SALDANHA STEEL (PTY) LTD

ATMOSPHERIC IMPACT REPORT IN SUPPORT OF THE SALDANHA STEEL AEL AMENDMENT APPLICATION

ARCELORMITTAL SOUTH AFRICA LIMITED

41103718
NOVEMBER 2023

CONFIDENTIAL

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REPORT (VERSION 1) CONFIDENTIAL

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EXECUTIVE SUMMARY

Saldanha Steel (Pty) Ltd (Saldanha Steel), a subsidiary of ArcelorMittal South Africa Limited (AMSA), is a steelwork focused on the export market located in Saldanha Bay, West Coast District Municipality (WCDM), Western Cape, South Africa. Given the activities undertaken at Saldanha Steel, the facility has obtained its Atmospheric Emission License (AEL) (Ref: WC/WC/020), aligned with Government Notice Regulation 893 of 2013[1], promulgated in line with Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004) (NEM:AQA)[2], which is valid until 01 March 2024. It is noted that an AEL renewal application has been submitted and accepted by the WCDM.

In line with the Listed Activities contemplated in Section 21, the categories applicable to Saldanha Steel are *Category 4: Metallurgical Industry, subcategories 4.2, 4.6, 4.7, 4.8, 4.11, 4.12* and *Category 5: Mineral Processing, Storage and Handling, subcategories 5.1 and 5.2*.

Importantly, Saldanha Steel is currently in Care and Maintenance (C&M), with the ironmaking operations ceasing 15 January 2020 and the remaining operations ceasing 26 March 2020 due to challenges in the global steel market. Given this, there are currently no operations occurring on the steelworks site. While steel production remains unlikely due to continued global market challenges, AMSA have been investigating alternatives to enable Saldanha Steel to return a portion of the facility back to economic productivity along with job regeneration at the site.

Given a component of the existing design at Saldanha Steel is for bulk materials handling and storage, as required as part of the steel production process, Saldanha Steel, in conjunction with Bidfreight Port Operations (BPO), have identified the opportunity to recommence with their storage and handling of bulk materials, for export through the Transnet Port Terminals (TPT) Saldanha Bay terminal.

Saldanha Steel and BPO intend to establish a Logistics Hub to store, handle and export up to 5,000,000 tpa of bulk material commodities, requiring an amendment of the current AEL. The bulk commodity will be stored within a fully enclosed warehouse, with most activities, such as the offloading and loading of haul trucks, stockpiling, stockpile management and material handling occurring within the warehouse. Bulk material received via haul road into the warehouse will be wetted by water sprayers to reduce emissions, whereas material received via rail will be chemically sprayed at the tippler and wetted along the conveyor belts prior to being deposited within the warehouse. Within the warehouse, the material stockpiles will be wetted by water sprayers to reduce emissions.

[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)

Saldanha Steel appointed WSP Group Africa (Pty) Ltd (WSP) to assist with the Atmospheric Impact Report (AIR) and AEL variation application.

This report presents the findings of the AIR, with a baseline assessment, comprehensive emissions inventory and dispersion modelling completed for various scenarios. Given that the Logistics Hub operations will only include the storage and handling of ore commodities within an enclosed warehouse, with no manufacturing or production processes being undertaken, only dust related pollutants such as PM_{10}, $PM_{2.5}$ and dust fallout were assessed, while emissions associated with specific commodities were also assessed.

To assess existing baseline air quality conditions, data was obtained from the Saldanha Bay Municipality continuous ambient air quality monitoring station, located in Saldanha Bay. Data recovery from the station was low for the period reviewed, therefore data presented in this report must be viewed with caution. Based on available data, indications are that both PM_{10} and $PM_{2.5}$ concentrations are compliant with the relevant National Ambient Air Quality Standards (NAAQS), with only one exceedance of the PM_{10} 24-hour standard being recorded, occurring in 2017, noting the standard permits four exceedances within a calendar year.

To further understand baseline conditions, dust fallout monitoring data was obtained from the Saldanha Bay Municipality and Saldanha Steel monitoring networks. The Saldanha Bay Municipality fallout rates indicated full compliance with the National Dust Control Regulations residential standard, with a few exceedances measured at certain locations, although all these remained within the permitted frequency of exceedances stipulated within the standard. The Saldanha Steel dust fallout network indicated the same level of compliance while operating (prior to C&M), with a few exceedances of the non-residential standard measured, although remaining within the permitted frequency of exceedances stipulated by the standard. Interestingly, seven months after Saldanha Steel went into C&M, two consecutive exceedances of the non-residential standard were measured at the same location (Nov'20 and Dec'20), which is non-compliant with the standard which only permits two non-sequential exceedances per 12-month running period. Importantly, during these months Saldanha Steel was not operational, therefore these exceedances are likely attributable to neighbouring sources of emissions or activities.

Given the steelmaking operations are likely to remain in C&M for the foreseeable future due to the global steel market conditions, it is anticipated that only the Logistics Hub will operate initially, without any steelmaking operations. However, should the global steel market improve, the operation of steelmaking would recommence, with the Logistics Hub then operating simultaneously with steelmaking. Given this, this AIR assessed three dispersion modelling scenarios, namely:

- Scenario 1: Saldanha Steel Steelmaking Operations only
- Scenario 2: Logistics Hub Operations
- Scenario 3: Future Cumulative Assessment (Scenario 1 + Scenario 2)

As per the existing Saldanha Steel AEL (Ref: WC/WC/020), the facility is permitted to handle 2,832,000 tpa of iron ore for the purposes of steelmaking. Since Saldanha Steel is under C&M, the Logistics Hub proposes to handle up to 5,000,000 tpa bulk material ore for the purposes of exporting via the port. Importantly, this will be in addition to the already permitted 2,832,000 tpa of iron ore, and not in replacement of this. Further, as shown below, the proposed bulk commodities do not include the handling of additional iron ore, with the Logistics Hub proposed to store and handle:

- Manganese Ore (maximum tonnage: 4,000,000 tpa)
- Phosphate Concentrate (maximum tonnage: 1,200,000 tpa)
- Garnet Sands (maximum tonnage: 500,000 tpa)
- Zircon Sands (maximum tonnage: 500,000 tpa)
- Lead Concentrate (maximum tonnage: 250,000 tpa)
- Copper Concentrate (maximum tonnage: 250,000 tpa)
- Zinc Concentrate (maximum tonnage: 250,000 tpa)

These quantities may fluctuate, depending on the bulk commodity required for export, although importantly, the total quantity of material handled, when operations are underway, will not exceed the threshold stipulated of 5,000,000 tpa.

To accurately quantify the potential impacts associated with the Logistics Hub a comprehensive emissions inventory was compiled. The inventory incorporated all key sources of emissions associated with the steelmaking process, the Logistics Hub process without steelmaking, and the Logistics Hub process with steelmaking. Sources of emissions included stacks, building fugitives (Conarc and Corex furnaces), conveyors, transfer stations, the rotary tippler, the stacker and reclaimers, stockpiles, materials handling by yellow equipment (e.g., front-end loaders), paved and unpaved road emissions, and vehicle exhaust emissions. Use was made of actual measured emissions (stack emissions tests) and appropriate emission factors as recommended in the *Modelling Regulations*.

The impact assessment comprised an emissions inventory and subsequent dispersion modelling simulations assessing the following under normal operating conditions:

- PM_{10}, $PM_{2.5}$ and dust fallout (calculated and modelled as Total Suspended Particulates (TSP)).

Following the emissions inventory compilation, dispersion modelling simulations were undertaken. After various considerations, and aligned with the *Modelling Regulations*, the CALPUFF modelling platform was selected. CALPUFF is a Tier 3 model, required in areas of complex meteorological conditions, such as coastal environments, while is also a recognised model within the *Modelling Regulations*.

Key findings from the dispersion simulations include:

- **During steelmaking operations (Scenario 1):**
  - PM_{10} 24-hour average and long-term (annual) concentration predictions will remain below the relevant NAAQS at all residential sensitive receptors.
    - 24-Hour average concentrations are predicted to exceed the 24-hour standard at Main Road, located north of Saldanha Steel, although notably this is not a residential area, but does represent an area where the public may be exposed to non-compliant PM_{10} concentrations at times. Long-term concentrations at Main Road remain below the NAAQS.
    - Fence line PM_{10} concentrations are predicted to exceed both the 24-hour average and annual average standards due to the proximity of the main Saldanha Steel operations to the fence line. Notably, the area immediately north of Saldanha Steel is predominantly open areas with rail networks, with no sensitive receptors near this area.
  - $PM_{2.5}$ 24-hour average and long-term (annual) concentration predictions will remain below the relevant NAAQS at all identified sensitive receptors, including Main Road.

- Fence line $PM_{2.5}$ concentrations are predicted to exceed both the 24-hour average and annual average standards due to the proximity of the main Saldanha Steel operations to the fence line. Notably, the area immediately north of Saldanha Steel is predominantly open areas with rail networks, with no sensitive receptors near this area. Further, this area of non-compliance is marginal and does not extend into the receiving environment for a considerable distance.

- Dust fallout rates are predicted to remain well below the residential standard at all residential sensitive receptors.
  - Of the nearest, publicly accessible areas, highest dust fallout rates are predicted at Main Road, although importantly remain below the Residential Standard.
  - The maximum fence line dust fallout rate predicted was 2,471 mg/m^2/day, occurring along the northern fence line of Saldanha Steel, exceeding the Non-Residential Standard of 1,200 mg/m^2/day. Importantly, the Saldanha Steel operations are located alongside the northern fence line, with emissions having little time to disperse sufficiently prior to reaching the fence line. Importantly, compliance with the residential standard is predicted approximately 400m from the fence line, with the area potentially impacted comprising a railway and open lands, with no inhabitants in the area.

- **During Logistics Hub operations (Scenario 2):**
  - PM_{10} 24-hour average and long-term (annual) concentration predictions will remain below the relevant NAAQS at all residential sensitive receptors.
    - 24-Hour average concentrations are predicted to exceed the 24-hour standard at the access point along OP538 road, located east of Saldanha Steel fence line, although notably this is not a residential area, but does represent an area where the public may be exposed to non-compliant PM_{10} concentrations at times. Long-term concentrations at the access point remain below the NAAQS.
    - Fence line PM_{10} concentrations are predicted to exceed the 24-hour average standard due to the proximity of the main haul road to the fence line. Notably, the area immediately east of Saldanha Steel is predominantly open areas, with no sensitive receptors near this area. Long-term concentrations at the fence line remain below the NAAQS.
  - $PM_{2.5}$ 24-hour average and long-term (annual) concentration predictions will remain below the relevant NAAQS at all identified sensitive receptors, including the access point.
    - Fence line $PM_{2.5}$ concentrations are predicted to below both the 24-hour average and annual average standards. Notably, the area immediately north of Saldanha Steel is predominantly open areas with rail networks, with no sensitive receptors near this area.
  - Dust fallout rates are predicted to remain well below the residential standard at all residential sensitive receptors.
    - Of the nearest, publicly accessible areas, highest dust fallout rates are predicted at Camp Street, which exceeds the Residential Standard. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent, elevated dust fallout rates.
    - The maximum fence line dust fallout rate predicted was 1,902 mg/m^2/day, occurring along the northern fence line of Saldanha Steel, exceeding the Non-Residential Standard of 1,200 mg/m^2/day. Importantly, compliance with the residential standard is predicted approximately 2,400m from the fence line, with the area potentially impacted comprising a railway and open lands, with no inhabitants in the area.

- Manganese (Mn) 24-hour average and long-term (annual) concentration predictions will remain below the relevant international guidelines at all residential sensitive receptors.
  - The maximum 24-hour average fence line concentration predicted was 0.097 µg/m^3, with a long-term concentration of 0.058 µg/m^3 predicted, both occurring at the same location on the northern fence line of Saldanha Steel.
  - This predicted concentration is for Mn with particle diameters of 10 µm or less (Mn_{10}), with the predicted 24-hour average Mn_{10} concentration remaining well below the Ontario, Canada ambient Mn_{10} guideline of 0.2 µg/m^3, while also remaining below the strictest Mn guideline for $Mn_{2.5}$ of 0.1 µg/m^3.
  - Predicted long-term Mn_{10} concentrations remain well below the World Health Organisation (WHO) annual guideline of 0.15 µg/m^3.

- **During future cumulative operations (Scenario 3):**
  - PM_{10} 24-hour average and long-term (annual) concentration predictions will remain below the relevant NAAQS at all residential sensitive receptors.
    - 24-Hour average concentrations are predicted to exceed the 24-hour standard at Main Road, located north of Saldanha Steel and at the access point along OP538 road, although notably this is not a residential area, but does represent an area where the public may be exposed to non-compliant PM_{10} concentrations at times. Long-term concentrations at Main Road and OP538 road remain below the NAAQS.
    - Fence line PM_{10} concentrations are predicted to exceed both the 24-hour average and annual average standards due to the proximity of the main Saldanha Steel operations and the unpaved access road to the fence line. Notably, the area immediately north and east of Saldanha Steel is predominantly open areas, with no sensitive receptors near this area.
  - $PM_{2.5}$ 24-hour average and long-term (annual) concentration predictions will remain below the relevant NAAQS at all identified sensitive receptors, including Main Road.
    - Fence line $PM_{2.5}$ concentrations are predicted to exceed both the 24-hour average and annual average standards due to the proximity of the main Saldanha Steel operations to the fence line. Notably, the area immediately north of Saldanha Steel is predominantly open areas with rail networks, with no sensitive receptors near this area. Further, this area of non-compliance is marginal and does not extend into the receiving environment for a considerable distance.
  - Dust fallout rates are predicted to remain well below the residential standard at all residential sensitive receptors.
    - Of the nearest, publicly accessible areas, highest dust fallout rates are predicted at Main Road (1,240 mg/m^2/day), which exceeds the Residential Standard. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent, elevated dust fallout rates.
    - The maximum fence line dust fallout rate predicted was 3,838 mg/m^2/day, occurring along the northern fence line of Saldanha Steel, exceeding the Non-Residential Standard of 1,200 mg/m^2/day. Importantly, the Saldanha Steel operations are located alongside the northern fence line, with emissions having little time to disperse sufficiently prior to reaching the fence line. Importantly, compliance with the residential standard is predicted approximately 2,400m from the fence line, with the area potentially impacted comprising a railway and open lands, with no inhabitants in the area.

- Mn 24-hour average and long-term (annual) concentration predictions will remain below the relevant international guidelines at all residential sensitive receptors.
  – The maximum 24-hour average fence line concentration predicted was 0.097 µg/m^3, with a long-term concentration of 0.058 µg/m^3 predicted, both occurring at the same location on the northern fence line of Saldanha Steel.
  – This predicted concentration is for Mn with particle diameters of 10 µm or less (Mn_{10}), with the predicted 24-hour average Mn_{10} concentration remaining well below the Ontario, Canada ambient Mn_{10} guideline of 0.2 µg/m^3, while also remaining below the strictest Mn guideline for $Mn_{2.5}$ of 0.1 µg/m^3.
  – Predicted long-term Mn_{10} concentrations remain well below the World Health Organisation (WHO) annual guideline of 0.15 µg/m^3.

Based on the findings of this assessment, impacts on the surrounding sensitive receptors due to steelmaking activities are considered to be low, although it is noted exceedances beyond the fenceline, associated with steelmaking, are predicted. WSP recommends the following measures be implemented on site:

- Should steelmaking recommence, investigate building fugitive emissions associated with the Corex and Conarc buildings. This should include, but not be limited to:
  - A review of the current dust extraction systems to ensure these are appropriate in design and operating efficiently. Should upgrades be required, implement accordingly.
  - Testing of building fugitive emissions to fully understand actual emissions from these buildings using best available methodologies.
- General housekeeping onsite, especially focusing on spilt material which can be re-entrained by vehicles and wind and potentially contribute to impacts on the receiving environment. All spilt material, for example around the tipplers, transfer stations and conveyors, should be collected within an acceptable time to ensure this material does not contribute to overall emissions from the site.
- Saldanha Steel implement robust maintenance programmes of all abatement equipment, ensuring these are maintained as per manufacturers specifications, minimising inefficient dust control and downtime.
- Ensure all dust control equipment is regularly maintained ensuring efficient operation and minimal downtime.

Further mitigation and activity specific recommendations are discussed in detail in **Section 10.1**.

In WSP's professional opinion and based on the findings of this AIR and recommendations provided, it is recommended Saldanha Steel's AEL be amended to include the operations of the Logistics Hub, as proposed herein.

1 FACILITY AND MODELLERS INFORMATION

1.1 PROJECT IDENTIFICATION INFORMATION

Facility details are presented in **Table 1-1** below.

Table 1-1: Facility information

Enterprise Name	Saldanha Steel (Pty) Ltd
Trading As / Site Name	Saldanha Steel (Pty) Ltd a subsidiary of ArcelorMittal South Africa Limited
Type of Enterprise, e.g. Company/Close Corporation/Trust, etc.	Company
Company/Close Corporation/Trust Registration Number	1995/000628/07
Registered Address	Yzervarkensrug, Saldanha
Postal Address	Private Bag X11, Saldanha, 7395
Telephone Number (General)	+27 22 709 4000
Fax Number (General)	+27 22 709 4200
Industry Type/Nature of Trade	Iron and Steelmaking
Land Use Zoning as per Town Planning Scheme	Industrial
Physical Address of the Facility	Farm Yzervarkensrug, Saldanha Site, Saldanha, Western Cape, 7395, South Africa
Description of Site (Where No Street Address)	Farm 1132 (Portion 2 of Yzervarkensrug No 129, portions 8 and 13 Yzervarkensrug No 127 and portion of Farm 195)
Coordinates of Approximate Centre of Operations	32.978435°S, 18.022642°E
Extent (property fenceline that the public cannot access, km^2)	6.74 km^2 (674 ha)
Elevation Above Mean Sea Level (m)	16
Province	Western Cape
Metropolitan/District Municipality	West Coast District Municipality
Local Municipality	Saldanha Bay
Designated Priority Area	N/A
AEL reference number	WC/WC/020
EIA reference number	N/A
Modelling consultant	WSP Group Africa (Pty) Ltd

1.2 PROJECT BACKGROUND

Saldanha Steel (Pty) Ltd (Saldanha Steel), a subsidiary of ArcelorMittal South Africa Limited (AMSA), is a steelwork focused on the export market located in Saldanha Bay, West Coast District Municipality (WCDM), Western Cape, South Africa. Given the activities undertaken at Saldanha Steel, the facility has obtained its Atmospheric Emission License (AEL) (Ref: WC/WC/020), aligned with Government Notice Regulation 893 of 2013[3], promulgated in line with Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004) (NEM:AQA)[4], which is valid until 01 March 2024. It is noted that an AEL renewal application has been submitted and accepted by the WCDM.

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[3] 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.

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

WSP Group Africa (Pty) Ltd (WSP) has therefore been appointed by Saldanha Steel to undertake the AIR to assess the potential impacts of air quality on the surrounding environment associated with the proposed Logistics Hub.

1.2.1 PROCESS DESCRIPTIONS

EXISTING PROCESS – STEELMAKING (SCENARIO 1)

Saldanha Steel employs operational equipment and technologies to convert lump iron ore into steel and Hot Rolled Coil (HRC), with the following key unit processes being undertaken, further illustrated in **Figure 1-1:**

- **Raw Materials Handling and Stockyard Area**
  Raw Materials areas and the Stockyard area are located west of the plant and are used for the bulk storage and handling of Iron Ore and Coal; offloading and storage of various other raw materials. These commodities are transported via ship and rail and offloaded on the stockyard via conveyor belts and conveying via transfer stations equipped with dust extraction systems, various by-products are also stored on the stockyard and at various locations on site for re-use within the process or sale to external users.
- **The Corex Plant**
  The Corex unit converts about 60% of the iron ore consumed into liquid iron. The plant consists of two main components, a reduction shaft and a melter-gasifier. Pellets can also be used to replace iron ore, or a mixture of pellets and iron ore can be used for the production of liquid iron.
  In the reduction shaft the lump iron ore, transported via a conveyor belt, is first reduced to sponge iron by reaction with a reducing gas generated in the melter-gasifier. The reduced iron ore is then melted in the melter-gasifier using heat generated by the combustion of coal and coke with injected oxygen. Coal or coke can only be used during the combustion process. Small volumes of by-products are fed into the Corex as part of the waste reduction initiative on site. The Corex process is similar to a blast furnace facility.
- **The Midrex Plant**
  Excess reducing gas generated in the Corex plant is used in the Midrex to convert the remaining 40% of the iron ore and pellets (transported via conveyor belts) into solid sponge iron (a highly metallised product suitable for steel commonly referred as DRI (Direct Reduced Iron).
- **The Steel Meltshop**
  The liquid iron (transported via ladles) and DRI (transported via conveyor belts) are converted into steel at the Conarc in the Steel Meltshop. The Corex liquid iron contains about 4% carbon, virtually all of which is removed by electric arc and oxygen injection in the Conarc process, a hybrid between an Electric Arc Furnace and a Basic Oxygen Furnace. Ferrous scrap steel, Hot Briquetted Iron (HBI) and various fluxes are also charged into the Conarc furnace in the Steel Meltshop. Further steel refining takes place in the Ladle Heating Furnace (LHF) & Vacuum Oxygen Decarburizer (VOD). The Conarc at the Steel Meltshop may also operate on Scrap only as an input material to produce steel.
- **The Thin Slab Caster (TSC)**

At the Thin Slab Caster (TSC) the liquid steel from the LHF and/or VOD in the Steel Meltshop, transported via ladles and overheard cranes in ladles are continuously cast into slabs that vary from 50 - 100 mm thickness and from 900 - 1560 mm in width.

- **Roller Hearth Furnace (RHF)**

After casting at the TSC, the slabs proceed directly into a long (about 180 m) temperature equalising Roller Heath Furnace (RHF) where the temperature of the slabs is increased and maintained according to specification, for the rolling of the steel. The Corex gas and/or LPG is used as fuel in this RHF.

- **Hot Strip Mill**

The steel slab is reduced or rolled to its final thickness in two stages: the Roughing Mill and the Finishing Mill. In the roughing mill, the steel slabs are rolled in two roughing mill stands (4-high) to create a transfer bar with a gauge of approximately 20 mm. The steel slabs are subjected to compressive and frictional forces which reduce the gauge of the steel slabs and elongate them into coils.

In the Finishing Mill the transfer bar is rolled to the final thickness in a five-stand (4-high) finishing mill. The final thickness is 0.8 mm to 8.5 mm, which is then rolled up in a coil.

- **Temper Mill**

The steel coils are transferred from the Hot Strip Mill to the Temper Mill with a walking beam. The Temper Mill rolling facility is available to process up to 70% of the hot rolled coils. The main objective of this mill is not to reduce the strip thickness but to achieve good strip flatness quality and rewind defective coils.

- **Briquetting Plant**

Briquetting is the process of compressing and compacting fine powders, granular or shredded materials into a solid mass (briquette). The by-products produced at Saldanha Steel are to be utilized in the manufacturing of briquettes. The Press Briquetting method is a roll type press which comprises of two rotating wheels. Materials are fed into the mixer where water is added. The rolls compress the materials under high pressure to form a briquette. The briquette is then discharged from the machine. The briquette will be wet due to the water added into the mixer. It is then stored in a dry and well-ventilated area before being reused in the iron and steel making process.

