¹⁷. Data recovery across the pollutant array measured failed to meet this requirement. Nonetheless, in the absence of any other ambient monitoring data, the available information has been used to provide insight into background NO₂, SO₂ and PM₁₀ concentrations in the study area. Data recovery for other pollutants was insufficient to provide meaningful interpretation. The averages calculated and the assessment of exceedences must be considered in the context of low data recovery.

Table 3-3: Station information and data recovery for the period January 2016 - December 2018

Station name		Thokoza
Zoning		Residential
Latitude (°S)		-26.329515
Longitude (°E)		28.142990
Data recovery (%)	CO	4.9
	NO ₂	51.8
	SO ₂	54.9
	PM ₁₀	12.2
	C ₆ H ₆	2.7

3.5.1 NITROGEN DIOXIDE

Hourly NO₂ concentrations measured at Thokoza for 2016, 2017 and 2018 (**Figure 3-6**) averaged below the annual NAAQS (40 µg/m³) at 38.83 µg/m³, 39.40 µg/m³ and 36.78 µg/m³ respectively. Ambient concentrations exceeded the 1-hour NAAQS (200 µg/m³, 88 exceedences permitted per annum) once in 2017.

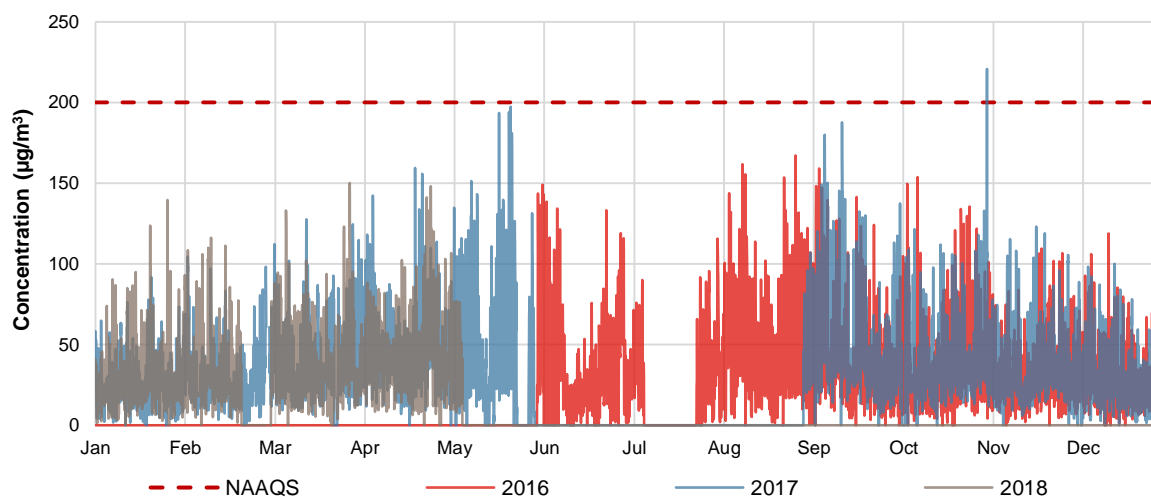


Figure 3-6: Hourly nitrogen dioxide concentrations measured at Thokoza

¹⁷ South African National Accreditation System (SANAS, 2012) in TR 07-03

3.5.2 SULPHUR DIOXIDE

Hourly SO₂ concentrations measured at Thokoza for 2016, 2017 and 2018 (**Figure 3-7**) averaged below the annual NAAQS (50 µg/m³) at 19.44 µg/m³, 16.52 µg/m³ and 14.42 µg/m³ respectively. Ambient concentrations exceeded the 1-hour NAAQS (350 µg/m³, 88 exceedences permitted per annum) once in 2016. No exceedences of the 24-hour (125 µg/m³) NAAQS were measured between January 2016 and December 2018.

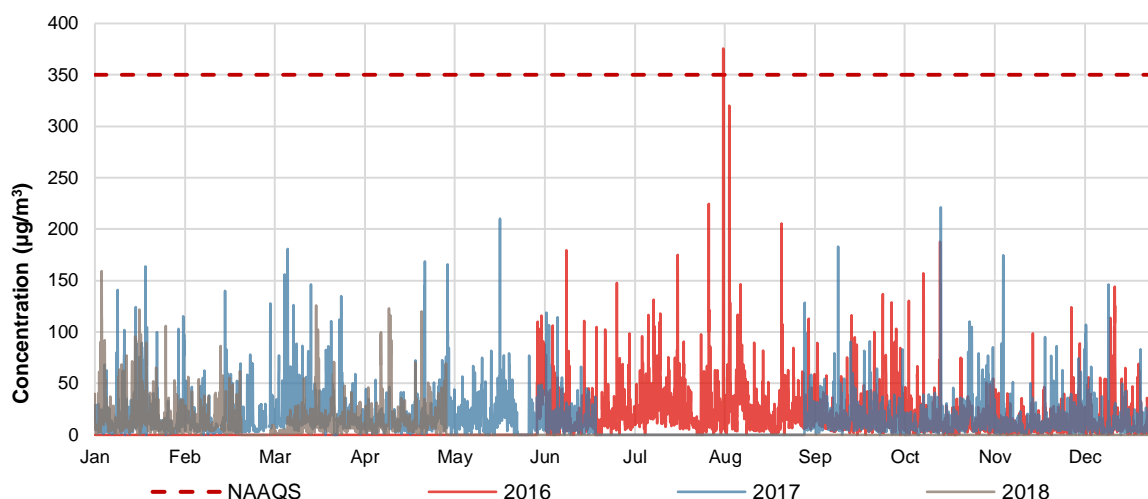


Figure 3-7: Hourly sulphur dioxide concentrations measured at Thokoza

3.5.3 PARTICULATE MATTER LESS THAN 10 MICROMETRES IN DIAMETER

The PM₁₀ dataset for the Thokoza station is limited (12.2% data recovery) but available data indicates that concentrations are exceeding the NAAQS and thus has been included in this ambient air quality analysis.

PM₁₀ concentrations measured at Thokoza for 2016, 2017 and 2018 (**Figure 3-8**) exceeded the annual NAAQS (40 µg/m³) in 2018 with an annual average of 49.76 µg/m³. Ambient concentrations exceeded the 24-hour NAAQS (75 µg/m³, four exceedences permitted per annum) 12 times in 2018. Data recovery for 2018 was 31.8%. No data is available for 2017. No exceedences of the annual (40 µg/m³) or 24-hour (75 µg/m³) NAAQS were measured in 2017. Data recovery for 2017 was 4.8%.



Figure 3-8: Daily PM₁₀ concentrations measured at Thokoza

4 IMPACT ASSESSMENT

4.1 EMISSIONS INVENTORY

An emissions inventory is a list of air pollution sources within a defined area, including their physical and chemical parameters. The inventory provides information on the types of emission sources, their location and the amount of air pollution emitted for a given time period. Emission factors are used to estimate emissions where actual emission data is not available. In most cases, these factors are averages of available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category. An emission factor is a value representing the relationship between an activity and the rate of emissions of a specified pollutant. Emission factors are always expressed as a function of the weight, volume, distance or duration of the activity emitting the pollutant. The general equation used for the estimation of emissions is:

$$E = A \times EF \times \left(1 - \frac{ER}{100}\right)$$

Where:

E	= emission rate
A	= activity rate
EF	= emission factor
ER	= overall emission reduction efficiency (%)

The *Modelling Regulations* recommend the use of published emission factors for national consistency (e.g. US EPA, AP-42 emission factors¹⁸).

4.1.1 METHODOLOGY

STORAGE TANK EMISSIONS

In line with South Africa's *Modelling Regulations*, the US EPA and American Petroleum Industry (API) TANKS 4.0.9d model was utilised to estimate emissions from petroleum product bulk storage tanks. TANKS is a Windows-based software created on the emission estimation procedures from the US EPA's AP-42 emission estimation manual. TANKS uses chemical, meteorological, roof fitting and rim seal data to generate breathing and working loss estimates for various types of storage tanks including:

- Vertical and horizontal fixed roof tanks;
- Internal and external floating roof tanks;
- Domed external floating roof tanks; and
- Underground tanks.

COMBUSTION INSTALLATIONS

Australia's National Pollutant Inventory (NPI) Emission Estimation Technique (EET) manuals¹⁹ recommend a number of methods for calculating atmospheric emissions where actual emission data is not available, including mass balance (also known as fuel analysis) and emission factors.

Combustion emissions (excluding SO₂) from the Richbay boiler were estimated using NPI emission factors for *Combustion in Boilers*²⁰. Emissions can be estimated using the following equation:

¹⁸ USEPA (1995): Compilation of Air Pollutant Emission Factors (AP-42) US Environmental Protection Agency

¹⁹ NPI EET(2011): Combustion in boilers v3.6

²⁰ NPI (2011): *Emissions estimate technique manual for combustion in boilers (v3.6)*

$$E_{(s)} = A \times EF_{(s)} \times (1 - CE)$$

where:

$E_{(s)}$	=	annual emissions (kg/annum)
A	=	activity rate over a year (e.g. operating hours or tonnage used)
$EF_{(s)}$	=	emission factor
CE	=	control efficiency (%)

In the absence of emission factors for paraffin fired boilers, emission factors for distillate (diesel) oil fired boilers less than 30 MW capacity were used as provided in **Table 4-1**.

Table 4-1: Emission factors for distillate (diesel) oil fired combustion appliances (<30 MW)

Pollutant	Emission Factor (kg/t)
CO	0.68
NO _x	2.72
PM ₁₀	0.14
PM _{2.5}	0.03
TVOC	0.0272
Pb	0.000174

A fuel analysis approach has been utilised to estimate SO₂ emissions based on typical sulphur content (by mass) of paraffin in South Africa (0.05%)²¹. Fuel analysis estimates emissions based on the application of conservation laws when the fuel consumption rate is known. The presence of certain elements within the fuel can thus be used to predict their presence in emission streams during the combustion process. This approach assumes that 100% of sulphur is converted to SO₂. This approach provided higher emission rates when compared with the default emission factor and thus is considered environmentally conservative.

The basic equation used in fuel analysis emission calculations is the following:

$$E_{kpy,i} = Q_f \times \frac{\text{pollutant concentration in fuel}}{100} \times \left(\frac{MW_p}{EW_f} \right) \times OpHrs$$

Where:

$E_{kpy,i}$	=	annual emissions of pollutant I, kg/yr
Q_f	=	fuel use, kg/hr
MW_p	=	molecular weight of pollutant emitted, kg/kg-mole
EW_f	=	elemental weight of pollutant in fuel, kg/kg-mole
OpHrs	=	operating hours, hr/yr
i	=	concentration of pollutant I in fuel expressed as weight percent, %

²¹ URL: <https://www.q4.co.za/products/illuminating-paraffin/>

4.1.2 ACTIVITY DATA

Storage tank specifications, forecasted throughput data, fuel consumption, boiler and scrubber specifications were provided by Richbay. This information was used to calculate atmospheric emissions arising from the proposed development and is detailed in **Table 4-2** to **Table 4-5**.

