GeT Alloys (Pty) Ltd

Aluminium and copper alloy production facility, Germiston

Atmospheric Impact Report

Ref.: SSC1066/1
Version: Final
Date: Feb-2022

SOUNDSCAPE

Document Control

Title	Atmospheric Impact Report for the proposed GeT Alloys aluminium and copper alloy production facility in Germiston
Prepared for	GeT Alloys
Prepared by	Nicolette von Reiche
Project number	SSC1066
Report number	SSC1066/1
Status	Final
Issue date	17 February 2022

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Specialist expertise and declaration of independence

Nicolette von Reiche is a mechanical engineer by training with over 13 years' relevant experience in environmental noise and air quality impact assessment. She has experience throughout Africa, liaised with different spheres of government and completed projects in a wide range of industrial sectors.

The views expressed in the document are the objective, independent views of the author. Neither Nicolette von Reiche nor Soundscape Consulting (Pty) Ltd have any business, personal, financial or other interest in the proposed development apart from fair remuneration for the work performed.

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Executive summary

GeT Alloys (Pty) Ltd plans to develop a foundry for the production of aluminium and copper alloys from scrap. The facility will be located within the Knights industrial area off Shaft Road on the remainder of Portion 1 of the farm Driefontein 87-IR, Germiston.

Scrap aluminium (2 400 tons per month) and copper (250 tons per month) will be cleaned, sorted, pre-heated (some aluminium scrap only), smelted, and cast to produce 2 000 tons of aluminium and 200 tons of copper alloy ingots per month. The foundry section of the facility will contain one pre-heater, four melting furnaces, three holding furnaces, and two casting machines. All furnaces will be fitted with fume extraction, both from the furnaces itself and via hoods to capture fumes during charging and/or tapping. Fugitive emissions will furthermore be extracted from the building roof at its apex. All extracted fumes/air will be mixed to lower the temperature of the off gas before it passes through a bagfilter to reduce the PM load. It will then be vented to atmosphere 30 m above ground level.

Dross (450 tons per month) from the aluminium furnaces will be tapped or skimmed from the molten material surface and cooled in the dross recovery plant. Al is recovered from dross by a cold process at a 10% recovery rate. Cooled dross will be passed through a vibratory screen, and, depending on size, passed through a ball mill or pulveriser. Aluminium will be separated from other metals in the dross with a magnetic drum. Recovered aluminium is returned to the melting process. Materials remaining after the recovery process (approximately 405 tons per month) will be bagged and disposed of by a waste disposal contractor. The entire dross recovery process will take place within an enclosed building. The dross recovery plant ball mill and pulveriser will be fitted with dust extraction. Extracted dust laden air will be passed through a bagfilter to reduce the particulate matter load before being vented to atmosphere via a stack at 24 m above ground level.

The plant will operate 24 hours per day, 365 days per year.

Combustion installations and secondary aluminium production are listed activities under Section 21 of the National Environmental Management Air Quality Act (NEMAQA) (Act no. 39 of 2004). As such GeT Alloys is required to apply for an Atmospheric Emissions Licence (AEL). This Atmospheric Impact Report (AIR) is submitted in support of the AEL application and addresses the potential for air quality related impacts on human health and the environment. This report also meets the reporting requirements for specialist studies under the National Environmental Management Act (NEMA) (Act no. 107 of 1998) as amended.

Pollutants generated by the pre-heating and melting process and released through the main baghouse stack that are subject to Minim Emission Standards (MES) include particulate matter (PM), combustion gases oxides of nitrogen (NOx), and sulphur dioxide (SO_2) as well as ammonia, hydrogen fluoride and volatile organic compounds (VOC). The cold dross recovery process will generate PM emissions will be released to atmosphere via the dedicated baghouse stack and as fugitives.

To determine the potential for air quality related impacts on human health and the environment, a Level 2 assessment, as per the requirements of the 2014 "Regulations Regarding Air Dispersion Modelling", was conducted. The assessment included inter alia:

- The identification of project specific air pollution sources, and quantification of these sources' emissions using MES and empirical emission factors. Estimated annual average emissions amount to:
  - NOx (as NO_2) 131 tons per annum (t/a)
  - SO_2 131 t/a
  - PM_{30} (total suspended particulates) 12.5 t/a
  - PM_{10} 10.3 t/a
  - $PM_{2.5}$ 9.5 t/a
  - Ammonia 7.88 t/a
  - Fluorides as hydrogen fluoride (0.263 t/a)
  - VOCs 7.88 t/a)
- The identification of applicable national ambient air quality, dustfall, screening and odour impact criteria.

- For inclusion in the dispersion model, a study of:
  - Local meteorology. Data from O.R. Tambo International Airport supplemented by a simulated data set for the period 2018 to 2020 were used.
  - Topography and land-use.
  - Background pollutant concentrations. Average pollutant concentrations determined from data retrieved from air quality monitoring stations at Bedfordview, Delville, and Thokoza: NO_2 55.6 µg/m^3, SO_2 23.9 µg/m^3, PM_{10} 60.1 µg/m^3, $PM_{2.5}$ 27.8 µg/m^3, and O_3 41.8 µg/m^3. No representative background data available for dustfall, ammonia, hydrogen fluorides, or VOCs.
- The identification of sensitive receptors. There are several residential suburbs of Germiston within 5 km of the property, the closest include Primrose to the north- and north-west, Woodmere to the north, Marlands to the North-west, Berton Park to the east, Balmoral and Delmore Park to the south-east, Germiston South to the south, and Residential clusters of Driefontein IR-87 to the south and west. All these areas have residences within 1 to 2 km from the property.
- Dispersion simulations to determine air pollutant concentrations and dustfall rates at sensitive receptors and a receptor grid covering the area of interest.

Through atmospheric dispersion simulations, the proposed GeT Alloys facility was shown to result in 1-year and 24-hour average PM_{10} and $PM_{2.5}$ concentrations which exceed NAAQS at the plant boundary and/or off-site. Exceedances are however limited to the immediate vicinity of the property boundary with concentrations at a fraction of NAAQS at nearby residential receptors. Dustfall in exceedance of the NDCR is localised and limited to the plant boundary. Off-site NO_2 and SO_2 concentrations are within NAAQS. The project will generally contribute less than 1% to NAAQS and existing pollutant levels at surrounding residential receptors.

Screening criteria for non-criteria pollutants (ammonia, hydrogen fluoride and VOC) will not be exceeded off-site. Increased lifetime cancer risk is expected to be low (less than one in 100 000). No off-site odour impacts are expected.

Key assumptions and limitations to the assessment that should be noted when considering dispersion modelling results are:

- The quantification of emissions and impacts are, as is typical of an AIR, limited to operational phase impacts. The significance of construction, decommissioning, and closure phase impacts are addressed qualitatively.
- Sources of atmospheric emission included in the assessment are those regulated by MES and those likely to generate fugitive dust. Sources of emission omitted from the study either because their contribution is considered immaterial or because insufficient information was available for its quantification include on-site vehicles (exhaust and dust emissions); standing and working losses from fuel storage; and fugitive ammonia emissions from dross if is exposed to water.
- All sources were simulated as continuous emitters i.e., 365 days per year, 24 hours per day.
- The NAAQS for benzene was included as a proxy for assessing the impact of emitted VOCs.
- The conversion process of NO to NO_2 as it is released to atmosphere is photochemical in nature and dependant on sunlight and ambient ozone concentrations. In the simulation of ambient NO_2 concentrations, use was made of the ozone limiting method with a NO_2/NOx emission ratio of 0.9 and ozone concentration of 41.3 µg/m^3.
- Simulations for SO_2 included 1-hour averages, 24-hour averages, and 1-year averages. Since AERMOD cannot simulate sub-1-hour pollutant concentrations without sub-hourly meteorological data, 10-minute average SO_2 concentrations could not be calculated for comparison with 10-minute NAAQS.
- There will always be some error in any geophysical model, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere. Nevertheless, dispersion modelling is generally accepted as a necessary and valuable tool in air quality management.

The significance of simulated impacts was determined by applying the appointed Environmental Impact Assessment Practitioner's (EAP) chosen methodology. Apart from the duration of the impact phases, the significance of construction, decommissioning, closure, and operational phases is expected to be similar, that is, low with mitigation.

It is concluded that air quality impacts should have an influence on the environmental authorisation decision and cannot be completely avoided. It is the specialist's reasoned opinion that the project may proceed provided that planned air quality management interventions listed in this report are implemented.

NEMA reporting requirements for specialist environmental studies

Requirement	Relevant section in report
Details of the specialist who prepared the report.	Report details (page 1)
The expertise of that person to compile a specialist report including curriculum vitae.	Annex C
A declaration that the person is independent in a form as may be specified by the competent authority.	Report details (page 1)
An indication of the scope of, and the purpose for which, the report was prepared.	Executive summary
The date and season of the site investigation and the relevance of the season to the outcome of the assessment.	A site investigation was not required as part of the scope of work.
A description of the methodology adopted in preparing the report or carrying out the specialised process.	Section 5
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.	Section 5
An identification of any areas to be avoided, including buffers.	Not applicable
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.	Figure 1, paragraph 1.3 Figure 2, paragraph 2.2
A description of any assumptions made and any uncertainties or gaps in knowledge.	Paragraph 5.2.7
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment.	Paragraph 5.3 Paragraph 9.1
Any mitigation or management measures for inclusion in the EMPr.	Section 8 Paragraph 9.1
Any conditions for inclusion in the environmental authorisation	Section 8 Paragraph 9.1
Any monitoring requirements for inclusion in the EMPr or environmental authorisation.	Section 8
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised.	Paragraph 9.2
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan.	Section 8 Paragraph 9.1
A description of any consultation process that was undertaken during the course of carrying out the study.	Not applicable.
A summary and copies if any comments that were received during any consultation process.	No comments received.
Any other information requested by the competent authority.	Not applicable.

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Acronyms and abbreviations

AEL	Atmospheric Emission Licence
AIR	Atmospheric Impact Report
AQMS	Air quality monitoring station
ATSDR	Agency for Toxic Substances and Disease Registry
CalEPA	California Environmental Protection Agency
CO	Carbon monoxide
CoEMM	City of Ekhuruleni Metropolitan Municipality
CPF	Cancer Potency Factor
D	Dustfall rate
DEWHA	Department of Environment, Water, Heritage and the Arts (Australia)
E	Emission factor
EAP	Environmental Assessment Practitioner
EETM	Emissions Estimation Technique Manual
IRIS	Integrated Risk Information System (US)
kg	Mass in kilogram
Ltd	Limited
masl	Meters above sea level
MES	Minimum Emission Standards
MRL	Minimal Risk Level
NAAQS	National Ambient Air Quality Standards
NDCR	National Dust Control Regulations
NEMAQA	National Environmental Management Air Quality Act
NO_x	Oxides of nitrogen
NO_2	Nitrogen dioxide
O_3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
ou_E	European odour units
Pa	Pressure in Pascal
PM	Particulate matter
PM_{30}	Particulate matter with an aerodynamic diameter of less than 30 µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 µm
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 µm
Pty	Proprietary
RAIS	Risk Assessment Information System
REL	Reference Exposure Level
RfC	Reference Concentration
SAAQIS	South African Air Quality Information System
SO_2	Sulphur dioxide
SRTM	Shuttle Radar Topography Mission
URF	Unit Risk Factor
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VOC	Volatile organic compounds
WHO	World Health Organisation
WGS	World Geodetic System

1 Enterprise details

1.1 Enterprise details

Details of the proposed GeT Alloys (Pty) Ltd aluminium and copper alloy production facility in Germiston in the City of Ekhuruleni Metropolitan Municipality (CoEMM) are provided in Table 1. The contact details of the responsible person, the emission control officer, are supplied in Table 2.

Table 1: Enterprise details

Enterprise name	GeT Alloys (Pty) Ltd
Trading as	GeT Alloys (Pty) Ltd
Type of enterprise	Private Company
Company registration number	2021 / 653290 / 07
Registered address	Head office: 13 Glenhurst Street, Beaconvale, Parow, Cape Town, 7475
Postal address	13 Glenhurst Street, Beaconvale, Parow, Cape Town, 7475
Telephone number (general)	021 879 3367
Fax number (general)	None
Industry type or nature of trade	Foundry
Land use zoning as per town planning scheme	Industrial 1
Land use rights of outside town planning scheme	N/A

Table 2: Contact details of the responsible person

Responsible person	Ebrahim Khan | ebrahim@getalloys.co.za | 079 877 2915
Emission control officer	TBC
Telephone number	TBC
Cell phone number	TBC
Fax number	TBC
E-mail address	TBC
After hours contact details	TBC

1.2 Location and extent of the plant

Table 3: Location and extent of the plant

Physical address of the plant	Shaft Road, Knights, Driefontein 87-IR, Germiston, 1401
Description of site (where no street address)	Not applicable
Coordinates of approximate centre of operations	Latitude: -26.196714 Longitude: 28.184152
Extent (km^2)	0.37 km^2
Elevation above mean sea level (m)	1 658 m
Province	Gauteng
Metropolitan/district municipality	City of Ekhuruleni Metropolitan Municipality
Local municipality	Not applicable
Designated priority area	Highveld Priority Area

1.3 Description of surrounding land use (5km radius)

The proposed aluminium and copper alloy production facility will be located within the Knights industrial area off Shaft Road on the remainder of Portion 1 of the farm Driefontein 87-IR, Germiston (the "property"). There are several national and regional roadways, industrial, commercial, and residential areas, as well as historical gold tailings disposal areas, within 5 km of the property.

The property is bordered to the south by gold tailings disposal areas in the process of being reclaimed. Other industries of Knights (including motor parts and repairs, metal works, scrapyards etc.) lie directly to the west and north. The R29, Main Reef Road, passes ~130 m to the north of the property. To the north, directly opposite the R29, are industries, a shooting range, and reclaimed gold tailings disposal areas.