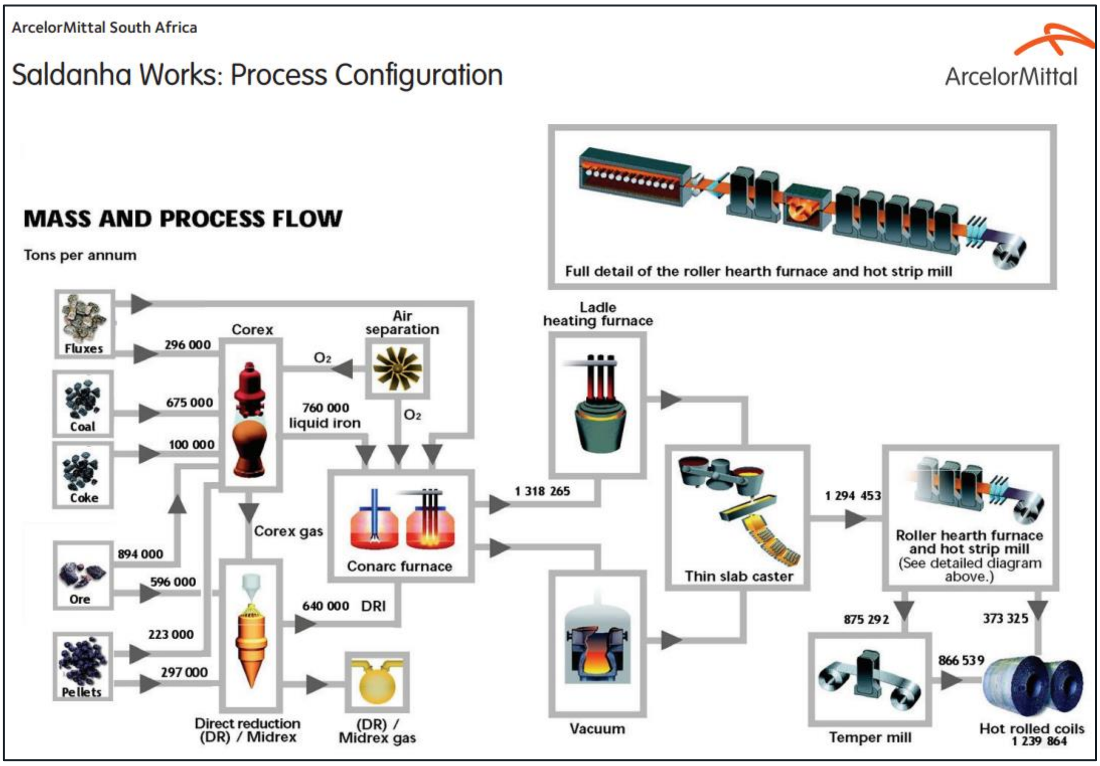


Figure 1-1: Process flow for the steelmaking process at Saldanha Steel

PROPOSED PROCESS – LOGISTICS HUB

As described previously, Saldanha Steel, in conjunction with Bidfreight Port Operations (BPO), intend to establish a Logistics Hub at the bulk materials storage and handling area of the steelworks. The following process will apply to the Logistics Hub, illustrated further in **Figure 1-2**:

- Up to 5,000,000 tpa of bulk material commodities will be handled within an enclosed warehouse by the Logistics Hub for export purposes. The individual bulk commodity quantities may fluctuate, depending on the bulk commodity required for export, although importantly, the total quantity of material handled, when operations are underway, will not exceed the threshold stipulated of 5,000,000 tpa.
- Up to 4,000,000 tpa will comprise of Manganese (Mn) ore. Of the 4,000,000 tpa Mn ore, up to 50% will be delivered via rail (2,000,000 tpa), with the remaining amount being delivered by truck (2,000,000 tpa).
  - The anticipated volume to be delivered by road presents a worst-case scenario, making allowance for current challenges regarding rail infrastructure. Following planned rail infrastructure upgrades in 2026, it is anticipated the volume of material delivered by road will decrease, with the majority then delivered by rail, via the tipplers.
- Up to the maximum tonnage of the other bulk material commodities, which will be delivered via road, will comprise:
  - Phosphate Concentrate (maximum tonnage: 1,200,000 tpa)

- Garnet Sands (maximum tonnage: 500,000 tpa)
- Zircon Sands (maximum tonnage: 500,000 tpa)
- Lead Concentrate (maximum tonnage: 250,000 tpa)
- Copper Concentrate (maximum tonnage: 250,000 tpa)
- Zinc Concentrate (maximum tonnage: 250,000 tpa)

These quantities may fluctuate, depending on the bulk commodity required for export, although importantly, the total quantity of material handled, when operations are underway, will not exceed the threshold stipulated of 5,000,000 tpa.

- Regarding the 50% of Mn ore delivered via rail, this will comprise:
  - Delivery from rail to the existing rotary tippler, contained within a building with dust extraction and sprayers delivering chemical suppressant to the Mn ore while being tipped from the rail wagons.
  - Mn ore will move from the rotary tippler along conveyor CV111 (underground conveyor) to Transfer Station 1 (TS1), contained within a building enclosure.
  - From TS1 the ore will be transferred to a new conveyor, which is an above-ground conveyor, semi-enclosed equipped with longitudinal water sprayers.
  - From the new conveyor, ore will be loaded onto the main Mn ore stockpile, within the warehouse. Notably, this ore will still be wet from the chemical suppressant applied at the rotary tippler and water applied by the longitudinal sprayers on the new conveyor. Further, the main Mn ore stockpile will be wetted via water sprayers and within an enclosed warehouse to reduce dust emissions.
- Regarding the bulk material commodities delivered by truck, 50% Mn ore and other commodities, to the warehouse, this will comprise:
  - Trucks will enter the Saldanha Steel site via the truck entrance road located southeast of the site, via the weighbridge. It is noted, prior to reaching the weighbridge, approximately 1 km of this road is unpaved, although this section receives chemical dust suppressant. From the weighbridge, onto the Saldanha site, the proposed entrance road is unpaved, which will also receive chemical suppressant.
  - Trucks will carry approximately 34 t of commodities per load, covered by the standard strapped tarpaulins required for side tippler road trucks.
  - Trucks will unload in the southern end of the warehouse to a truck stockpile, with water being applied to the truck stockpile to reduce dust emissions.
  - Yellow equipment (front-end loaders) will be used to transfer material from the truck stockpile to the main commodity stockpiles for reclaiming.
- Trucks delivering commodities to the TPT terminal will carry approximately 69 t of commodities per load, comprising three skips covered by heavy duty, fixed tarpaulins.
  - Trucks will exit the warehouse, and Saldanha Steel, via paved roads, making use of the existing paved haul road established for terminal access. Trucks exporting commodities to the terminal will not make use of public roads.

- The bulk of the trucks for commodities export to the terminal will remain onsite between deliveries, located at the designated truck staging area, avoiding unnecessary use of public roads. Note, this will be dependent on the trucking requirements of the cargo handling company, so the number of trucks onsite may vary from time to time.

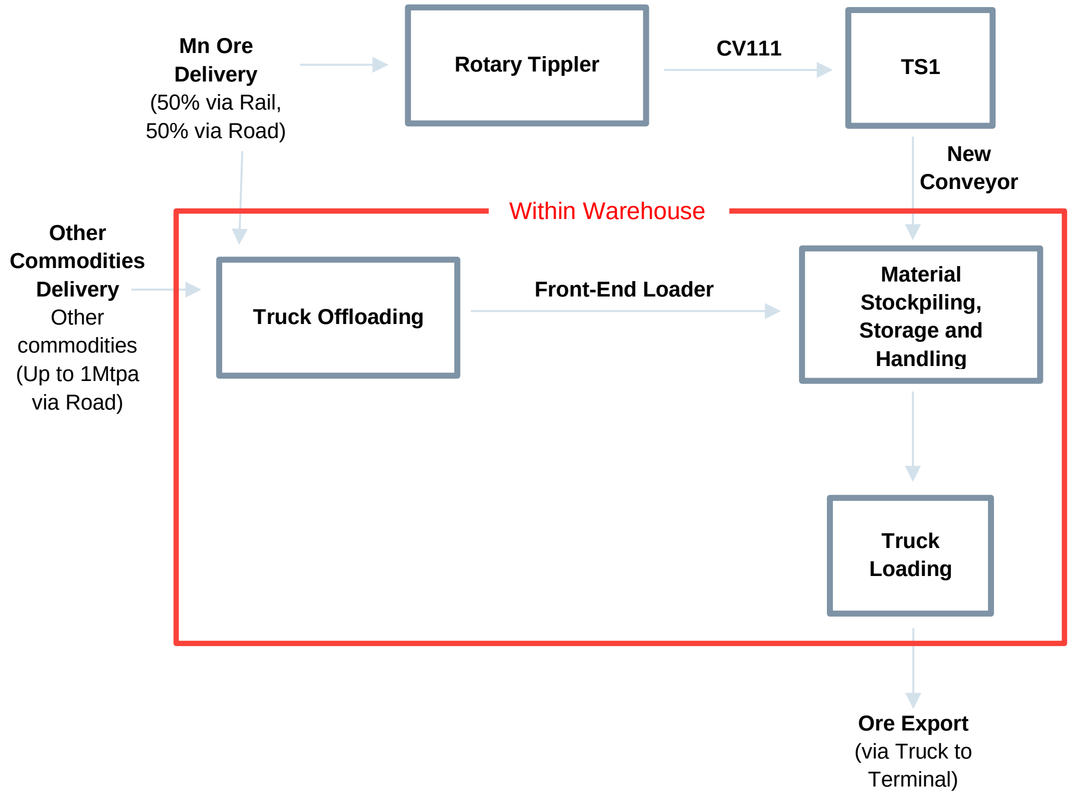


Figure 1-2: Process flow for the Logistics Hub

1.3 PROJECT LOCATION

Saldanha Steel is in the Western Cape, approximately 120 km north-northwest of Cape Town, along the West Coast of South Africa, 2 km off the coast of Saldanha Bay (**Figure 1-3**). The immediate area surrounding Saldanha Steel does not contain sensitive receptors, with this area predominantly comprising open areas, light industry to the west, the TPT Iron Ore Terminal to the south-southwest, two steel processing plants to the west, with a third to the northeast, and a petroleum storage facility to the southeast of Saldanha Steel.

The nearest sensitive receptors include Bluewater Bay, approximately 4.8 km west-southwest of Saldanha Steel, Langebaan approximately 6.8 km south-southeast of Saldanha Steel and Vredenburg, approximately 6.1 km north of Saldanha Steel. Although these are not located in immediate proximity to Saldanha Steel, it must be noted each of these are densely populated residential areas containing medical facilities, schools, and old age / retirement homes.

Saldanha Steel is situated approximately 2 km off the northern shore of Saldanha Bay. The surrounding area is characterised by a gently undulating coastal plain with low hills. Vredenburg is located on such a hill at an elevation of approximately 150 meters above sea level (mamsl). Terrain influences dispersion of pollutants, especially during periods of stable conditions.

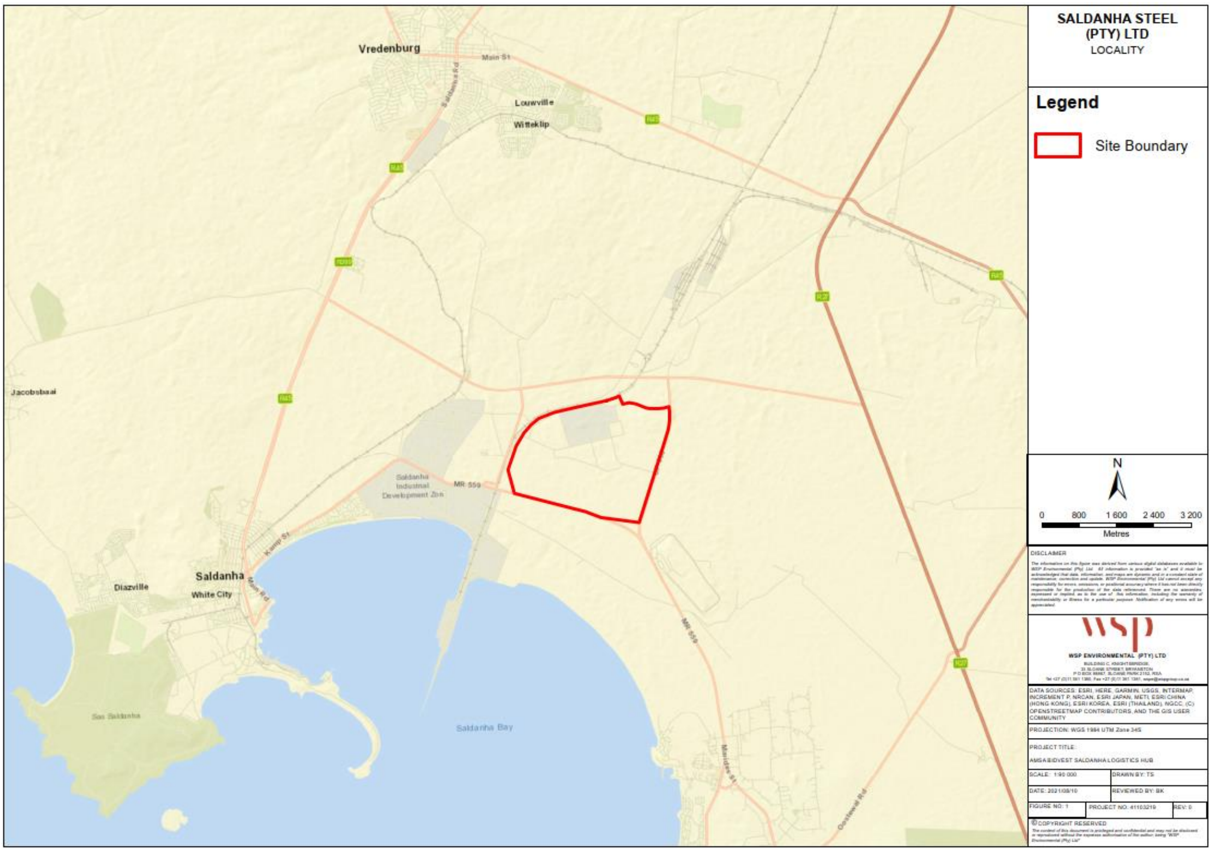


Figure 1-3: Site location

1.4 LAND USE DETERMINATION AND ELEVATION DATA

Terrain influences dispersion of pollutants, especially during periods of stable conditions. The NASA Shuttle Radar Topographic Mission (SRTM) digital elevation model (DEM) (resolution 90 m x 90 m) was extracted and inputted to the model to account for terrain influences on dispersion. For the land use categorization, a surface output was created from the Global Land Cover Characterization Global Coverage – Version 2 (1 km x 1 km resolution).

2 REGULATORY FRAMEWORK

2.1 MINIMUM EMISSION STANDARDS

Saldanha Steel has obtained its AEL (Ref: WC/WC/020), triggering *Category 4: Metallurgical Industry and Category 5: Mineral Processing,* valid until 01 March 2024. In line with the Listed Activities contemplated in Section 21, the category which is applicable to this AIR and triggers an AEL amendment is *Category 5: Mineral Processing, Storage and Handling, subcategories 5.1*.

Category 4: Metallurgical Industry, subcategories 4.2, 4.6, 4.7, 4.8, 4.11, 4.12 and *subcategories 5.2* are applicable to the Saldanha Steel operations and do not require amendment in this application.

The specific subcategories applicable to the steelmaking process, and as contained within the existing AEL, are:

- Subcategory 4.2: Combustion Installations (**Table 2-1**)
- Subcategory 4.6: Basic Oxygen Furnaces (**Table 2-2**)
- Subcategory 4.7: Electric Arc Furnaces (Primary and Secondary) (**Table 2-3**)
- Subcategory 4.8: Blast Furnaces (**Table 2-4**)
- Subcategory 4.11: Agglomeration Operations (**Table 2-5**)
- Subcategory 4.12: Pre-Reduction and Direct Reduction (**Table 2-6**)
- Subcategory 5.1: Storage and Handling of Ore and Coal (**Table 2-7**)
- Subcategory 5.2: Drying (**Table 2-8**)

Table 2-1: Minimum Emission Standards for subcategory 4.2: Combustion Installations

Description	Combustion installations not used for primarily steam raising and electricity generation (except drying)		
Applications	All combustion installations (except test or experimental).		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common name	**Chemical symbol**		
Particulate Matter	N/A	New	50
		Existing	100
Sulphur dioxide	SO_2	New	500
		Existing	500
Oxides of nitrogen	NO_x expressed as NO_2	New	500
		Existing	2000

The following special arrangements shall apply:

- Reference oxygen content appropriate to fuel type must be used.
- Where co-feeding with waste materials with calorific value allowed in terms of the Waste Disposal Standards published in terms of the Waste Act, 2008 (Act No.59 of 2008) occurs, additional requirements under subcategory 1.6 shall apply.

Table 2-2: Minimum Emission Standards for subcategory 4.6: Basic Oxygen Furnaces

Description	Basic oxygen furnaces in the steel making industry.		
Applications	All installations		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common name	**Chemical symbol**		
Particulate Matter	N/A	New	30
		Existing	100
Sulphur dioxide	SO_2	New	500
		Existing	500
Oxides of nitrogen	NO_x expressed as NO_2	New	500
		Existing	500

The following special arrangement shall apply:
- Secondary fume capture installations shall be fitted to all new furnace installations.

Table 2-3: Minimum Emission Standards for subcategory 4.7: Electric Arc Furnaces

Description	Electric arc furnaces in the steel making industry.		
Applications	All installations		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common name	**Chemical symbol**		
Particulate Matter	N/A	New	30
		Existing	100
Sulphur dioxide	SO_2	New	500
		Existing	500
Oxides of nitrogen	NO_x expressed as NO_2	New	500
		Existing	500

The following special arrangement shall apply:
- Secondary fume capture installations shall be fitted to all new furnace installations.

Table 2-4: Minimum Emission Standards for subcategory 4.8: Blast Furnaces

Description	Blast furnace operations		
Applications	All installations		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common name	**Chemical symbol**		
Particulate Matter	N/A	New	30
		Existing	100
Sulphur dioxide	SO_2	New	500

Description	Blast furnace operations		
Applications	All installations		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common name	**Chemical symbol**		
		Existing	500
Oxides of nitrogen	NO_x expressed as NO_2	New	500
		Existing	500
The following special arrangement shall apply: ▪ Secondary fume capture installations shall be fitted to all new furnace installations.			

Table 2-5: Minimum Emission Standards for subcategory 4.11: Agglomeration Operations

Description	Production of pellets or briquettes using presses, inclined discs or rotating drums		
Applications	All installations		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common name	**Chemical symbol**		
Particulate Matter	N/A	New	30
		Existing	100
Ammonia	NH_3	New	30
		Existing	50

Table 2-6: Minimum Emission Standards for subcategory 4.12: Pre-Reduction and Direct Reduction

Description	Production of pre-reduced or metallised ore or pellets using gaseous or solid fuels.		
Applications	All installations		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common name	**Chemical symbol**		
Particulate Matter	N/A	New	50
		Existing	100
Sulphur dioxide (from natural gas)	SO_2	New	100
		Existing	500
Sulphur dioxide (from all other fuels)	SO_2	New	500
		Existing	1700
Oxides of nitrogen		New (gas based)	500

Description	Production of pre-reduced or metallised ore or pellets using gaseous or solid fuels.		
Applications	All installations		
Substance or mixture of substances		Plant status	mg/Nm^3 under normal conditions of 273 Kelvin and 101.3 kPa
Common name	Chemical symbol		
	NO_x expressed as NO_2	New (all other fuels)	1000
		Existing	2000

Table 2-7: Minimum Emission Standards for subcategory 5.1: Storage and Handling of Ore and Coal

Description	Storage and handling of ore and coal not situated on the premises of a mine or works as defined in the Mines Health and Safety Act 29/1996.		
Applications	Locations designed to hold more than 100 000 tons.		
Substance or mixture of substances		Plant status	mg/Nm^3 under normal conditions of 273 Kelvin and 101.3 kPa
Common name	Chemical symbol		
Dust fall	N/A	New	a
		Existing	a
[a] three months running average not to exceed limit value for adjacent land use according to dust control regulations promulgated in terms of section 32 of the NEM:AQA, 2004 (Act No. 39 of 2004), in eight principal wind directions.			

Table 2-8: Minimum Emission Standards for subcategory 5.2: Drying

Description	The drying of mineral solids including ore, using dedicated combustion installations.		
Applications	Facilities with a capacity of more than 100 tons/month product		
Substance or mixture of substances		Plant status	mg/Nm^3 under normal conditions of 273 Kelvin and 101.3 kPa
Common name	Chemical symbol		
Particulate Matter	N/A	New	50
		Existing	100
Sulphur dioxide	SO_2	New	1000
		Existing	1000
Oxides of nitrogen	NO_x expressed as NO_2	New	500
		Existing	1200

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*"[5]. 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 2-9** became applicable for air quality management from their promulgation in 2009[6] and 2012[7]. The NAAQS generally have specific averaging periods, compliance timeframes, permissible frequencies of exceedance and measurement reference methods.

Table 2-9: South African National Ambient Air Quality Standards

Pollutant	Averaging Period	Concentration μg/m³	Permissible Frequency of Exceedance
Particulate matter (PM_{10})	24 hours	75	4
	1 year	40	0
Particulate matter ($PM_{2.5}$)	24 hours	40	4
		25[a]	4
	1 year	20	0
		15[a]	0
Benzene (C_6H_6)	1 year	5	0
Sulphur dioxide (SO_2)	10 minutes	500	526
	1 hour	350	88
	24 hours	125	4

[5] 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)

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

[7] 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)

Pollutant	Averaging Period	Concentration µg/m³	Permissible Frequency of Exceedance
	1 year	50	0
Nitrogen dioxide (NO_2)	1 hour	200	88
	1 year	40	0
Carbon monoxide (CO)	1 hour	30000	88
	8 hours	10000	11
Ozone (O_3)	8 hours	120	11
Lead (Pb)	1 year	0.5	0

a: Effective date is 01 January 2030

2.3 NATIONAL DUST CONTROL REGULATIONS

On 01 November 2013 the legislated standards for dust fallout were promulgated in the form of the National Environmental Management: Air Quality Act (NEM:AQA) National Dust Control Regulations (GNR 827)[8]. These regulations provide the acceptable / allowable dust fallout rates for both residential and non-residential areas, as presented in **Table 2-10**.

Table 2-10: Acceptable Dust Fallout Rates as per the National Dust Control Regulations

Restriction Areas	Dust Fallout Rate (D) (mg/m²/day) 30-day average	Permitted frequency of exceeding dust fallout Rate	Reference Method
Residential Area	D < 600	Two within a year, not sequential months	ASTM D1739
Non-Residential Area	600 < D < 1,200	Two within a year, not sequential months	ASTM D1739
The method to be used for measuring dust fall rate and the guideline for locating sampling points shall be ASTM D1739:1970, or equivalent method approved by any internally recognised body. As confirmed by Saldanha Steel, the dust fallout method applied onsite for existing dust fallout monitoring is the ASTM D1739:1970 methodology, as per the requirements of GNR 827 of 2013.			

2.4 INTERNATIONAL AMBIENT AIR QUALITY GUIDELINES

The Logistics Hub Operations proposes to store, handle and export bulk commodities. Of these commodities, manganese ore forms most of the ore handled, with this also being potentially hazardous under certain conditions. Given this, Mn emissions were assessed

8 Department of Environmental Affairs (2013): National Dust Control Regulations. Government Gazette (No. R 827 of 2013), 01 November 2013 (No. 36974)

separately to overall dust related emissions. South Africa does not have ambient air quality standards in place for ambient Mn concentrations. As a result, international ambient air quality limits/guidelines have been sourced for comparison of the predicted Mn concentrations.

Mn exposure is related with occupational exposure mainly in the production of steel and welding operations. Inhalation of Mn fumes and dust may be harmful to the lungs, liver, and kidneys. Prolonged exposure to Mn fumes or dust may lead to a neurological condition referred to as manganism[9]. It is important to note, that the hazardous fumes and dust from Mn are produced from the application of heat on the metal ore [10]. The Logistics Hub operations involve the storage and handling of Mn ore without application of heat; therefore, the hazardous nature of ore is substantially reduced. Further, the ore will be within an enclosed warehouse and stockpiles will be wetted by water sprayers. Material transported via the rail system and related infrastructure will receive chemical suppressants at the rotary tippler and wetted by water along the conveyor lines prior to stockpiling within the warehouse, where further wetting by water sprayers will occur.

The international ambient air quality guidelines are presented in **Table 2-11**. The international ambient air quality guidelines generally have specific averaging periods. For the purpose of this assessment, the Ontario, Canada and World Health Organization ambient air quality guidelines have been used for comparative purposes.

Table 2-11: International Ambient Air Quality Guidelines for Manganese (Mn)

Authority	Averaging Period	Concentration µg/m³
Ontario, Canada [a]	24 hours (as $PM_{2.5}$)	0.1
	24 hours (as PM_{10})	0.2
	24 hours (as TSP)	0.4
World Health Organization (WHO) [b]	Annual	0.15

Notes:
For particles with a diameter of 2.5 micrometres or less, hereafter referred to as $Mn_{2.5}$
For particles with a diameter of 10 micrometres or less, hereafter referred to as Mn_{10}

[a]: Human Toxicology and Air Standards Section, Technical Assessment and Standards Development Branch, Ontario Ministry of the Environment, Conservation and Parks (MECP). 2020. Ambient Air Quality Criteria. MECP, Toronto, ON, Canada.