Table 4-2: Unit processes and operational times

Unit process	Function	Hours per day	Days per annum
Bulk chemical storage	Bulk storage of various chemicals in above ground tanks	24	365
Boiler	Heat generation	10	260

Table 4-3: Raw materials and energy sources

Category	Section	Raw material	Forecast capacity	Unit
Raw materials	Filling Plant	Hydrochloric acid	112,207.80	m ³ /year
		Nitric acid	6,400.00	m ³ /year
		Phosphoric Acid	2,032.90	m ³ /year
		Sulphuric acid	14,163.90	m ³ /year
		SLES70 / Sulfonic Acid	3,323.10	m ³ /year
		Ferric chloride (In Filling Plant)	2,468.60	m ³ /year
		Sodium metbisulphite	2,541.20	m ³ /year
		Caustic soda lye / Soda ash / Potassium hydroxide	69,120.00	m ³ /year
		Sodium hypo chlorite	28,562.00	m ³ /year
		Sodium chlorite	2,809.80	m ³ /year
	Solvent Filling Plant	Methanol / Ethanol	2,187.30	m ³ /year
		Thinners	1,986.20	m ³ /year
		Shellsol A	1,986.20	m ³ /year
		Formalin	368.10	m ³ /year
		Paraffin	2,304.00	m ³ /year
		Benzine ²²	2,032.90	m ³ /year
		Toluene	1,440.00	m ³ /year
		Acetone	2,187.30	m ³ /year
	Acid Regeneration Plant	Ferric chloride (In Regeneration Plant)	14,811.40	m ³ /year
Paraffin		81.0	kg/hr	
Energy		264	m ³ /year	

²² Not to be confused with benzene (a carcinogenic, organic chemical compound with the molecular formula C₆H₆), benzine is a chemical mixture that is predominantly petroleum naphtha based and commonly used as a solvent. Refer to **Section 4.1.3** for more details on mixture properties.

Table 4-4: Point emission source parameters

Source ID	Source Name	Latitude (°S)	Longitude (°E)	Stack height above ground (m)	Stack height below nearby building (m)	Stack Exit Diameter (m)	Gas Exit Temperature (°C)	Gas Volumetric Flow (Nm ³ /s)	Gas Exit Velocity (m/s)	Hours per day	Days per annum
STK 1	Boiler	-26.359367	28.2373	4	0	0.3	300	0.141	2	10	260
STK 2	HCl Scrubber	-26.359267	28.237299	5	0	0.5	35	0.5	2.546	24	365

Table 4-5: Storage tank emission source parameters

Section	Tank ID	Chemical Name	No of duplicate tanks	Latitude (S)	Longitude (E)	Horizontal / Vertical?	Floating or Fixed Roof	Height / Length (m)	Diameter (m)	Maximum Liquid Height (m)	Average Liquid Height (m)	Tank Capacity (m ³)	Working Volume (m ³)	Turnovers per tank per year	Net Throughput per tank (m ³ /yr)	Heated?	Colour of tank
Filling Plant	FP1 - FP6	Hydrochloric acid	6	-26.358104°	28.237245°	Vertical	Fixed dome	3.3	4.6	3.0	1.5	55.0	49.5	377.8	18,701.3	No	Blue
	FP7 - FP8	Nitric Acid	2	-26.358338°	28.237249°	Vertical	Fixed dome	2.0	4.6	1.8	0.9	33.0	29.7	107.7	3,200.0	No	Yellow
	FP9 - FP10	Phosphoric Acid	2	-26.358338°	28.237249°	Vertical	Fixed dome	2.0	4.6	1.8	0.9	33.0	29.7	34.2	1,016.5	No	Grey

Section	Tank ID	Chemical Name	No of duplicate tanks	Latitude (S)	Longitude (E)	Horizontal / Vertical?	Floating or Fixed Roof	Height / Length (m)	Diameter (m)	Maximum Liquid Height (m)	Average Liquid Height (m)	Tank Capacity (m ³)	Working Volume (m ³)	Turnovers per tank per year	Net Throughput per tank (m ³ /yr)	Heated?	Colour of tank
	FP11 - FP13	sulphuric acid	3	-26.358630°	28.237245°	Vertical	Fixed dome	2.0	4.6	1.8	0.9	33.0	29.7	159.0	4,721.3	No	Black
	FP14 - FP15	SLES70 / sulfonic acid	2	-26.358106°	28.236990°	Vertical	Fixed dome	2.0	4.6	1.8	0.9	33.0	29.7	55.9	1,661.6	No	Purple
	FP16 - FP17	ferric chloride	2	-26.358342°	28.236985°	Vertical	Fixed dome	2.0	4.6	1.8	0.9	33.0	29.7	41.6	1,234.3	No	Brown
	FP18 - FP19	sodium metbisulphite	2	-26.358635°	28.236977°	Vertical	Fixed dome	2.2	3.1	1.9	1.0	16.5	14.9	85.6	1,270.6	No	Orange
	FP20 - FP25	caustic soda lye / soda ash / potassium hydroxide	6	-26.358096°	28.236716°	Vertical	Fixed dome	3.3	4.6	3.0	1.5	55.0	49.5	232.7	11,520.0	No	White

Section	Tank ID	Chemical Name	No of duplicate tanks	Latitude (S)	Longitude (E)	Horizontal / Vertical?	Floating or Fixed Roof	Height / Length (m)	Diameter (m)	Maximum Liquid Height (m)	Average Liquid Height (m)	Tank Capacity (m ³)	Working Volume (m ³)	Turnovers per tank per year	Net Throughput per tank (m ³ /yr)	Heated?	Colour of tank
	FP26 - FP29	sodium hypo chlorite	4	-26.358339°	28.236708°	Vertical	Fixed dome	2.2	3.1	1.9	1.0	16.5	14.9	480.8	7,140.5	No	Red
	FP30 - FP31	sodium chlorite	2	-26.358626°	28.236706°	Vertical	Fixed dome	2.2	3.1	1.9	1.0	16.5	14.9	94.6	1,404.9	No	Orange
Solvent Filling Plant	SF1	methanol / ethanol	1	-26.359151°	28.236619°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	55.2	2,187.3	No	Stainless steel
	SF2	thinners	1	-26.359340°	28.236614°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	50.2	1,986.2	No	Stainless steel
	SF3	Shelsol A / formalin	1	-26.359148°	28.236450°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	50.2	1,986.2	No	Stainless steel

Section	Tank ID	Chemical Name	No of duplicate tanks	Latitude (S)	Longitude (E)	Horizontal / Vertical?	Floating or Fixed Roof	Height / Length (m)	Diameter (m)	Maximum Liquid Height (m)	Average Liquid Height (m)	Tank Capacity (m ³)	Working Volume (m ³)	Turnovers per tank per year	Net Throughput per tank (m ³ /yr)	Heated?	Colour of tank
	SF4	paraffin	1	-26.359341°	28.236446°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	58.2	2,304.0	No	Stainless steel
	SF5	Benzine ²³	1	-26.359141°	28.236302°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	51.3	2,032.9	No	Stainless steel
	SF6	toluene	1	-26.359353°	28.236296°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	36.4	1,440.0	No	Stainless steel
	SF7	acetone	1	-26.359142°	28.236124°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	55.2	2,187.3	No	Stainless steel

²³ Not to be confused with benzene (a carcinogenic, organic chemical compound with the molecular formula C₆H₆), benzine is a chemical mixture that is predominantly petroleum naphtha based and commonly used as a solvent. Refer to **Section 4.1.3** for more details on mixture properties.

Section	Tank ID	Chemical Name	No of duplicate tanks	Latitude (S)	Longitude (E)	Horizontal / Vertical?	Floating or Fixed Roof	Height / Length (m)	Diameter (m)	Maximum Liquid Height (m)	Average Liquid Height (m)	Tank Capacity (m3)	Working Volume (m3)	Turnovers per tank per year	Net Throughput per tank (m ³ /yr)	Heated?	Colour of tank
	SF8	diesel	1	-26.359352°	28.236124°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	129.1	5,112.4	No	Stainless steel
Acid Regeneration Plant	AR1 - AR3	ferric chloride	3	-26.359132°	28.236963°	Vertical	Fixed dome	2.0	4.6	1.8	0.9	33.0	29.7	166.2	4,937.1	No	Brown
	AR4	paraffin	1	-26.359366°	28.237155°	Horizontal	Fixed	2.6	4.6	2.4	1.2	44.0	39.6	6.7	264.0	No	Stainless steel

4.1.3 EMISSIONS MODEL INPUTS

The US EPA TANKS 4.0.9d model requires local meteorological input at an annual and monthly resolution. Surface meteorology (ambient temperature and wind speed) was sourced from the modelled MM5 data supplied by Lakes Environmental for the study site and the Atmospheric Science Data Centre: NASA GEOS-4 model (solar energy). Annual and monthly meteorological variables (in imperial units as required for TANKS input) are presented in **Table 4-6**.

Table 4-6: Meteorological data input for TANKS model calculations

Month	Daily Maximum Ambient Temperature (F)	Daily Minimum Ambient Temperature (F)	Solar Insulation Factor (Btu/(ft ² *day))	Average Wind Speed (mph)
January	85.10	52.88	2813.10	6.91
February	83.12	52.88	2603.24	6.84
March	80.60	53.60	2277.82	6.45
April	76.28	48.56	1804.93	5.80
May	66.56	40.28	1507.44	5.76
June	62.96	33.44	1326.89	5.66
July	62.96	29.84	1421.35	7.15
August	71.60	33.44	1641.74	10.25
September	79.88	34.52	2051.97	9.73
October	81.50	40.10	2410.39	6.86
November	85.82	42.44	2736.78	8.30
December	88.52	51.08	2831.50	8.04
Annual Average	77.08	42.76	2118.93	7.31

There is a broad spectrum of chemicals preloaded into TANKS. In the case of Richbay, where solvent or fuel oil based products were not standard to TANKS, Material Safety Data Sheets (MSDS) and online chemical databases were used to determine the chemical composition and chemical properties of each liquid. When insufficient information was available with which to calculate mixture properties, one of the chemicals preloaded to TANKS, either considered synonymous, or with near identical properties, was used as a substitute to imitate the material's emission potential. Chemical mixtures and substitutes input into TANKS for organic liquids stored in the acid regeneration plant (Phase 2) and solvent filling plant (Phase 3) that would result in VOC emissions are listed in **Table 4-7**.