Industrial areas further afield include Jet Park ~3 km to the north and north-east, and Jupiter ~3.5 km to the south-west. Transnet Germiston, the Germiston train station, and taxi rank is located ~1.5 km south-west of the property. The N12 passes in an east-west direction approximately 3.5 km to the north of the property.

Although there are several residential suburbs of Germiston within 5 km of the property, the closest include Primrose to the north- and north-west, Woodmere to the north, Marlands to the North-west, Berton Park to the east, Balmoral and Delmore Park to the south-east, Germiston South to the south, and Residential clusters of Driefontein IR-87 to the south and west. All these areas have residences within 1 to 2 km from the property.

See Figure 1 for the proposed location of the property earmarked for the proposed Al and Cu alloy production plant within Germiston and surrounding land-use.

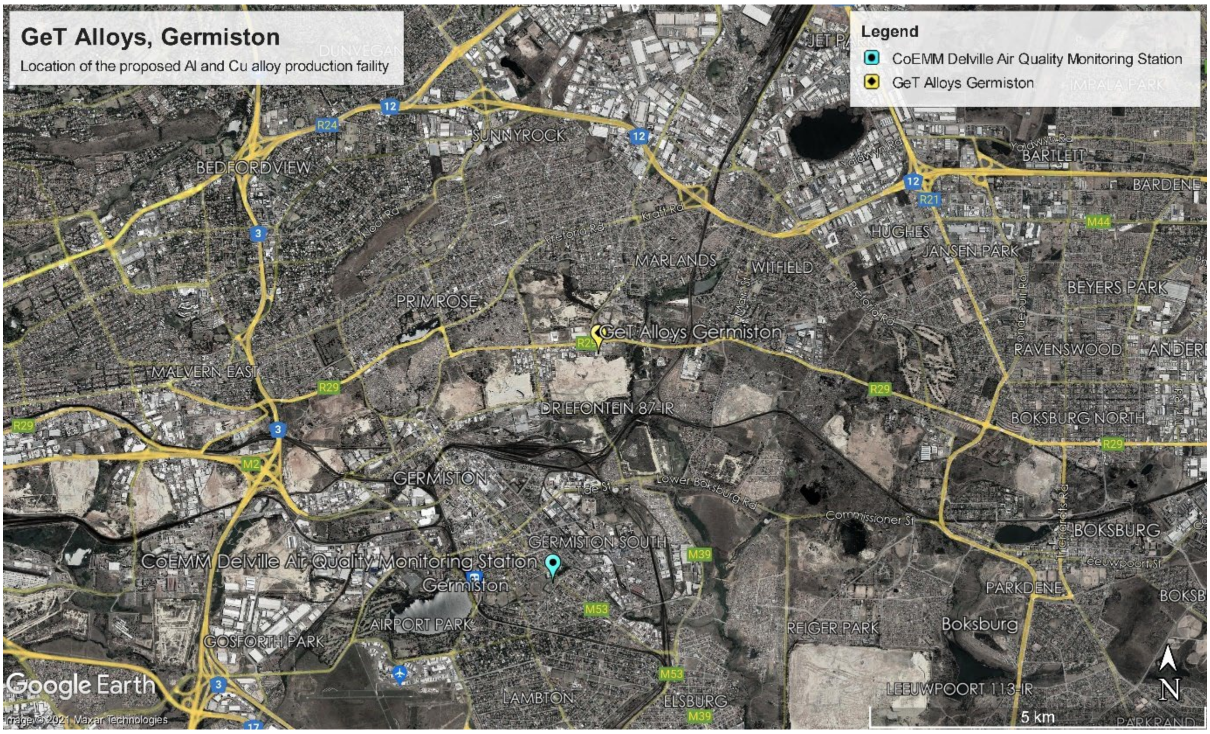


Figure 1: Location of the GeT Alloys property for proposed Al and Cu alloy production plant, Germiston

1.4 Atmospheric emission licence and other authorisations

There are currently no authorisations, permits, and/or licences relating to air quality management for this property. This report is prepared in support of a new Atmospheric Emissions Licence (AEL) application.

2 Nature of the process

2.1 Listed activities

Listed activities, as published in terms of Section 21 of the National Environmental Management Air Quality Act (NEMAQA) (Act no. 39 of 2004), conducted at the premises are listed in Table 4. Minimum Emission Standards (MES) under Section 21 of NEMAQA, for listed activity subcategory 4.2 (combustion installations) and 4.4 (secondary aluminium production), are indicated in
Table 5 and Table 6 respectively.

Note: The production and/or casting of bronze, brass, and copper at a rate exceeding 10 tons per day, is also a Section 21 listed activity (subcategory 4.19) with MES for PM (50 mg/Nm3), SO_2 (500 mg/Nm^3), and NOx as NO_2 (1 000 mg/Nm^3). Compared to other applicable MES, those for combustion and secondary aluminium production is more stringent. Compliance with MES for combustion and secondary aluminium processes therefor implies compliance with MES for production and/or casting of bronze, brass, and copper. The proposed facility is however design to produce less than 10 tons of copper alloy per day.

Table 4: Listed activities

Category of listed activity	Sub-category of listed activity	Description of listed activity	Application
4. Metallurgical industry	4.2: Combustion installations	Combustion installations not used primarily for steam raising and electricity generation (except drying).	All combustion installations (except test or experimental)
4. Metallurgical industry	4.4 Secondary aluminium production	Secondary aluminium production and alloying through the application of heat (excluding metal recovery).	All installations

Table 5: MES for subcategory 4.2 (combustion installations)

Description	Combustion installations not used primarily for steam raising and electricity generation (except drying).		
Application	All combustion installations (except test or experimental).		
Substance or mixture of substances		**Plant status**	**mg/Nm^3 under normal conditions of 273 K and 101.3 kPa**
Common name	**Chemical symbol**		
Particulate matter (PM)	Not applicable	New	50
Sulphur dioxide	SO_2	New	500
Oxides of nitrogen	NOx expressed as NO_2	New	500

Table 6: MES for subcategory 4.4 (secondary aluminium production)

Description	Secondary aluminium production and alloying through the application of heat (excluding metal recovery).		
Application	All installations.		
Substance or mixture of substances		**Plant status**	**mg/Nm^3 under normal conditions of 273 K and 101.3 kPa**
Common name	**Chemical symbol**		
Particulate matter	Not applicable	New	30
Total fluorides measured as hydrogen fluoride	F as HF	New	1
Total volatile organic compounds (TVOC)	Not applicable	New	40
Ammonia	NH_3	New	30

2.2 Process description

Scrap aluminium (2 400 tons per month) and copper (250 tons per month) arrives on site via truck. Aluminium scrap arrives as bales, briquettes, hammered, shredded, or loose, and may contain plastic, oils, grease, dust, and/or laminates. Copper scrap is from industrial and domestic used. Scrap is sorted manually. Some aluminium scrap may require pre-heating in oil fired pre-heater. Copper scrap will not require pre-heating.

Aluminium scrap is fed to one of three oil fired melting furnaces (two 8-ton reverberatory and one 10-ton vortex pump furnace) in batches using charging machines. Molten aluminium is tapped from the furnaces into one of three oil fired 10-ton holding furnaces. Alloy is then cast into moulds via one of two casting machines and cooled to form ingots. The plant will produce 2 000 tons of aluminium alloy per month.

The 4-ton box type oil fired furnace is charged with copper scrap in a batch process. Copper alloy is tapped and cast into moulds on a mould trolley and allowed to cool to form copper ingots. The plant will produce 200 tons of copper alloy per month. Both aluminium and copper alloy ingots are packed and dispatched via truck.

Note: The pre-heater and all furnaces may also be fired with natural gas. For this application, the use of low sulphur fuel oil, with higher sulphur and PM content, is assumed.

All furnaces are fitted with fume extraction, both from the furnaces itself and via hoods to capture fumes during charging and/or tapping. Fugitive emissions are furthermore be extracted from the building roof at its apex. All extracted fumes/air (30 000 Nm^3/h) are mixed to lower the temperature of the off gas before it passes through a bagfilter to reduce the PM load. It is then vented to atmosphere 30 m above ground level. Bagfilter dust is bagged and disposed of by a waste disposal contractor.

Dross (450 tons per month) from the aluminium furnaces is tapped or skimmed from the molten material surface and cooled in the dross recovery plant. Aluminium is recovered from dross by a cold process at a 10% recovery rate. Cooled dross is passed through a vibratory screen, and, depending on size, passed through a ball mill or pulveriser. Aluminium is separated from other metals in the dross with a magnetic drum. Recovered aluminium is returned to the melting process. Materials remaining after the recovery of Al (approximately 405 tons per month) is bagged and disposed of by a waste disposal contractor. The entire dross recovery process takes place within an enclosed building.

The dross recovery plant ball mill and pulveriser are fitted with dust extraction. Extracted dust laden air will be passed through a bagfilter to reduce the particulate matter load before being vented to atmosphere via a stack at 24 m above ground level. Bagfilter dust will be bagged disposed of by a waste disposal contractor.

The plant will operate 24 hours per day, 365 days per year.

Pollutants regulated under the applicable listed activities (PM, SO_2, NOx, HF, TVOC, and NH_3) and their formation in the process are discussed.

Atmospheric emissions will consist primarily of PM in various particle sizes and a distinction is made between specifically particulate matter less than 10 micrometres (PM_{10}) and particulate matter less than 2.5 micrometres ($PM_{2.5}$) for its potential impact on human health. Metal, and other trace hazardous air pollutant emissions are dependent on scrap metal composition but can generally be assumed to be present in the same proportions in emitted PM as in the scrap.

Since Al scrap may contain paints, plastics, and oils, pollutants such as VOCs may be also emitted. Since demagging[1] does not form part of the aluminium process, HF emissions from this process are generally negligible.

A study of literature related to secondary metal processing indicate that the formation of ammonia is associated with the aluminium process. Is believed to originate from aluminium dross when aluminium nitride within the dross reacts with water. NH_3 emissions are therefore believed to be fugitive in nature. Since all dross recovery processes will be contained within a building to be kept dry, NH_3 emissions are expected to be negligible.

The combustion of oil will also result in emissions and will include PM, and combustion gases such as carbon dioxide (CO_2), carbon monoxide (CO), NOx, SO_2 and VOCs. Of these pollutants, only PM, SO_2 and NOx are subject to MES (Table 5). Minimal amounts of vehicle exhaust emissions will be released by trucks, mobile equipment, and passenger vehicles on-site. Standing and working losses from on-site fuel storage in the form of VOC emissions may also occur.

A diagram of the process indicating operations, inputs, outputs, and points of emissions is included in Figure 3.

[1] Demagging is process during which either aluminium chloride (AlCl3) or aluminium fluoride (AlF3) is used to reduce the manganese content of the aluminium. The addition of AlCl3 or AlF3 during the melting process produces emissions of chlorides or fluorides.