[b]: World Health Organization (WHO). 2000. Air Quality Guidelines for Europe, 2nd Edition. WHO Regional Publications, European Series, No. 91. WHO Regional Office for Europe, Copenhagen. 273 pp.

[9] The National Institute for Occupational Safety and Health (NIOSH) (2019): Manganese Overview, CAS No. 7439-96-5 (metal).
[10] Agency for Toxic Substances and Disease Registry (ATSDR) (2012): Toxicology Profile of Manganese, Chapter 6: Potential for Human Exposure, pg. 390.

3 EMISSIONS CHARCTERISATION

An emissions inventory is a list of air pollution sources, their physical and chemical parameters, as well as the quantification of emissions. Emissions are calculated using emission factors or mass balance approaches, requiring chemical and activity data inputs. For the purposes of this assessment, only existing operations are assessed, under normal operating conditions.

Since the activities at the proposed Logistics Hub only involve the storage and handling of bulk commodities, only particulate related pollutants are of concern, and therefore assessed in this AIR, namely, PM_{10}, $PM_{2.5}$ and dust fallout (calculated and modelled as Total Suspended Particulates (TSP)), as well as the Mn component of total dust.

For the purposes of this AIR, use was made of actual, tested emissions on the existing Saldanha Steel point sources (stacks). For the remaining Saldanha Steel and Logistics Hub processes use was made of the United States Environmental Protection Agency (USEPA) AP-42 emission factors[11] and the Australian Government National Pollutant Inventory (NPI)[12], where applicable, as detailed in the following sections, and aligned with the Modelling Regulations.

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, in this case, the USEPA AP-42 or NPI emission factors being applied.

[11] USEPA (1995): Compilation of Air Pollutant Emission Factors (AP-42)
[12] Australian Government: National Pollutant Inventory (NPI)

For the purposes of this AIR, three modelling scenarios were assessed.

3.1.1 SCENARIO 1: SALDANHA STEEL OPERATIONS

Activity Data

The activity data applicable to Saldanha Steel, as contained within the existing AEL (Ref: WC/WC/020), is presented below.

Table 3-1: Unit processes

Unit process	Unit Process Function	Batch or Continuous Process
Raw Material Handling	Offloading, storage and handling of various raw materials (including ore and coal) and by-products awaiting reuse and conveying via transfer stations.	Continuous
Corex	Produce liquid iron for Conarc furnace and supply gas to Midrex Plant. Slag is granulated to render a sought-after by-product.	Continuous
Midrex	Produce DRI for Conarc furnace from ore and pellets supplied by raw materials handling section.	Continuous
Coal Drying Plant	The coal dryer is used to reduce the moisture content of the coal.	Continuous
Slag Granulation Plant	Produces slag granules for the cement industry.	Continuous
Roller Hearth Furnace	Heats up slabs.	Continuous
Conarc Furnace	The Conarc converts molten iron, direct reduced iron and scrap to molten steel. HBI and by-products could also be added.	Batch
Ladle Heating Furnace	Treats molten steel for casting.	Batch
VOD (Vacuum oxygen decarburising)	Treats molten steel for casting.	Batch
Briquetting Plant	Fine metallurgical materials generated onsite are used to manufacture briquettes to be re-used in the iron and steel making process.	Continuous
Temper Mill	Improves steel flatness quality.	Continuous
Iron Granulation Plant	Iron Granulation Plant produces iron granules for steelmaking.	Intermittent
Thin Slab Caster	Casting of steel slabs.	Continuous
VOD Boiler	The VOD boiler supplies steam to the VOD plant and the ladle heating furnace treats the molten steel for casting at the caster. The VOD boiler can operate on Corex Gas or LPG.	Batch
HSM	Roll slabs to flat strip of required thickness.	Batch
Air Liquide	Atmospheric air is compressed, dried and carbon dioxide removed through a purification process. The liquid air is separated into nitrogen and oxygen by distillation. Oxygen, nitrogen and argon is then vaporised and supplied to Saldanha Works.	Continuous

Unit process	Unit Process Function	Batch or Continuous Process
Lancing Booth at IGP (Iron Granulation Plant)	Iron sculls are removed from the tundish after granulation by lancing.	Intermittent

Table 3-2: Hours of operation

Unit process	Operating Hours	Days of Operation / Year
Raw Material Handling	00h00 – 24h00	365
Corex	00h00 – 24h00	365
Midrex	00h00 – 24h00	365
Coal Drying Plant	00h00 – 24h00	365
Slag Granulation Plant	00h00 – 24h00	365
Roller Hearth Furnace	00h00 – 24h00	365
***Conarc Furnace**	00h00 – 24h00	365
***Ladle Heating Furnace**	00h00 – 24h00	365
***VOD (Vacuum oxygen decarburising)**	00h00 – 24h00	365
Briquetting Plant	00h00 – 24h00	365
Temper Mill	00h00 – 24h00	365
Iron Granulation Plant*	00h00 – 24h00	365
Thin Slab Caster	00h00 – 24h00	365
VOD Boiler*	00h00 – 24h00	365
HSM*	00h00 – 24h00	365
Air Liquide	00h00 – 24h00	365
Lancing Booth at IGP (Iron Granulation Plant)*	00h00 – 24h00	365
Note: Unit processes marked with * do not operate 24 hours per day, but either intermittently or batch		

Table 3-3: Raw materials used

Raw Material Type	Maximum Permitted Consumption Rate (Quantity)	Units (quantity / period)
Regulated Raw Materials*		
Instrument Air	18,000	Nm^3/hr
Nitrogen	30,000	Nm^3/hr
Argon	600	Nm^3/hr
Oxygen (99.5%)	20,000	Nm^3/hr

Raw Material Type	Maximum Permitted Consumption Rate (Quantity)	Units (quantity / period)
Oxygen (95%) Purity	75,000	Nm^3/hr
Iron Ore & Iron Ore Pellets	2,832,000	Tons/annum
Dolomite	228,000	Tons/annum
Limestone	162,000	Tons/annum
Burnt Lime	138,000	Tons/annum
Scrap	500,000	Tons/annum
Imported DRI/HBI	120,000	Tons/annum
Minor Components	720,000	Tons/annum
Lump Lime	98,000	Tons/annum
Burnt Dolomite	65,000	Tons/annum
Raw Dolomite	282,000	Tons/annum
Bulk Coal	1,140,000	Tons/annum
Coke	180,000	Tons/annum
Fine Lime	24,000	Tons/annum
Steel Plant Slag and Steel Scrap, Liquid Steel, Cast Steel Slab, Tundish Sculls, Unrolled Slab, Steel Strip	300,000	Tons/annum
Other (Recycled materials and by-products)	150,000	Tons/annum
Non-Regulated Raw Materials*		
N/A	N/A	N/A
* Regulated raw materials refers to those materials when increased or decreased may result in the change of air emissions output. * Non-regulated raw materials refer to those materials when increased or decreased may not result in any change of air emissions output.		

Table 3-4: Production rates

Product Name	Maximum Permitted Production Capacity (Quantity)	Units (quantity / period)
Hot Rolled Coil	1,350,000	Tons/annum
Granulated Corex Slag	310,000	Tons/annum
Coal Fines	200,000	Tons/annum
Sludge Granules	100,000	Tons/annum
Burnt Dolomite Fine	5,000	Tons/annum
Briquettes	87,600	Tons/annum

Table 3-5: By-products

By-Product Name	Maximum Permitted Production Capacity (Quantity)	Design Production Capacity (Quantity)	Actual Production Capacity (Quantity)	Units (quantity / period)
Air Cooled Corex Slag	N/A	N/A	50,000	Tons/annum
Conarc Slag	N/A	N/A	276,000	Tons/annum
Refractories	N/A	N/A	12,000	Tons/annum
By-Product Iron	166,506	N/A	166,506	Tons/annum
Granulated Corex Slag	310,000	N/A	310,000	Tons/annum
Conarc Dust	N/A	N/A	30,000	Tons/annum
Corex Classifier Sand	N/A	N/A	14,000	Tons/annum
Midrex Classifier Sand	N/A	N/A	1,400	Tons/annum
Mill Scale	N/A	N/A	12,000	Tons/annum
Caster Scale	N/A	N/A	13,000	Tons/annum
Note: The above-mentioned by-products are either re-used back in the processes or sold if markets are available or disposed of as a waste.				

Table 3-6: Materials used in energy sources

Materials for Energy Source	Actual Consumption Rate (Quantity)	Units (quantity / period)	Material Characteristics
Coal	950,000	Tons/annum	Sulphur: 0.5% - 0.9% Ash: 14% - 25%
Coke	150,000	Tons/annum	Sulphur: 0.4% - 0.9% Ash: 12% - 15%
Electricity	N/A	MWh/annum	N/A
LPG	36,000	Tons/annum	N/A
Carbonaceous Product	30,000	Tons/annum	Sulphur: 0.5% - 2% Ash: 20%
Paraffin	1,800	kl/annum	N/A
Diesel	2,600	kl/annum	N/A
Corex Producer Gas	125,000,000	m^3/month	N/A

Point Source Emissions

Table 3-7 presents the point source parameters and **Table 3-8** presents the point source emissions rates, as well as their source of information, while **Figure 3-1** presents the point source locations, as included in the dispersion model. Stack emissions testing, either through a continuous method or isokinetic sampling, was provided for TSP. Given this, assumptions were applied to calculate the finer fractions (PM_{10} and $PM_{2.5}$) of TSP:

- For point sources linked to materials handling activities (Source ID 220, 221, 222, 224, 502 and 927) the ratio of PM_{10} and $PM_{2.5}$ to TSP was calculated from the US EPA AP42 Section 13.2.4 Aggregate Handling and Storage Piles materials handling equation (presented in the following section). This ratio was estimated to be:
  - 47.3% of TSP = PM_{10}
  - 7.16% of TSP = $PM_{2.5}$
- For the hearth furnace point sources (Source ID RH1 and RH2), the ratio of PM_{10} and $PM_{2.5}$ to TSP was calculated from the US EPA AP42 Section 12.5 Iron and Steel Production, Table 12.5-2 Size Specific Emission Factors. This section presents the ratio of PM_{10} and $PM_{2.5}$ to TSP emissions for hearth furnaces. Based on this, the ratios for the hearth furnaces were estimated to be:
  - 83.03% of TSP = PM_{10}
  - 7.16% of TSP = $PM_{2.5}$
- For the point sources related to other furnaces (Source ID 225, 320, 411 and 302), the ratio of PM_{10} and $PM_{2.5}$ to TSP was calculated from the US EPA AP42 Section 12.5 Iron and Steel Production, Table 12.5-2 Size Specific Emission Factors. This section presents the ratio of PM_{10} and $PM_{2.5}$ to TSP emissions for blast furnaces. Based on this, the ratios for sources linked to the furnaces were estimated to be:
  - 24.62% of TSP = PM_{10}
  - 15.38% of TSP = $PM_{2.5}$
- For the remaining point sources (Source ID 321, 313 and 405), appropriate size emission factors were not available. Given this, it was assumed that PM_{10} was 100% of TSP, and $PM_{2.5}$ was 100% of TSP. This is environmentally conservative and presents a worst-case. In reality, PM_{10} and $PM_{2.5}$ emissions associated with these sources will be lower than presented in this report.

Figure 3-1: Saldanha steel point source locations

Table 3-7: Point source parameters

Point Source Code	Source Name	Latitude[2] (S, DD)	Longitude[2] (N, DD)	Height of Release Above Ground (m)	Height Above Nearby Building (m)	Diameter at Stack Tip (m)	Actual Gas Exit Temperature[3] (°C)	Actual Gas Volumetric Flow[3] (m^3/hr)	Actual Gas Exit Velocity[3] (m/s)	Emission Hours	Type of Emission (Continuous / Batch)
221	Coal Drier[1]	32.979795°	18.018405°	26	~7	2.5	42.3	186,120	10.7	24	Continuous
222	Coal Transport	32.979743°	18.018550°	26	~7	1.3	29.5	32,040	6.9	24	Continuous
220	Coal Blending & Screening	32.978489°	18.018443°	25	~4	1.0	29.7	14,040	5.0	24	Continuous
225	Corex Cast House[1]	32.978690°	18.021356°	26	~5	4.8	57.2	723,240	11.2	24	Continuous
223	Coal Stock House	32.979248°	18.019954°	44	~5	1.3	23.2	48,600	10.3	24	Continuous
224	Ore Stock House	32.979026°	18.020500°	16	~7	1.6	23.9	81,360	11.4	24	Continuous
321	Midrex Metallised Fines	32.976130°	18.020687°	30	~2	1.1	27.7	39,960	11.3	24	Continuous
320	Midrex Product De-Dusting	32.976543°	18.019848°	30	~12	1.1	44.0	29,160	8.2	24	Continuous
411	Conarc[1]	32.979884°	18.021521°	45	~2	5.8	79.3	1,562,040	16.2	24	Continuous
219	Flare	32.976488°	18.021215°	80	~50	1.0	Not determined			24	Continuous
209	Granulation Plant (Slag)	32.978872°	18.021628°	40	~15	2.5	46.7	98,640	7.8	24	Continuous
501	Caster stack	32.978380°	18.023062°	16	~2	1.3	Not determined			24	Continuous
RH1	Roller Hearth Furnace Stack #1[1]	32.978453°	18.024249°	16	~5	1.4	299.0	34,504	18.7	24	Continuous

Point Source Code	Source Name	Latitude[2] (S, DD)	Longitude[2] (N, DD)	Height of Release Above Ground (m)	Height Above Nearby Building (m)	Diameter at Stack Tip (m)	Actual Gas Exit Temperature[3] (°C)	Actual Gas Volumetric Flow[3] (m^3/hr)	Actual Gas Exit Velocity[3] (m/s)	Emission Hours	Type of Emission (Continuous / Batch)
RH2	Roller Hearth Furnace Stack #2[1]	32.978297°	18.025185°	16	~5	0.78	167.1	15,956	11.8	24	Continuous
313	Midrex Gas Heater Stack[1]	32.977838°	18.020325°	30	~6	2.4	354.5	463,158	14.3	24	Continuous
405	VOD Boiler[1]	32.978300°	18.022800°	50	~2	0.9	236.0	31,680	13.4	24	Continuous
302	Furnace De-Dusting (Midrex)[1]	32.977521°	18.020633°	30	~6	1	42.4	36,294	17.8	24	Continuous
927	Iron Granulation Plant (IGP)[1]	32.982024°	18.022202°	4	N/A	1	60.0	43,920	15.5	24	Continuous
224-1	Stock House Extension	Listed in AEL as point source, although actually area source (building extension to the stock house) – included in inventory as area source									
502	Alloy Store De-Dusting Unit	32.976613°	18.022315°	4	N/A	1	29.5	19,298	6.8	24	Continuous
503	Stock House Extension Outlet	32.979305°	18.018521°	4	Not Determined						

1 – Stacks associated with NO_2 and SO_2 emissions
2 - Accuracy improved on some coordinates, with input from Saldanha Steel
3 - Values presented based on averages from stack emissions testing reports, where available (Reports dated 2017 – 2019, prior to C&M)

Table 3-8: Point source emission rates

Point source Code	Source Name	NO_2 (g/s)	SO_2 (g/s)	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
221	Coal Drier	0.10	4.48E-05	3.96E-01	1.87E-01	2.83E-02	12.48	5.90	0.89
222	Coal Transport	N/A	N/A	1.29E-02	6.08E-03	9.20E-04	0.41	0.19	0.03
220	Coal Blending & Screening	N/A	N/A	7.68E-03	3.63E-03	5.50E-04	0.24	0.11	0.02
225	Corex Cast House	0.60	0.19	4.31E-01	1.06E-01	6.63E-02	13.59	3.35	2.09
223	Coal Stock House	N/A	N/A	6.79E-02	3.21E-02	4.86E-03	2.14	1.01	0.15
224	Ore Stock House	N/A	N/A	2.15E-01	1.02E-01	1.54E-02	6.79	3.21	0.49
321	Midrex Metallised Fines	4.88	4.88	5.33E-04	1.31E-04	8.20E-05	0.017	0.004	0.003
320	Midrex Product De-Dusting	N/A	N/A	1.99E-02	4.89E-03	3.06E-03	0.63	0.15	0.10
411	Conarc	8.71	5.36	1.38E+00	3.39E-01	2.12E-01	43.47	10.70	6.69
219	Flare	*Excluded from model, emergency release only*							
209	Granulation Plant (Slag)	0.01	2.34E-05	*No particulate emissions*					
501	Caster Stack	*Steam stack, no emissions*							
RH1	Roller Hearth Furnace Stack #1	0.01	0.03	1.81E-02	1.51E-02	1.09E-02	0.57	0.47	0.34
RH2	Roller Hearth Furnace Stack #2	0.07	0.02	8.42E-02	6.99E-02	5.05E-02	2.66	2.20	1.59
313	Midrex Gas Heater Stack	0.32	0.13	4.75E-01	4.75E-01	4.75E-01	14.98	14.98	14.98
405	VOD Boiler	2.29	2.29	2.37E-01	2.37E-01	2.37E-01	7.47	7.47	7.47
302	Furnace De-Dusting (Midrex)	6.05	6.05	5.67E-02	1.39E-02	8.72E-03	1.79	0.44	0.27

927	Iron Granulation Plant (IGP)[1]	4.99	4.99	5.00E-01	2.36E-01	3.58E-02	15.77	7.46	1.13
224-1	Stock House Extension	*Stock house extension is not a point source, it is an area source, therefore modelled as such*							
502	Alloy Store De-Dusting Unit	N/A	N/A	1.38E-01	6.51E-02	9.86E-03	4.34	2.05	0.31
503	Stock House Extension Outlet	*Not calculated due to no stack information – included in model as area source, as part of stock house emissions (environmentally conservative)*							

Volume Sources

Operations at Saldanha Steel comprise several volume sources relating to material handling activities occurring within buildings or structures, as well as fugitive releases from buildings due to furnace operations, as illustrated in **Figure 3-2**.

Emission rates were calculated using US EPA AP42 emission factors. To estimate emissions from materials handling related volume sources, use was made of the US EPA AP42 emission factor equation extracted from Section 13.2.4 Aggregate Handling and Storage Piles, as presented below:

$$E = k(0.016)\frac{\left(\frac{u}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \quad (1)$$

Where: u is the mean wind speed (3.8 m/s from Langebaan weg station), M is the material moisture content (%, as per US EPA AP42 Table 13.2.4-1) and k is the particle size multiplier (TSP = 0.74, PM_{10} = 0.35 and $PM_{2.5}$ = 0.053).

Equation has an "A" Confidence Rating, being rated by the US EPA AP42 as being excellent, with the factor developed from A or B rated source test data from a variety of industries.

Despite the above equation having a confidence rating of "A", it must be noted this is likely to still provide an overestimation of emissions as it considers outdoor wind velocity when these material handling activities are occurring within buildings / structures. This equation was deemed appropriate given the lack of alternative equations for indoor materials handling, while remaining environmentally conservative. Further, to account for control of emissions by the buildings / structures, certain control efficiencies were applied to the volume sources.

Table 3-9 presents the raw material quantities, and associated moisture contents, handled by the volume sources, while **Table 3-10** presents the dust control efficiencies applied and **Table 3-11** presents the calculated, controlled emission rates.

Figure 3-2: Saldanha Steel volume source locations

Table 3-9: Raw materials handled at volume sources

Raw Material Type	Maximum Permitted Consumption Rate (t/a)	Moisture Content (%)[13]
Iron Ore & Iron Ore Pellets	2,832,000	5.4
Dolomite	228,000	0.2
Limestone	162,000	0.2
Burnt Lime	138,000	0.2
Imported DRI/HBI	120,000	5.4
Minor Components	720,000	4.8
Lump Lime	98,000	0.2
Burnt Dolomite	65,000	0.2
Raw Dolomite	282,000	0.2
Bulk Coal	1,140,000	4.8
Coke	180,000	7.8
Fine Lime	24,000	0.2
Other (Recycled materials and by-products)	150,000	4.8

Table 3-10: Material handling volume source control efficiencies

Source Description	Control Description	Control Efficiency (%)
Stock House	Housed within building	50%
Transfer Station 1	Housed within building	50%
Transfer Station 2	Housed within building	50%
Transfer Station 3	Housed within building, chemical additive sprayers	70%
Transfer Station 4	Housed within building	50%
Transfer Station 5	Housed within building	50%
Transfer Station 6	Housed within building	50%
Transfer Station 7	Housed within building	50%
Transfer Station 8	Housed within building	50%
Coal Screen House	Housed within building	50%

[13] USEPA (1995): Compilation of Air Pollutant Emission Factors (AP-42), Chapter 13.2.4 Aggregate Handling and Storage Piles, Table 13.2.4-1 Typical Silt and Moisture Contents of Materials at Various Industries.

Source Description	Control Description	Control Efficiency (%)
Coal Blending Station	Housed within building	50%
Coal Drying Plant	Housed within building	50%
Side Tippler	Housed within building, extraction system, water sprayers and strip curtain	70%
Rotary Tippler	Housed within building, extraction system, chemical additive sprayers and strip curtain	90%

Table 3-11: Material handling volume source emission rates (controlled)

Source Description	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
Stock House	1.01E+00	4.77E-01	7.22E-02	31.80	15.04	2.28
Transfer Station 1	1.26E-01	5.96E-02	9.02E-03	3.97	1.88	0.28
Transfer Station 2	1.26E-01	5.96E-02	9.02E-03	3.97	1.88	0.28
Transfer Station 3	7.55E-02	3.57E-02	5.41E-03	2.38	1.13	0.17
Transfer Station 4	1.26E-01	5.96E-02	9.02E-03	3.97	1.88	0.28
Transfer Station 5	1.26E-01	5.96E-02	9.02E-03	3.97	1.88	0.28
Transfer Station 6	1.26E-01	5.96E-02	9.02E-03	3.97	1.88	0.28
Transfer Station 7	1.26E-01	5.96E-02	9.02E-03	3.97	1.88	0.28
Transfer Station 8	1.26E-01	5.96E-02	9.02E-03	3.97	1.88	0.28
Coal Screen House	1.28E-02	6.05E-03	9.16E-04	0.40	0.19	0.03
Coal Blending Station	1.28E-02	6.05E-03	9.16E-04	0.40	0.19	0.03
Coal Drying Plant	1.28E-02	6.05E-03	9.16E-04	0.40	0.19	0.03
Side Tippler	6.04E-01	2.86E-01	4.33E-02	19.06	9.01	1.37
Rotary Tippler	2.01E-01	9.53E-02	1.44E-02	6.35	3.00	0.46

Fugitive emissions associated with the operation of the furnaces were calculated from the US EPA AP42 Section 12.5 Iron and Steel Production, Table 12.5-2 Size Specific Emission Factors, specifically those factors associated with blast furnaces, determined by roof monitors. These emission factors were applied to the Corex Tapping Aisle North and South Building and the Conarc North and South Building. Importantly, since these emission rates are determined by roof monitors, no control efficiencies are applied to the calculated emission rates i.e., it is assumed these are the actual emissions exiting the building roofs.

According to the US EPA AP42 Section 12.5 Iron and Steel Production, Table 12.5-2 Size Specific Emission Factors, emission factors to be applied for roof emissions associated with blast furnaces are:

- TSP: 0.3 kg/Mg of product

- PM_{10}: 0.15 kg/Mg of product
- $PM_{2.5}$: 0.07 kg/Mg of product

To calculate roof emissions associated with furnace operations the following production rates were applied, as supplied by Saldanha Steel:

- Corex Furnace: 750,000 tpa of liquid iron
- Conarc Furnace: 1,467,391 tpa of liquid steel

Table 3-12 presents calculated roof emission rates for the Corex and Conarc buildings. Importantly, the rates presented below are calculated as average emissions for a year, whereas the furnaces operate in batches, with the tapping of these furnaces only occurring for a short period during each furnace batch.