Table 4-7: Chemical characteristics and substitutes (where applicable) for TANKS model

Tank ID	Chemical Name	Chemical Type	Modelled in TANKS as	Chemical properties
SF1	Methanol / Ethanol	Solvent	Methyl alcohol ²⁴	Molecular weight = 32.04 g/mol; Vapour pressure at 20°C = 13.5 kPa
SF2	Thinners	Solvent	Chemical mixture ²⁵	Light Aliphatic Petroleum ²⁶ = 30% Toluene = 33.95% Xylene (mixed isomers) = 33.95% n-Hexane = 2% Benzene = 0.1% Molecular weight = 78.1 g/mol; Vapour pressure at 20°C = 2.3 kPa

²⁴ Sasol (2019): Safety Data Sheet - Technical grade methanol (URL: https://sasoldcproducts.blob.core.windows.net/documents/Safety%20Datasheets/b5507b82-b3bb_ZA_Methanol%20Technical%20Grade_EN-CN.pdf)

²⁵ Dura Paints (2016): Material Safety Data Sheet – Thinners (URL: <http://durapaints.co.za/wp-content/uploads/2016/02/DI005-DURA-INDUSTRIAL-QD-THINNERS-.pdf>)

²⁶ Defined as petroleum ether with a molecular weight of 32.066 g/mol and vapour pressure at 20°C of 1.99 kPa (URL: https://www.chemicalbook.com/ChemicalProductProperty_EN_CB5248177.htm)

Tank ID	Chemical Name	Chemical Type	Modelled in TANKS as	Chemical properties
SF3 ²⁷	Shellsol A	Solvent	Shellsol A ²⁸	Antoine's equation constants (using °C): A: 7.45653; B: 2459.76; C: 269.313 Molecular weight = 130 g/mol; Vapour pressure at 20°C = 0.012 kPa
SF4 and AR4	Paraffin	Fuel oil	Kerosene ²⁹	Vapour pressure (psia) for each temperature (°F): 40 = 0.01 50 = 0.02 60 = 0.03 70 = 0.041 80 = 0.056 90 = 0.075 100 = 0.099 Molecular weight = 170 g/mol; Vapour pressure at 20°C = 0.27 kPa
SF5	Benzine	Solvent	Chemical mixture ³⁰	Light Aliphatic Petroleum ³¹ = 85% n-Hexane = 15% Molecular weight = 66.8 g/mol; Vapour pressure at 20°C = 4.4 kPa
SF6	Toluene	Solvent	Toluene	Molecular weight = 92.13 g/mol; Vapour pressure at 20°C = 2.94 kPa
SF7	Acetone	Solvent	Acetone	Molecular weight = 58.08 g/mol; Vapour pressure at 20°C = 24.97 kPa
SF8	Diesel	Fuel oil	Distillate fuel oil no. 2 ³²	Molecular weight = 130 g/mol; Vapour pressure at 20°C = 0.06 kPa

4.1.4 EMISSION RATES

STORAGE TANKS

VOC emission rates calculated for fuel oil and solvent based liquids stored by Richbay are summarised in **Table 4-8**.

Table 4-8: Quantified TVOC emissions for fuel and solvent storage tanks

Tank ID	Chemical Name	TVOC Emission rate (kg/annum)
SF1	Methanol / Ethanol	481.4
SF2	Thinners	198.2
SF3	Shellsol A	1.6
SF4	Paraffin	46.7
SF5	Benzine	374.3
SF6	Toluene	268.9
SF7	Acetone	1,764.9
SF8	Diesel	9.3
AR4	Paraffin	21.8

²⁷ While SF3 may also be used to store Formalin (formaldehyde) at times depending on market requirements, this tank has been conservatively modelled as containing ShellsolA to ensure the potential TVOC emissions from this solvent liquid are accounted for.

²⁸ Shell Chemicals (2016): Technical Datasheet - ShellsolA (URL: https://www.shell.com/business-customers/chemicals/our-products/solvents-hydrocarbon/aromatic-solvents/_jcr_content/par/textimage.stream/1519802119559/bb1a595594f4d9acbf19318febe2c4cfb24f0583/shellsol-a150-q7493-eu-18042016.pdf)

²⁹ Cameo Chemicals (1999): Cautionary Response Information – Kerosene (URL: <https://cameochemicals.noaa.gov/chris/KRS.pdf>)

³⁰ Powafix (2014): Safety Data Sheet – Benzine (URL: <https://www.powafix.co.za/wp-content/uploads/2017/08/SDS-Benzine.pdf>)

³¹ Defined as petroleum ether with a molecular weight of 32.066 g/mol and vapour pressure at 20°C of 1.99 kPa (URL: https://www.chemicalbook.com/ChemicalProductProperty_EN_CB5248177.htm)

³² As defined within the US EPA AP-42 for Gasoline and Diesel Industrial Engines (URL: <https://www3.epa.gov/ttn/chieff/ap42/ch03/final/c03s03.pdf>)

POINT SOURCES

Emission rates calculated for pollutants emitted by the boiler and HCl scrubber are summarised in **Table 4-9**.

Table 4-9: Quantified emissions for point sources

Source ID	Pollutant	Emission rate (kg/annum)
STK 1 (Boiler)	CO	143.2
	NO ₂	458.3
	PM ₁₀	29.5
	PM _{2.5}	6.3
	SO ₂	210.6
	TVOC	5.7
	Pb	0.037
STK 2 (Scrubber)	HCl	9.4

GREENHOUSE GAS EMISSIONS

GHG emissions were calculated using the *Technical Guidelines for monitoring, reporting and verification of Greenhouse Gases by Industry*³³. This is a tier 2 methodology based on fuel combusted per annum and South Africa specific calorific values for paraffin and emission factors for source category 1A1a (Electricity and heat production). Annual CO₂ contributions from the proposed Richbay Vosloorus facility to national GHG emissions are estimated at 0.67 Gg/annum CO_{2-eq} (i.e. 0.00067 Mt/annum CO_{2-eq}). As such, Richbay is not required to submit a Pollution Prevention Plan for the proposed facility.

4.2 DISPERSION MODELLING

Atmospheric dispersion modelling mathematically simulates the transport and fate of pollutants emitted from a source to the atmosphere. Algorithms incorporate source criteria, surface topography, land use and meteorology to predict the downwind concentrations of these pollutants. These provide a useful tool to ascertain the spatial and temporal patterns of ground level pollutant concentrations arising from various point, line, area and volume sources. These outputs are primarily used in environmental and health impact assessments, risk assessments and to determine monitoring requirements, including spatial and temporal resolution.

4.2.1 APPROACH

As per the *Modelling Regulations* the level of assessment is dependent on technical factors such as geophysical and meteorological context and the complexity of the emissions inventory. The temporal and spatial resolution and accuracy required from a model must also be taken into account.

A Level 2 assessment is applicable in generic assessments where:

- The distribution of pollutant concentrations and deposition are required in time and space;
- Pollutant dispersion can be reasonably treated by a straight-line, steady-state, Gaussian plume model with first order chemical transformation; and
- Emissions are from sources where the greatest impacts are in the order of a few kilometres (less than 50 km) downwind.

AERMOD is a new generation air dispersion model designed for short-range dispersion of airborne pollutants in steady state plumes that uses hourly sequential meteorological files with pre-processors to generate flow and stability regimes for each hour. The model outputs can be used to produce maps of plume spread with key isopleths for visual interpretation and statistical outputs allowing for comparison with national and international ambient

³³ Department of Environmental Affairs (2017): Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by industry, Version No: TG-2016.1

air quality guidelines and standards for compliance testing. AERMOD is the recommended Level 2 model prescribed in the *Modelling Regulations*.

The AERMOD atmospheric dispersion modelling system is an integrated system that includes three modules:

- A steady-state dispersion model designed for short-range (up to 50 km) dispersion of air pollutant emissions from stationary sources;
- A meteorological data pre-processor (AERMET) that accepts surface meteorological data, upper air soundings, and optionally, data from onsite instrument towers. It then calculates atmospheric parameters needed by the dispersion model, such as atmospheric turbulence characteristics, mixing heights, friction velocity, Monin-Obukov length and surface heat flux; and
- A terrain pre-processor (AERMAP) to provide the physical relationship between terrain features and the behaviour of air pollution plumes. It generates location and height data for each receptor location. It also provides information that allows the dispersion model to simulate the effects of air flowing over hills or splitting to flow around hills.

AERMOD View version 9.9.0 was utilised for this assessment.

MODEL INPUTS

DOMAIN AND TERRAIN

According to the *Modelling Regulations*, the selected size and extent of the model domain is influenced by factors such as source buoyancy, terrain features (i.e. mountains) and the location of contributing sources. Larger domains are recommended for elevated, buoyant sources (e.g. stacks) while smaller domains are considered sufficient for lower release heights. The modelling domain used for this study is thus 20,000 m by 20,000 m centred over the proposed site. The *Modelling Regulations* specify the use of a multi-tier grid and recommend specific tier resolutions. In line with these requirements, the risk receptor resolution grid is 50 m x 50 m up to 2,500 m from the centre of the site, 100 m x 100 m up to 5,000 m from the centre of site and 250 m x 250 m thereafter. The plant boundary receptor resolution is set at 25 m.

Terrain influences dispersion of pollutants, especially during periods of stable conditions. The NASA Shuttle Radar Topographic Mission digital elevation model (DEM) (resolution 30 m x 30 m) has been extracted for the modelling domain to account for terrain influences on dispersion. Terrain within the model domain is relatively flat (i.e. elevation within a range of 150 m).

METEOROLOGY

Meteorological conditions affect how pollutants emitted into the air are directed, diluted and dispersed within the atmosphere, and therefore incorporation of reliable data to an air quality assessment is of the utmost importance. To represent meteorological conditions at the site, MM5 (Penn State/NCAR Fifth Generation Mesoscale Model) data was purchased from Lakes Environmental as recommended in the *Modelling Regulations*. For the purposes of this study, an AERMET-ready MM5 dataset (**Figure 4-1**) for the years January 2016 – December 2018 centred at -26.3584°S, 28.235986°E has been utilised.

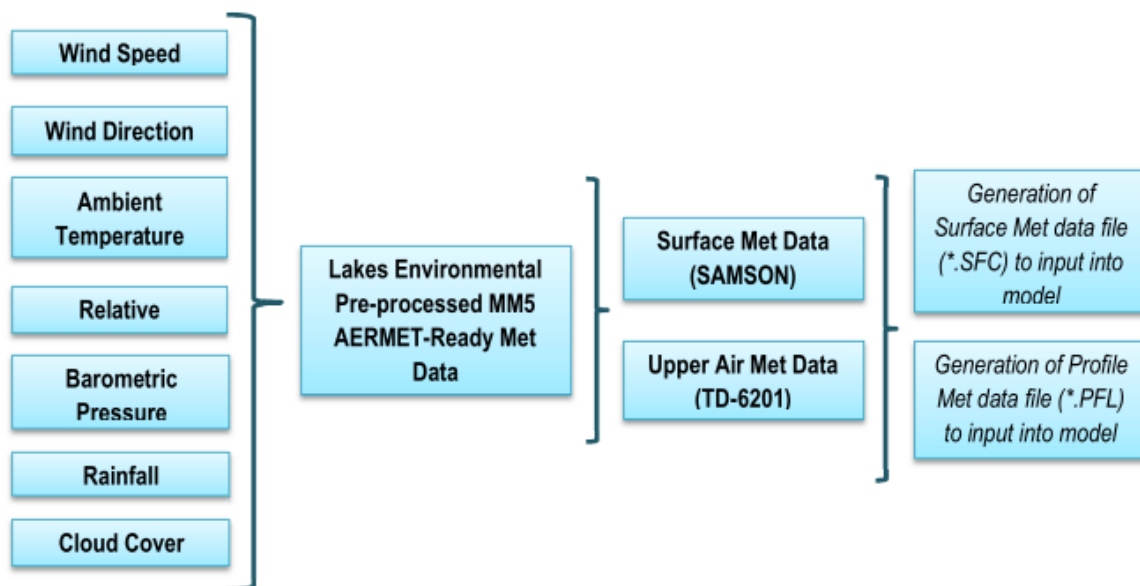


Figure 4-1: Meteorological data path

DISCRETE RECEPTORS

Discrete receptors selected for this study are listed in **Table 3-2**. Receptors were selected based on proximity to the study site (within a 5 km radius) and are places where sensitive individuals may be impacted, such as residences, schools or medical facilities. Their proximity to the proposed development site is shown in **Figure 3-1**.