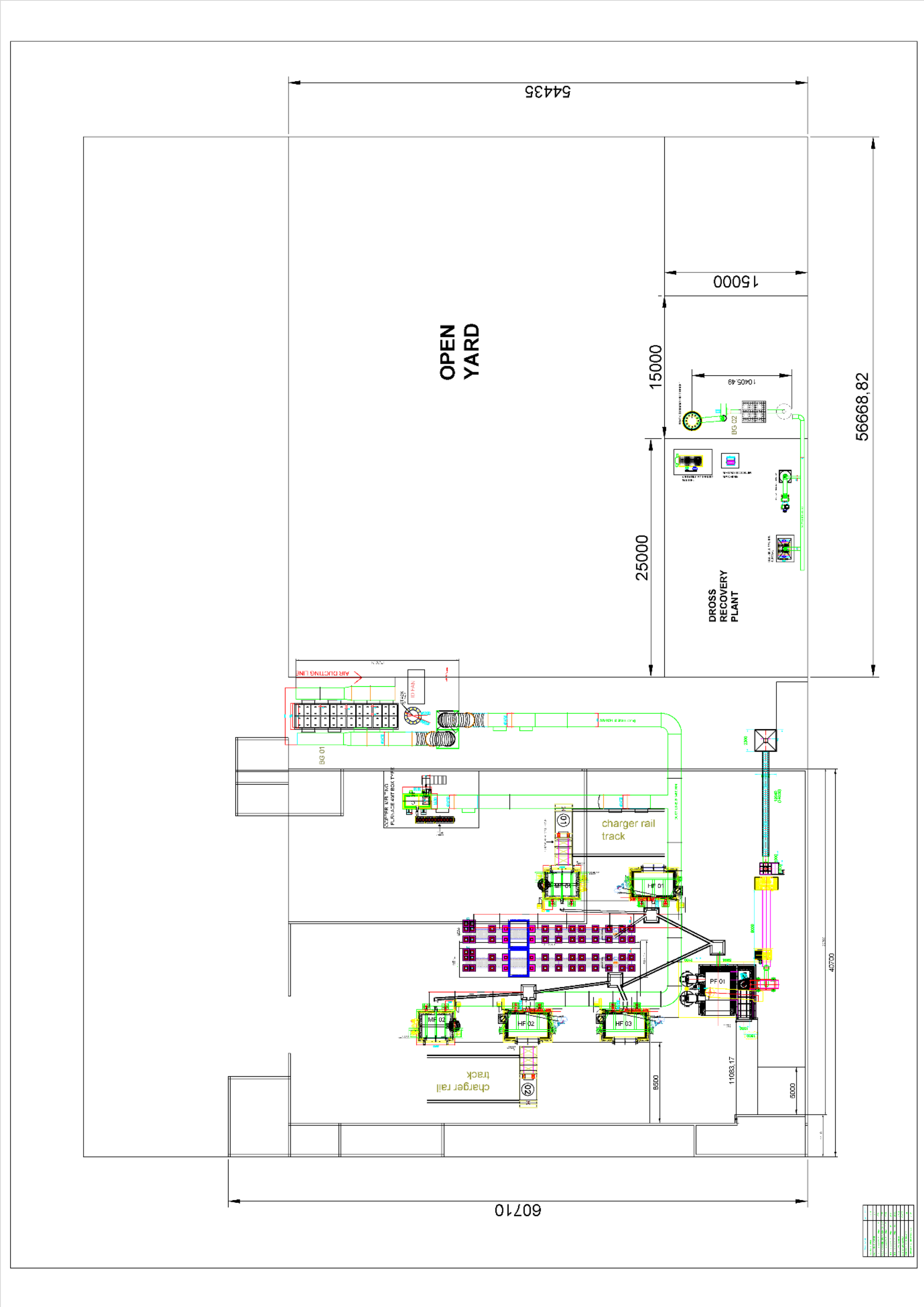


Figure 2: Site layout plan

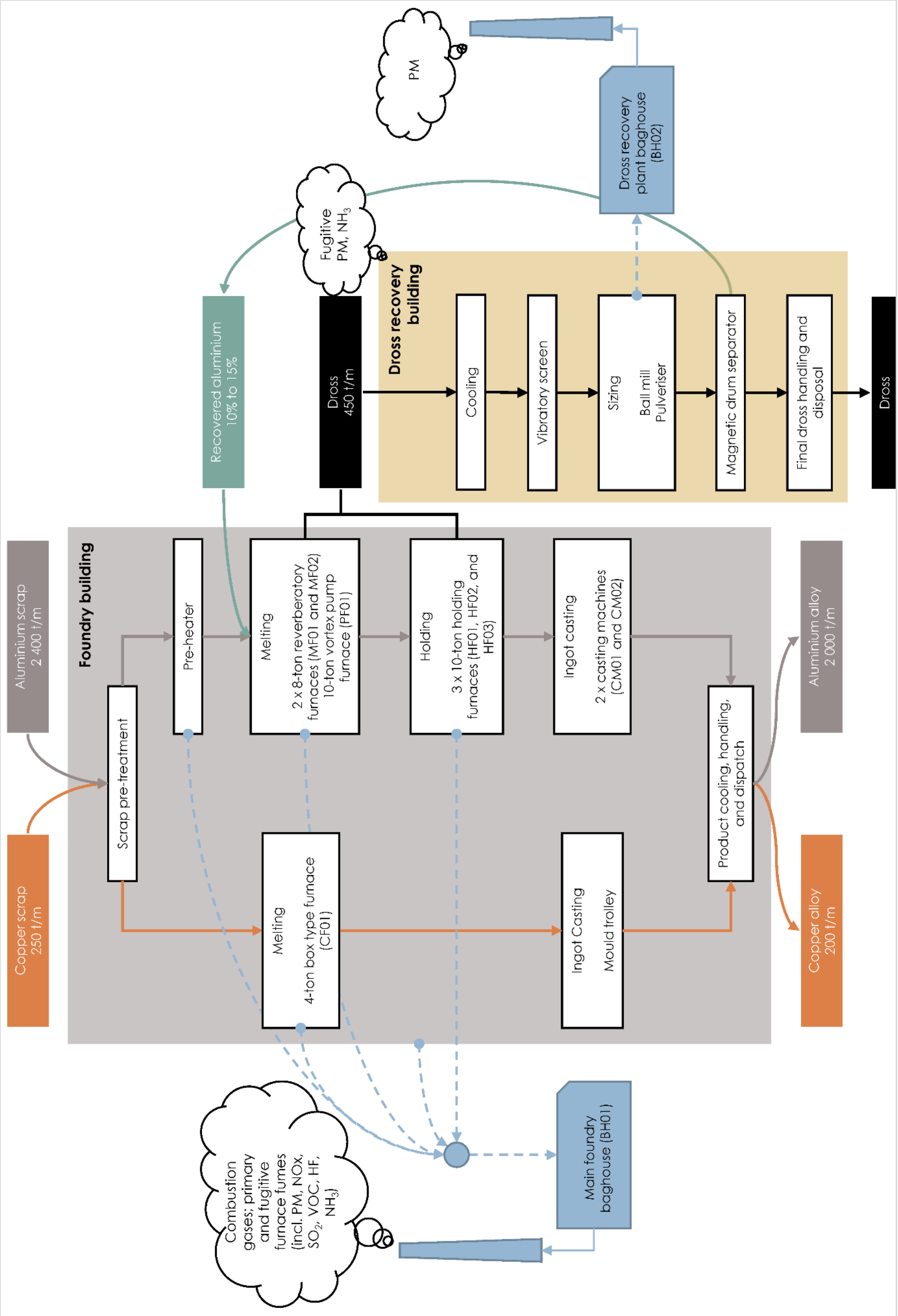


Figure 3: Simplified process flow diagram indicating material in- and outputs, unit processes and emissions

2.3 Unit process or processes

Unit processes associated with listed activities proposed at the premises are listed in Table 7.

Table 7: Unit processes

Name of unit process	Unit process function	Batch or continuous process
Scrap pre-treatment	Manual cleaning, sizing, and sorting of aluminium and copper scrap metal	Batch
Scrap pre-heater	Pre-heating of aluminium scrap before charging to furnace	Batch
8-ton reverberatory melting furnace (MF01)	Melting of aluminium scrap	Batch
8-ton reverberatory melting furnace (MF02)	Melting of aluminium scrap	Batch
10-ton vortex pump furnace (PF01)	Melting of aluminium scrap	Batch
10-ton holding furnace (HF01)	Holding of molten alloy before casting	Batch
10-ton holding furnace (HF02)	Holding of molten alloy before casting	Batch
10-ton holding furnace (HF03)	Holding of molten alloy before casting	Batch
4-ton box-type melting furnace (CF01)	Melting of copper scrap	Batch
Casting machine (CM01)	Casting and cooling of aluminium alloy ingots	Batch
Casting machine (CM02)	Casting and cooling of aluminium alloy ingots	Batch
Casting mould trolley	Casting and cooling of copper alloy ingots	Batch
Product handling and dispatch	Packing and loading of aluminium and copper ingots for dispatch	Batch
Cooling	Cooling of dross prior to cold processing and recovery	Batch
Vibrating screen	Screening of cooled dross into various size fractions	Batch
Ball mill	Sizing of dross to recover aluminium	Batch
Pulveriser	Sizing of dross to recover aluminium	Batch
Magnetic drum separator	Separating aluminium from other metallics	Batch
Waste handling and disposal	Bagging and loading of waste and baghouse dust for disposal b contractor	Batch

3 Technical Information

Regulations prescribing the format of the AIR require the inclusion of a list of raw materials used (Table 8) and a list of appliance and abatement equipment control technology to be installed (Table 9).

Hours of operation, production rates, and energy sources are also supplied in this section in Table 10, Table 11, and Table 12 respectively.

3.1 Raw material used

Table 8: Raw materials

Raw material type	Design consumption rate	Units
Aluminium scrap	2 400	Tons per month
Copper scrap	250	Tons per month

3.2 Appliance and abatement equipment control technology

Table 9: Appliance and abatement equipment control technology

Appliance name	Appliance type/description	Appliance function/purpose
Main foundry baghouse	Baghouse	For the removal of PM captured and extracted fumes from furnaces and the foundry building.
Dross recovery plant baghouse	Baghouse	For the removal of PM captured and extracted from ball mill and pulveriser at dross recovery plant.

3.3 Other

Table 10: Operational hours

Unit process	Operating hours per day	Number of operational days per year
All unit processes (batch)	24	365

Table 11: Production rates

Product type	Design production rate	Units
Aluminium alloy	2 000	Tons per month
Copper alloy	200	Tons per month

Table 12: Materials used as energy sources

Material for energy	Sulphur content (%)	Ash content (%)	Design consumption rate	Units
Fuel oil	1%	Not applicable	3 000	Litres per day

4 Atmospheric emissions

4.1 Point source parameters

Table 13: Point source parameters

Point source number	Point source name	Point source coordinates	Elev. (m)	Height of release above ground (m)	Height above nearby building	Diameter at stack tip (m)	Actual gas exit temperature (˚C)	Volumetric flow rate at 273 K and 101.3 kPa (Nm³/hour)	Actual gas volumetric flow rate (m³/hour)	Actual gas exit velocity (m/s)	Type of emission
S01	Main foundry baghouse stack	26°11'47.84" S 28°11'2.74" E	1 658	30	Approx. 10 m	1.2	100[(a)]	30 000	50 074[(a)]	12.3	Continuous
S02	Dross recovery plant baghouse stack	26°11'48.75" S 28°11'3.97" E	1 658	24	Approx. 10 m	0.4	Ambient[(b)]	3 480	4 524[(b)]	10[(b)]	Continuous

Notes:

a) It is assumed that the temperature of the plume as it exists the baghouse stack will be 100 ˚C. The actual volumetric flow rate is at the actual plume temperature of 100 ˚C, and an ambient air pressure of 82.9 kPa at 1 658 masl.

b) The temperature of the baghouse plume will be that of ambient air. The average hourly temperature in Germiston is 17 ˚C. The actual volumetric flow rate was calculated based on an assumed plume exit velocity of 10 m/s, temperature of 17 ˚C, and at an ambient air pressure of 82.9 kPa at 1 658 masl.

4.2 Point source maximum emissions under normal working conditions

For this application, and in accordance with the Regulations Regarding Air Dispersion Modelling and Regulations Prescribing the format of the Atmospheric Impact Report, Point source emissions are based on MES. Where MES of different subcategories overlap, the most stringent is applied.

Note: Although dross recovery is not a Section 21 listed activity *per se*, it can be considered part of the secondary aluninium production process and is therfore assumed to be subject to subcategory 4.4 MES of for PM. PM is the only pollutant likely to be reased by sizing of dross.

Table 14: Point source maximum emissions under normal working conditions

Point source number	Point source name	Pollutant name	Maximum emissions under normal operating conditions				Duration of emissions
			MES (mg/Nm^3)[(a)]	Averaging period[(a)]	Emission rate (g/s)	Emission rate (t/a)[(b)]	
S01	Main foundry baghouse stack	PM[(c)]	30	Daily average	0.250	7.82	Continuous
		SO_2[(c)]	500	Daily average	4.17	130	Continuous
		NOx as NO_2	500	Daily average	4.17	130	Continuous
		F as HF	1	Daily average	0.00833	0.261	Continuous
		TVOC	40	Daily average	0.333	10.4	Continuous
		NH_3	30	Daily average	0.250	7.82	Continuous
S02	Dross recovery plant baghouse stack	PM[(c)]	30	Daily average	0.0290	0.908	Continuous

Notes:

a) Minimum emission standards are expressed on a daily average basis, under normal conditions of 273 K, 101.3 kPa, specific oxygen percentage and dry gas.
b) For continuous operation, 24 hours per day, 365 days per year
c) General particle size distribution for heated processes such as smelting utilizing bagfilters for emission control: 100% in the 30 µm size fraction, 99.5% in the 10 µm size fraction, 99% in the 2.5 µm size fraction (US EPA, 1990)

4.3 Point source maximum emissions during start-up, maintenance, and/or shutdown

The plant and all its components will operate at 98% availability. Fume extraction systems will start-up prior to process start-up. These will also only be shut-down once all emission generating processes have been shut-down. This will ensure emission control even during star-up and shut-down which may be slightly higher than during normal operation. During maintenance of pollution abatement equipment, process operations will shut down.

4.4 Fugitive emissions

Fugitive source air emissions refer to emissions that are distributed spatially over a wide area and not confined to a specific discharge point. They originate in operations where fumes are not captured and passed through a stack. Fugitive emissions have the potential for much greater ground-level impacts per unit than point source emissions, since they are discharged and dispersed close to the ground (IFC, 2007).

The main foundry building is fitted with an extraction system that will maintain a negative pressure within the building. Primary melting fumes, fumes during furnace charging, and fugitives escaping furnace extraction hoods, will be captured, and passed through the main bagfilter to be released through the main stack. Since there is no accurate way to determine the theoretic efficiency of the extraction system, it is assumed that all fugitives generated inside the foundry will be captured through the roof apex extraction system, that is, no furnace fugitives emitted through building openings.

Although some equipment (ball mill and pulveriser) within the dross recovery building will be fitted with dust extraction and filtration, other activities such as the handling and screening of dross for disposal will result in fugitive dust emissions which may escape through building openings. To quantify these, use is typically made of emission factors published by the United States Environmental Protection Agency (US EPA) in the 5th edition of the Compilation of Air Pollutant Emission Factors (AP-42), and the Australian Department of the Environment, Water, Heritage, and the Arts (DEWHA) in their Emission Estimation Technique Manuals (EETM).

There are currently no emission factors specifically related to the handling and processing of aluminium dross. Emission factors for screening and handling of various operations (incl. coal, metallic, and non-metallic mineral mining, and crushed stone processing) were considered. It was ultimately decided to use factors for metallic minerals mining and processing as these would yield a slightly more conservative estimate of fugitive dust emissions.

For fugitive emission estimation methods, inputs, and assumptions, refer to Table 16. Fugitive dust source locations, dimensions, and emissions rates, as applied in atmospheric dispersion simulations, are included in Table 17 on page 22.

Note that in the quantification of fugitive PM (dust) emissions, a distinction is made between three particle size groups: PM_{30}, PM_{10}, and $PM_{2.5}$ with particle sizes less than 30, 10, and 2.5 µm in diameter, respectively. Whereas PM_{30} is included to account for nuisance dust impacts, PM_{10} and $PM_{2.5}$ are included because of the potential impact on human health when inhaled.