Table 3-12: Furnace building average fugitive emissions

Source Description	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
Corex Tapping Aisle South	3.57	1.78	0.83	112.5	56.3	26.3
Corex Tapping Aisle North	3.57	1.78	0.83	112.5	56.3	26.3
Conarc Building South	6.98	3.49	1.63	220.1	110.1	51.4
Conarc Building North	6.98	3.49	1.63	220.1	110.1	51.4

Area Sources

As part of the ECOSERVE monitoring undertaken in 2007, sampling was conducted at each of the stockpiles and dumps to understand emission rates associated with these sources. Despite the age of these tests, these are deemed to remain representative since stockpiling procedures, and material types, have remained unchanged to what was originally tested. Area sources not sampled by ECOSERV were the 9000t iron ore stockpile and the Briquetting Plant. To calculate these emission rates, use was made of the US EPA AP42 emission factor equation extracted from Section 13.2.4 Aggregate Handling and Storage Piles, as presented below:

$$E = k(0.016)\frac{\left(\frac{u}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \qquad (2)$$

Where: u is the mean wind speed (3.8 m/s from Langebaan weg station), M is the material moisture content (5.4%, as per US EPA AP42 Table 13.2.4-1) and k is the particle size multiplier (TSP = 0.74, PM_{10} = 0.35 and $PM_{2.5}$ = 0.053).

Equation has an "A" Confidence Rating, being rated by the US EPA AP42 as being excellent, with the factor developed from A or B rated source test data from a variety of industries.

Further, and in addition to actual sampled and calculated emission rates, to account for wind erosion impacts on stockpiles and open areas, use was made of the Australian NPI Mining Section 1.1.18: Wind Erosion from Active Stockpiles, adopted from the US EPA AP42. As recommended by the NPI, and in the absence of detailed data, an emission factor of 0.4 kg/ha be applied to calculate wind erosion from active stockpiles, with the US EPA estimating that 50% of TSP will comprise PM_{10}. Given a $PM_{2.5}$ ratio is not available, it was conservatively assumed that 50% of PM_{10} will comprise $PM_{2.5}$. **Table 3-13** presents each individual area sources' dimensions.

Table 3-13: Area source dimensions

Source Description	Height (m)	Length (m)	Width (m)	Diameter (m)
Corex slag dump	30	208	352	-
Conarc slag dump	30	208	352	-
9000t iron ore stockpile	5	62	55	-
Briquetting plant	4.3	22	12	-
VDD Coal Stockpile	20	132	24	-
Coal stockpile 1	20	137	24	-
Coal stockpile 2	20	127	24	-
VDD Coal Stockpile	20	123	24	-
Limestone stockpile	20	-	-	12
Coke (STP 20) stockpile	20	-	-	12
Limestone stockpile	20	-	-	12
Coke stockpile	20	115	24	-
Pellets stockpile	20	115	24	-
Pellets stockpile	20	115	24	-
Iron Ore stockpile	20	70	42	-
Iron Ore stockpile	20	70	42	-
Dolomite stockpile	20	24	24	-
Dolomite stockpile	20	24	24	-
Coke (STP 17) stockpile	20	-	-	12
Coke stockpile	20	-	-	12
Limestone stockpile	20	70	24	-
DRI stockpile	10	-	-	12
Coke Chinese stockpile	10	207	24	-
Limestone stockpile	10	-	-	12
DRI stockpile	10	-	-	12
DRI stockpile	10	-	-	12
DRI/Pellet fines stockpile	10	-	-	12
Pellet (black) stockpile	10	-	-	12

Source Description	Height (m)	Length (m)	Width (m)	Diameter (m)
DRI Clusters stockpile	10	-	-	12
99% dolomite fines + 1% coal mix stockpile	10	-	-	12
Pellets stockpile	20	-	-	12
Coke Fines stockpile	10	-	-	12
Oxide waste stockpile	10	-	-	12
Caster Scale stockpile	10	-	-	12
Waste mix 10 stockpile	10	-	-	12
RHF scale stockpile	10	-	-	12
Screened Classifier Sands stockpile	10	-	-	12
Coke Chinese stockpile	20	-	-	12
Screened Shaft Cleaning mat stockpile	10	-	-	12
Screened RHF Scale stockpile	10	-	-	12
Classifier sand stockpile	10	-	-	12
Medium ore (6-12mm) stockpile	20	-	-	12
Iron ore fines (6-8mm) stockpile	10	-	-	12
Iron ore fines (red square) stockpile	10	-	-	12
Iron ore fines (red square) stockpile	10	-	-	12
Iron ore fines (6-8mm) stockpile	10	-	-	12
Iron ore fines (<6mm) stockpile	10	-	-	12

Figure 3-3: Saldanha Steel area source locations

Given the numerous stockpiles at Saldanha Steel, for the purposes of dispersion modelling, the above area sources were grouped into larger area sources, where appropriate, namely:

- Stockyard East
- Stockyard West
- Corex Slag Dump
- Conarc Slag Dump
- 9000 t iron ore stockpile
- Briquetting Plant
- Stockyard Extension (*importantly, since the stockyard extension is not routinely used for stockpiling of materials, all stockpiles were assumed to occur within the east and west stockyards. Given this, only wind erosion was applied to the Stockyard Extension to account for the exposed surface*).
- Laydown Area (*since use of this area is ad hoc, when required, and generally remains empty, although with exposed surfaces, only wind erosion is applied to the area*).

Table 3-14 presents the emission rates for the area sources at Saldanha Steel, inclusive of both materials handling and wind erosion, where applicable.

Table 3-14: Area source emission rates

Source Description	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
Stockyard East[1]	2.95E-01	1.45E-01	5.86E-02	9.30	4.58	1.85
Stockyard West[1]	2.95E-01	1.45E-01	5.86E-02	9.30	4.58	1.85
Corex Slag Dump[1]	8.59E-01	4.28E-01	2.07E-01	27.07	13.50	6.52
Conarc Slag Dump[1]	8.44E-01	4.21E-01	2.06E-01	26.60	13.27	6.48
9000t Iron Ore Stockpile[2]	9.18E-02	4.44E-02	1.33E-02	2.89	1.40	0.42
Briquetting Plant[2]	2.28E-02	1.09E-02	2.16E-03	0.72	0.34	0.07
Stockyard Extension[2]	6.60E-01	3.30E-01	1.65E-01	20.83	10.41	5.21
Laydown Area[2]	1.16E-01	5.78E-02	2.89E-02	3.65	1.82	0.91

Source Description	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
[1] Based on actual, sampled emission rates (ECOSERV, 2007) [2] Based on calculated emission rates						

Line Sources - Conveyors

Saldanha Steel operations require the use of various conveyor systems onsite, with only partially enclosed conveyors considered in this AIR i.e., underground or fully enclosed conveyors were excluded given they will not contribute to emissions. To remain environmentally conservative, it was assumed that all raw materials are handled by conveyors, although importantly this cannot occur simultaneously. To calculate emission rates associated with materials handling by conveyors, use was made of the US EPA AP42 emission factor equation extracted from Section 13.2.4 Aggregate Handling and Storage Piles, as presented below:

$$E = k(0.016)\frac{\left(\frac{u}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \qquad (3)$$

Where: u is the mean wind speed (3.8 m/s from Langebaan Weg station), M is the material moisture content (%, as per US EPA AP42 Table 13.2.4-1) and k is the particle size multiplier (TSP = 0.74, PM_{10} = 0.35 and $PM_{2.5}$ = 0.053).

Equation has an “A” Confidence Rating, being rated by the US EPA AP42 as being excellent, with the factor developed from A or B rated source test data from a variety of industries.

Given all conveyors considered in this assessment are partially enclosed, it was assumed emissions would be controlled, with a 50% control efficiency applied to these conveyors. Of these conveyors, a further four contain longitudinal sprayers to further control dust emissions, with a control efficiency of 70% applied to these.

Table 3-15 presents the control efficiencies applied to the conveyors, while **Table 3-16** presents the calculated emission rates.

Figure 3-4: Saldanha Steel conveyors

Table 3-15: Conveyor control efficiencies

Source Description	Control Description	Control Efficiency (%)
Conveyor CV101	Partially enclosed conveyor	50%
Conveyor CV102	Partially enclosed, with longitudinal sprayers	70%
Conveyor CV103	Partially enclosed, with longitudinal sprayers	70%
Conveyor CV105	Partially enclosed, with longitudinal sprayers	70%
Conveyor CV107	Partially enclosed conveyor	50%
Conveyor CV108	Partially enclosed conveyor	50%
Conveyor CV112	Partially enclosed, with longitudinal sprayers	70%
Conveyor 143F01	Partially enclosed conveyor	50%
Conveyor 145F11	Partially enclosed conveyor	50%
Conveyor 145F01	Partially enclosed conveyor	50%
Conveyor 147F01	Partially enclosed conveyor	50%
Conveyor 236F01	Partially enclosed conveyor	50%
Conveyor 221F01	Partially enclosed conveyor	50%
Conveyor 521F52/1	Partially enclosed conveyor	50%
Conveyor 521F52	Partially enclosed conveyor	50%

Table 3-16: Conveyor emission rates

Source Description	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
Conveyor CV101	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor CV102	4.03E-02	1.91E-02	2.89E-03	1.27	0.60	0.09
Conveyor CV103	4.03E-02	1.91E-02	2.89E-03	1.27	0.60	0.09
Conveyor CV105	4.03E-02	1.91E-02	2.89E-03	1.27	0.60	0.09
Conveyor CV107	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor CV108	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor CV112	4.03E-02	1.91E-02	2.89E-03	1.27	0.60	0.09
Conveyor 143F01	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor 145F11	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor 145F01	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor 147F01	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor 236F01	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15

Source Description	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
Conveyor 221F01	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor 521F52/1	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15
Conveyor 521F52	6.72E-02	3.18E-02	4.81E-03	2.12	1.00	0.15

Line Sources – Roads

The Saldanha Steel facility makes use of a road network, as illustrated in **Figure 3-5**, predominantly for the export of final product from site, however, in some cases for the delivery of raw materials to site, for e.g., coke. Key, paved roads comprise the main onsite truck route and the haul road to the TPT port terminal. The truck entrance to the weighbridge is the only unpaved road onsite.

PM emissions generated from vehicles travelling on paved roads were calculated using the US EPA's AP42 Section 13.2.1 Paved Roads equation. The equation quantifies particulate matter emissions from the resuspension of loose material on the road surface due to vehicle travel on a dry paved road:

$$E = k(sL)^{0.91} \times (W)^{1.02} \qquad g/VKT \qquad (4)$$

Where E = particulate emission factor

k = particle size multiplier for particle size range

sL = road surface silt loading (g/m^2)

W = average weight (tons) of vehicles traveling on the road

This emission factor relates the amount of particulate emissions (in grams) to the number of kilometres travelled by vehicles on site (VKT). An average vehicle weight of 23 tons (8 tons unloaded and 38 tons loaded) was utilised in the equation. **Table 3-17** presents the paved road specifications, while **Table 3-18** presents calculated paved road emission rates.

Figure 3-5: Saldanha Steel main roads

Table 3-17: Paved road specifications

Paved Road Name	Length (m)	Vehicles / Year	Vehicles / Day	Trips / Day	Total VKT / Day	Total VKT / Year
Main Onsite Road	2,501	7,750	21	42	106	38,758
Haul Road (to Terminal)	3,219	33,250	91	182	586	214,064

Table 3-18: Paved road emission rates

Source Description	TSP Emission Rate (g/m/s)	PM_{10} Emission Rate (g/m/s)	PM_{10} Emission Rate (g/m/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	PM_{10} Emission Rate (t/a)
Main Onsite Road	2.44E-05	4.69E-06	1.13E-06	1.93	0.37	0.09
Haul Road (to Terminal)	1.05E-04	2.01E-05	4.87E-06	10.64	2.04	0.49

PM emissions generated from vehicles travelling on unpaved roads (the truck entrance) were calculated using the US EPA's AP42 Section 13.2.2 Unpaved Roads equation. The equation quantifies particulate matter emissions from the resuspension of loose material on the road surface due to vehicle travel on unpaved roads. The unpaved truck entrance road receives a chemical suppressant frequently, with observations onsite confirming the effectiveness of this suppression. Given this, the emissions from the unpaved road were calculated with a 90% control efficiency.

$$E = k(\frac{S}{12})^a \, (\frac{W}{3})^b \quad x\, 281.9 \quad g/VKT \tag{5}$$

Where E = particulate emission factor

k = particle size multiplier for particle size range

S = road surface silt loading (%)

W = average weight (tons) of vehicles traveling on the road

This emission factor relates the amount of particulate emissions (in grams) to the number of kilometres travelled by vehicles on site (VKT). An average vehicle weight of 23 tons (8 tons unloaded and 38 tons loaded) was utilised in the equation. **Table 3-19** presents the unpaved road specifications, while **Table 3-20** presents calculated unpaved road emission rates.

Table 3-19: Unpaved road specifications

Unpaved Road Name	Length (m)	Vehicles / Year	Vehicles / Day	Trips / Day	Total VKT / Day	Total VKT / Year
Truck Entrance (to weighbridge)	1,036	4,000	11	22	23	8,285

Table 3-20: Unpaved road emission rates

Source Description	TSP Emission	PM_{10} Emission	$PM_{2.5}$ Emission	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)

	Rate (g/m/s)	Rate (g/m/s)	Rate (g/m/s)			
Truck Entrance (to weighbridge)	1.08E-05	1.81E-06	1.81E-07	0.35	0.06	0.01

PM emissions generated by vehicle exhausts were calculated using the Australian NPI Emission Estimation Manual for Combustion Engines v.3.0, Appendix B, Table 21: Emission Factors for Diesel Vehicle Exhausts14. This emission factor (kg/m^3) relates the amount of PM_{10} (kg) or $PM_{2.5}$ (kg) emissions per m^3 diesel combusted in a vehicle engine. As confirmed by Saldanha Steel, it was assumed that fuel consumption was 25 L / 100 km for all diesel trucks. Further, since the split of diesel consumption between roads is unknown, exhaust related emissions were calculated across all roads modelled, as presented in the above Paved and Unpaved Road calculations. Based on the NPI Emission Estimation Manual, it is estimated that:

- 1.8 kg of PM_{10} is released per m^3 diesel combusted.
- 1.7 kg of $PM_{2.5}$ is released per m^3 diesel combusted.

Table 3-21 presents the vehicle exhaust emission specifications, while **Table 3-22** presents calculated vehicle exhaust emission rates.

Table 3-21: Vehicle exhaust emission specifications

Description	Total VKT / Year	Diesel Consumption Rate (per 100 km)	Total Diesel Consumed (L / year)
All Roads (Paved & Unpaved)	261,106	25	65,277

Table 3-22: Vehicle exhaust emission rates

Description	TSP Emission Rate (g/m/s)	PM_{10} Emission Rate (g/m/s)	$PM_{2.5}$ Emission Rate (g/m/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
All Roads (Paved & Unpaved)	-*	5.52E-07	5.21E-07	-*	0.12	0.11
*Since the NPI Emission Estimation does not provide a TSP emission factor, TSP could not be calculated for vehicle exhaust emissions.						

Existing Source Dust Apportionment

Table 3-23 presents the total emissions for each group of sources, as well as the contribution of these sources to overall emissions, while **Figure 3-6, Figure 3-7** and **Figure 3-8** illustrates TSP, PM_{10} and $PM_{2.5}$ source contributions, respectively. The largest source of emissions at Saldanha Steel are the volume sources, contributing 72% of total TSP emissions, 73% of total PM_{10} emissions and 70% of total $PM_{2.5}$ emissions. Within this group, the largest source is the Corex and Conarc building emissions due to the furnaces. The second largest contributor to

[14] Australian Government: National Pollutant Inventory (NPI), 2008: Emission Estimation Technique Manual for Combustion Engines Version 3.0, Appendix B, Table 21: Emission factors (kg/m^3) for diesel vehicle exhausts emissions (HGV)

emissions is the point source group, followed by the area sources, although these emissions constitute a small portion of total emissions when compared to contributions from volume sources.

Table 3-23: Source Contributions

Description	TSP Emissions (tpa)	TSP Source Contribution (%)	PM_{10} Emissions (tpa)	PM_{10} Source Contribution (%)	$PM_{2.5}$ Emissions (tpa)	$PM_{2.5}$ Source Contribution (%)
Point Source Emissions	127.3	7.7%	59.7	7.3%	36.6	9.8%
Volume Source Emissions	613.2	71.5%	304.2	72.8%	128.8	69.5%
Area Source Emissions	75.9	4.6%	37.7	4.6%	17.2	4.6%
Line Source Emissions	28.4	1.7%	13.4	1.6%	2.0	0.5%
Road Source Emissions (incl. Exhaust)	12.9	0.8%	2.6	0.3%	0.7	0.2%
TOTAL EMISSIONS	857.8	100%	417.6	100%	185.2	100%

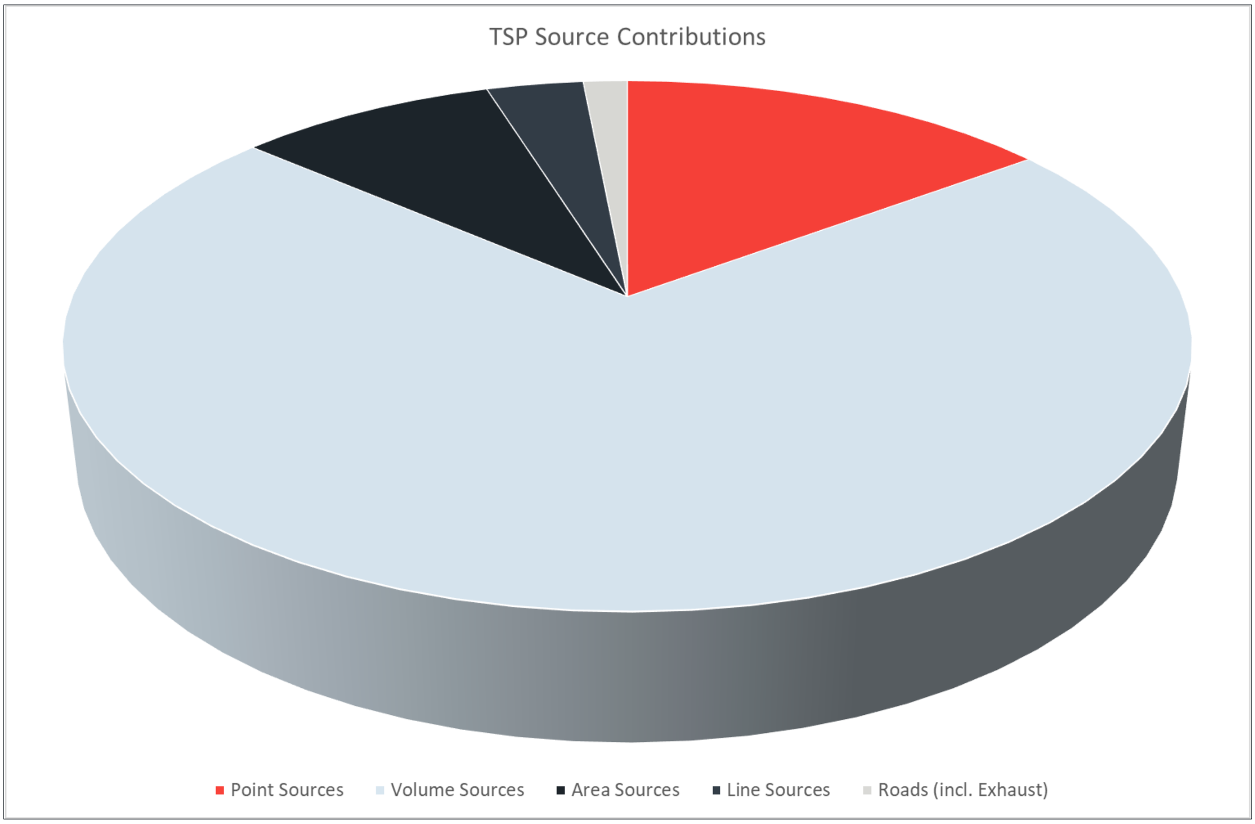


Figure 3-6: Saldanha Steel TSP Source Contributions

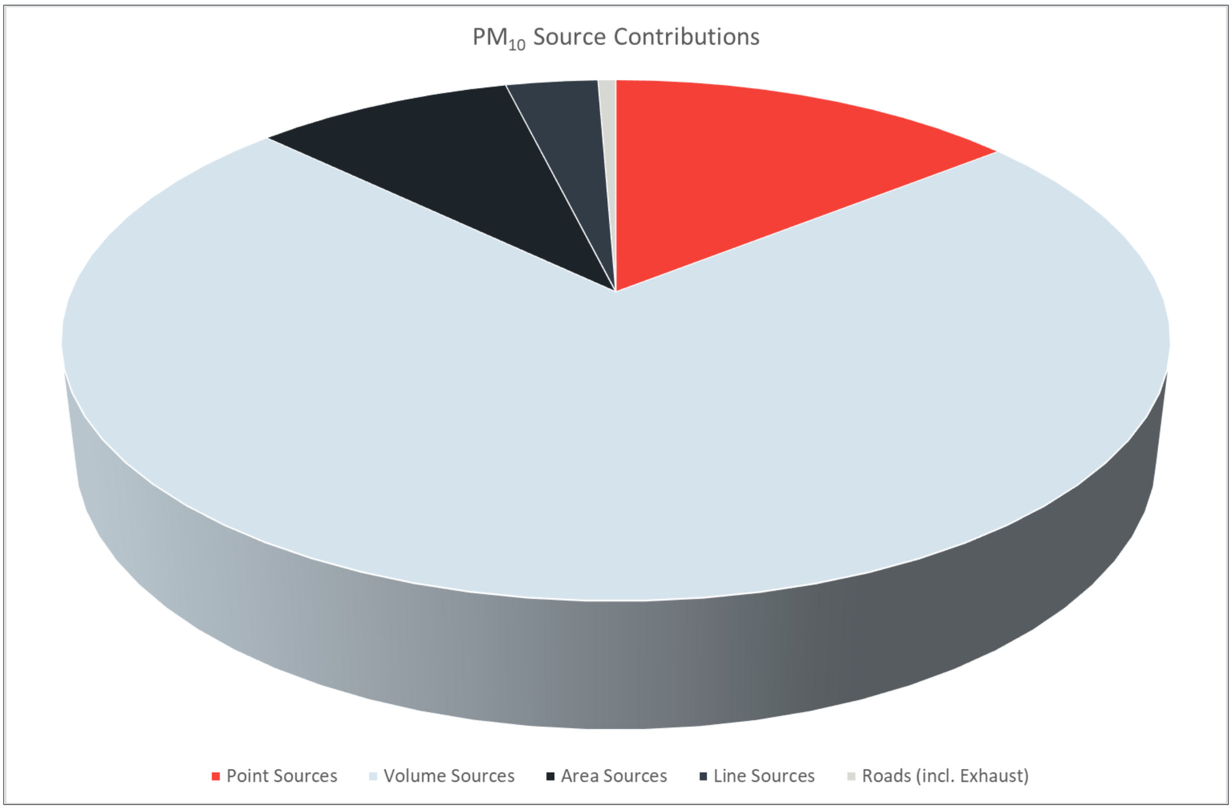


Figure 3-7: Saldanha Steel PM_{10} Source Contributions

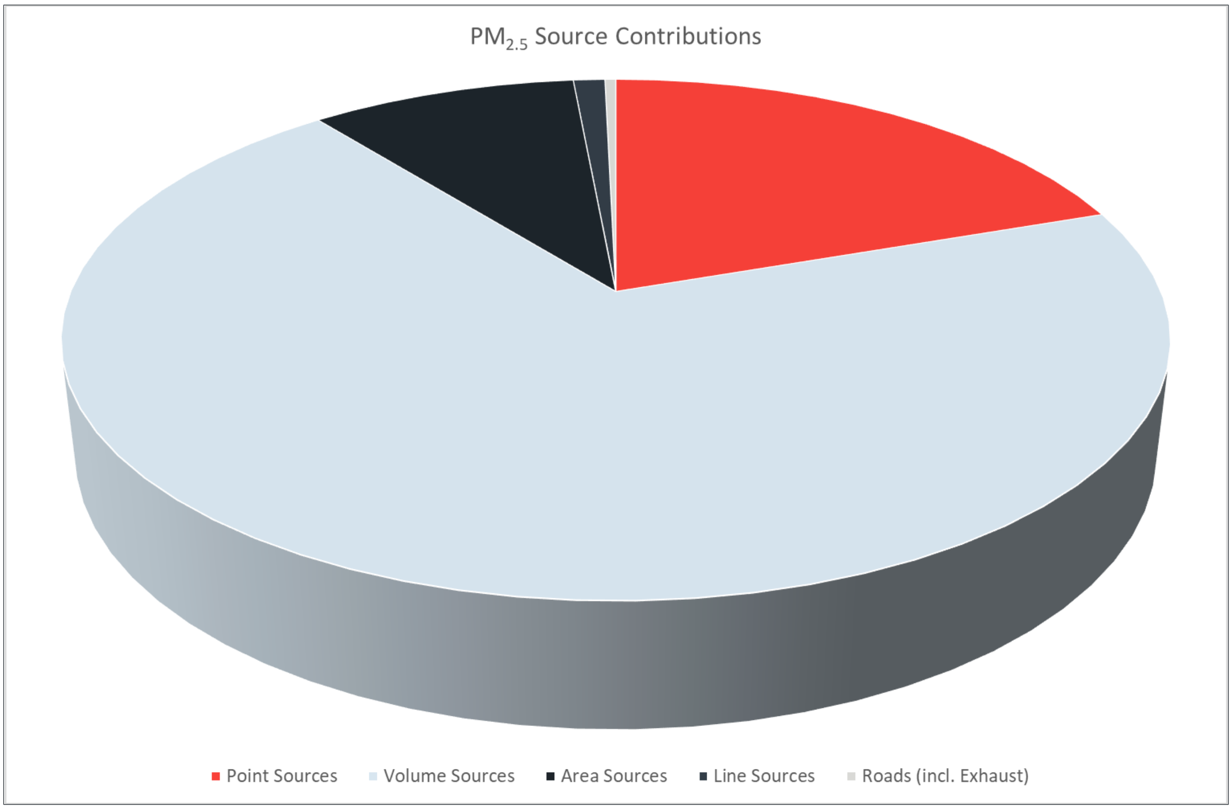


Figure 3-8: Saldanha Steel $PM_{2.5}$ Source Contributions

3.1.2 SCENARIO 2: LOGISTICS HUB OPERATIONS

Activity Data

The activity data proposed for the Logistics Hub is presented below.