MODEL OUTPUTS

The model outputs that follow in **Section** — show simulated pollutant concentrations experienced at ground level for the operational phase of the Richbay Vosloorus facility. Where applicable, ambient concentrations are compared with the NAAQS and other relevant International standards (in the absence of local standards) to assess the associated health impacts. For the purposes of this investigation the following statistical outputs were generated:

- The long-term scenario refers to the period average concentration, which is calculated by averaging all hourly concentrations for a three year period. The calculation is conducted for each grid point within the modelling domain;
- 99th percentile (P99) concentrations are calculated for comparison with national ambient air quality standards as specified in the *Modelling Regulations*. This is because the highest (P100) predicted short-term ground-level concentrations may be considered outliers due to complex variability of meteorological processes which might cause exceptionally high predicted concentrations that a facility may never actually exceed in its lifetime; and
- 100th percentile concentrations are calculated for comparison with international health guidelines if a lower percentile threshold is not specified by the guidance documentation.

4.2.2 RESULTS

Simulated pollutant concentrations at each discrete receptor are presented in **Table 4-10** and **Figure 4-2** to **Figure 4-15**. Where applicable, predicted concentrations have been evaluated against their respective short-term (i.e. 1-hour and 24-hour) and long-term (i.e. annual) NAAQS or international guidelines. Key findings are as follows:

- SO₂ emissions do not result in exceedances of the ambient SO₂ 1-hour (350 µg/m³), 24-hour (125 µg/m³) or annual (50 µg/m³) NAAQS at any sensitive receptors;
- NO₂ emissions do not result in exceedances of the ambient NO₂ 1-hour (200 µg/m³) or annual (40 µg/m³) NAAQS at any sensitive receptors;

- PM₁₀ emissions do not result in exceedances of the ambient PM₁₀ 24-hour (75 µg/m³) or annual (40 µg/m³) NAAQS at any sensitive receptors;
- PM_{2.5} emissions do not result in exceedances of the ambient PM_{2.5} 24-hour (40 µg/m³) or annual (20 µg/m³) NAAQS at any sensitive receptors;
- TVOC emissions do not result in exceedances of the ambient benzene annual (0.5 µg/m³) NAAQS at any sensitive receptors, however, exceedances of the benzene NAAQS beyond the site boundary are noted;
 - The comparison of TVOC against the benzene NAAQS is considered conservative, as TVOCs comprise a vast array of compounds and the NAAQS is only applicable to the benzene proportion. As such, the benzene NAAQS cannot be used in this instance to demonstrate compliance, however has been used here as a conservative reference threshold.
- CO emissions do not result in exceedances of the ambient CO 1-hour (30,000 µg/m³) NAAQS at any sensitive receptors;
- Pb emissions do not result in exceedances of the ambient Pb annual (0.5 µg/m³) NAAQS at any sensitive receptors;
- HCl emissions do not result in exceedances of the ambient HCl 1-hour (190 µg/m³) or annual (7.9 µg/m³) TCEQ guideline at any sensitive receptors;
- Peak concentrations across all pollutants occur either within the site boundary or along the facility fenceline; and
- A cumulative assessment using background ambient air quality monitoring data has not been offered due to low data recovery and operational reliability of the available monitoring station.

Table 4-10: Predicted concentrations for criteria and applicable MES pollutants

Pollutant	Averaging period	NAAQS / Guideline	Predicted concentrations ($\mu\text{g}/\text{m}^3$)											
			Domain peak	Boundary peak	Sensitive receptor									
					1	2	3	4	5	6	7	8	9	10
SO ₂	Period	50	9.99E-01	9.99E-01	7.95E-03	1.17E-03	1.09E-03	1.08E-03	1.19E-03	6.50E-04	4.40E-04	1.30E-04	1.40E-04	3.50E-04
	24-hour	125	3.82E+00	3.82E+00	1.17E-01	1.21E-02	1.21E-02	7.74E-03	5.79E-03	1.60E-02	6.05E-03	1.40E-03	1.11E-03	5.51E-03
	1-hour	350	1.32E+01	1.32E+01	1.23E-01	8.48E-03	1.91E-02	1.75E-02	1.57E-02	4.10E-03	1.59E-03	1.70E-03	2.12E-03	4.32E-03
NO ₂	Period	40	2.18E+00	2.18E+00	1.73E-02	2.54E-03	2.37E-03	2.36E-03	2.58E-03	1.42E-03	9.60E-04	2.70E-04	3.00E-04	7.60E-04
	1-hour	200	2.87E+01	2.87E+01	2.68E-01	1.85E-02	4.15E-02	3.81E-02	3.42E-02	8.93E-03	3.47E-03	3.70E-03	4.62E-03	9.41E-03
PM ₁₀	Period	40	1.42E-01	1.42E-01	1.13E-03	1.70E-04	1.50E-04	1.50E-04	1.70E-04	9.00E-05	6.00E-05	2.00E-05	2.00E-05	5.00E-05
	24-hour	75	5.44E-01	5.44E-01	1.66E-02	1.72E-03	1.72E-03	1.10E-03	8.23E-04	2.28E-03	8.61E-04	1.98E-04	1.58E-04	7.83E-04
PM _{2.5}	Period	40	3.11E-02	3.11E-02	2.50E-04	4.00E-05	3.00E-05	3.00E-05	4.00E-05	2.00E-05	1.00E-05	0.00E+00	0.00E+00	1.00E-05
	24-hour	25	1.19E-01	1.19E-01	3.64E-03	3.76E-04	3.75E-04	2.41E-04	1.80E-04	4.98E-04	1.88E-04	4.34E-05	3.45E-05	1.71E-04
TVOC	Period	5 ^a	2.45E+02	4.46E+01	1.84E+00	2.61E-01	3.08E-02	5.45E-02	1.03E-01	5.75E-02	1.83E-02	4.62E-03	2.03E-02	3.59E-02
CO	1-hour	30000	8.95E+00	8.95E+00	8.37E-02	5.76E-03	1.30E-02	1.19E-02	1.07E-02	2.79E-03	1.08E-03	1.16E-03	1.44E-03	2.94E-03
Lead	Period	0.5	1.80E-04	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HCl	Period	7.9	1.39E-01	1.33E-01	4.16E-03	1.11E-03	3.10E-04	5.30E-04	6.00E-04	4.30E-04	1.90E-04	4.00E-05	1.00E-04	2.50E-04
	1-hour	190	1.19E+00	1.14E+00	3.65E-01	2.47E-01	7.74E-02	1.88E-01	7.38E-02	1.08E-01	8.07E-02	1.71E-02	2.28E-02	4.38E-02