Table 15: Fugitive emissions

Source ID	Source description	Source Type	Emission type	Wind dependent	Source location and dimensions
AREA01	Fugitive PM generated by the screening of dross before sizing, and dross handling.	Area	Intermittent	No, enclosed building	

Table 16: Fugitive emission estimation methods, inputs, and assumptions

Source group	Emissions estimation method	Inputs and assumptions
Screening	Screening emission factor for low moisture ore: ❖ E_{TSP} = 0.08 kg/t processed ❖ E_{PM10} = 0.06 kg/t processed Reference: DEWHA Australia (2019)	❖ $PM_{2.5}$ emissions 35% of PM_{10}, from the general particle size distribution for mechanically generated dust from processed ore and non-metallic minerals handling and processing (US EPA, 1990) ❖ Emissions assumed to be uncontrolled ❖ Activity conservatively assumed to occur 24 hours per day, 365 days per year
Handling and transfer of materials	Miscellaneous handling and transfer of low moisture ore: ❖ E_{TSP} = 0.06 kg/t handled ❖ E_{PM10} = 0.03 kg/t handled Reference: DEWHA Australia (2019)	❖ $PM_{2.5}$ emissions 35% of PM_{10}, from the general particle size distribution for mechanically generated dust from processed ore and non-metallic minerals handling and processing (US EPA, 1990) ❖ Given the cold dross process, 5 to 10 likely handling and transfer steps were identified. For this calculation, 10 handling staps in total were assumed. ❖ Emissions assumed to be uncontrolled ❖ Activity conservatively assumed to occur 24 hours per day, 365 days per year

Table 17: Volume sources

Source ID	Source centre coordinates	Elev. (m)	Release Height (m)	Dimensions (m)	Area (m^2)	Description	Emission rate (g/s)			Emission rate (t/a)		
							PM_{30}	PM_{10}	$PM_{2.5}$	PM_{30}	PM_{10}	$PM_{2.5}$
AREA01[(a)]	26°11'48.96'' S 28°11' 3.38'' E	1 658	2.5	25 (length) 15 (width)	375	Screening	0.0137	0.0103	0.00363	0.432	0.324	0.114
						Handling and transfers	0.103	0.0514	0.0181	3.24	1.62	0.572
						Total	**0.116**	**0.0616**	**0.0218**	**3.67**	**1.94**	**0.686**

a) For application purposes fugitive dust emissions from dross processing are reported as an area source of 375 m^2, the area of the dross recovery plant. These emissions were however simulated as a volume source with initial lateral and vertical dimensions of 4.5 and 4.6 m respectively.

4.5 Emergency incidents

Not applicable.

5 Impact of enterprise of the human health and the environment

5.1 Ambient air quality, dustfall, and odour criteria

In preparation of the dispersion model and analyses of results, the criteria against which simulated ambient air pollutant concentrations and dustfall rates are assessed, must be considered. Air quality guidelines and/or standards are important tools for impact management since it forms the link between the source of air pollution and the receiver.

A distinction is made between criteria and non-criteria pollutants. Criteria pollutants are named so because they are regulated by developing health-based and/or environmentally based criteria for setting permissible levels. Volatile organic and inorganic pollutants released to atmosphere in trace amounts may however also result in health and odour impacts. The concentrations of such pollutants in ambient air are generally not regulated by air quality standards but its impact rather determined from inhalation exposure, risk, and odour thresholds.

5.1.1 Standards and guidelines for criteria pollutants

National Ambient Air Quality Standards (NAAQS), established for the protection of human health, for criteria pollutants considered in this assessment are listed in Table 18 (South Africa. Department of Environmental Affairs, 2009; South Africa. Department of Environmental Affairs, 2012). Criteria pollutants are named so because they are regulated by developing health-based and/or environmentally based criteria for setting permissible levels. Benzene is included as a proxy for assessing the impact of emitted VOCs.

It should be noted that 24-hour and 1-hour standards are for the 99th percentile of measured or simulated concentrations. This implies a 1% permitted frequency of exceedance of the specified limit value i.e., 4 days or 88 hours per year.

Table 18: NAAQS for selected criteria pollutants

Pollutant	Averaging period	Limit value in µg/m³	Permitted frequency of exceedance
PM_{10}	1-year	40	0
	24-hour	75	4
$PM_{2.5}$	1-year	20	0
	24-hour	40	4
NO_2	1-year	40	0
	1-hour	200	88
SO_2	1-year	50	0
	24-hour	125	4
	1-hour	350	88
	10-minute	500	526
Benzene	1-year	5	0

5.1.2 Inhalation exposure and risk thresholds for non-criteria pollutants

For the protection of human health from exposure to non-criteria pollutants (which may be carcinogenic), reference is typically made to the following:

- Air quality guidelines (AQG) and cancer Unit Risk Factors (URFs) adopted by the WHO.
- The US EPA inhalation reference concentrations (RfCs) available from the Integrated Risk Information System (IRIS).
- Minimal Risk Levels (MRLs) published by the US Agency for Toxic Substances and Disease Registry (ATSDR).

- Chronic Reference Exposure Levels (RELs) and the Cancer Potency Factors (CPFs) adopted by the California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA).

Screening criteria for ammonia, benzene (a proxy for emitted VOCs), and hydrogen fluoride (Table 19) were extracted from the Risk Assessment Information System (RAIS), an online database, developed and maintained by the University of Tennessee and available at https://rais.ornl.gov/.

In assessing simulated pollutant concentrations, 1-year averages are compared to chronic exposure limits and 1-hour maximums to acute exposure screening criteria.

Cancer risk factors (or unit risk factors) are applied in the calculation of carcinogenic risks. These factors are defined as the estimated probability of a person (60-70 kg) contracting cancer as a result of constant exposure to an ambient concentration of 1 µg/m³ over a 70-year lifetime. There is much debate over the identification of an acceptable cancer risk level. The WHO considers risks of less than 1 in 1 million to be *very low* with risks less than 1 in 100 000 generally considered *low*. Increased lifetime cancer risk as a result of exposure to a carcinogenic pollutant through the inhalation pathway is conservatively estimated as the product of 1-year average concentrations and cancer risk factors. The estimate is conservative since the average concentration a person would be exposed to over a lifetime will be less than the 1-year average.

Table 19: Screening criteria for non-criteria pollutants

Pollutant	Chronic exposure screening criteria (µg/m³)	Acute exposure screening criteria (µg/m³)	Cancer risk factor (µg/m³)$^{-1}$	WHO AQG
Ammonia	500 (IRIS)	1 184 (ATSDR)	Not applicable	None
Benzene	30 (IRIS)	28.8 (ATSDR)	2.9×10^{-5} (IRIS)	Benzene is carcinogenic to humans and no safe level is recommended. The concentration of benzene in ambient air associated with an excess lifetime cancer risk of 1 in 1 million (very low risk), is 0.17 µg/m³ i.e., the URF is 6.0×10^{-6} (µg/m³)$^{-1}$
Hydrogen fluoride	14 (CalEPA)	16.3 (ATSDR)	Not applicable	Available information does not permit the derivation of an air quality guideline value for fluoride(s). The 1-hour reference exposure level to protect against any respiratory irritation is about 600 µg/m³, and the level to protect against severe irritation from a once in a lifetime release is about 1 600 µg/m³. It has been recognized that fluoride levels in ambient air should be less than 1 µg/m³ to prevent effects on livestock and plants. These concentrations will also sufficiently protect human health.

5.1.3 Odour criteria

An odour impact is the negative evaluation by a human receptor when exposed to and odorous substance. The exposure may occur over a matter of seconds or minutes and involves many complex psychological and socio-economic factors. Once exposure to an odorous air pollutant has occurred, the process can lead to adverse effects such as annoyance, nuisance and possibly complaints. Whereas *annoyance* is the adverse effect occurring from an immediate exposure, *nuisance* is the adverse effect caused cumulatively, by repeated events of annoyance (Bull, et al., 2014).

Odour impacts may occur through exposure to individual and easily identifiable compounds or complex mixtures of air pollutants as might be released from the GeT Alloys process. In assessing odours two types of assessment criteria may be adopted:

- Ground-level concentration criteria for individual odorous pollutants; and
- Odour assessment criteria for an individual compound or complex mixtures of odours.

The concentration at which an odour is just detectable to a "typical" human nose is referred to as the "threshold" concentration. This concept of a threshold concentration is the basis of olfactometry in which a quantitative sensory measurement is used to define the concentration of an odour.

Standardised methods for measuring and reporting the detectability or concentration of an odour sample have been defined by a European standard (BSEN 13725:2003). The concentration at which an odour is just detectable by a panel of selected human "sniffers" is defined as the **detection threshold** and as an **odour concentration of 1 European odour unit per cubic metre (1 ou_E/m^3), sometimes simply expressed as an ou_E** (DEFRA, 2012). At the detection threshold, the concentration of an odour is so low that it is not recognisable as any specific odour at all, but the presence of some, very faint, odour can be sensed when the "sample" odour is compared to a clean, odour-free sample of air. As an example, we refer to the odour threshold for ammonia.

Odour detection thresholds for ammonia as low as 3.5 mg/m³ (5 ppm) and as high as 35 mg/m³ (50 ppm) have been reported. Leonardos, Kendall, & Bernard, et. al. (1969) determined the odour detection threshold of ammonia to be 32.8 mg/m³ (46.8 ppm) but most organizations agree that most people can smell ammonia somewhere around 3.5 mg/m³ (5 ppm). The *odour recognition threshold* is the concentration at which the characteristic pungent smell of ammonia appears. The variability in published odour recognition thresholds is evident in data collated by Verschueren (1996) (0.5 to 55 800 µg/m³). 50% of published *odour recognition thresholds* is approximately 3 mg/m³ (4.3 ppm) or less.

Odour detection thresholds applied in this assessment for ammonia, benzene and hydrogen fluoride are resented in Table 20. These were sourced from:

- *Air Quality Guidelines for Europe* (WHO, 2000);
- The *Reference Guide to Odour Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act of 1990* (US EPA, 1992); and
- *Odour Threshold Determinations of 53 Odorants Chemicals* (Leonardos, Kendall, & Bernard, 1969)

Table 20: Odour detection thresholds applied in assessment

Odorant	Character	Odour detection threshold	Reference
Ammonia	Pungent	3.5 mg/m³ (5 ppm)	Leonardos, et al. (1969)
Benzene	Aromatic, sweet, solvent	4.8 mg/m³ (1.5 ppm)	US EPA (1992)
Hydrogen fluoride	Strong irritating odour	0.033 mg/m³ (0.04 ppm)	WHO (2000)

The *odour assessment criteria* recommended for planning by the United Kingdom (UK) Institute of Air Quality Management (IAQM) is discussed. As is the approach by various international regulatory authorities, use is made of the $C_{98,1\text{-hour}}$ metric. The $C_{98,1\ hour}$ metric represents the 98th percentile of hourly mean odour concentrations over a calendar year. For example, an odour assessment criterion ($C_{98,1\ hour}$) of 3 ou_E/m^3 means in simple terms that an odour concentration of 3 ou_E/m^3 should not be exceeded for more than 2% of the hours in a year at any sensitive receptor outside the site boundary, equivalent to approximately 175 hours per annum.

The UK IAQM considered all available scientific evidence and proposes the odour concentration descriptors together with impact descriptors in Table 21. These (a) adopt the $C_{98,1\text{-hour}}$ as the appropriate frequency metric, (b) covers the 1 to 10 ou_E/m^3 concentration ranges referred to by various UK and European institutions, and (3) also considers the potential sensitivity of different receptors. It is also consistent in format and concept with other guidance in the air quality field (Bull, et al., 2014). These values assume, on a conservative basis, that the odour in question is at the offensive end of the spectrum. For odours that are less unpleasant, the level of odour exposure required to elicit the same effect may be somewhat higher, requiring professional judgement to be applied.

Receptor sensitivity can be determined from the general principles set out in Table 22 (Bull, et al., 2014). It is the specialist's view/opinion that the **receptors surrounding the GeT Alloys project be considered "highly sensitivity" since they are largely residential in nature**. It is therefore recommended that GeT Alloys limit its odour impact to **1.5 ou_E/m^3** at the nearest residential sensitive receptor.

To contextualise the above European criteria, the following from the Australian New South Wales (NSW) Technical Framework for the 'Assessment and Management of Odour from Stationary sources' (DEC NSW, 2006) should be noted:

- The level at which an odour is perceived to be of nuisance can range from 2 ou_E/m^3 to 10 ou_E/m^3.
- Adverse health effects can be expected at odour exposure levels of 7 ou_E/m^3 and higher.

Table 21: Odour effect descriptors for impacts predicted by modelling as recommended by the UK IAQM (Bull, et al., 2014)

Odour Exposure Level $C_{98,1\ hour}$, ou_E/m^3	Receptor Sensitivity		
	Low	**Moderate**	**High**
≥10	Moderate	Substantial	Substantial
5 to <10	Moderate	Moderate	Substantial
3 to <5	Slight	Moderate	Moderate
1.5 to <3	Negligible	Slight	Moderate
0.5 to <1.5	Negligible	Negligible	Slight
< 0.5	Negligible	Negligible	Negligible

Table 22: Receptor sensitivity to odours (Bull, et al., 2014)

Sensitivity	Description
High sensitivity receptor	Surrounding land where: • users can reasonably expect enjoyment of a high level of amenity; and • people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Moderate sensitivity receptor	Surrounding land where: • users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or • people wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises, and playing/recreation fields.
Low sensitivity receptor	Surrounding land where: • the enjoyment of amenity would not reasonably be expected; or • there is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial use, farms, footpaths, and roads.

5.1.4 Dustfall criteria

Dustfall, a nuisance impact associated with large particle emissions typically PM_{30}, are screened against the rates deemed acceptable for residential and non-residential areas as stipulated in the South African National Dust Control Standards (NDCR) and indicated in Table 23 (South Africa. Department of Environmental Affairs, 2013).

Table 23: Acceptable dustfall rates

Restriction areas	Dustfall rate (D) in mg/m2-day, 30-day average[(a)]	Permitted frequency of exceedance
Residential area	D < 600	Two within a year, not sequential months.
Non-residential area	600 < D < 1 200	Two within a year, not sequential months.