Table 3-24: Unit processes

Unit process	Unit Process Function	Batch or Continuous Process
Rotary Tippler	Mn ore will enter Saldanha Steel via rail, through the rotary tippler where material will be wetted with chemical suppressants.	Batch
Conveyors	Mn ore will be transferred to the enclosed warehouse by conveyors, specifically CV111 and a new conveyor, and wetted by water sprayers along the conveyor line.	Batch
Transfer Station	Mn ore will be directed to conveyors via transfer station TS1, enclosed within a building.	Batch
Truck Offloading	Offloading of material commodities from haul trucks within an enclosed warehouse onto commodity stockpiles. Material stockpiles are wetted by water sprayers.	Batch
Material handling	Front-end loader stockpile management and material movement within an enclosed warehouse.	Batch
Truck Loading	The use of front-end loaders to load material commodities within the warehouse from stockpiles onto haul trucks.	Batch

Table 3-25: Hours of Operation

Unit process	Operating Hours	Days of Operation / Year
Rotary Tippler	00h00 – 24h00	365
Conveyors	00h00 – 24h00	365
Transfer Station	00h00 – 24h00	365
Truck Offloading	00h00 – 24h00	365
Material Handling	00h00 – 24h00	365
Truck Loading	00h00 – 24h00	365

Table 3-26: Raw Materials Handled

Raw Material Type	Maximum Permitted Handling Rate (Quantity)	Units (quantity / period)
Regulated Raw Materials*		
Manganese Ore	4,000,000	Tons/annum
Phosphate Concentrate	1,200,000	Tons/annum
Garnet Sands	500,000	Tons/annum
Zircon Sands	500,000	Tons/annum
Lead Concentrate	250,000	Tons/annum

Copper Concentrate	250,000	Tons/annum
Zinc Concentrate	250,000	Tons/annum
Non-Regulated Raw Materials*		
N/A	N/A	N/A
*Regulated raw materials refers to those materials when increased or decreased may result in the change of air emissions output. *Non-regulated raw materials refer to those materials when increased or decreased may not result in any change of air emissions output.		

Table 3-27: Production Rates

Product Name	Maximum Permitted Production Capacity (Quantity)	Units (quantity / period)
N/A	N/A	N/A
Logistics Hub will not be producing any product, therefore production rate not applicable.		

Table 3-28: By-Products

By-Product Name	Maximum Permitted Production Capacity (Quantity)	Design Production Capacity (Quantity)	Actual Production Capacity (Quantity)	Units (quantity / period)
N/A	N/A	N/A	N/A	N/A
The Logistics Hub will not produce any By-Products, therefore not applicable.				

Table 3-29: Materials used in energy sources

Materials for Energy Source	Actual Consumption Rate (Quantity)	Units (quantity / period)	Material Characteristics
N/A	N/A	N/A	N/A
The operation of the Logistics Hub will not require additional sources of energy, other than what is already provided by AMSA (electricity).			

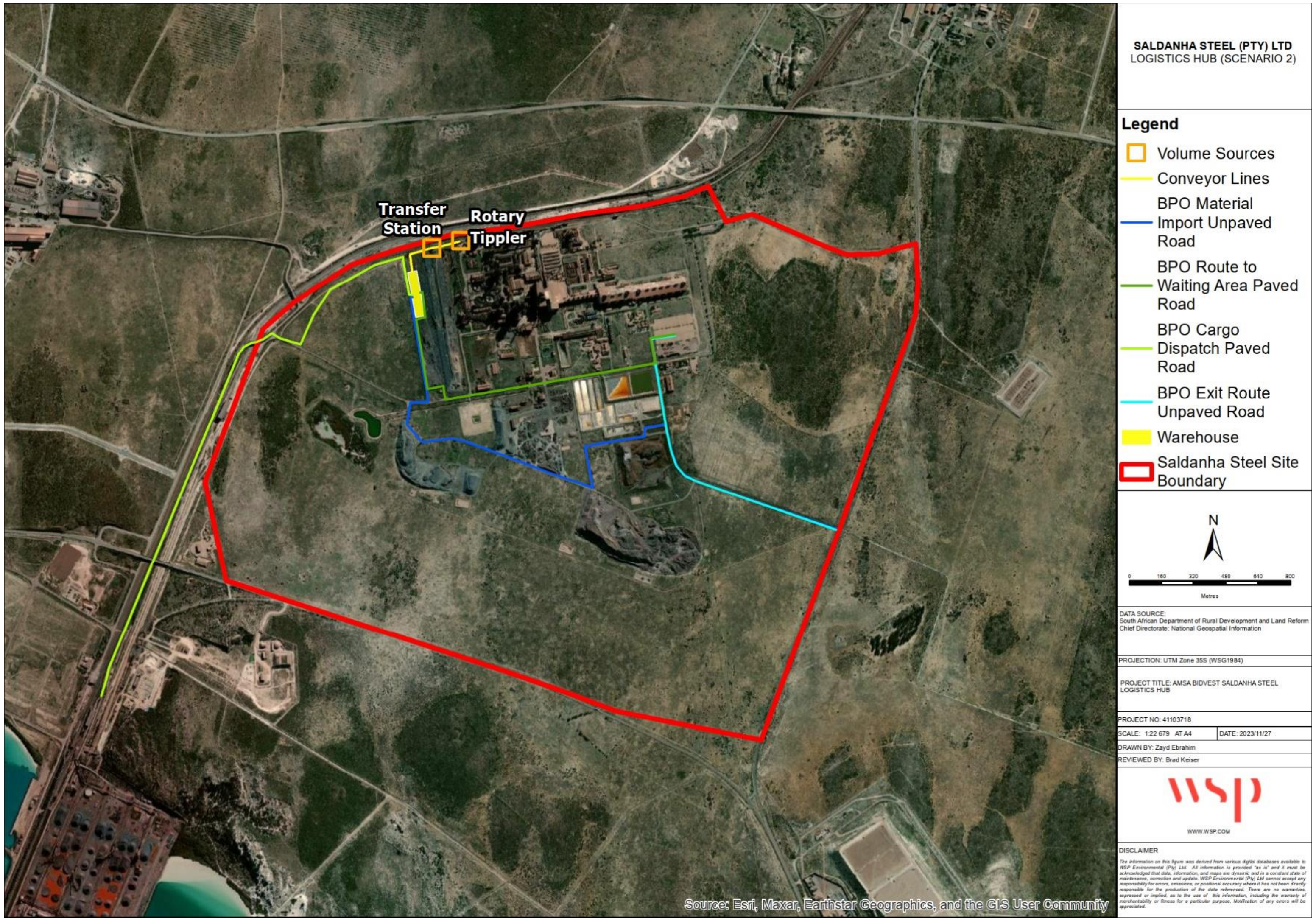


Figure 3-9: Logistics Hub source layout

Volume Sources

Operations at the Logistics Hub will include volume sources related to the handling of bulk material commodities. Emission rates, due to materials handling, were calculated using US EPA AP42 emission factors. To estimate emissions from materials handling related volume sources, use was made of the US EPA AP42 emission factor equation extracted from Section 13.2.4 Aggregate Handling and Storage Piles, as presented below:

$$E = k(0.016)\frac{\left(\frac{u}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \qquad (6)$$

Where: u is the mean wind speed (3.8 m/s from Langebaan Weg station), M is the material moisture content (5.4%, as per US EPA AP42 Table 13.2.4-1) and k is the particle size multiplier (TSP = 0.74, PM_{10} = 0.35 and $PM_{2.5}$ = 0.053).

Equation has an "A" Confidence Rating, being rated by the US EPA AP42 as being excellent, with the factor developed from A or B rated source test data from a variety of industries.

To account for control of emissions by structures and/or sprayers, certain control efficiencies were applied to the volume sources. **Table 3-30** presents the dust control efficiencies applied and **Table 3-31** presents the calculated, controlled emission rates. **Table 3-32** presents the Mn controlled emission rates.

Table 3-30: Material handling volume source control efficiencies

Source Description	Control Description	Control Efficiency (%)
Transfer Station 1	Housed within structure, chemical additive from Rotary Tippler	98%
Rotary Tippler	Housed within building, extraction system, chemical additive sprayers and strip curtain	98%
Warehouse	Enclosed structure, chemical additive from Rotary Tippler, water sprayers from New Conveyor, water sprayers	98%

Table 3-31: Material handling volume source emission rates (controlled)

Source Description	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
Transfer Station 1	7.61E-04	3.60E-04	5.45E-05	2.40E-02	1.13E-02	1.72E-03
Rotary Tippler	7.61E-04	3.60E-04	5.45E-05	2.40E-02	1.13E-02	1.72E-03
Warehouse	4.17E-03	1.46E-03	2.13E-04	1.32E-01	4.61E-02	6.71E-03

Table 3-32: Material handling volume source Mn emission rates (controlled)

Source Description	Mn_{10} Emission Rate (g/s)	Mn_{10} Emission Rate (t/a)
Transfer Station 1	3.60E-04	1.13E-02
Rotary Tippler	3.60E-04	1.13E-02
Warehouse	1.29E-03	4.06E-02

Line Sources - Conveyors

The proposed Logistics Hub will require the use of existing and proposed conveyor systems onsite (CV111 and one new conveyor), with only partially enclosed conveyors considered in this AIR i.e., underground or fully enclosed conveyors were excluded given they will not contribute to emissions. To calculate emission rates associated with materials handling by conveyors, use was made of the US EPA AP42 emission factor equation extracted from Section 13.2.4 Aggregate Handling and Storage Piles, as presented below:

$$E = k(0.016)\frac{\left(\frac{u}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \qquad (8)$$

Where: u is the mean wind speed (3.8 m/s from Langebaan Weg station), M is the material moisture content (%, as per US EPA AP42 Table 13.2.4-1) and k is the particle size multiplier (TSP = 0.74, PM_{10} = 0.35 and $PM_{2.5}$ = 0.053).

Equation has an "A" Confidence Rating, being rated by the US EPA AP42 as being excellent, with the factor developed from A or B rated source test data from a variety of industries.

Given all conveyors considered in this assessment are partially enclosed, it was assumed emissions would be controlled, with a 50% control efficiency applied to these conveyors. Additionally, these conveyors will have sprayers further controlling dust, with final control efficiencies applied to each conveyor detailed in **Table 3-33**. **Table 3-34** presents calculated emission rates for each conveyor.

Table 3-33: Conveyor control efficiencies

Source Description	Control Description	Control Efficiency (%)
Conveyor CV111	Underground conveyor, therefore excluded from assessment	100%
New Conveyor	Partially enclosed, with longitudinal water sprayers	70%

Table 3-34: Conveyor emission rates (controlled)

Source Description	TSP Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
New Conveyor	2.28E-02	1.08E-02	1.63E-03	7.20E-01	3.40E-01	5.16E-02

Table 3-35: Conveyor Mn emission rates (controlled)

Source Description	Mn_{10} Emission Rate (g/s)	Mn_{10} Emission Rate (t/a)
New Conveyor	1.08E-02	3.40E-01

Line Sources – Roads

The proposed Logistics Hub will make use of the existing road network for the export of material commodities from site to the terminal. 50% of the total Mn ore delivered and all other bulk material commodities delivered to the Logistics Hub will be via the existing truck entrance road and weighbridge. Importantly, once the export trucks have been loaded with bulk material within the warehouse, all truck bins will be covered with heavy-duty tarpaulin covers to ensure no dust emissions will occur from the truck bins during transit to the terminal.

Key, paved roads will comprise the onsite paved road route for vehicles to the waiting area, and the paved haul road route to export bulk material commodities to the terminal. PM emissions generated from vehicles travelling on paved roads were calculated using the US EPA's AP42 Section 13.2.1 Paved Roads equation. The equation quantifies particulate matter emissions from the resuspension of loose material on the road surface due to vehicle travel on a dry paved road:

$$E = k(sL)^{0.91} \times (W)^{1.02} \qquad g/VKT \tag{9}$$

Where E = particulate emission factor

k = particle size multiplier for particle size range

sL = road surface silt loading (g/m²)

W = average weight (tons) of vehicles traveling on the road

This emission factor relates the amount of particulate emissions (in grams) to the number of kilometres travelled by vehicles (VKT). An average vehicle weight of 50 tons (Delivery Trucks: 54 t loaded, 20 t empty; and Export Trucks: 98 t loaded, 29 t empty) was applied where both types of vehicles are active on the same route. **Table 3-36** presents the paved road specifications, while **Table 3-37** presents calculated paved road emission rates.

Table 3-36: Paved road specifications

Paved Road Name	Length (m)	Trips / Day	Total VKT / Day	Total VKT / Year
Onsite Roads – Haul truck to waiting area	1,989	439	1,747	637,915
Haul Road to Terminal	3,109	199	617	225,290

Table 3-37: Paved road emission rates

Source Description	TSP Emission Rate (g/m²/s)	PM_{10} Emission Rate (g/m²/s)	$PM_{2.5}$ Emission Rate (g/m²/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
Onsite Roads – Haul truck to waiting area	2.23E-05	4.31E-06	1.06E-06	1.40E+01	2.70E+00	6.63E-01
Haul Road to Terminal	1.00E-5	1.94E-06	4.86E-07	9.81E+00	1.19E+00	4.77E-01

PM emissions generated from vehicles travelling on unpaved roads (truck entrance and stockyard road) were calculated using the US EPA's AP42 Section 13.2.2 Unpaved Roads equation. The equation quantifies particulate matter emissions from the resuspension of loose material on the road surface due to vehicle travel on unpaved roads. The unpaved truck entrance road receives a chemical suppressant frequently, with it planned that the unpaved stockyard truck road will receive the same chemical suppressant. Given this, the emissions from unpaved roads were calculated with a 90% control efficiency.

$$E = k(\frac{S}{12})^a \, (\frac{W}{3})^b \;\; x \, 281.9 \quad g/VKT \qquad (10)$$

Where E = particulate emission factor

k = particle size multiplier for particle size range

S = road surface silt loading (%)

W = average weight (tons) of vehicles traveling on the road

This emission factor relates the amount of particulate emissions (in grams) to the number of kilometres travelled by vehicles on site (VKT). An average vehicle weight of 50 tons (Delivery Trucks: 54 t loaded, 20 t empty; and Export Trucks: 98 t loaded, 29 t empty) was applied. **Table 3-38** presents the unpaved road specifications, while **Table 3-39** presents calculated unpaved road emission rates.

Table 3-38: Unpaved road specifications

Unpaved Road Name	Length (m)	Trips / Day	Total VKT / Day	Total VKT / Year
Truck Entrance (to warehouse)	3,481	241	838	305,970
Truck Road Exit	1,630	241	393	143,272

Table 3-39: Unpaved road emission rates

Source Description	TSP Emission Rate (g/m²/s)	PM_{10} Emission Rate (g/m²/s)	$PM_{2.5}$ Emission Rate (g/m²/s)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
Truck Entrance (to warehouse)	6.04E-05	9.70E-06	1.02E-06	6.63E+01	1.06E+01	1.12E+00
Truck Road Exit	2.39E-05	4.54E-06	4.80E-07	2.34E+01	2.33E+00	2.47E-01

PM emissions generated by vehicle exhausts were calculated using the Australian NPI Emission Estimation Manual for Combustion Engines v.3.0, Appendix B, Table 21: Emission Factors for Diesel Vehicle Exhausts[15]. This emission factor (kg/m^3) relates the amount of PM_{10} (kg) or $PM_{2.5}$ (kg) emissions per m^3 diesel combusted in a vehicle engine. As confirmed by BPO, it was assumed that fuel consumption was an average of 35 L / 100 km (45 L / 100 km loaded, 25 L / 100 km unloaded) for all diesel trucks. Further, since the split of diesel consumption between roads is unknown, exhaust related emissions were calculated across all roads modelled, as presented in the above Paved and Unpaved Road calculations. Based on the NPI Emission Estimation Manual, it is estimated that:

- 1.8 kg of PM_{10} is released per m^3 diesel combusted.
- 1.7 kg of $PM_{2.5}$ is released per m^3 diesel combusted.

[15] Australian Government: National Pollutant Inventory (NPI), 2008: Emission Estimation Technique Manual for Combustion Engines Version 3.0, Appendix B, Table 21: Emission factors (kg/m^3) for diesel vehicle exhausts emissions (HGV)

Table 3-40 presents the vehicle exhaust emission specifications, while **Table 3-40** presents calculated vehicle exhaust emission rates.

Table 3-40: Vehicle exhaust emission specifications

Description	Total VKT / Year	Diesel Consumption Rate (per 100km)	Total Diesel Consumed (L / year)
All Roads (Paved & Unpaved)	1,312,447	35	328,112

Table 3-41: Vehicle exhaust emission rates

Description	TSP Emission Rate ($g/m^2/s$)	PM_{10} Emission Rate ($g/m^2/s$)	$PM_{2.5}$ Emission Rate ($g/m^2/s$)	TSP Emission Rate (t/a)	PM_{10} Emission Rate (t/a)	$PM_{2.5}$ Emission Rate (t/a)
All Roads (Paved & Unpaved)	-*	1.22E-07	1.12E-07	-*	3.94E-01	3.61E-01
*Since the NPI Emission Estimation does not provide a TSP emission factor, TSP could not be calculated for vehicle exhaust emissions.						

Source Apportionment

Table 3-42 presents the total emissions for each group of sources, as well as the contribution f these sources to overall emissions associated with the proposed Logistics Hub, while **Figure 3-10, Figure 3-11** and **Figure 3-12** illustrate TSP, PM_{10} and $PM_{2.5}$ source contributions, respectively. The largest source of emissions associated with the Logistics Hub operations are road emissions (including vehicle exhaust emissions), contributing 99% of total TSP emissions, 98% of total PM_{10} emissions and 98% of total $PM_{2.5}$ emissions. The second largest contributor to emissions is the line sources (conveyors), although these emissions remain relatively low and constitute a small portion of total emissions. The road emissions contribute the largest portion of emissions estimated as the Logistics Hub activities will occur within an enclosed warehouse, therefore these contributions remain extremely low.

Table 3-42: Source Contributions

Description	TSP Emissions (tpa)	TSP Source Contribution (%)	PM_{10} Emissions (tpa)	PM_{10} Source Contribution (%)	$PM_{2.5}$ Emissions (tpa)	$PM_{2.5}$ Source Contribution (%)
Volume Sources	0.18	0.2%	0.07	0.3%	0.01	0.3%
Roads (incl. exhaust)	113.55	99.2%	20.05	98.0%	3.01	98.0%
Line Sources	0.72	0.6%	0.34	1.7%	0.05	1.7%
TOTAL EMISSIONS	**114.45**	**100.00%**	**20.46**	**100.00%**	**3.07**	**100.00%**