a: applicable to the C₆H₆ proportion of total TVOC only

Red: exceeds NAAQS

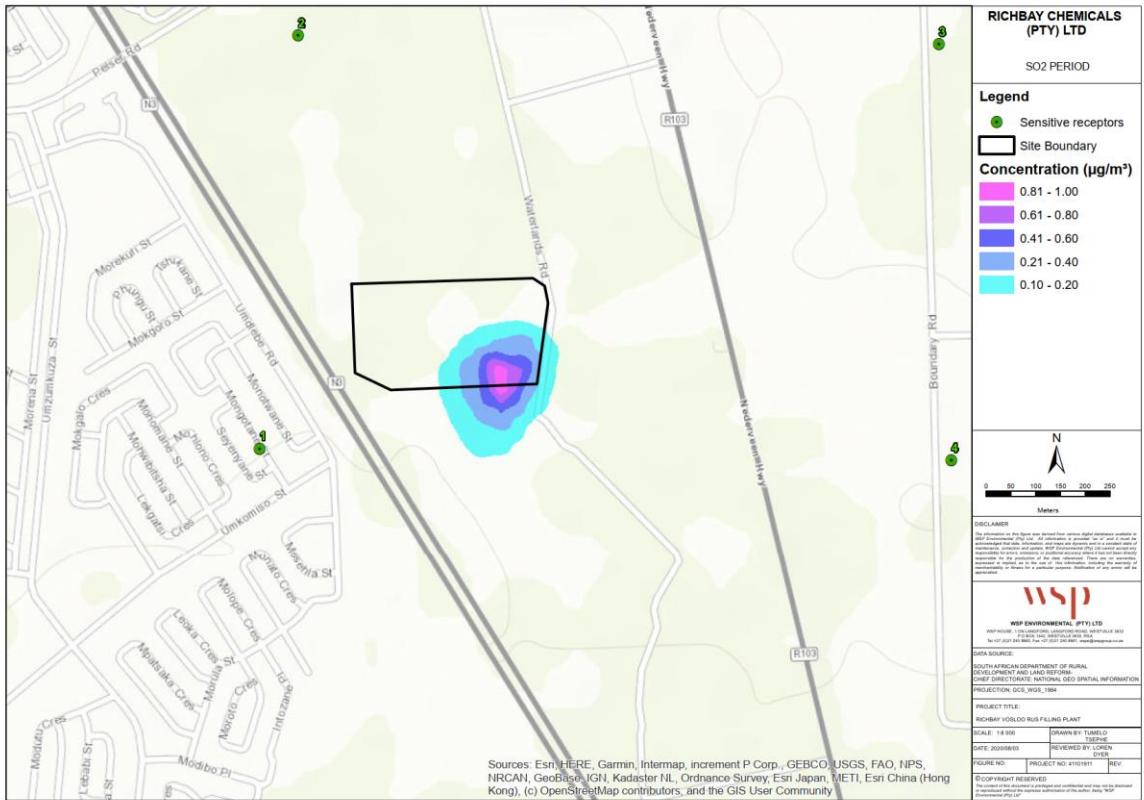


Figure 4-2: Period SO₂

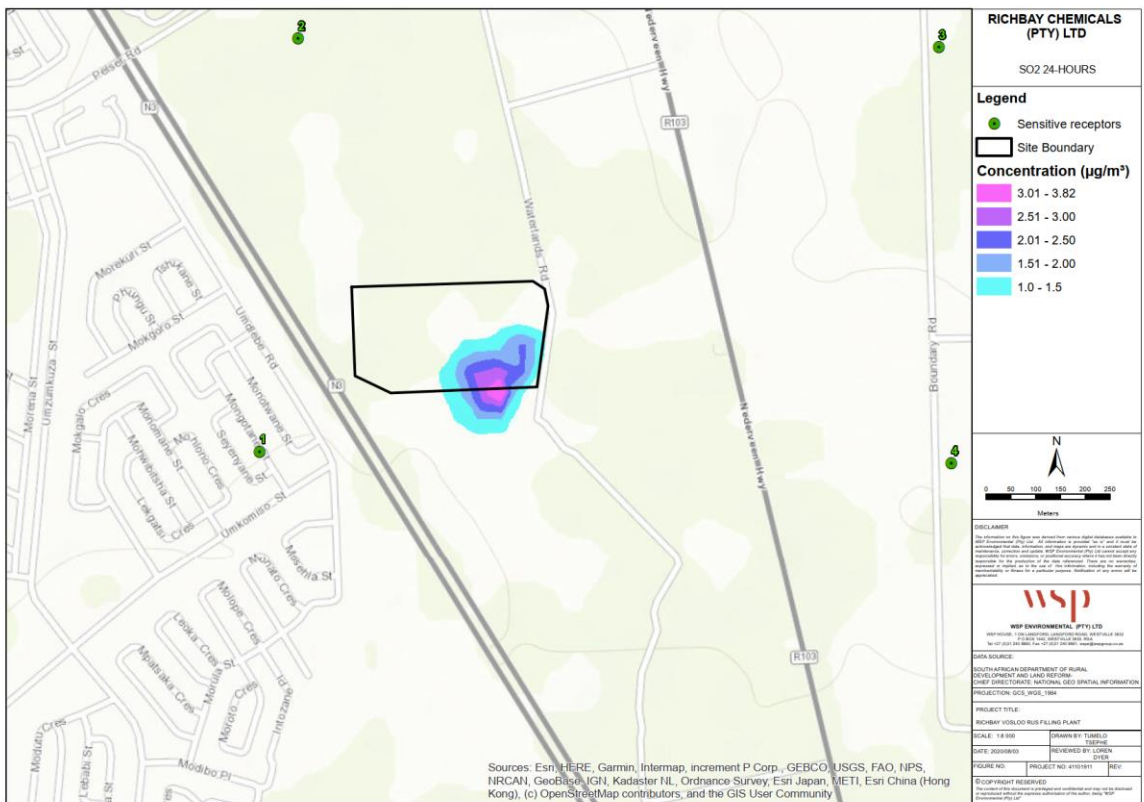


Figure 4-3: P99 24-hour SO₂

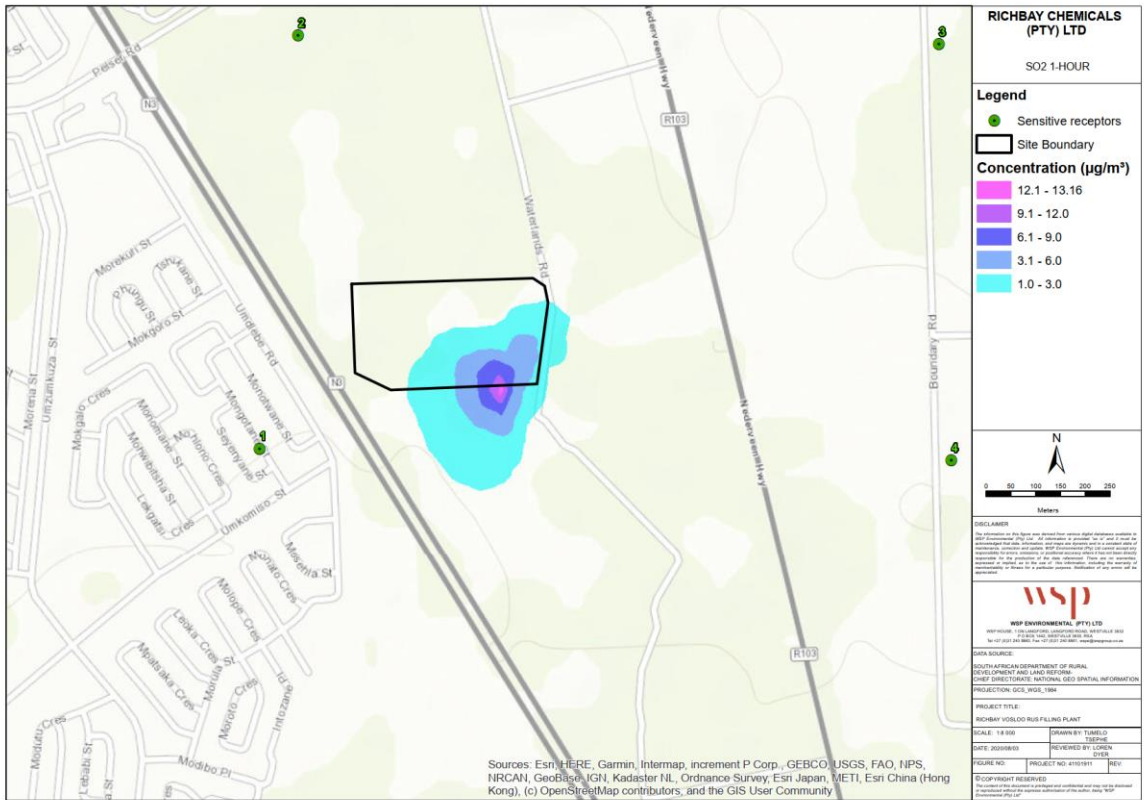


Figure 4-4: P99 1-hour SO₂

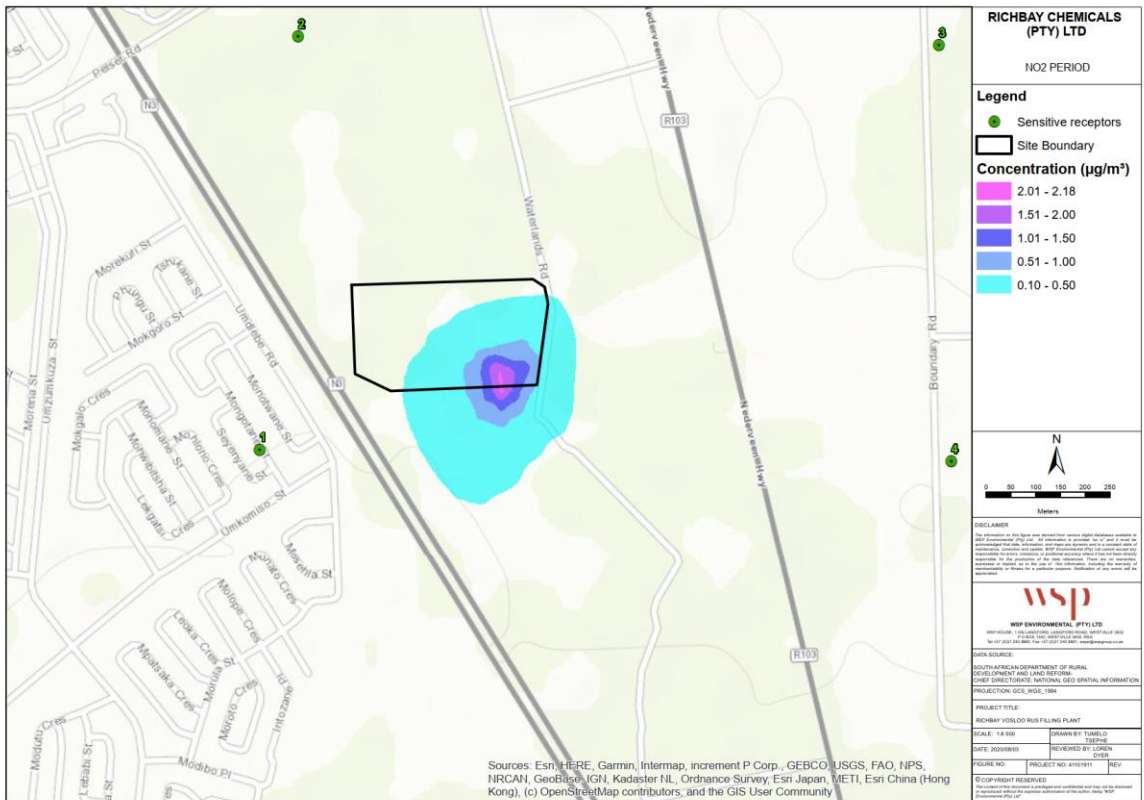


Figure 4-5: Period NO₂

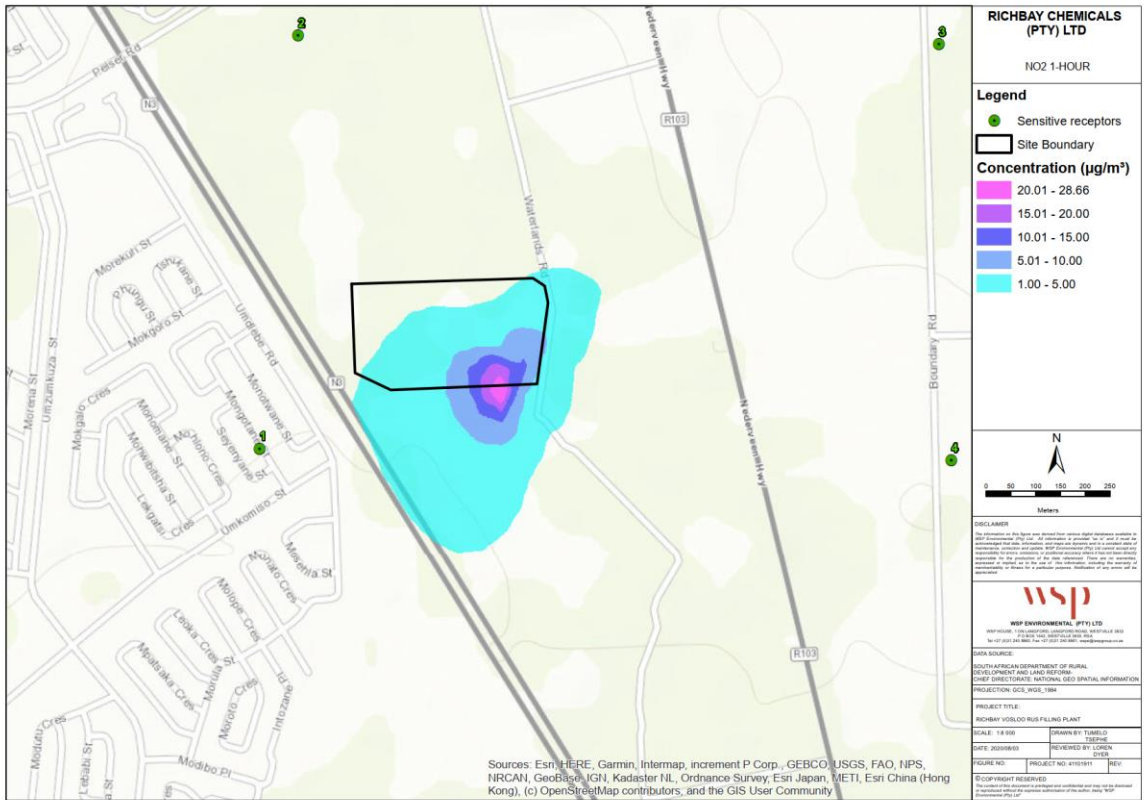


Figure 4-6: P99 1-hour NO₂

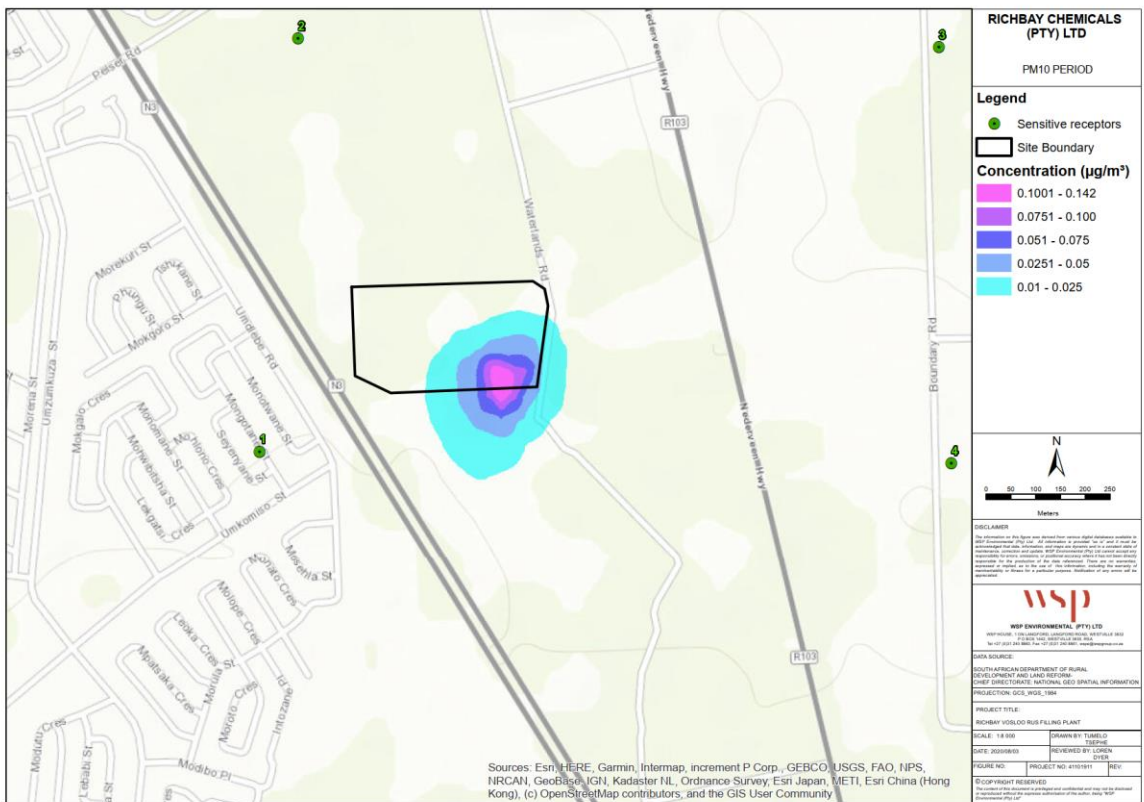


Figure 4-7: Period PM₁₀

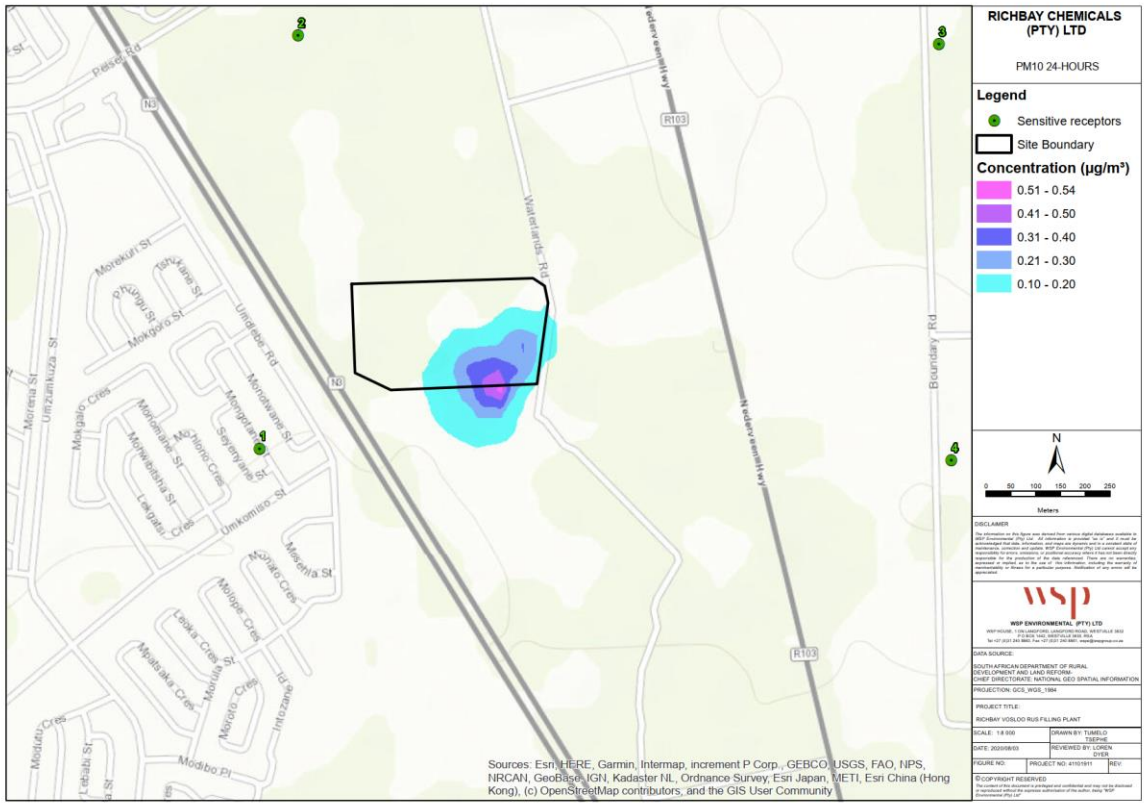


Figure 4-8: P99 24-hour PM₁₀

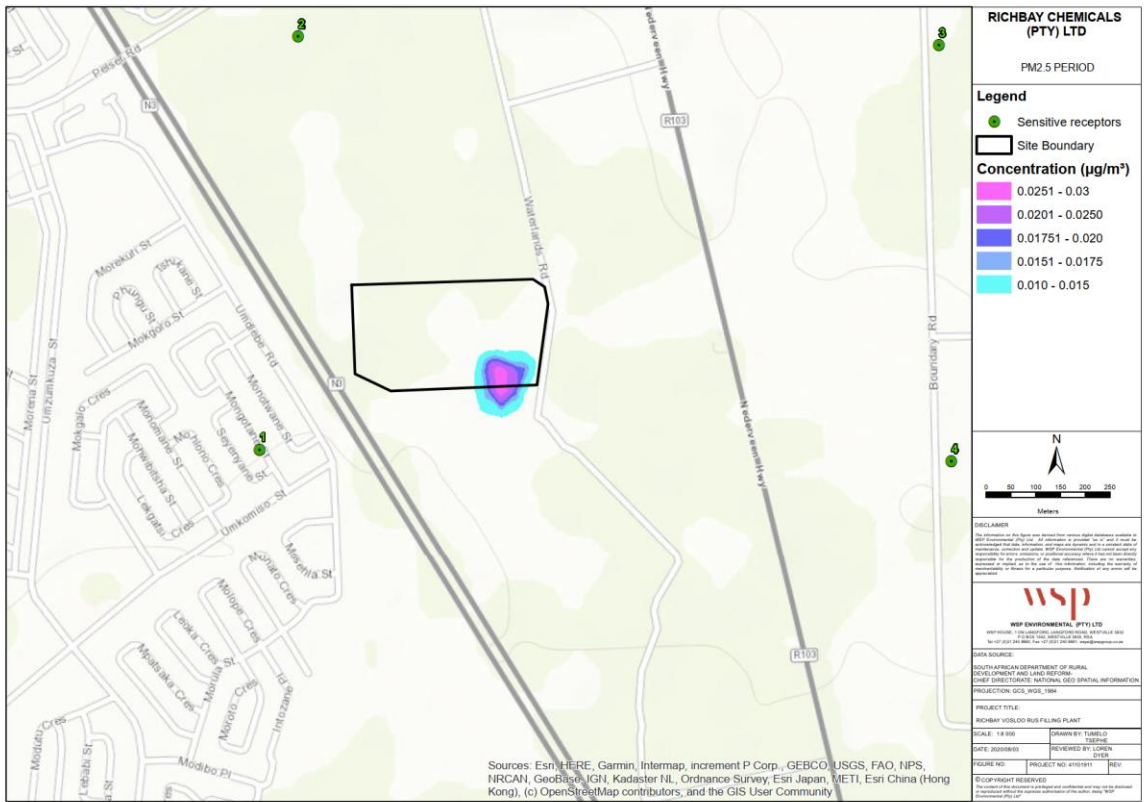


Figure 4-9: Period PM_{2.5}

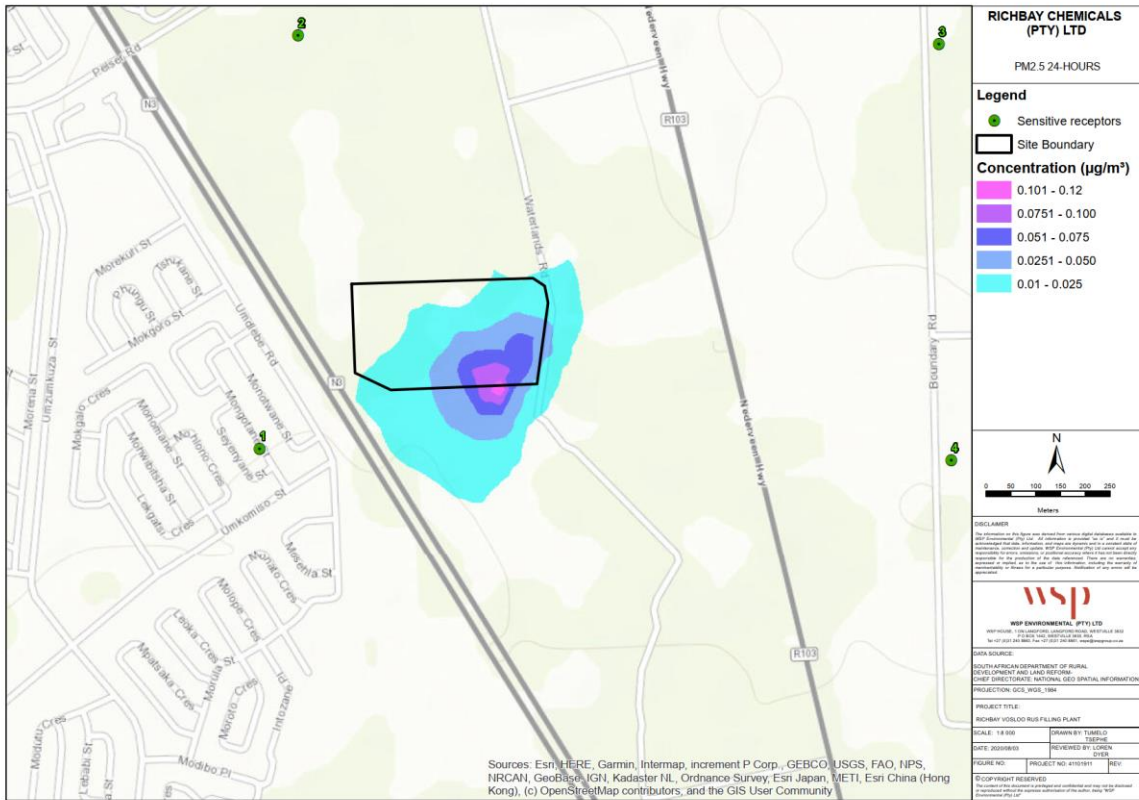


Figure 4-10: P99 24-hour PM_{2.5}

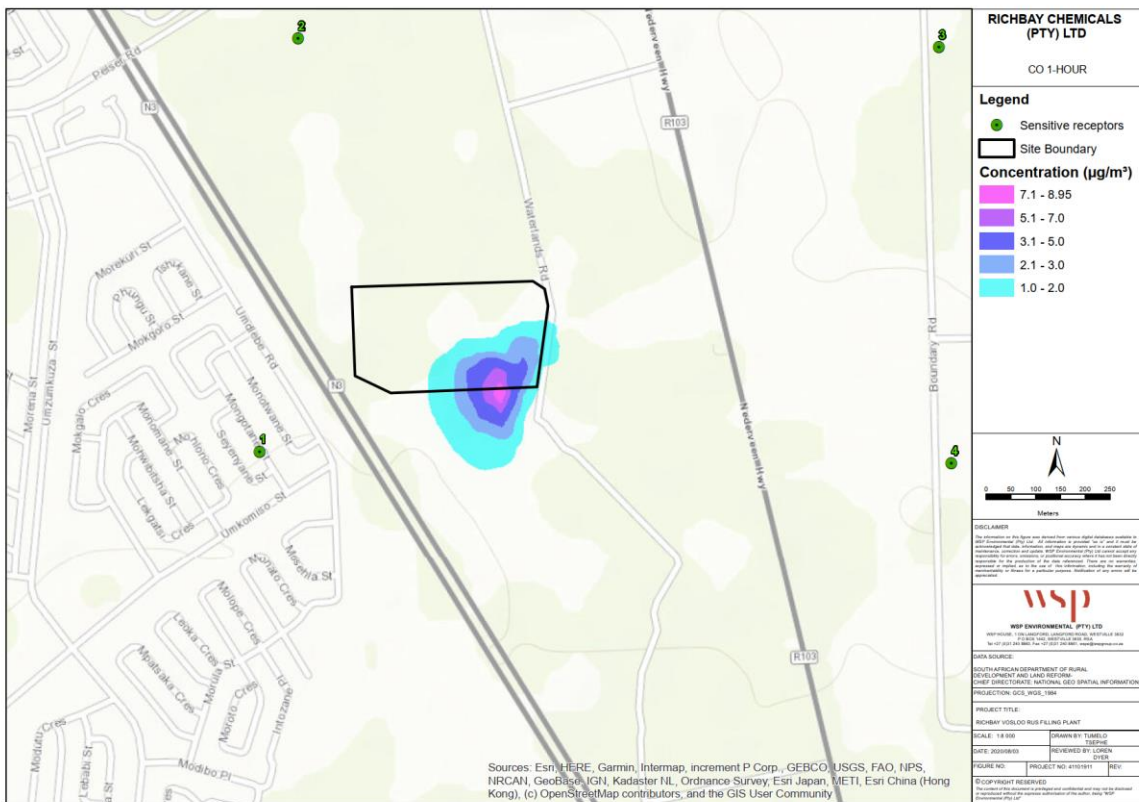


Figure 4-11: P99 1-hour CO

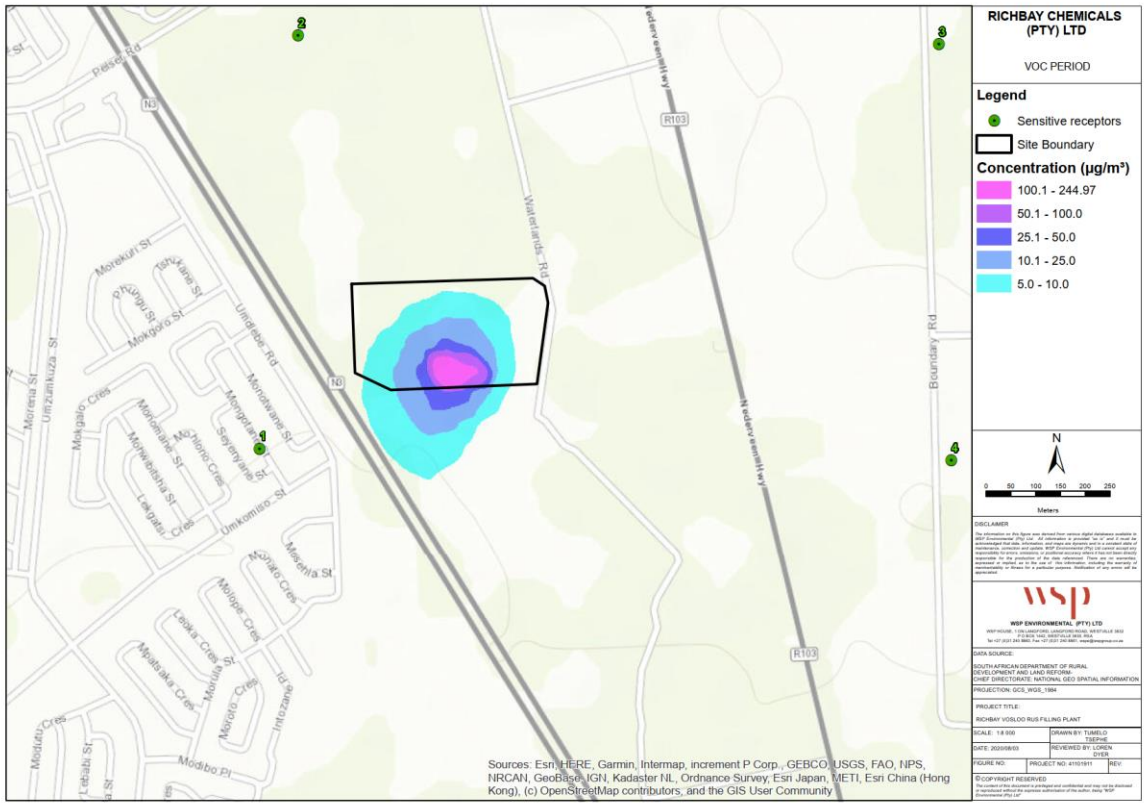


Figure 4-12: Period TVOC

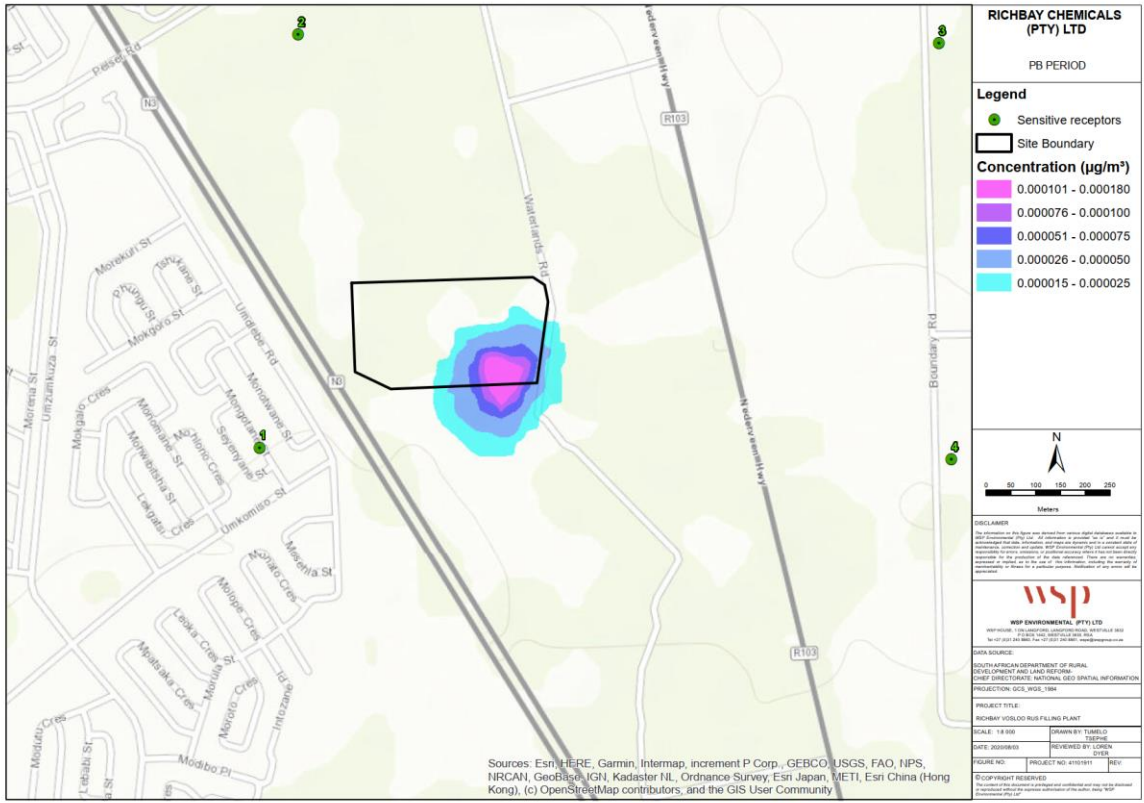


Figure 4-13: Period Pb

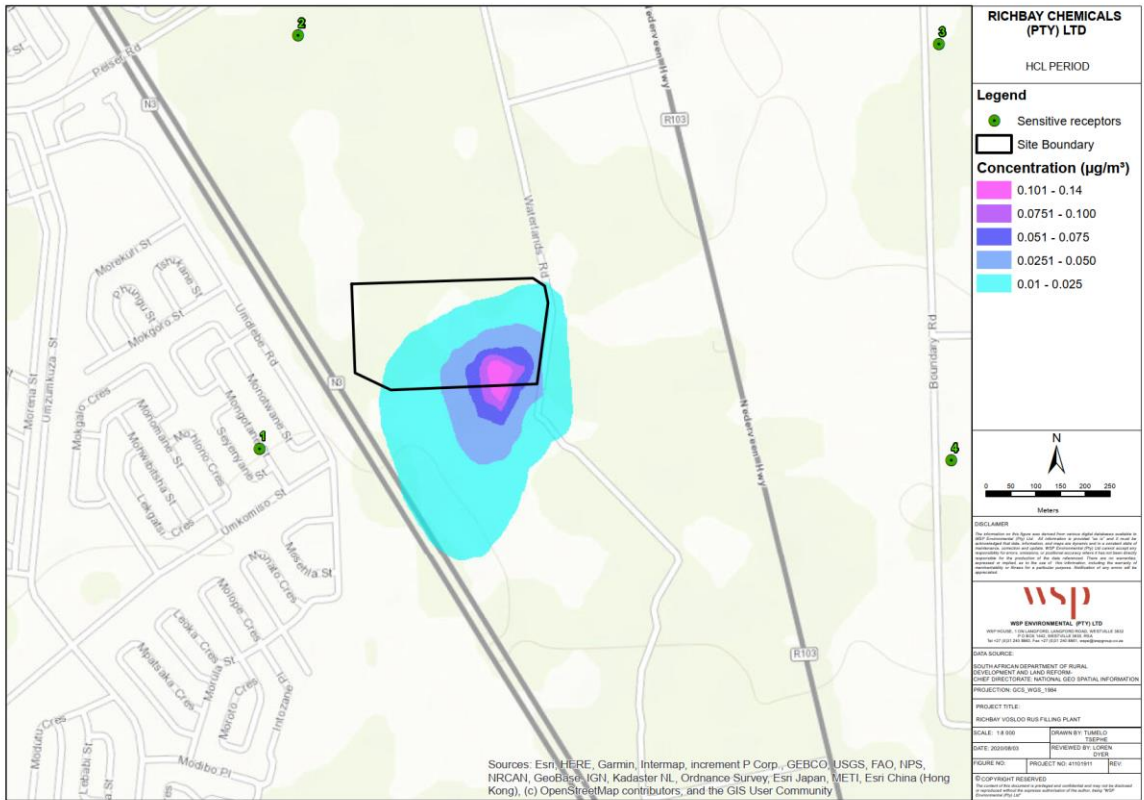


Figure 4-14: Period HCl

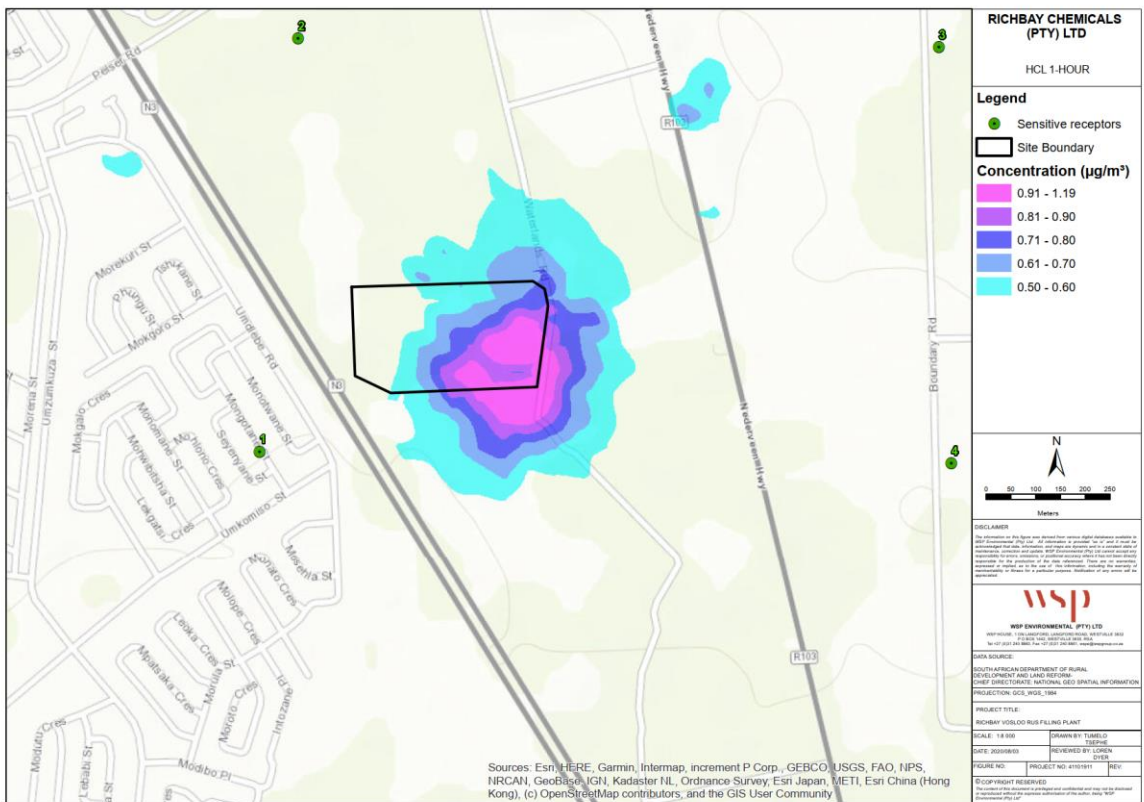


Figure 4-15: P100 1-hour HCl

5 ASSUMPTIONS AND LIMITATIONS

Various assumptions were made in the execution of this AQIA. Where possible, the more environmentally conservative approach was taken to ensure emission rate calculations and model predictions represent a worst-case scenario. The assumptions and limitations underlying the study methodology are as follows:

- Unless otherwise stated, operational information for the proposed development was provided by Richbay. Any errors, limitations or assumptions inherent in these datasets extend to this study. The following assumptions are also applicable to the information provided by Richbay:
 - Tank heights have been calculated based on tank diameter and tank capacity;
 - Tank working volumes have been calculated based on a maximum liquid height of 90%;
 - Average liquid heights are 50% of the maximum liquid height;
 - Net throughput of each tank is based on product consumption rates, the number of duplicate tanks (applicable to the filling plant only) and calculated working volumes;
 - Where required, the coordinates of each emission source have been adjusted to better align with the proposed plant layout;
 - Emission source IDs have been independently assigned by WSP to assist with the interpretation of data and findings presented in this AQIA. These IDs will not necessarily feed through to other specialist assessments conducted as part of the Richbay Vosloorus EIA, nor Richbay's record keeping going forward.
 - Richbay intend to duct the vents from HCl storage tanks through the HCl scrubber. HCl emissions from these storage tanks are thus emitted via the scrubber exhaust stack and not considered to be fugitive releases.