5.2 Dispersion modelling methodology

The impact of GeT Alloys on the atmospheric environment was determined through simulation of ambient pollutant concentrations and dustfall rates using an atmospheric dispersion model.

Dispersion models simulate ambient pollutant concentrations and dustfall rates as a function of source configurations, emission strengths and meteorological characteristics, thus providing a useful tool to ascertain the spatial and temporal patterns in the ground level concentrations arising from the emissions of various sources. Increasing reliance has been placed on concentration estimates from models as the primary basis for environmental and health impact assessments, risk assessments and emission control requirements.

A Level 2 assessment was conducted as per the' Regulations Regarding Air Dispersion Modelling'. As such, the methodology adopted in the simulation of air quality impacts associated with this project is described in subsequently.

5.2.1 Dispersion model selection

Version 10 of Trinity Consultant's Breeze AERMOD and the US EPA Aermod version 9.2 released in May 2021 was used in the study.

The AERMOD atmospheric modelling system, developed by the American Meteorological Society and US EPA Regulatory Model Improvement Committee, includes three modules namely, a steady-state dispersion model designed for short-range (up to 50 kilometres) dispersion of air pollutant emissions from stationary industrial sources, a meteorological data pre-processor (AERMET), and a terrain pre-processor (AERMAP).

The AERMET pre-processor was used to calculate atmospheric parameters needed by the dispersion model, such as atmospheric turbulence characteristics, mixing heights, friction velocity, Monin-Obukhov length and surface heat flux from available meteorological data.

The purpose of AERMAP is to provide a physical relationship between terrain features and the behaviour of air pollution plumes. Terrain effects on dispersion were however not considered since the average slope between the property and nearby sensitive receptors is less the 10%.

5.2.2 Meteorological requirements

Any air pollution impact study should include a study of local weather patterns and specifically wind speed and direction, temperature, humidity, rainfall, and solar radiation. While all these variables provide valuable information the most important are wind speed and direction, and temperature (NIWAR, 2004). In the dispersion of air pollutants, wind speed and direction are important since higher wind speeds result in better dispersion while wind direction determines the spatial distribution of pollutants. Temperature plays a role in the stability of the atmosphere which is determined by comparing the temperature of ambient air and the temperature of a rising (or sinking) parcel of air i.e., a parcel of air heated by the temperature of earth's surface after sunrise.

The concept of atmospheric stability is useful in determining whether pollutants will rise and disperse from a source or accumulate near the surface. When the atmosphere is *unstable* pollutants rise vertically resulting in lower concentrations since emissions are dispersed over a larger volume of air. A *stable* atmosphere inhibits vertical movement of pollutants and leads to higher ground level concentrations. In a *neutral* atmosphere, an emission plume remains at the height at which it was released (Diab, 2008). Meteorological data pre-processors such as AERMET are used calculate atmospheric stability from local weather parameters as well as land-cover (see paragraph 5.2.3) and prepare files suitable for input to dispersion models.

As per the Regulations Regarding Air Dispersion Modelling, a minimum of 1-year on-site specific data or at least three years of appropriate off-site data must be used for Level 2 assessments, as is the case here. The meteorological data must be from a period no older than five years to the year of assessment. All data must be subjected to quality assurance procedures and documented in the modelling study report (South Africa. Department of Environmental Affairs, 2014).

Weather data recorded at O.R. Tambo International Airport (ORTIA), located ~8 km north-east of the property, was procured from the South African Weather Service (SAWS). The data set includes hourly averaged wind speed, wind direction, temperature, relative humidity, solar radiation, and air pressure. Weather data availability for the period 2018 to 2020 are presented in Table 24. Note that the data set was carefully analysed, and erroneous values removed. A summary of minimum, maximum, and average hourly values is included in Table 25.

Table 24: Meteorological data availability, ORTIA 2018 to 2020

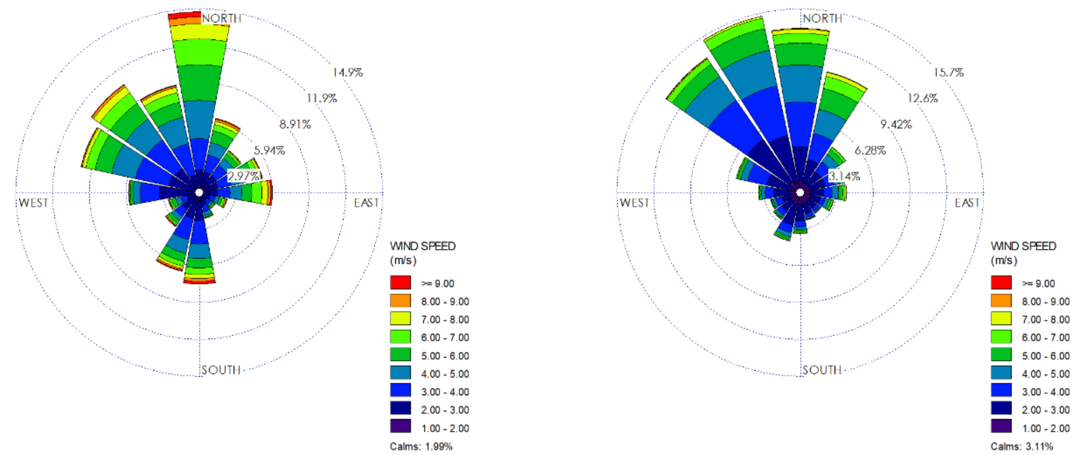
	2018	2019	2020
Wind speed	100%	100%	98%
Wind direction	100%	100%	98%
Temperature	100%	100%	98%
Relative humidity	100%	100%	98%
Solar radiation	98%	91%	77%
Air pressure	100%	100%	98%

Table 25: Minimum, maximum, and average of hourly weather parameters recorded at ORTIA between 2018 and 2020

	Minimum	Maximum	Average
Wind speed	0 m/s	12.4 m/s	4.1 m/s
Temperature	-5 ˚C	33 ˚C	17.1 ˚C
Relative humidity	4%	99%	53.5%
Solar radiation	0 W/m²	4 276 W/m²	838 W/m²
Air pressure	82.5 kPa	84.8 kPa	83.6 kPa

For a Level 2 assessment using US EPA AERMOD and its meteorological data pre-processor AERMET, additional meteorological parameters, not contained in the ORTIA data set, are required. These are cloud cover, cloud height, temperature at two levels, and vertical wind profiles. The data set was supplemented with a simulated WRF data set for an on-site location. The Weather Research and Forecasting (WRF) model is a numerical weather prediction system designed to serve both atmospheric research and operational forecasting needs.

Wind roses generated to reflect the wind field as recorded at ORTIA is presented in Figure 4 (a). Figure 4 (b) represents the wind field generated from WRF data. A wind rose is a graphic tool to give a concise view of how wind speed and direction are distributed at a specific location. The colours reflect the wind speed and the size of the 'petal' the occurrences of wind from a specific direction. The wind field is generally characterised by airflow from the north and north-easterly sectors with calm wind conditions (where wind speeds are less than 1 m/s) occurring less than 3% of the time.



(a) Period wind rose, ORTIA, 2018 to 2020 (b) Period wind rose, WFR, 2018 to 2020

Figure 4: Period wind roses

5.2.3 Terrain and land-cover

Topographical data obtained from the US Geological Survey at https://earthexplorer.usgs.gov/ was considered whereas land-cover within the study area was determined from satellite images. Shuttle Radar Topography Mission (SRTM) data from the USGS was studied to determine the likely effect of local terrain on the dispersion of pollutants. The property, and surrounding areas lie between 1 600 and 1 740 meters above sea level (masl). The average slope within a 5 km radius of the site is less than 10%, the threshold for the inclusion of terrain in dispersion simulations.

Land-cover characteristics is used by the AERMET meteorological pre-processer to determine atmospheric parameters needed by the dispersion model. As per the description of land use in paragraph 1.3 (page 10), AERMET's default average site characteristics for urban areas were used.

5.2.4 Building downwash

The term building downwash describes the effect that wind flowing over or around buildings has on plumes released from nearby stacks. Building downwash often leads to elevated concentrations downwind of affected stacks. Both the main foundry and dross recovery buildings (~10 m high) were included in simulations. AERMOD uses the building pre-processor BPIPPRM to analyse the building and dimensions relative to the height and distance of each emission release.

5.2.5 Simulation domain, receptor grid and discrete receptors

The dispersion of pollutants expected to arise from the proposed facility was simulated for an area covering 5 km (east-west) by 5 km (north-south) with the facility located centrally. The area was divided into a grid matrix with a resolution of 50 m.

Table 26: Simulation domain

South-western extent	615 807 m; 7 099 500 m
North-eastern extent	620 807 m; 7 104 500 m
Projection	Grid: UTM Zone 35 Datum: WGS 84
Resolution	50 m
Receptor height	1.5 m

Sensitive receptors in terms of air quality impacts typically include places of residence, commercial, industrial and community locations such as schools and hospitals located outside the boundary of a development. The closest sensitive receptors included in the atmospheric dispersion model, representative of community locations in the main wind directions from the project were identified from satellite imagery and are presented in Figure 5.

Although there are several residential suburbs of Germiston within 5 km of the property, the closest include Primrose to the north- and north-west, Woodmere to the north, Marlands to the North-west, Berton Park to the east, Balmoral and Delmore Park to the south-east, Germiston South to the south, and Residential clusters of Driefontein IR-87 to the south and west. All these areas have residences within 1 to 2 km from the property.

Discrete receptors representative of surrounding residential suburbs, included in dispersion simulations, are listed in Table 27 and shown in relation to the property, in Figure 5.

Table 27: Location and description of discrete receptors included in simulations

#	Suburb of Germiston or Boksburg	Description	Coordinates		Height (m)
			UTM East (m)	UTM South (m)	
1	Balmoral	Wit Deep Rd	619 388	7 101 688	1.5
2	Berton	Berton Mews Julius Rd	619 751	7 102 480	1.5
3	Boksburg	Witwatersrand Gold Mining Co Wit Deep Rd	620 189	7 101 601	1.5
4	Delmore	Morgan's Shopping Centre	620 646	7 100 272	1.5
5	Delmore Park	Cnr Malcolm and Smith Ave	619 570	7 100 812	1.5
6	Driefontein	Cnr Stanley and Main Reef Rd	617 285	7 102 155	1.5
7	Driefontein	Residences	619 393	7 102 586	1.5
8	Driefontein	Residences	619 555	7 102 299	1.5
9	Elandsfontein	Cnr Johann Rissik and May Deep Rd	615 972	7 101 924	1.5
10	Fisher	Cnr Ceres and Castor Rd	616 709	7 103 662	1.5
11	Germiston	Cnr Institute and Swawel St	617 325	7 100 238	1.5
12	Germiston South	Cnr Lower Boksburg and Simon Bekker Rd	619 110	7 100 098	1.5
13	Marlands	Cnr Kiepersol and Boekenhout St	618 788	7 102 903	1.5
14	Primrose	Camelot Village Cnr Rietfontein and Hackea Rd	616 887	7 103 127	1.5
15	Primrose	Quince Rd	617 710	7 103 220	1.5
16	Primrose	Ithembelihle LSEN School	618 433	7 103 486	1.5
17	Primrose	Lantrusa Flats Cnr End Rd and Cedar Ave	618 508	7 102 968	1.5
18	Ravensky	TRANS-50 Witfield Park Retirement Centre	619 896	7 103 594	1.5
19	Solheim	Solheim Retirement Home	616 864	7 104 330	1.5
20	Symhurst	Life Roseacres Hospital	616 824	7 104 010	1.5
21	Ulana Park	Ulana Park	619 116	7 101 378	1.5
22	Wannenburghoogte	Cnr 1st Ave and Pear Rd	617 544	7 103 878	1.5
23	Witfield	Cnr Wit and De Villiers St	619 226	7 102 992	1.5
24	Woodmere	Cnr Barbara Rd and Oak Ave	618 835	7 103 339	1.5