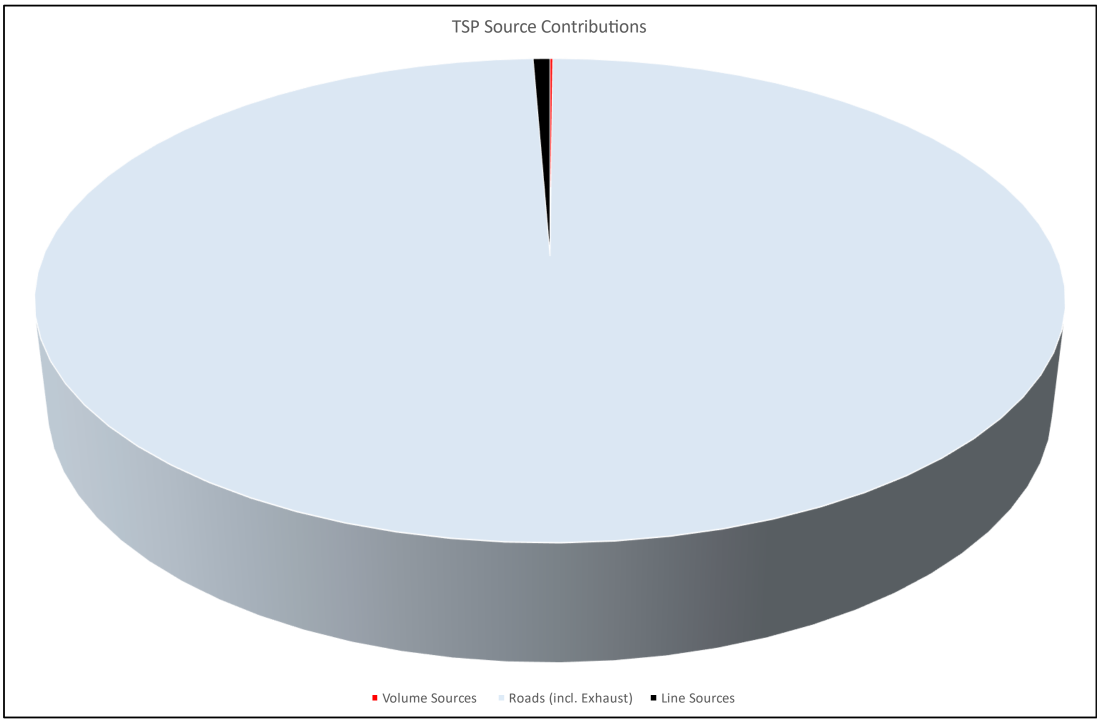


Figure 3-10: Proposed Logistics Hub TSP Source Contributions

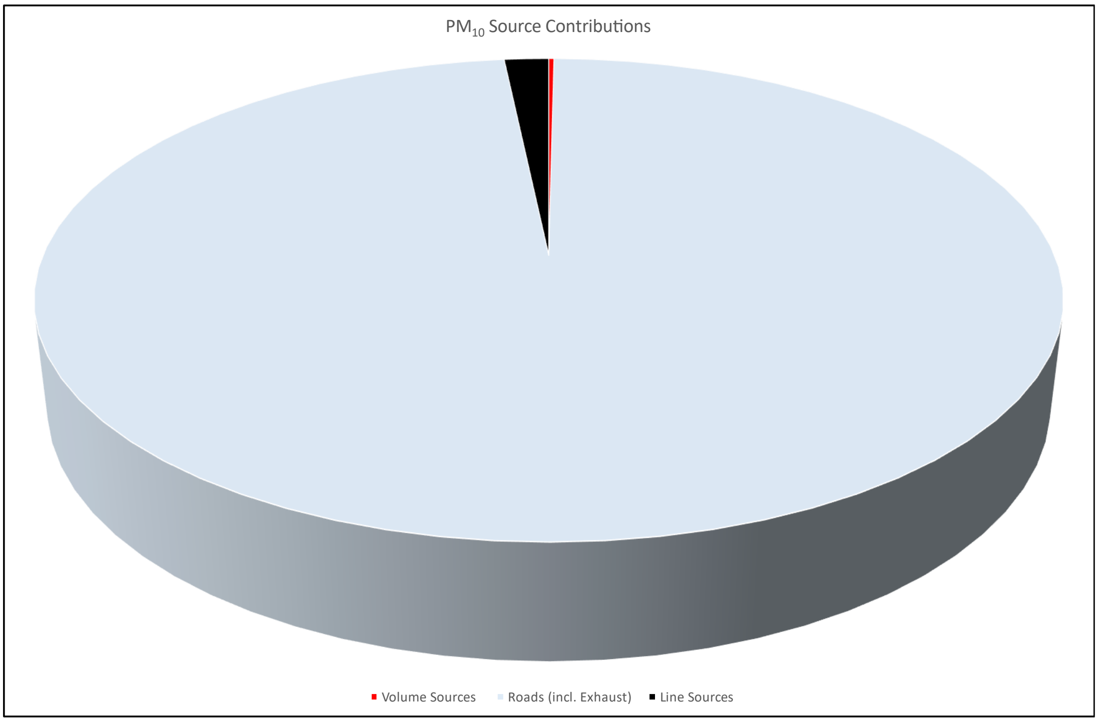


Figure 3-11: Proposed Logistics Hub PM_{10} Source Contributions

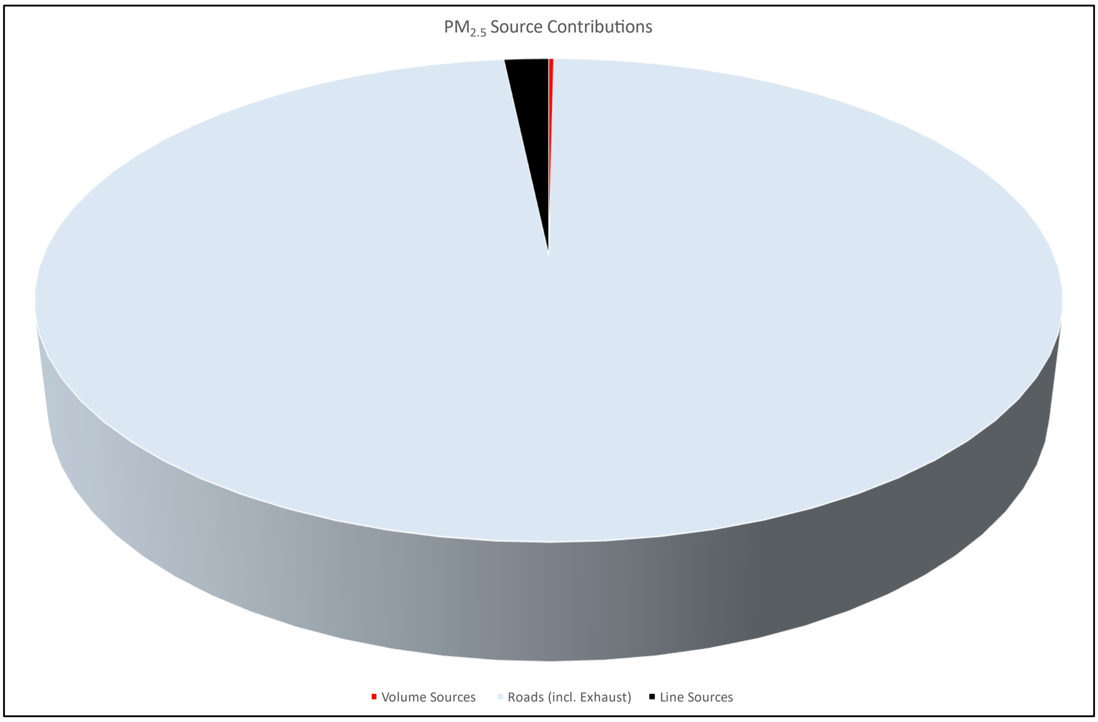


Figure 3-12: Proposed Logistics Hub $PM_{2.5}$ Source Contributions

3.1.3 SCENARIO 3: FUTURE CUMULATIVE OPERATIONS

Initially, the intention is only for the Logistics Hub (Scenario 2), to proceed, with Saldanha Steel remaining in C&M. However, in the future, and depending on market requirements, the start-up of the steelmaking process may be required. Under this scenario, both Saldanha Steel and the Logistics Hub will operate (Scenario 1 + Scenario 2), as detailed previously. **Table 3-43, Table 3-44** and **Table 3-45** present cumulative emissions (Scenario 1 + Scenario 2) for TSP, PM_{10} and $PM_{2.5}$, respectively. Should the Logistics Hub operate simultaneously with steelmaking, the overall TSP emissions are estimated to increase by 13.34%, PM_{10} emissions by 4.90% and $PM_{2.5}$ emissions by 1.66%.

Table 3-43: Cumulative TSP emissions

Source Description	Scenario 1 (AMSA) TSP Emission Rate (tpa)	Scenario 2 (Logistics Hub) TSP Emission Rate (tpa)	Cumulative TSP Emissions (tpa)	Emissions Increase (%)
Point Source Emissions	127.30	0.00	127.30	0.00%
Volume Source Emissions	613.20	0.30	613.50	0.05%
Area Source Emissions	75.90	0.00	75.90	0.00%
Line Source Emissions	28.40	0.72	29.12	2.54%
Road Source Emissions (incl. Exhaust)	12.90	113.55	126.45	880.23%
TOTAL EMISSIONS	**857.80**	**114.45**	**972.25**	**13.34%**

Table 3-44: Cumulative PM_{10} emissions

Source Description	Scenario 1 (AMSA) PM_{10} Emission Rate (tpa)	Scenario 2 (Logistics Hub) PM_{10} Emission Rate (tpa)	Cumulative PM_{10} Emissions (tpa)	Emissions Increase (%)
Point Source Emissions	59.70	0.00	59.70	0.00%
Volume Source Emissions	304.20	0.07	304.27	0.02%
Area Source Emissions	37.70	0.00	37.70	0.00%
Line Source Emissions	13.40	0.34	13.74	2.54%
Road Source Emissions (incl. Exhaust)	2.60	20.05	22.65	771.30%
TOTAL EMISSIONS	**417.60**	**20.46**	**438.06**	**4.90%**

Table 3-45: Cumulative $PM_{2.5}$ emissions

Source Description	Scenario 1 (AMSA) $PM_{2.5}$ Emission Rate (tpa)	Scenario 2 (Logistics Hub) $PM_{2.5}$ Emission Rate (tpa)	Cumulative $PM_{2.5}$ Emissions (tpa)	Emissions Increase (%)
Point Source Emissions	36.60	0.00	36.60	0.00%
Volume Source Emissions	128.80	0.01	128.81	0.01%
Area Source Emissions	17.20	0.00	17.20	0.00%
Line Source Emissions	2.00	0.05	2.05	2.58%
Road Source Emissions (incl. Exhaust)	0.70	3.01	3.71	429.63%
TOTAL EMISSIONS	**185.20**	**3.07**	**188.27**	**1.66%**

4 METEOROLOGICAL DATA

The climate experienced along the south-western coastline and adjacent interior of South Africa is controlled predominantly by subtropical high pressure, with temporary disruptions by low pressure cells or fronts. This high-pressure zone is located along 33°S latitude and is associated with strong divergence at the surface and convergence in the upper atmosphere (Tyson and Preston-Whyte, 2000[16]). **Figure 4-1** below shows the predominant macroscale atmospheric circulations over the subcontinent. Easterly waves and lows tend to be summer phenomena, while the westerly wave and lows tend to be autumn to spring phenomena.

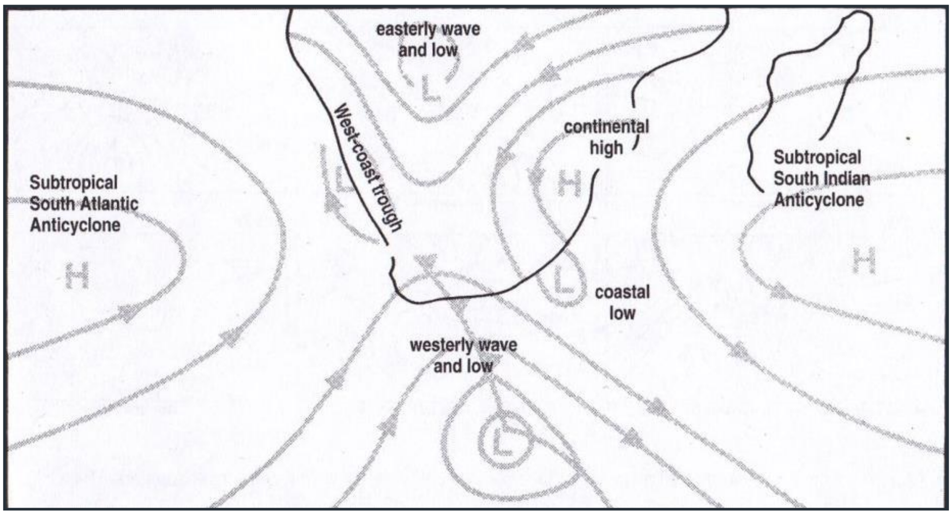


Figure 4-1: South African meteorological phenomena (Tyson & Preston-Whyte, 2000)

Rainfall falls predominantly in winter and spring over the south-western sector of the country due to the influence of westerly waves. Upper-level divergence and surface-level convergence occurs to the rear of a trough, which causes uplift and cloud formation resulting in precipitation. A surface trough over the west coast and an upper-tropospheric westerly atmospheric wave to the west of the continent can result in widespread rainfall over the western region. During summer, cold fronts associated with these westerly waves migrate further south and thus away from the coast of South Africa, limiting frontal rainfall in the region. While a warm ocean current and onshore winds promote summer rainfall along the east coast of south Africa, the cold Benguela ocean current along the west coast of South Africa limits evaporation off the ocean surface (Tyson and Preston-Whyte, 2000). Saldanha consequently has a semi-arid Mediterranean climate of warm dry summers and cool, wet winters.

Along the coastline, sea and land breeze circulations influence the diurnal wind profile. During the day, the land heats up more rapidly than the ocean surface, which has a higher heat capacity. The warmer air over the land rises causing a low pressure to develop. The cool air over the sea subsides and flows along the pressure gradient, causing a sea-land breeze to

[16] Tyson, P.D. & Preston-Whyte, R.A. (2000). *The Weather and Climate of Southern Africa*, 2nd Ed, Oxford University Press Southern Africa, Cape Town

develop. The converse is true for night-time conditions, where the air above the land cools due to a lack of insulation, while the air above the sea remains warm. A land-sea breeze will therefore prevail at night.

Since meteorological conditions affect how pollutants emitted into the air are directed, diluted and dispersed within the atmosphere, incorporation of reliable data to an air quality assessment is of the utmost importance. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the atmospheric mixing layer control the vertical component. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as the plume 'stretches'. Mechanical turbulence is influenced by wind speed, in combination with surface roughness.

4.1 SURFACE DATA

The hourly averaged wind fields for the study area were simulated using meteorological data from two surface stations; the South African Weather Services (SAWS) Langebaan station (January 2018 – December 2020) located approximately 12 km east of Saldanha Steel and the Saldanha Bay Municipality meteorological station (January 2018 – April 2020) located approximately 7.5 km west of Saldanha Steel. Station data statistics are provided in **Table 4-1** below. Notably, data was only available until April 2020 from the Saldanha Bay Municipality station. Data for the Vredenburg continuous monitoring station was also received, owned and managed by the Saldanha Bay Municipality, however, meteorological data was not available for the required period. **Figure 5-1**, in **Section 5**, illustrates the location of the meteorological stations relative to Saldanha Steel.

Table 4-1: Details of the surface meteorological stations in the Saldanha area

Station Name	Latitude (S)	Longitude (E)	Altitude (masl)	Data Recovery		
				Temperature	Rainfall	Wind
SAWS Langebaan	32.973084°	18.157616°	~33	99%	100%	100%
Saldanha Bay	33.001116°	17.944906°	~9	87%	0%	87%

4.1.1 WIND FIELD

Wind roses summarize wind speed and directional frequency at a location. Each directional branch on a wind rose represents wind originating from that direction, with each branch divided into segments of colour, representative of different wind speeds. Calm conditions are defined as wind speeds less than 0.5 m/s, although it is noted the SAWS wind sensor only records from 1 m/s.

Wind roses were developed using Lakes Environmental WRPlot Freeware (Version 8.0.2) for the full period (January 2018 – December 2020); diurnally for early morning (00h00 – 06h00), morning (06h00 – 12h00), afternoon (12h00 – 18h00) and night (18h00 – 00h00); and seasonally for summer (December, January and February), autumn (March, April and May), winter (June, July and August) and spring (September, October and November). Wind roses for the Langebaan and Saldanha Bay meteorological stations are presented in **Figure 4-2** and **Figure 4-3**, respectively. The following key items are highlighted:

- Calm conditions occurred 6.1% of the time at Langebaan and 0.3% of the time at Saldanha Bay.
- Predominant winds at both stations originated from the southwest, although an increase in winds originating from the north is observed at Langebaan. The frequency of east and west winds at both stations is extremely low.
- Fastest winds were measured at Langebaan, frequently exceeding 7.9 m/s, particularly from the south-southwest, southwest and north. Fastest winds at Saldanha Bay originated from the south-southwest, although seldom exceeding 7.9 m/s.
- Early morning winds (00h00 – 06h00) exhibited similar patterns at both stations, with winds predominantly originating from the southwest and south-southwest, with light to gentle breeze wind speeds, although an increase in speeds is observed at Langebaan originating from the north.
- Winds during the morning (06h00 – 12h00) and afternoon (12h00 – 18h00) predominantly originate from the south-southwest and southwest at both stations, with a larger component of winds from the north at Langebaan. Wind speeds increase when compared to morning hours, with winds frequently exceeding 7.9 m/s at Langebaan.
- Evening (18h00 – 24h00) winds exhibit similar patterns at both stations, with winds predominantly originating from the south-southwest, although fastest winds were measured at Langebaan, predominantly originating from the south-southwest.
- Summer winds predominantly originate from the south-southwest at both stations, as well as the southwest at Langebaan, with Langebaan wind speeds again substantially faster than those measured at Saldanha Bay, frequently exceeding 7.9 m/s.
- Autumn winds at both stations remain similar to those measured in summer, although with an increase in winds originating from the north at Langebaan.
- Winter winds show substantial changes at both stations, with winds predominantly originating from the north, south-southwest and southwest at Langebaan, and south-southwest, northeast and northwest at Saldanha Bay. Fastest winds occurred most frequently at Langebaan, originating from the north, frequently exceeding 7.9 m/s.
- Patterns in spring return to the summer and autumn patterns at both stations, with winds predominantly from the south-southwest, with Langebaan again measuring fastest winds.

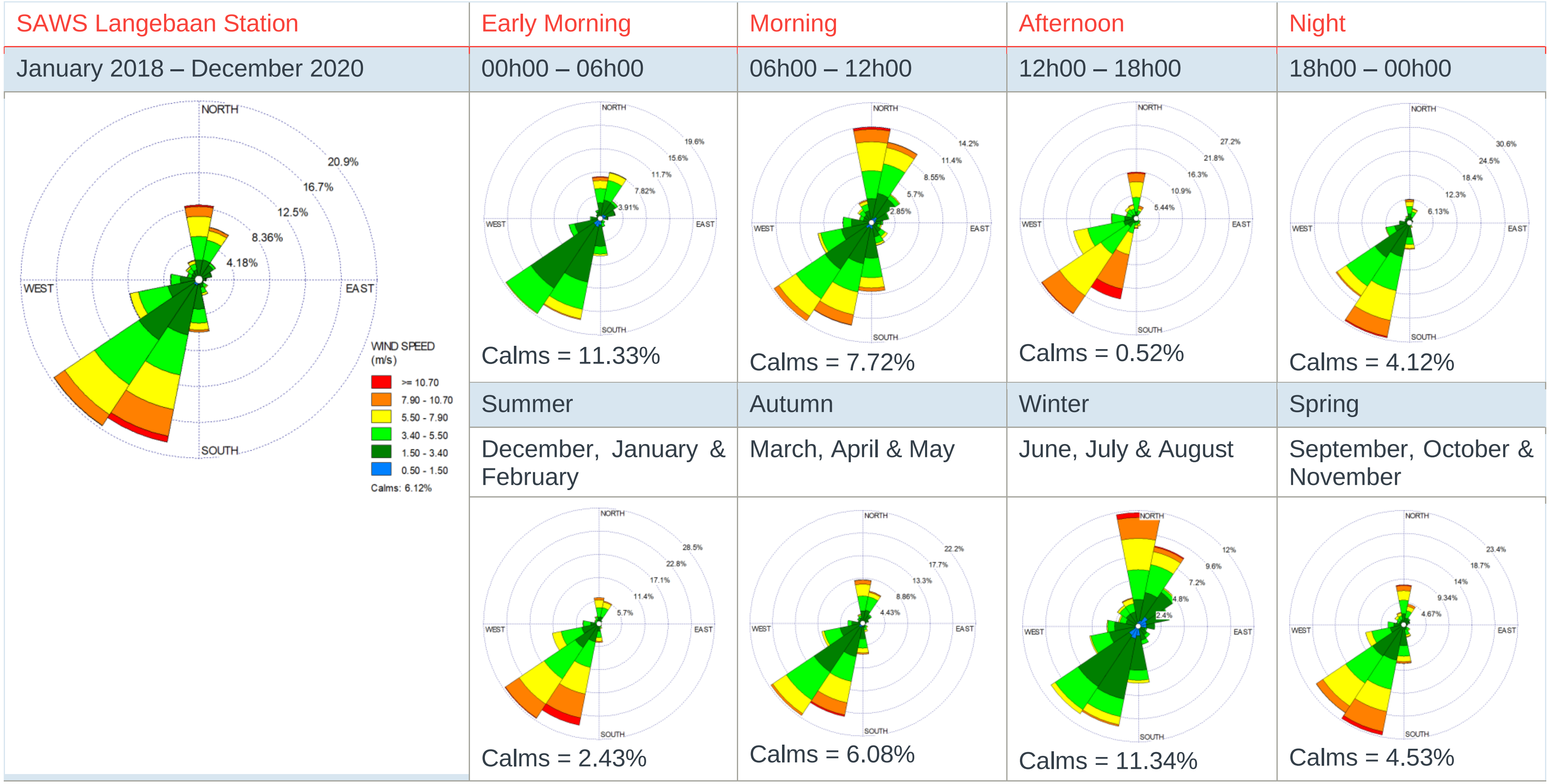


Figure 4-2: Local wind conditions at the SAWS Langebaan meteorological station for the period 2018 - 2020

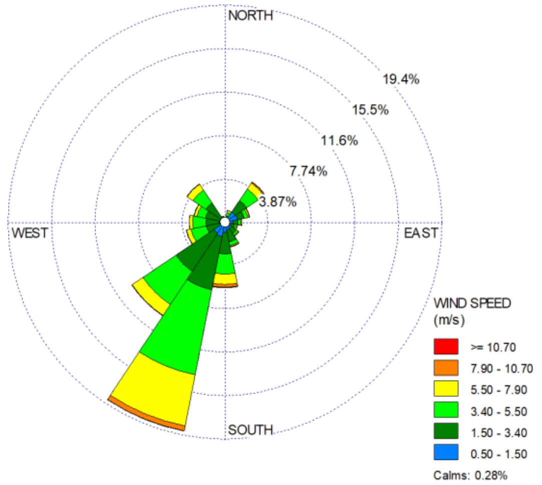
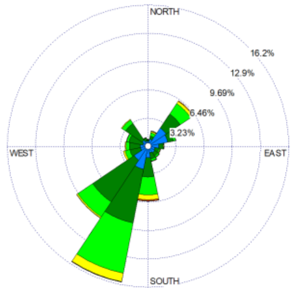
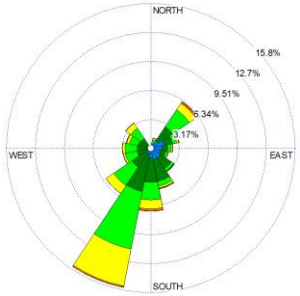
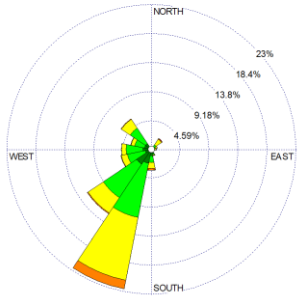
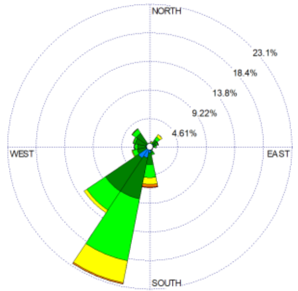
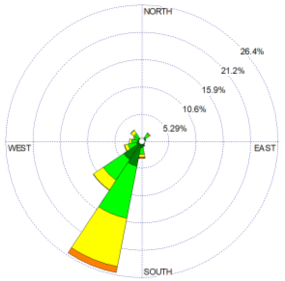
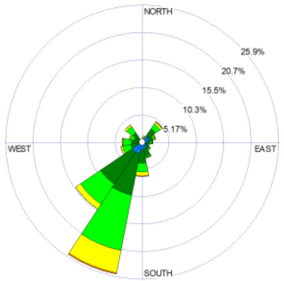
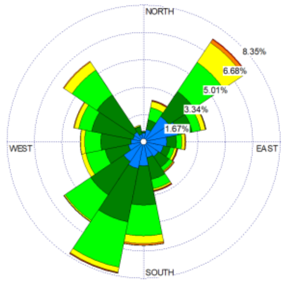
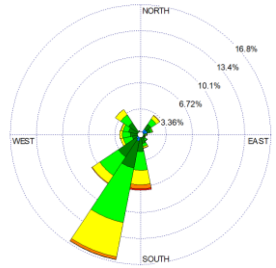
Saldanha Bay Station	Early Morning	Morning	Afternoon	Night
January 2018 – December 2020	00h00 – 06h00	06h00 – 12h00	12h00 – 18h00	18h00 – 00h00
	 Calms = 0.52%	 Calms = 0.16%	 Calms = 0.03%	 Calms = 0.38%
	Summer	Autumn	Winter	Spring
	December, January & February	March, April & May	June, July & August	September, October & November
	 Calms = 0.06%	 Calms = 0.41%	 Calms = 0.51%	 Calms = 0.14%

Figure 4-3: Local wind conditions at the Saldanha Bay meteorological station for the period 2018 - 2020

4.1.2 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., formation of mixing or inversion layers), while rainfall is an effective removal mechanism of atmospheric pollutants and thus also relevant in the assessment of pollution potential.

Figure 4-4 illustrates the average monthly temperature and rainfall measured at the SAWS Langebaan station, while **Figure 4-5** illustrates average temperature measured at the Saldanha Bay station, noting rainfall was not measured at this station for the period in question. Higher rainfall occurs during the cooler months (June, July and August) with drier conditions during the warmer months (December, January and February). Langebaan received on average 260 mm of rainfall annually, with approximately 58% received during winter (June, July and August) and 8 % during summer (December, January and February). Summer temperatures for the region average 21°C while winter temperatures average 13°C.