- In the absence of NPI emission factors for paraffin fired boilers, emission factors for the combustion of distillate (diesel) oil fired boilers less than 30 MW capacity have been substituted for criteria pollutants (excluding SO₂).
- SO₂ emission rates were calculated using a fuel analysis approach and a typical sulphur content (by mass) of paraffin in South Africa of 0.05%. This approach assumes that 100% of sulphur is converted to SO₂.
- Buildings downwash effects have been accounted for in the dispersion model using approximate building location and building shape provided in the proposed site layout plan. In line with the *Modelling Regulations*, all bulk storage tanks have been represented as circular buildings for downwash calculations. All buildings (with the exception of storage tanks) are assumed to be 3 m in height (i.e. the average height of a single storey).
- Variable emission rates have been applied to simulate a 10 hour/weekday operating scenario for the boiler (i.e. Monday to Friday from 07h00 to 17h00, inclusive). All other emission sources are considered continuous (i.e. 24 hours per day for 365 days per year).
- This study adopts a Tier 2 NO_x to NO₂ conversion ratio of 0.8, which is considered as a conservative ratio by the *Modelling Regulations*.
- While it is suspected that the 'Leondale' ambient air quality monitoring station is also located within 10 km of the study site, the exact location of this station could not be confirmed by SAWS or the Ekurhuleni Metropolitan Municipality at the time this report was completed and thus has been omitted from this assessment.

6 CONCLUSION

Richbay Chemicals is proposing to establish a chemical filling plant in Vosloorus, near Johannesburg and have initiated the EIA process required for environmental authorisation. Primary business operations at the proposed plant will include:

- A filling plant for the decanting of chemicals from bulk storage into smaller packages for distribution; and
- An acid regeneration plant for the reprocessing waste HCl.

The proposed activity falls under *Category 6: Organic Chemicals Industry*, and *Subcategory 7.2: Production of Acids* of the Listed Activities³⁴, promulgated in line with Section 21 of NEM:AQA. As such, an AQIA is required as part of the EIA process to support the application for an AEL.

This study assessed the potential impacts to ambient air quality associated with the proposed development using a Level 2 (AERMOD) dispersion modelling assessment. Impacts to ambient air quality for criteria pollutants, namely SO₂, NO₂, PM₁₀, PM_{2.5}, TVOC, CO, Pb and HCl were simulated.