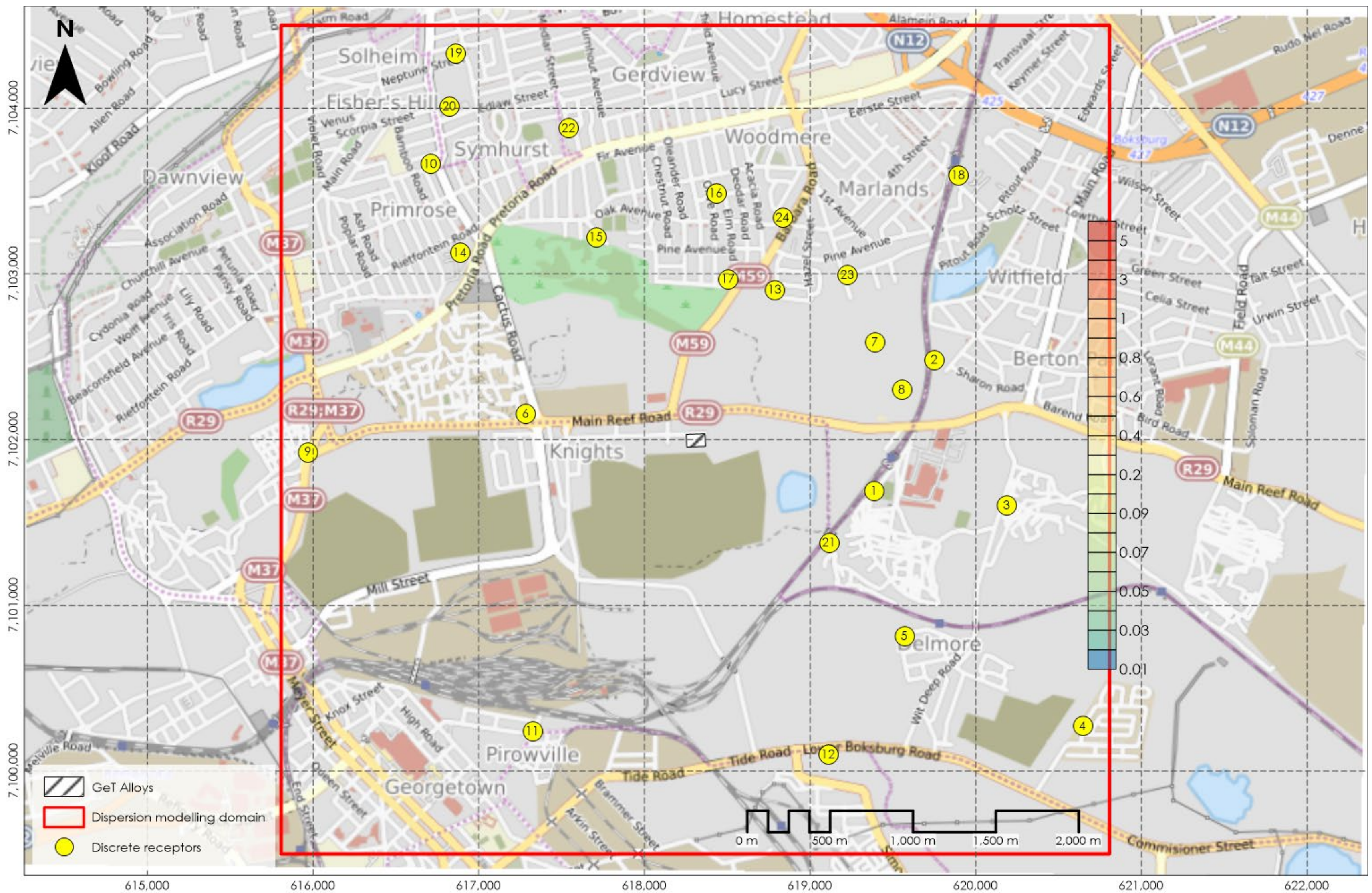


Figure 5: Site location and representative discrete receptor locations

5.2.6 Background pollutant concentrations

Dispersion modelling regulations require the consideration and inclusion of background pollutant concentrations in simulations to account for other sources of atmospheric emission in the area and potential cumulative air quality impacts.

Atmospheric pollutant concentrations recorded at nearby ambient air quality monitoring stations (AQMS) were sourced from the South African Air Quality Information System (SAAQIS) for the period January 2017 to October 2021. Of the pollutants of interest, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ data from the CoEMM-owned Bedfordview, Delville, and Thokoza AQMS were included in the analyses. O_3 data from Bedfordview and Thokoza are included as it is used in the simulation of the conversion of NO_x emitted by GeT Alloys, to NO_2.

Note that the data sets were carefully analysed, and erroneous or out-of-range values removed. Data availability and a summary of annual average and long-term pollutant concentrations are included in the tables below. Weighted average background pollutant concentrations applied in dispersion simulations for the assessment of cumulative impacts are: NO_2 55.6 µg/m³, SO_2 23.9 µg/m³, PM_{10} 60.1 µg/m³, $PM_{2.5}$ 27.8 µg/m³, and O_3 41.8 µg/m³. AERMOD adds average background pollutant concentrations to both long- and short-term simulation results. It is noted that NO_2, PM_{10}, and $PM_{2.5}$ concentrations within the area are in exceedance of NAAQS.

Table 28: Average NO_2 concentrations recorded near Germiston

	Average NO_2 concentrations in µg/m³ and data availability		
	CoEMM **Bedfordview** AQMS	CoEMM **Delville** AQMS	CoEMM **Thokoza** AQMS
2017	51.4 (16%)	(0%)	39.2 (49%)
2018	61.7 (14%)	35.4 (57%)	15.6 (39%)
2019	82 (95%)	14 (0.2%)	(0%)
2020	68.3 (78%)	(0%)	(0%)
2021	(0%)	(0%)	(0%)
Weighted average overall	72.9	35.3	28.8

Table 29: Average SO_2 concentrations recorded near Germiston

	Average SO_2 concentrations in µg/m³ and data availability		
	CoEMM **Bedfordview** AQMS	CoEMM **Delville** AQMS	CoEMM **Thokoza** AQMS
2017	40.1 (21%)	(0%)	81.4 (44%)
2018	19.7 (13%)	29.1 (49%)	17.8 (48%)
2019	22.8 (90%)	20 (30%)	19.5 (71%)
2020	19.8 (96%)	18.5 (83%)	15.9 (68%)
2021	20.1 (94%)	22.2 (7%)	17.8 (88%)
Weighted average overall	22.1	21.9	26.6

Table 30: Average PM_{10} concentrations recorded near Germiston

	Average PM_{10} concentrations in µg/m³ and data availability		
	CoEMM **Bedfordview** AQMS	CoEMM **Delville** AQMS	CoEMM **Thokoza** AQMS
2017	(0%)	(0%)	21.9 (6%)
2018	(0%)	16.1 (39%)	47.1 (56%)
2019	48.4 (74%)	(0%)	93.7 (83%)

2020	37 (89%)	(0%)	89.8 (87%)
2021	60.6 (99%)	(0%)	73.8 (10%)
Weighted average overall	49.2	16.1	79.1

Table 31: Average $PM_{2.5}$ concentrations recorded near Germiston

	Average $PM_{2.5}$ concentrations in µg/m³ and data availability
	CoEMM **Bedfordview** AQMS
2017	(0%)
2018	(0%)
2019	24.5 (74%)
2020	21.7 (89%)
2021	35.7 (99%)
Weighted average overall	27.8

Table 32: Average O_3 concentrations recorded near Germiston

	Average O_3 concentrations in µg/m³ and data availability	
	CoEMM **Bedfordview** AQMS	CoEMM **Thokoza** AQMS
2017	5.85 (1%)	57 (37%)
2018	48.7 (14%)	52 (24%)
2019	24.1 (42%)	22.7 (8%)
2020	(0%)	(0%)
2021	(0%)	(0%)
Weighted average overall	30	51.4

5.2.7 Assumptions and limitations

The following assumptions and limitations to the study and dispersion modelling should be noted:

- The quantification of emissions and impacts are, as is typical of an AIR, limited to operational phase impacts. The significance of construction, decommissioning, and closure phase impacts are addressed qualitatively.
- The pre-heater and all furnaces may be fired with low sulphur fuel oil or natural gas. For this application, the use of low sulphur fuel oil, with higher sulphur and PM content, is assumed.
- Sources of atmospheric emission included in the assessment are those regulated by MES and those likely to generate fugitive dust. Sources of emission omitted from the study either because their contribution is considered immaterial or because insufficient information was available for its quantification include on-site vehicles (exhaust and dust emissions); standing and working losses from fuel storage; and fugitive ammonia emissions from dross if is exposed to water.
- The main foundry extraction system is designed as such that the temperature of the extracted fumes is reduced to 130 ˚C before it enters the baghouse. The temperature of the off gas as it is released to atmosphere was therefore assumed to be 100 ˚C.
- The temperature and velocity of plume released from the dross recovery plant baghouse were assumed to be ambient and 10 m/s.
- Where MES of different subcategories overlap, the most stringent was applied.
- Although dross recovery is not a Section 21 listed activity *per se*, it can be considered part of the secondary aluninium production process and is therfore assumed to be subject to subcategory 4.4 MES of for PM. PM is the only pollutant likely to be reased by sizing of dross.
- It was assumed that all fugitives generated inside the foundry will be captured through the roof apex extraction system, that is, no furnace fugitives emitted through building openings.

- Particle size distributions used for determining the 30, 10, and 2.5 µm split in PM emissions were sourced from the *AP 42, Fifth Edition, Volume I, Appendix B.2, Generalized Particle Size Distributions* (US EPA, 1990).
- All sources were simulated as continuous emitters i.e., 365 days per year, 24 hours per day.
- The NAAQS for benzene was included as a proxy for assessing the impact of emitted VOCs.
- The conversion process of NO to NO_2 as it is released to atmosphere is photochemical in nature and dependant on sunlight and ambient ozone concentrations. In the simulation of ambient NO_2 concentrations, use was made of the ozone limiting method with a NO_2/NOx emission ratio of 0.9 and ozone concentration of 41.3 µg/m^3.
- Simulations for SO_2 included 1-hour averages, 24-hour averages, and 1-year averages. Since AERMOD cannot simulate sub-1-hour pollutant concentrations without sub-hourly meteorological data, 10-minute average SO_2 concentrations could not be calculated for comparison with 10-minute NAAQS.
- There will always be some error in any geophysical model, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere. Nevertheless, dispersion modelling is generally accepted as a necessary and valuable tool in air quality management.

5.2.8 Source data requirements

Source parameters and emission rates as presented in section 4 were included in dispersion simulations.

5.2.9 Presentation of results

The averaging periods for simulation output concentrations and dustfall rates were selected to facilitate the comparison with NAAQS, selected health and odour criteria, and NDCR.

Results are primarily presented in tabular form as simulated maximum concentrations and dustfall rates occurring off-site. Where off-site exceedances of NAAQS or NDCR are predicted, results are also presented as contours on a map showing the spatial extent of such exceedances. Contours or 'isopleths' are lines on a map connecting points at which a given variable (in this case concentration or dustfall rate) has a specified constant value. This is analogous to contour lines on a map showing terrain elevation.

Note: some short-term air quality limits (i.e., 24-hour and 1-hour) allow the exceedance of certain limit values for 1% of the time per calendar year. For compliance assessment purposes, therefore, the 99th percentile of 24-hour (5th highest) and 1-hour (89th highest) average pollutant concentrations are presented. For the assessment of odours, the 98th percentile of 1-hour concentrations (177th highest) is used.

5.3 Dispersion modelling results

Dispersion simulation results for criteria (incl. dustfall) and non-criteria pollutants are presented in Table 33 and Table 34 respectively. Table 33 includes both incremental (GeT Alloys project only) and cumulative (with background) ground level concentrations as calculated by the dispersion model.

The proposed GeT Alloys facility is shown to result in 1-year and 24-hour average PM_{10} and $PM_{2.5}$ concentrations which exceed NAAQS at the plant boundary and/or off-site. Exceedances are however limited to the immediate vicinity of the property boundary with concentrations at a fraction of NAAQS at nearby residential receptors (Figure 6 to Figure 9). Dustfall in exceedance of the NDCR is localised and limited to the plant boundary (Figure 10, page 40). Off-site NO_2 and SO_2 concentrations are within NAAQS. Incrementally, the project will generally contribute less than 1% to NAAQS at surrounding residential receptors.

Screening criteria for non-criteria pollutants (ammonia, hydrogen fluoride and VOC) will not be exceeded off-site. Increased lifetime cancer risk is expected to be low (less than one in 100 000). No off-site odour impacts are expected.

Table 33: Maximum criteria air pollutant concentrations and dustfall rates occurring off-site

				Maximum off-site impact	
Pollutant	**Averaging period**	**NAAQS limit value**	**Unit**	**Incremental, GeT Alloys Only**	**Cumulative, incl. background**
NO_2	1-year	40	µg/m³	7.51	63.1 (c)
	1-hour(a)	200	µg/m³	16.5	72.1
SO_2	1-year	50	µg/m³	8.34	32.2
	24-hour a)	125	µg/m³	25.2	49.1
	1-hour a)	350	µg/m³	44.8	68.7
PM_{10}	1-year	40	µg/m³	70.8(c) (Figure 6)	131 (c)
	24-hour a)	75	µg/m³	142(c) (Figure 7)	202(c)
$PM_{2.5}$	1-year	20	µg/m³	25.8(c) (Figure 8)	53.6(c)
	24-hour a)	40	µg/m³	52(c) (Figure 9)	79.8(c)
Dustfall	1-month	1 200	mg/m²-day	1 980(c) (Figure 10)	n/d(b)

Notes:

a) 99th percentile of 24-hour or 1-hour values
b) n/d no data
c) Exceeds NAAQS or NDCR limit value

Table 34: Maximum concentrations of non-criteria pollutant occurring off-site

Pollutant	**Impact assessed**	**Averaging period**	**Screening criteria**	**Unit**	**Maximum off-site impact Incremental, GeT Alloys Only**
Ammonia, NH_3	Health, non-carcinogenic	1-year	500	µg/m³	0.5
		1-hour(a)	1 184	µg/m³	16
	Odour	1-hour(b)	3 500	µg/m³	2.55 (Less than 1 ou_E)
Hydrogen fluoride, HF	Health, non-carcinogenic	1-year	14	µg/m³	0.0167
		1-hour(a)	16.3	µg/m³	0.535
	Odour	1-hour(b)	33	µg/m³	0.085 (Less than 1 ou_E)
TVOCs (benzene as proxy)	Health, carcinogenic	1-year	1.7 for 'low risk', < 1 in 100 000 0.17 for 'very low risk', < 1 in 1 million	(µg/m³)	0.666 (Low risk)
	Health, non-carcinogenic	1-year	5	µg/m³	0.666
		1-hour(a)	28.8	µg/m³	21.4
	Odour	1-hour(b)	4 800	µg/m³	3.4 (Less than 1 ou_E)