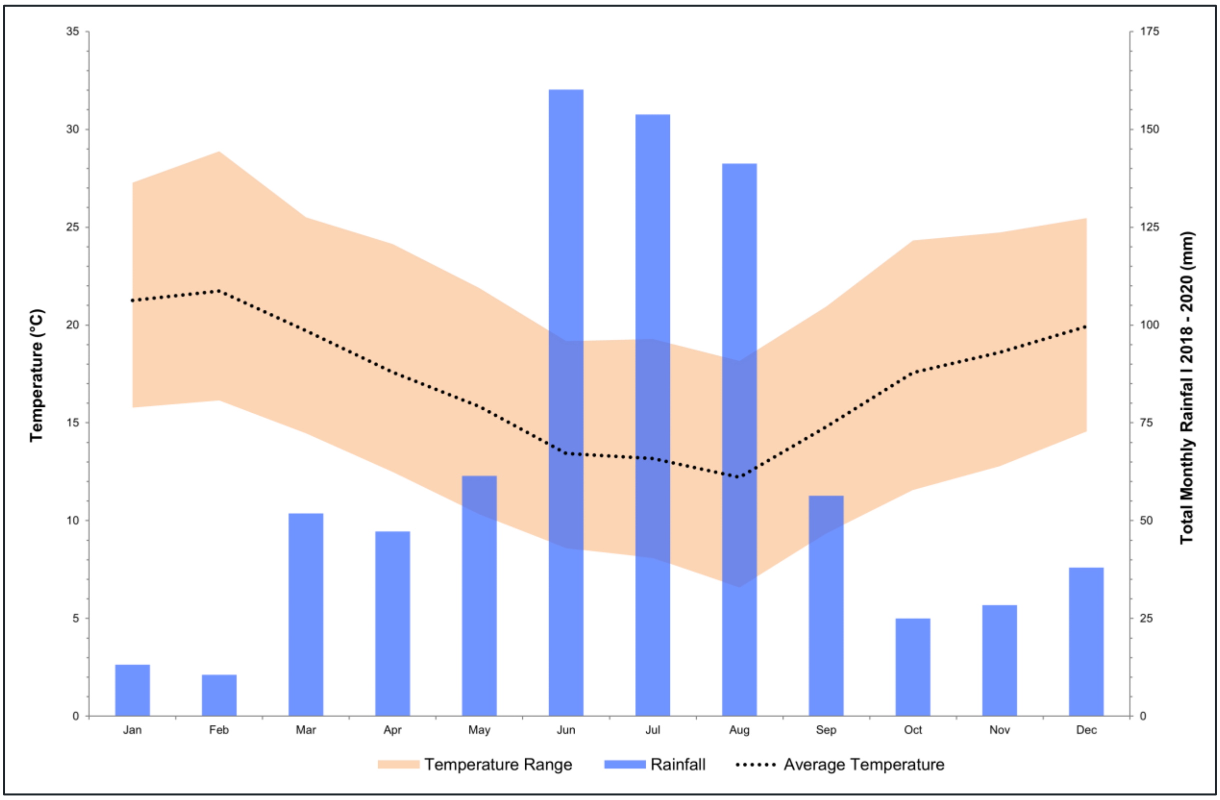


Figure 4-4: Meteorological summary for the Langebaan station (2018 – 2020)

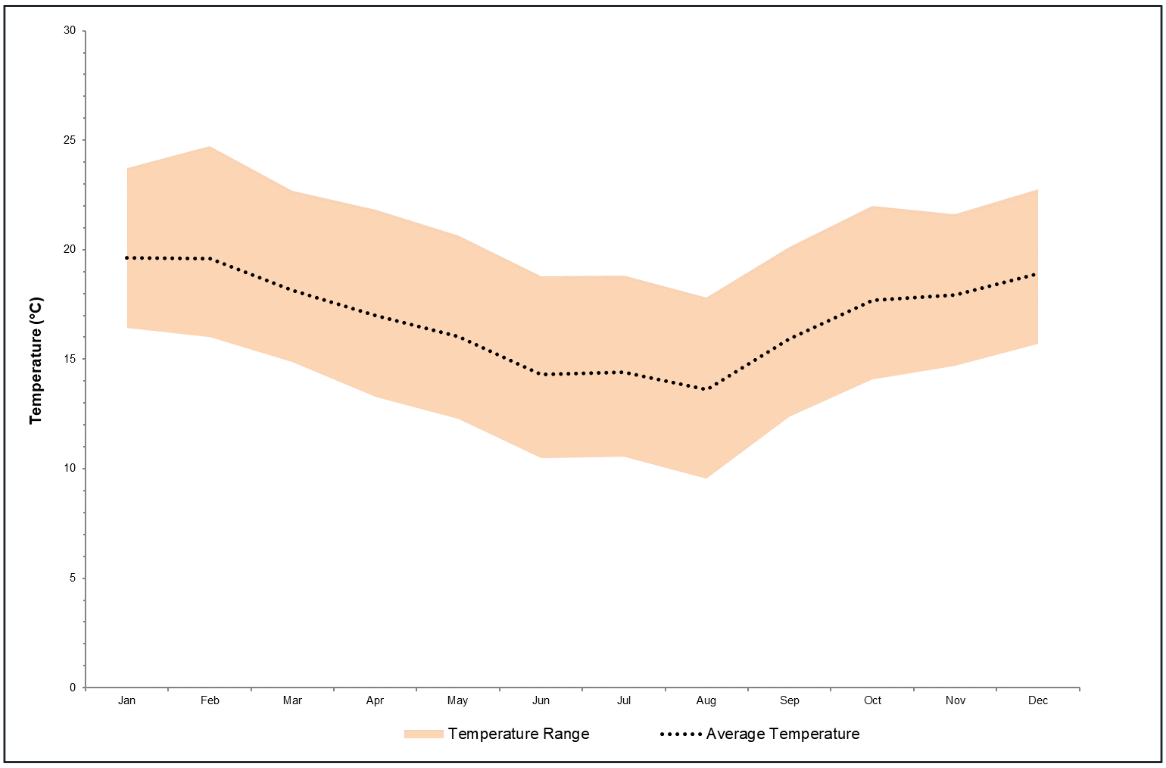


Figure 4-5: Meteorological summary for the Saldanha Bay station (2018 – 2020)

4.2 UPPER AIR DATA

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. Important parameters for the characterisation of dispersion potential include wind speed, wind direction, extent of atmospheric turbulence, ambient air temperature and mixing depth. To accurately represent meteorological conditions at Saldanha, MM5 (Fifth Generation NCAR/Penn State Mesoscale Model) data was purchased from Lakes Environmental. A 4 km resolution CALMET-ready MM5 dataset for the years 2018 to 2020 covering a domain of 100 km x 100 km was utilised. The CALMET meteorological model contains a diagnostic wind field module that includes parameterized treatments of terrain effects.

Given the limited parameters available from the surface stations, which are required for input into CALMET, the CALMET-Ready MM5 dataset was used for input into the dispersion model, in-line with the Modelling Regulations. Further, measured upper air data is not available for the region, therefore the use of the MM5 dataset was required.

The special treatment of calm conditions was not required in this assessment since CALPUFF can fully handle stagnant conditions (i.e., calm conditions), without resulting in unrealistically high concentration predictions as experienced with gaussian-plume models. This approach of not addressing calm conditions when using CALPUFF is aligned with the *Modelling Regulations*.

5 AMBIENT IMPACT ANALYSIS AND AMBIENT LEVELS

To assess the existing air quality situation in the Saldanha Bay and Vredenburg areas, data was obtained from the Saldanha Bay Municipality owned and operated continuous monitoring stations, located in Saldanha Bay and Vredenburg. Data was requested for the period 2017 – 2020 for both stations. Unfortunately, no PM_{10} and $PM_{2.5}$ data was available from the Vredenburg station during the required period. Additionally, dust fallout data was obtained from the Saldanha Bay Municipality monitoring network for the period January 2017 – May 2020 and the AMSA monitoring network for the period January 2017 – December 2020.

Figure 5-1: Locations of the continuous monitoring stations and dust fallout samplers

5.1 AMBIENT PM_{10} AND $PM_{2.5}$ CONCENTRATIONS

Table 5-1 presents the data recovery at each of the continuous monitoring stations. No PM_{10} and $PM_{2.5}$ was recovered at the Vredenburg continuous monitoring station. Data recovery at the Saldanha Bay station was low for the period in question, with 52% PM_{10} data recovered and 51% $PM_{2.5}$ data recovered, both below the required minimum of 80% for a representative dataset. Despite the low data recovery at Saldanha Bay, and due to the limited availability of alternative data sources, this data is presented in this AIR, although must be viewed with caution due to the low data recovery.

Table 5-1: PM_{10} and $PM_{2.5}$ data recovery

Station Name	Latitude (S)	Longitude (E)	Altitude (masl)	Data Recovery	
				PM_{10}	$PM_{2.5}$
Saldanha Bay	33.001116°	17.944906°	~33	51.6%	51.4%
Vredenburg	32.901722°	17.992206°	~124	0%	0%

Figure 5-2 presents the 24-hour average PM_{10} concentrations measured in Saldanha Bay for the period January 2017 – April 2020. For this period, one exceedance of the National Ambient Air Quality Standard (NAAQS) 24-hour standard was recorded, occurring in January 2017, noting the NAAQS allows for four exceedances of the standard per calendar year. An annual average concentration of 20.8 µg/m^3 and 17.7 µg/m^3 was measured in 2017 and 2018, respectively. Both these concentrations remain well below the NAAQS annual average standard (40 µg/m^3). PM_{10} concentrations were not measured in 2019 and 2020, therefore annual averages cannot be presented.

Figure 5-3 presents the 24-hour average $PM_{2.5}$ concentrations measured in Saldanha Bay for the period January 2017 – April 2020. No exceedances of the NAAQS 24-hour average standard were recorded during this period, remaining well below the standard. An annual average concentration of 6.8 µg/m^3 and 6.0 µg/m^3 was measured in 2017 and 2018, respectively. Both these concentrations remain well below the NAAQS annual average standard (20 µg/m^3). $PM_{2.5}$ concentrations were not measured in 2019 and 2020, therefore annual averages cannot be presented.

As mentioned previously, Saldanha Steel went into C&M early 2020. Unfortunately, given the lack of data from the Saldanha Bay continuous monitoring station in 2019 and 2020, it is not possible to identify an improvement in air quality in the Saldanha Bay airshed due to Saldanha Steel being in C&M.

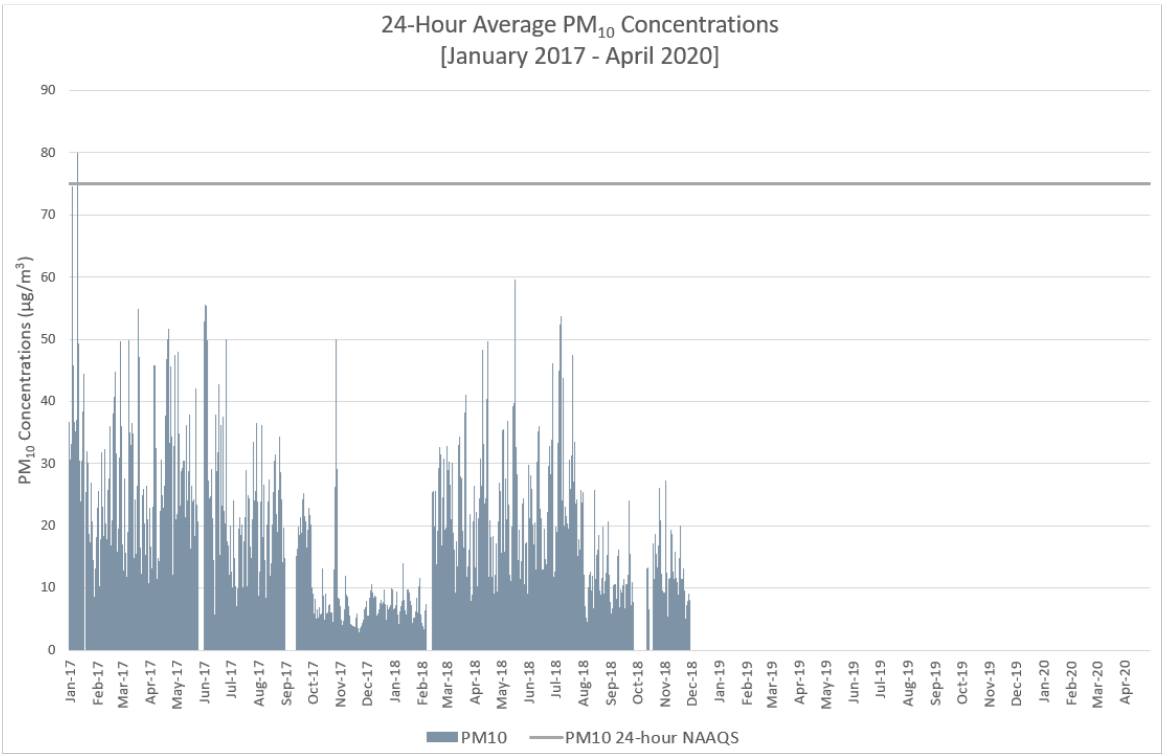


Figure 5-2: Saldanha Bay 24-hour averaged PM_{10} concentrations for the period Jan'17 – Apr'20

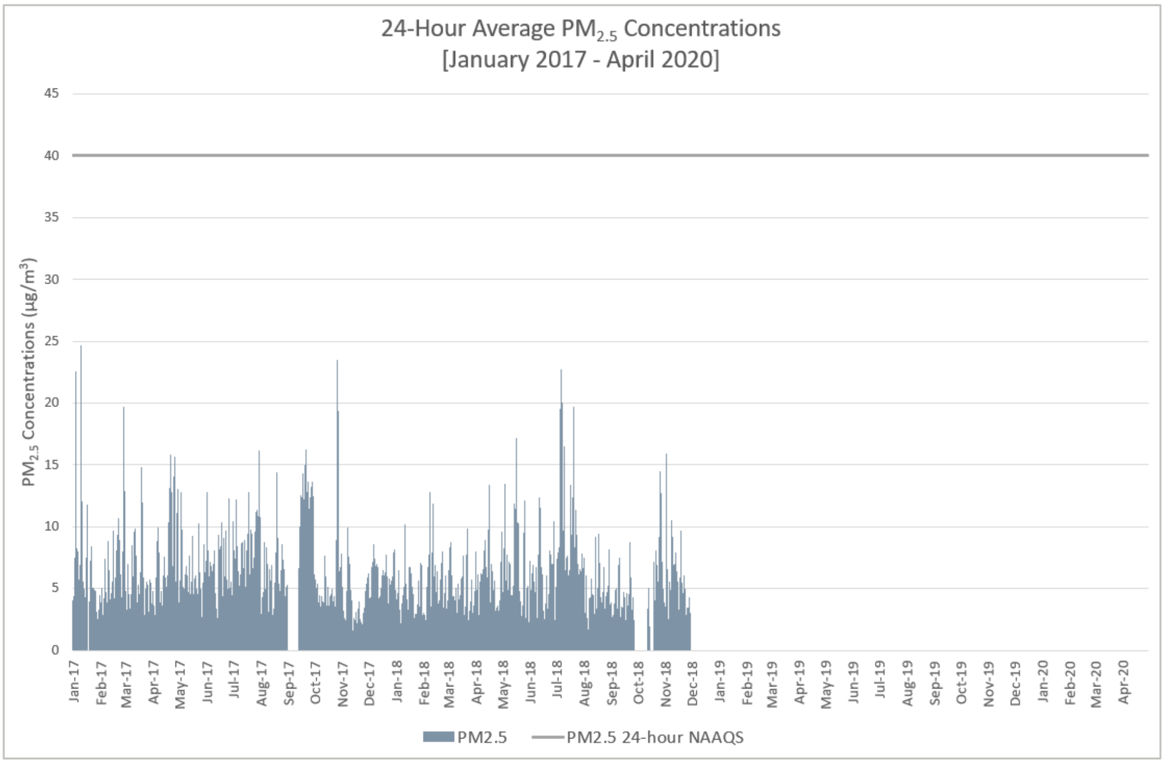


Figure 5-3: Saldanha Bay 24-hour averaged $PM_{2.5}$ concentrations for the period Jan'17 – Apr'20

5.2 DUST FALLOUT MONITORING

Dust fallout in the Saldanha Bay, Vredenburg and Langebaan areas are monitored by the Saldanha Bay Municipality monthly [17]. Additional to this, Saldanha Steel [18] undertakes dust fallout monitoring in and around the Saldanha Steel facility. Aligned with the monthly monitoring reports received for each network, and for the purposes of this assessment, it is assumed the Saldanha Bay monitoring network comprises only residential sampling locations, while the Saldanha Steel monitoring network comprises only non-residential sampling locations. Data was obtained from the Saldanha Bay Municipality network for the period January 2017 – May 2020, and from the Saldanha Steel network for January 2017 – December 2020. **Table 5-2** and **Table 5-3** presents the monitoring network details of the Saldanha Bay network and Saldanha Steel network, respectively, while **Figure 5-1**, presented previously, illustrates the sampling locations.

Table 5-2: Saldanha Bay Municipality dust fallout monitoring network

Station Name	Latitude (S)	Longitude (E)	Classification	Direction from AMSA Boundary	Distance from AMSA Boundary
SBM-06 [Vredenburg Electricity Dept.]	32.907556°	17.987139°	Residential (600 mg/m²/day)	NNW	8.2 km
SBM-05 [Vredenburg Reservoir]	32.915583°	17.986917°	Residential (600 mg/m²/day)	NNW	7.5 km
SBM-07 [Juffroushooogte]	32.937167°	18.076000°	Residential (600 mg/m²/day)	NNE	5.4 km
SBM-01 [Airport]	-32.959583°	17.970139°	Residential (600 mg/m²/day)	NW	4.3 km
SBM-02 [Saldanha AQM Station]	-33.011389°	17.938472°	Residential (600 mg/m²/day)	SW	6.7 km
SBM-04 [Bluewater Bay]	-32.995500°	17.973528°	Residential (600 mg/m²/day)	WSW	3.0 km
SBM-03 [Curro School]	-33·037833°	18.049972°	Residential (600 mg/m²/day)	SSE	4.7 km

Table 5-3: Saldanha Steel dust fallout monitoring network

Station Name	Latitude (°S)	Longitude (°E)	Classification	Fence line / Offsite / Onsite
AM_NE [Northeast]	32.973397°	18.031272°	Non-Residential (1,200 mg/m²/day)	Fence line
AM_SE [Southeast]	32.987269°	18.031633°	Non-Residential (1,200 mg/m²/day)	Onsite
AM_SW [Southwest]	32.987317°	18.014097°	Non-Residential (1,200 mg/m²/day)	Onsite

[17] Source: Saldanha Bay Municipality, Dust Fallout Monitoring Monthly Reports, January 2017 – May 2020
[18] Source: Saldanha Steel, Dust Fallout Monitoring Monthly Reports, January 2017 – December 2020

Station Name	Latitude (°S)	Longitude (°E)	Classification	Fence line / Offsite / Onsite
AM_NW [Northwest]	32.971192°	18.011889°	Non-Residential (1,200 mg/m²/day)	Offsite
AM_N [North]	32.971314°	18.023183°	Non-Residential (1,200 mg/m²/day)	Offsite
AM_S [South]	32.991094°	18.023197°	Non-Residential (1,200 mg/m²/day)	Onsite
AM_E [East]	32.987814°	18.038583°	Non-Residential (1,200 mg/m²/day)	Fence line
AM_W [West]	32.982314°	18.012867°	Non-Residential (1,200 mg/m²/day)	Onsite

5.2.1 SALDANHA BAY MUNICIPALITY DUST FALLOUT RESULTS

Table 5-4 presents a summary of the exceedances of the residential standard recorded at the Saldanha Bay Municipality monitoring network between January 2017 – May 2020, while **Figure 5-4, Figure 5-5** and **Figure 5-6** present the monthly fallout measured at the northerly, westerly and south-easterly samplers, respectively. One exceedance of the residential standard has occurred at SBM-01 (Jul'17), SBM-02 (Dec'19), SBM-04 (Feb'20) and SBM-03 (Mar'18), remaining compliant with the standard as two non-sequential exceedances of the standard are permitted per twelve-month rolling period. Dust fallout at SBM-07 exceeded the standard on two occasions, in Jul'18 and Mar'19, also remaining compliant due to the permitted two non-sequential exceedances per twelve-month rolling period.

Highest fallout typically occurs at SBM-01, located approximately 4.3 km northwest of Saldanha Steel. Given the predominant southwest and northerly winds measured by the Saldanha Municipality and SAWS Langebaan meteorological stations, it is unlikely that Saldanha Steel contributed substantial fallout to this location; predominant east-southeast winds would be required to transport Saldanha Steel emissions towards this location. The red highlighted area in **Figure 5-4, Figure 5-5** and **Figure 5-6** represents when Saldanha Steel went into C&M, from April 2020 onwards. Unfortunately, due to only receiving data until May 2020, no clear trend can be identified relating to the decrease in dust fallout due to Saldanha Steel going into C&M. However, and to be viewed with caution due to only April and May 2020 being available of when Saldanha Steel was in C&M, some fallout locations show an increase in fallout levels, possibly indicating other sources of emissions in the area.

Table 5-4: Saldanha Bay Municipality dust fallout exceedance summary

Station Name	1st Exceedance	2nd Exceedance	Total Exceedances (Jan'17 – May'20)	Compliance Status
SBM-06 [Vredenburg Electricity Dept.]	-	-	0	Compliant, no exceedances
SBM-05 [Vredenburg Reservoir]	-	-	0	Compliant, no exceedances

Station Name	1st Exceedance	2nd Exceedance	Total Exceedances (Jan'17 – May'20)	Compliance Status
SBM-07 [Juffroushooogte]	Jul-18	Mar-19	2	Compliant, two non-sequential exceedances permitted / 12 months
SBM-01 [Airport]	Jul-17	-	1	Compliant, two non-sequential exceedances permitted / 12 months
SBM-02 [Saldanha AQM Station]	Dec-19	-	1	Compliant, two non-sequential exceedances permitted / 12 months
SBM-04 [Bluewater Bay]	Feb-20	-	1	Compliant, two non-sequential exceedances permitted / 12 months
SBM-03 [Curro School]	Mar-18	-	1	Compliant, two non-sequential exceedances permitted / 12 months

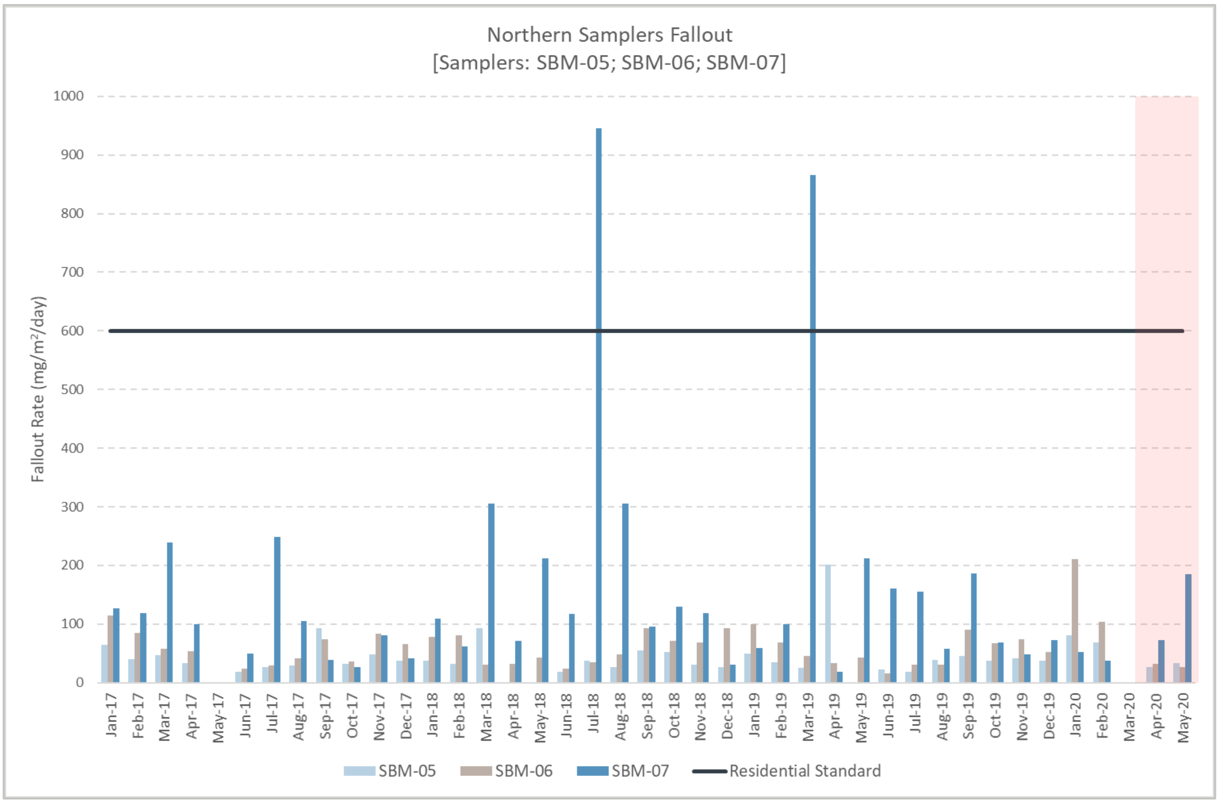


Figure 5-4: Saldanha Bay Municipality northern samplers fallout (Jan'17 – May'20)