An emissions inventory was developed using emission rate calculators (i.e. TANKS 4.0.9d) and emission factors developed by reputable international environmental bodies (e.g. Australian NPI) for input into the dispersion model. Quantified sources include bulk solvent or fuel oil based chemical storage tanks, the paraffin fired boiler and HCl scrubber. Simulated pollutant dispersion outputs were compared to NAAQS or international guidelines (in the absence of local standards) to assess the degree of impact. Key findings are as follows:

- SO₂ emissions do not result in exceedances of the ambient SO₂ 1-hour (350 µg/m³), 24-hour (125 µg/m³) or annual (50 µg/m³) NAAQS at any sensitive receptors;
- NO₂ emissions do not result in exceedances of the ambient NO₂ 1-hour (200 µg/m³) or annual (40 µg/m³) NAAQS at any sensitive receptors;
- PM₁₀ emissions do not result in exceedances of the ambient PM₁₀ 24-hour (75 µg/m³) or annual (40 µg/m³) NAAQS at any sensitive receptors;
- PM_{2.5} emissions do not result in exceedances of the ambient PM_{2.5} 24-hour (40 µg/m³) or annual (20 µg/m³) NAAQS at any sensitive receptors;
- TVOC emissions do not result in exceedances of the ambient benzene annual (0.5 µg/m³) NAAQS at any sensitive receptors, however, exceedances of the benzene NAAQS beyond the site boundary are noted;
 - The comparison of TVOC against the benzene NAAQS is considered conservative, as TVOCs comprise a vast array of compounds and the NAAQS is only applicable to the benzene proportion. As such, the benzene NAAQS cannot be used in this instance to demonstrate compliance, however has been used here as a conservative reference threshold for assessing the degree of impact.
- CO emissions do not result in exceedances of the ambient CO 1-hour (30,000 µg/m³) NAAQS at any sensitive receptors;
- Pb emissions do not result in exceedances of the ambient Pb annual (0.5 µg/m³) NAAQS at any sensitive receptors;
- HCl emissions do not result in exceedances of the ambient HCl 1-hour (190 µg/m³) or annual (7.9 µg/m³) TCEQ guideline at any sensitive receptors;
- Peak concentrations across all pollutants occur either within the site boundary or along the facility fenceline; and
- A cumulative assessment using background ambient air quality monitoring data has not been offered due to low data recovery and operational reliability of the available monitoring station.

Based on the findings of this this environmentally conservative AQIA, ground-level impacts associated with atmospheric emissions from the proposed development are assessed to be very low.

In line with MES requirements for Listed Activity Category 6, it is recommended that:

³⁴ Department of Environmental Affairs: (2013): List of Activities which result in Atmospheric Emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage (No. R. 893), Government Gazette, 22 November 2013, (No. 37054), as amended by GN 551 in 2015 and GN 1207 in 2018.

- An LDAR program be instituted to monitor fugitive emissions from the storage and handling of products with a vapour pressure greater than 14 kPa; and
- Storage tanks holding products with a vapour pressure greater than 14 kPa must be fitted with pressure vacuum vents, at a minimum, to prevent breathing losses.

General recommendations for emissions control and monitoring include:

- Routine inspections conducted at a maximum of six-month intervals to assess the condition of any tank covers or seals;
- The unloading of liquid products received by road tanker be offloaded using bottom loading techniques;
- Regular servicing of combustion installations to maintain optimum operational efficiency; and
- Undertake fence-line passive monitoring of HCl and VOCs, specifically the benzene, ethylbenzene, toluene and xylene range (i.e. BTEX).

7 FORMAL DECLARATIONS

7.1 DECLARATION OF ACCURACY OF INFORMATION

DECLARATION OF ACCURACY OF INFORMATION - APPLICANT

Name of Enterprise: Richbay Chemicals (Pty) Ltd

Declaration of accuracy of information provided:

Atmospheric Impact Report in terms of section 30 of the Act.

I, Mathias F. Klipper (duly authorised), declare that the information provided in this atmospheric impact report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality officer is a criminal offence in terms of section 51(1) (g) of this Act.

Signed at Pietermaritzburg on this 31st day of August 2020



SIGNATURE



CAPACITY OF SIGNATORY

7.2 DECLARATION OF INDEPENDENCE

DECLARATION OF INDEPENDENCE - PRACTITIONER

Name of Practitioner: Loren Dyer

Declaration of independence and accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act.

I, Loren Dyer, declare that I am independent of the applicant. I have the necessary expertise to conduct the assessments required for the report and will perform the work relating the application in an objective manner, even if this results in views and findings that are not favourable to the applicant. I will disclose to the applicant and the air quality officer all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the air quality officer. The information provided in this atmospheric impact report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality officer is a criminal offence in terms of section 51(1) (g) of this Act.

Signed at Westville on this 1st day of September 2020

SIGNATURE

Air Quality Specialist

CAPACITY OF SIGNATORY