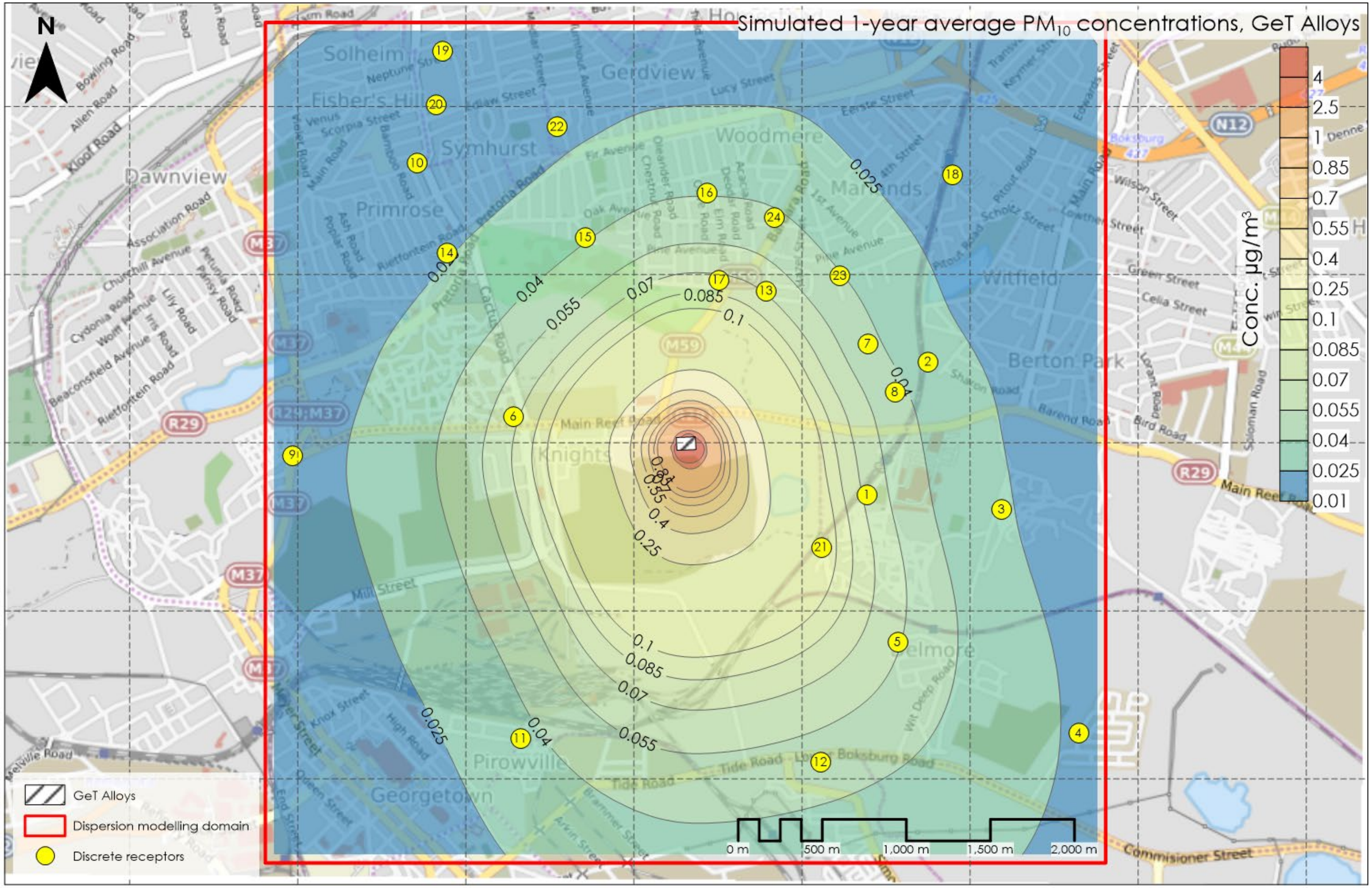


Figure 6: Simulated 1-year average PM_{10} concentrations, GeT Alloys

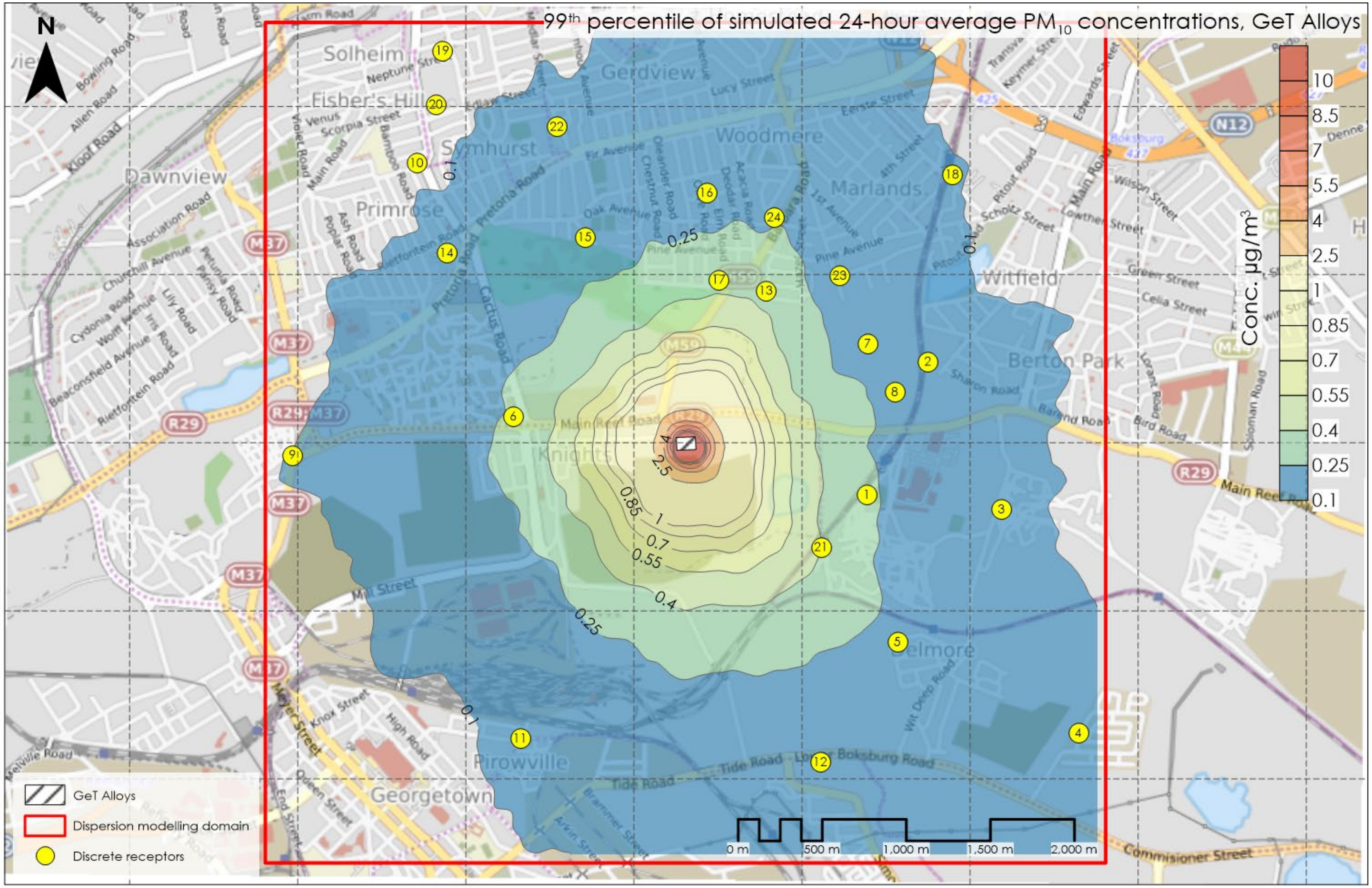


Figure 7: 99th percentile of simulated 24-hour average PM_{10} concentrations, GeT Alloys

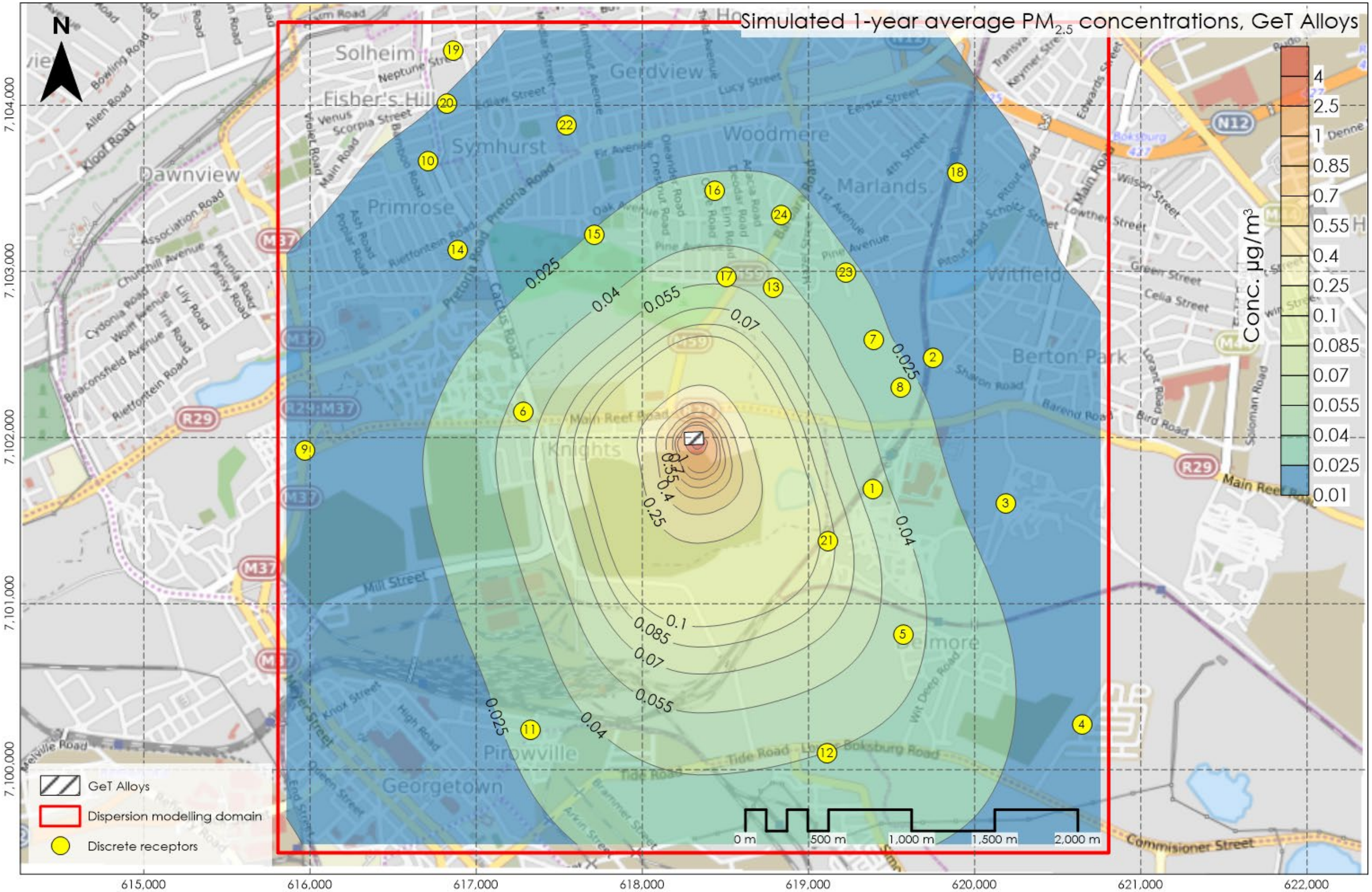


Figure 8: Simulated 1-year average $PM_{2.5}$ concentrations, GeT Alloys

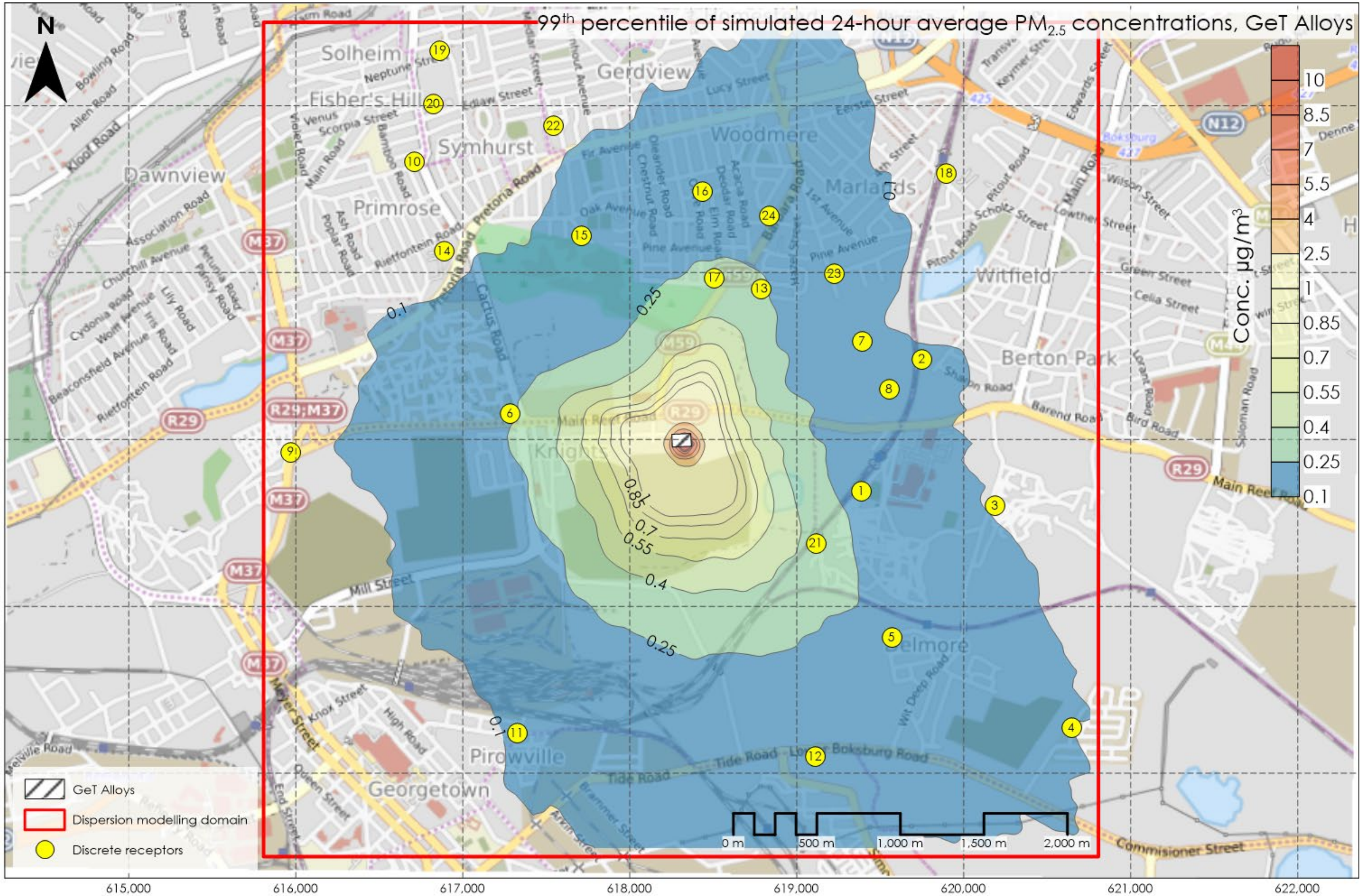


Figure 9: 99th percentile of simulated 24-hour average $PM_{2.5}$ concentrations, GeT Alloys

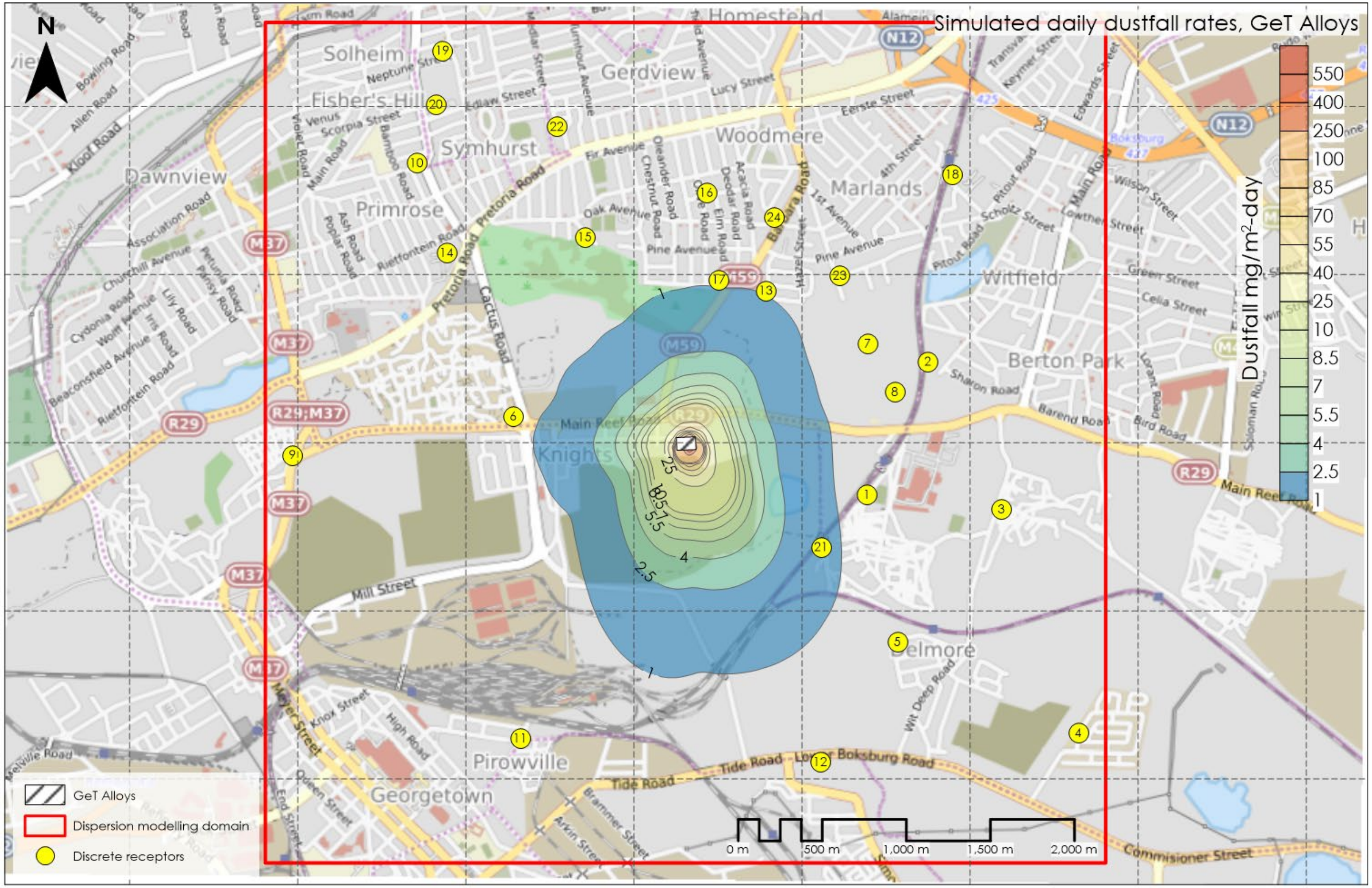


Figure 10: Simulated daily dustfall rates, GeT Alloys

6 Complaints

None. A complaints register will be kept on-site.

7 Current or planned air quality management interventions

7.1 Measures to reduce emissions

- As per the planned Turnkey Modular air pollution control system design, all furnaces must be fitted with fume extraction, both from the furnaces itself and via hoods to capture fumes during charging and/or tapping. Fugitive emissions must furthermore be extracted from the building roof at its apex. The system design must ensure the PM concentration in the plume exiting the 30 m stack meets the MES of 30 mg/Nm^3.
- It is also recommended that the outlet PM concentration at the dross recovery baghouse meet the MES of 30 mg/Nm^3 for secondary aluminium production processes.
- Fugitive PM emissions should be minimised to avoid off-site exceedances of NAAQS and NDCR. Measures to be considered are:
    - Good housekeeping, e.g., avoiding and cleaning up spillages of fine materials such as baghouse dust and dross.
    - Keep vehicle driveways clean and free of dust to avoid entrainment.
- The proposed dryer will be fitted with air pollution control equipment to reduce PM emissions. It is understood the type and design is still being finalised. The equipment must be designed as such that the outlet PM concentrations meets the MES of 50 mg/Nm^3.
- Fugitive ammonia emissions must be avoided by keeping dross dry i.e., covered within the dross recovery building.
- To reduce vehicle exhaust emissions, avoid unnecessary idling of vehicles on-site.

7.2 Emissions Monitoring

In terms of *compliance monitoring*, the periodic compliance emissions monitoring will be required from GeT Alloys under section 21(1)(b) of NEMAQA. The requirements for periodic emissions monitoring are as follows:

- The averaging period shall be expressed on an hourly average basis or as prescribed in the AEL.
- Emission measurement must be conducted in accordance with the methods listed in Annexure A of section 21(1)(b) of NEMAQA.
- Measurements shall take place on, at least, an annual basis unless otherwise prescribed in the AEL.
- Sampling will take place under normal operating conditions using the permitted feed-stock or raw material.
- All tests will be conducted by South African National Accreditation System (SANAS) accredited laboratories or laboratories accredited by similar foreign authorities.

7.3 Ambient air quality monitoring

An **air quality monitoring** programme can confirm both baseline and project related air pollution levels and provide information useful in assessing the effectiveness of emissions management strategies. After careful consideration of the dispersion simulations, the following is recommended:

- Visual inspection and reporting of dust emissions sources annually and in response to complaints. Photographic records can be useful.

- Passive diffusive sampling of ammonia within the dross recovery building upon commencement of production to confirm assumptions with regards to the formation and emissions of ammonia. A specialist should be consulted in the methodology.

7.4 Air quality complaints register

A register for complaints relating to air quality should be maintained. It must include the name, contact and affiliation details of the complainant, the date of the complaint, the date and time of the pollution incident, and a detailed description of the incident. In response to a complaint, GeT Alloys should investigate possible causes and if required make use of a specialist to determine the likely source through a site inspection. Remedial actions to prevent such events in future should then be taken.

8 Compliance and enforcement actions

None.

9 Additional information

9.1 Impact significance

The significance of air quality related impacts associated with the proposed development was assessed in accordance with the procedure summarised in Annex D. Since this AIR is concerned with the operational phase of the project as part of the application for an AEL, the significance of operational phase impacts is based the findings of the dispersion simulation results (Table 36). The significance of construction, decommissioning, and closure phase impacts were however determined qualitatively (Table 35).

Apart from the duration of the impact phases, the significance of construction, decommissioning, closure, and operational phases is expected to be similar, that is low with mitigation.

9.2 Specialist opinion

It is concluded that air quality impacts should have an influence on the environmental authorisation decision and cannot be completely avoided. It is the specialist's reasoned opinion that the project may proceed provided that planned and proposed air quality management interventions listed in this report are implemented.

10 Formal declarations

The following declarations are included as annexures to this report:

- Annex A: a declaration of accuracy of information by the applicant.
- Annex B: a declaration of independence by the practitioner preparing the AIR.

Table 35: Impact significance rating for the construction, decommissioning, and closure phases

Alternative:	**Development proposal (scrap aluminium and copper foundry)**
CONSTRUCTION, DECOMMISSIONING & CLOSURE PHASE	
Potential impact and risk:	Particulate matter and vehicle exhaust emissions resulting in potential health and nuisance dust impacts.
Nature of impact:	Particulate matter and vehicle exhaust emissions from equipment installation and building construction.
Extent of impact:	Medium, beyond site boundary but local, without mitigation. Low, mostly on-site, with mitigation.
Duration of impact:	Short-term (construction phase) without mitigation. Short-term (construction phase) with mitigation.
Intensity/severity/magnitude	Low (minor deterioration) without mitigation. Low (minor deterioration) with mitigation.
Consequence of impact or risk:	Low without mitigation. Low with mitigation.
Probability of occurrence:	Definite without mitigation. Probable with mitigation.
Confidence	High
Degree to which the impact may cause irreplaceable loss of resources:	Low
Degree to which the impact can be reversed:	High
Indirect impacts:	Direct impacts: nuisance, health, and wellbeing of receptors. Indirect impacts: none
Cumulative impact prior to mitigation:	The contribution of the project to current ambient air quality at sensitive receptors is expected to be minimal.
Significance rating of impact prior to mitigation	Medium
Degree to which the impact can be avoided:	Low
Degree to which the impact can be managed:	Medium
Degree to which the impact can be mitigated:	Medium
Proposed mitigation:	❖ Minimise areas to be disturbed. ❖ Erect shade netting around site fenceline for very dusty operations. ❖ Limit materials stockpiles to 2 m in height. ❖ Dust control at materials stockpiles can include covering with shade cloth, wetting down, and application of chemical binders. ❖ Non-potable water to be used for wetting down. ❖ Enforce speed limits to reduce dust entrained from road surfaces. ❖ Avoid unnecessary idling of vehicles on-site to reduce vehicle exhaust emissions. ❖ Establish a complaint register. ❖ Visual inspection of dust sources.
Residual impacts:	Some emissions are unavoidable even with the implementation of mitigation measures.
Cumulative impact post mitigation:	Low
Significance rating of impact after mitigation	Low

Table 36: Impact significance rating for the operational phase

Alternative:	**Development proposal (scrap aluminium and copper foundry)**
OPERATIONAL PHASE	
Potential impact and risk:	Particulate matter, gaseous and vehicle exhaust emissions resulting in potential health and nuisance dust and odour impacts.
Nature of impact:	Particulate matter and gaseous emissions from aluminium scrap pre-heating and oil-fired furnaces. Fugitive particulate matter emissions from dross handling. Vehicle exhaust emissions from on-site vehicles. Volatile organic emissions from fuel storage.
Extent of impact:	Medium, beyond site boundary but local, without mitigation. Low, mostly on-site, with mitigation.
Duration of impact:	Medium-term (lifetime of the project) without mitigation. Medium-term (lifetime of the project) with mitigation.
Intensity/severity/magnitude	Low (minor deterioration) without mitigation. Low (minor deterioration) with mitigation.
Consequence of impact or risk:	Low without mitigation. Low with mitigation.
Probability of occurrence:	Definite without mitigation. Probable with mitigation.
Confidence	High
Degree to which the impact may cause irreplaceable loss of resources:	Low
Degree to which the impact can be reversed:	High
Indirect impacts:	Direct impacts: nuisance, health, and wellbeing of receptors. Indirect impacts: none
Cumulative impact prior to mitigation:	Indicative background NO_2 and SO_2 levels do not exceed NAAQS. Background PM_{10} and $PM_{2.5}$ concentrations are above NAAQS in the Germiston area. The contribution of the project to existing ambient air quality at sensitive receptors is however minimal.
Significance rating of impact prior to mitigation	Medium
Degree to which the impact can be avoided:	Low
Degree to which the impact can be managed:	Medium
Degree to which the impact can be mitigated:	Medium
Proposed mitigation:	❖ All surfaces where vehicle movement is likely should either be kept free of dust. ❖ Good housekeeping, e.g., avoiding and cleaning up spillages of dross and baghouse dust. ❖ As planned, the raw material bunker should be enclosed on three sides to avoid windblown dust. ❖ Avoid unnecessary idling of vehicles on-site to reduce vehicle exhaust emissions.
Residual impacts:	Some fugitive emissions are unavoidable even with the implementation of mitigation measures.
Cumulative impact post mitigation:	Low
Significance rating of impact after mitigation	Low

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12 Annex A: Declaration of accuracy of information

13 Annex B: Declaration of independence of practitioner

14 Annex C: Specialist's CV

15 Annex D: Impact significance assessment methodology