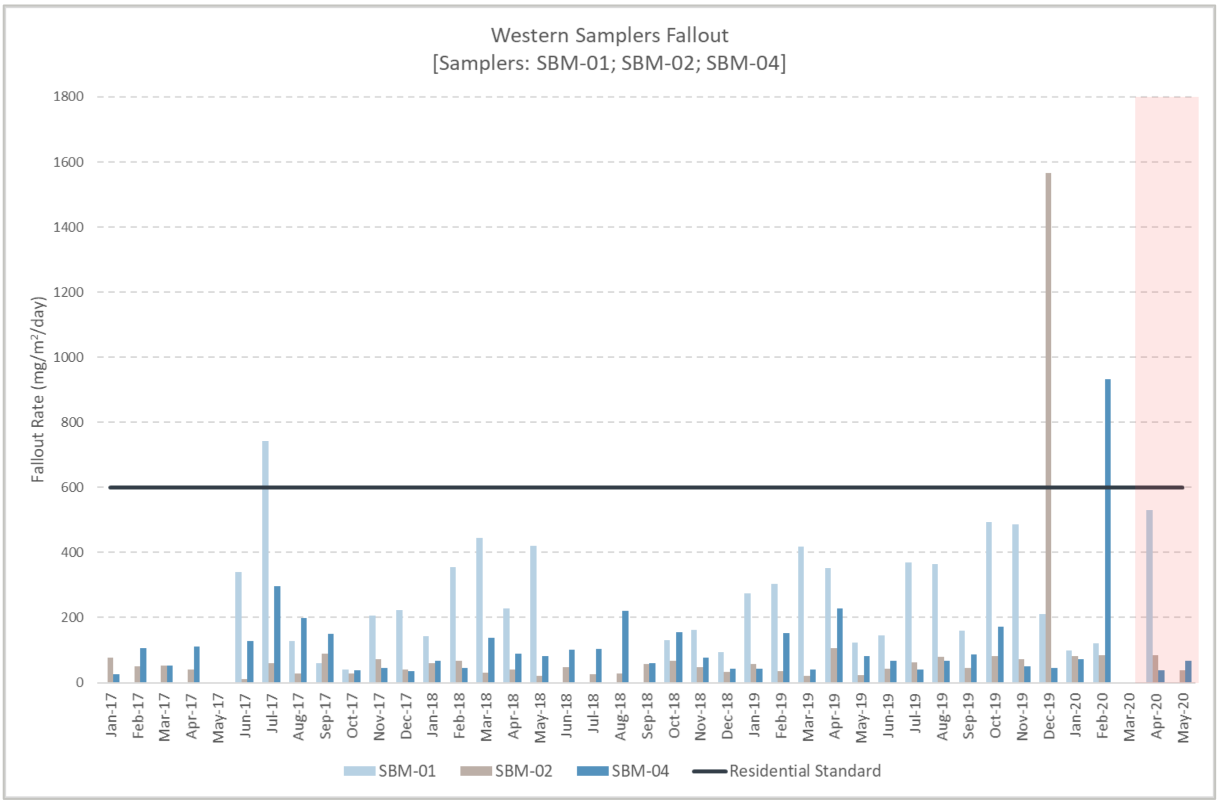


Figure 5-5: Saldanha Bay Municipality western samplers fallout (Jan'17 – May'20)

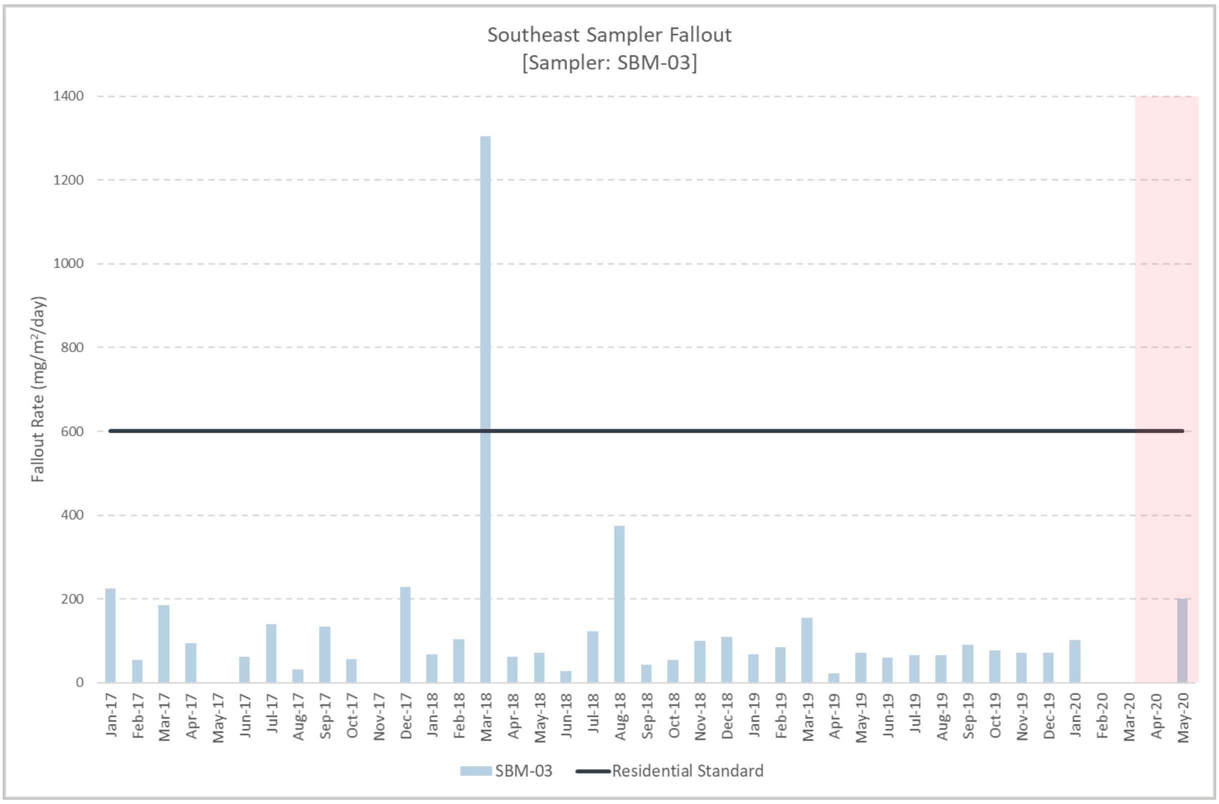


Figure 5-6: Saldanha Bay Municipality southeast sampler fallout (Jan'17 – May'20)

5.2.2 SALDANHA STEEL DUST FALLOUT RESULTS

Table 5-5 presents the exceedances measured at the Saldanha Steel monitoring locations for the period January 2017 – December 2020, while **Figure 5-7, Figure 5-8** and **Figure 5-9** present the monthly fallout rates measured at the northern, south and southeast, and west and southwest samplers, respectively. While Saldanha Steel was in operation fallout rates typically remained low at all sampling locations (prior to April 2020); red, highlighted area in fallout figures presents the period of C&M.

For the period under review, one exceedance of the non-residential standard was recorded at AM_SE (Jan'17), AM_NW (May'17) and AM_S (Feb'19), remaining compliant with the standard as two non-sequential exceedances are permitted per twelve-month rolling period. Two exceedances were recorded at AM_SW (Apr'17 and Sep'18) and AM_W (Sep'18 and Apr'19), again remaining compliant as two non-sequential exceedances are permitted per twelve-month rolling period. AM_NE recorded three exceedances of the standard, in Feb'20, Nov'20 and Dec'20, resulting in non-compliance with the standard as three exceedances were recorded within a twelve-month period, two of which were sequential (Nov'20 and Dec'20). Notably, the two sequential exceedances measured occurred seven months after Saldanha Steel went into C&M. Given the C&M, no operations occur at Saldanha Steel, with all stockpiles being removed during shutdown. Despite this, highest fallout levels at AM_NE, from the available dataset, occurred during C&M, indicating other contributing sources in the area.

On average, dust fallout shows a decrease after Saldanha Steel went into C&M, as would be expected given the complete shutdown. However, location AM_NE shows a 98% increase in average fallout compared to historic data, while sampler AM_S shows a 10% increase in average fallout, again indicating potential contributions to fallout from neighbouring sources.

Table 5-5: Saldanha Steel dust fallout exceedance summary (Jan'17 – Dec'20)

Station Name	1st Exceedance	2nd Exceedance	3rd Exceedance	Total Exceedances (Jan'17 – Dec'20)	Compliance Status
AM_NE [Northeast]	Feb'20	Nov'20	Dec'20	3	Non-compliant, three exceedances in 12-month period, two sequential
AM_SE [Southeast]	Jan'17	-	-	1	Compliant, two non-sequential exceedances permitted / 12 months
AM_SW [Southwest]	Apr'17	Sep'18	-	2	Compliant, two non-sequential exceedances permitted / 12 months
AM_NW [Northwest]	May'17	-	-	1	Compliant, two non-sequential exceedances permitted / 12 months
AM_N [North]	-	-	-	0	Compliant, no exceedances
AM_S [South]	Feb'19	-	-	1	Compliant, two non-sequential exceedances permitted / 12 months
AM_E [East]	-	-	-	0	Compliant, no exceedances

Station Name	1st Exceedance	2nd Exceedance	3rd Exceedance	Total Exceedances (Jan'17 – Dec'20)	Compliance Status
AM_W [West]	Sep'18	Apr'19	-	2	Compliant, two non-sequential exceedances permitted / 12 months

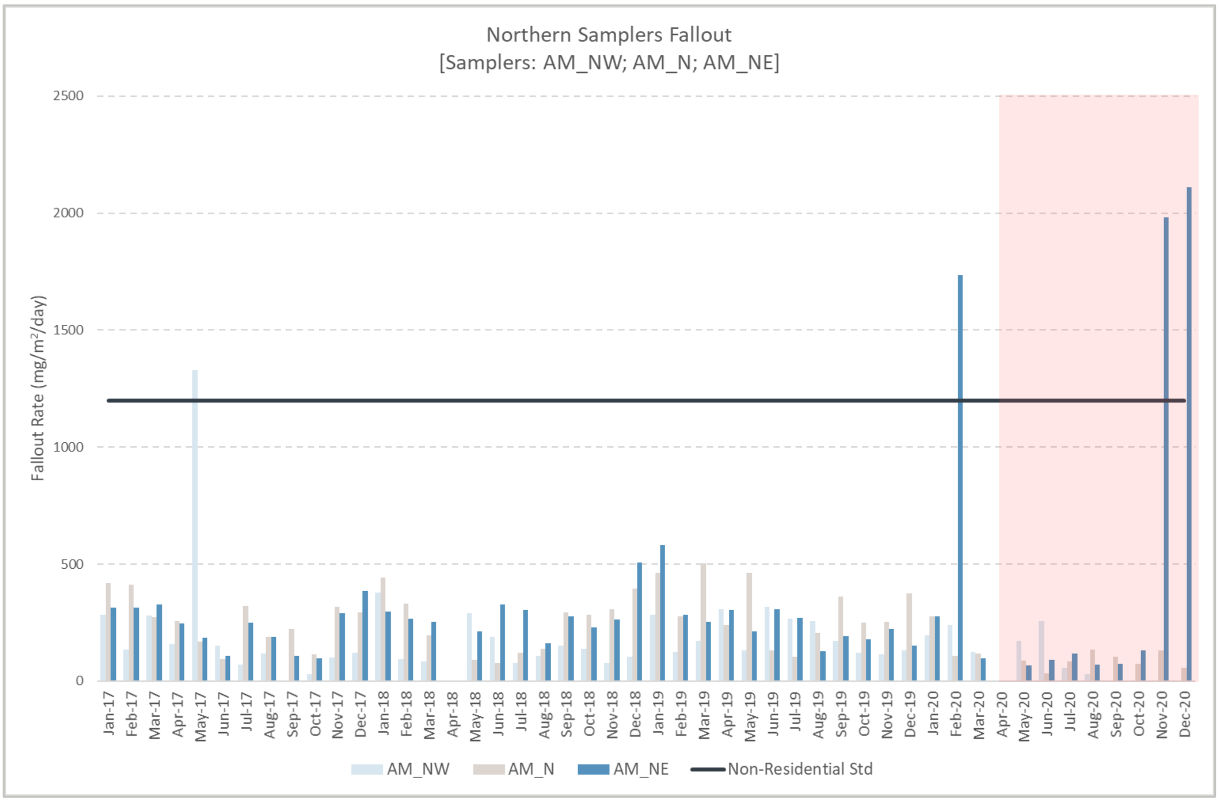


Figure 5-7: Saldanha Steel northerly samplers fallout rates, Jan'17 – Dec'20

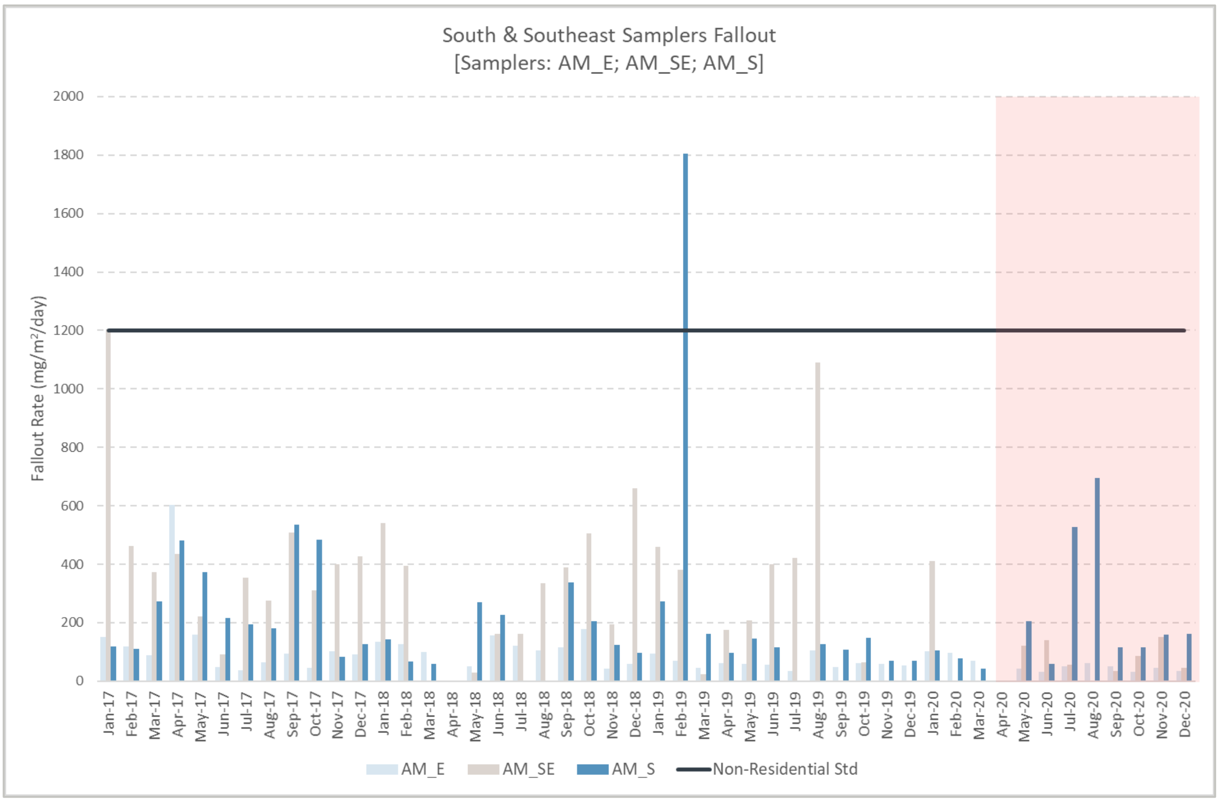


Figure 5-8: Saldanha Steel south and southeast samplers fallout rates, Jan'17 – Dec'20

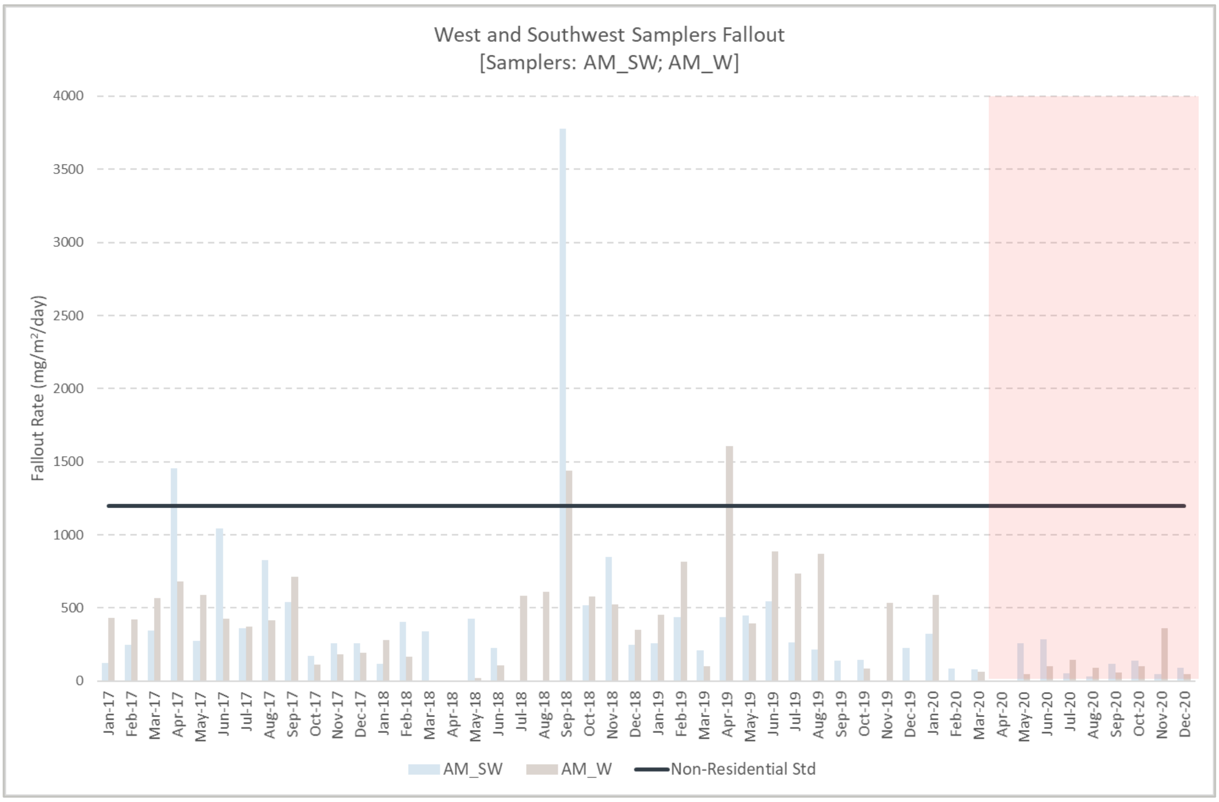


Figure 5-9: Saldanha Steel west and southwest fallout rates, Jan'17 – Dec'20

6 MODELLING PROCEDURES

6.1 ASSESSMENT LEVEL AND PROPOSED MODEL

A Level 3 modelling assessment was undertaken in line with the Modelling Regulations. Level 3 modelling assessments are recommended for:

- Understanding air quality impacts, including spatial and temporal variation in concentrations.
- Ensuring causality effects, calms, non-linear plume trajectories, spatial variations in turbulent mixing, multiple emission source types and where chemical transformations need to be accounted for.
- Informing air quality management approaches that involve multi-source, multi-sector contributions from permitted and non-permitted sources in an airshed.

CALPUFF is the recommended Level 3 model in the Modelling Regulations. CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model, which can simulate the effects of time and space, as well as varying meteorological conditions on pollutant transport, transformation, and removal. CALPUFF is an internationally recognised dispersion model recommended for:

- Long-range transport distances up to 300 km.
- Assessment of multiple emission source types (i.e., point, line, area, volume) and emission sectors (i.e., industry, traffic, etc.).
- Deposition and light extinction for long-range transport.
- Secondary formation of particulate matter in long-range transport.
- Complex non-steady-state meteorological conditions such as inhomogeneous winds, stagnation conditions and inversion breakup dispersion.

The CALPUFF atmospheric dispersion modelling system includes three main components:

- CALMET: a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded modelling domain.
- CALPUFF: a transport and dispersion model that advents “puffs” of material emitted from modelled sources, simulating dispersion and transformation processes using the fields generated by CALMET. Temporal and spatial variations in the meteorological fields selected are incorporated in the resulting distribution of puffs throughout a simulation period. Output files contain hourly concentration or deposition fluxes evaluated for selected receptor locations.
- CALPOST: a post run processor for tabulating and summarising the results of the simulation for selected averaging times and locations.

6.2 MODEL INPUTS

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 proposed modelling domain for this study is 30 km x 30 km, centred over the Saldanha Steel site, ensuring key receptor locations of Langebaan, Vredenburg and Saldanha Bay are included.

6.2.1 RECEPTORS

Receptor Grid

The *Modelling Regulations* specify the use of a multi-tier grid and recommend specific tier resolutions; 50 m for general area of maximum impact, 100 m for 5 km from the facility of interest, 250 m for 10 km from the facility of interest and 1,000 m exceeding 10 km from the facility of interest. Due to the limitations of CALPUFF, with only 10,000 gridded receptors possible in the model, and the size of the modelling domain (30 km x 30 km), these tier resolutions are not achievable. Given this, the tiered grid resolution applied in the model comprise:

- 150 m grid spacing up to 5 km from the site.
- 300 m grid spacing up to 10 km from the site.
- 1,000 m grid spacing up to 15 km from the site.

Discrete Sensitive Receptors

Discrete receptors selected for this study are listed in **Table 6-1.** Receptors were selected based on proximity to the study site and are places where sensitive individuals may be impacted, such as residences, retirement homes, schools or medical facilities. Their proximity from the centre of Saldanha Steel is shown in **Figure 6-1**.

Table 6-1: Discrete receptor locations

ID	Receptor Name	Receptor Type	Distance from Centre (km)	Direction	Latitude (S)	Longitude (E)
R_1	Langebaan Weg	Residential	11.2	E	32.977917°	18.143021°
R_2	Main Rd (R399)	Public Rd	1.0	N	32.970374°	18.020201°
R_3	Camp St	Public Rd	1.8	S	32.994865°	18.019281°
R_4	Saldanha Industrial Development	Industrial	2.9	W	32.984353°	17.992036°
R_5	Curro School Langebaan	Residential / School	7.0	S	33.038541°	18.051365°
R_6	Long Acres Country Estate	Residential	7.0	SSE	33.030881°	18.069473°
R_7	Mykonos	Residential	7.3	S	33.042835°	18.046138°
R_8	Paradise Beach	Residential	6.7	S	33.039169°	18.038693°
R_9	Langebaan Country Estate	Residential	9.7	S	33.063997°	18.049296°
R_10	Langebaan Clinic	Residential / Medical	11.5	S	33.082731°	18.035615°

ID	Receptor Name	Receptor Type	Distance from Centre (km)	Direction	Latitude (S)	Longitude (E)
R_11	Gerimed Langebaan (Retirement)	Residential / Retirement	12.2	S	33.089673°	18.032619°
R_12	Blue Water Bay Lodge	Residential	4.7	WSW	32.995083°	17.973392°
R_13	Blue Water Bay	Residential	4.7	WSW	32.994665°	17.975107°
R_14	Saldanha Continuous Station	Monitoring Station	7.7	WSW	33.001135°	17.944864°
R_15	Olive Manor Nursing Home	Residential / Retirement	8.2	SW	33.004819°	17.941188°
R_16	Saldanha FamMed	Residential / Medical	8.1	SW	33.010406°	17.943963°
R_17	Saldanha Aerodrome	Residential	5.3	WNW	32.961776°	17.970228°
R_18	Vredenburg (Weskus Mall)	Residential	7.3	NNW	32.922362°	17.985660°
R_19	Vredenburg (Witteklip)	Residential	5.9	N	32.927218°	18.011537°
R_20	Vredenburg (Ongegund)	Residential	6.2	N	32.924020°	18.024889°
R_21	Life West Coast Private Hospital	Residential / Medical	8.1	NNW	32.911951°	17.990494°
R_22	Huis Wittekruin (Vredenburg Old Age Home)	Residential / Retirement	8.5	NNW	32.912373°	17.979980°
R_23	Vredenburg Continuous Station	Monitoring Station	9.1	N	32.901704°	17.992211°
R_24	Vredenburg Golf Club	Residential	7.2	NNE	32.920856°	18.055342°

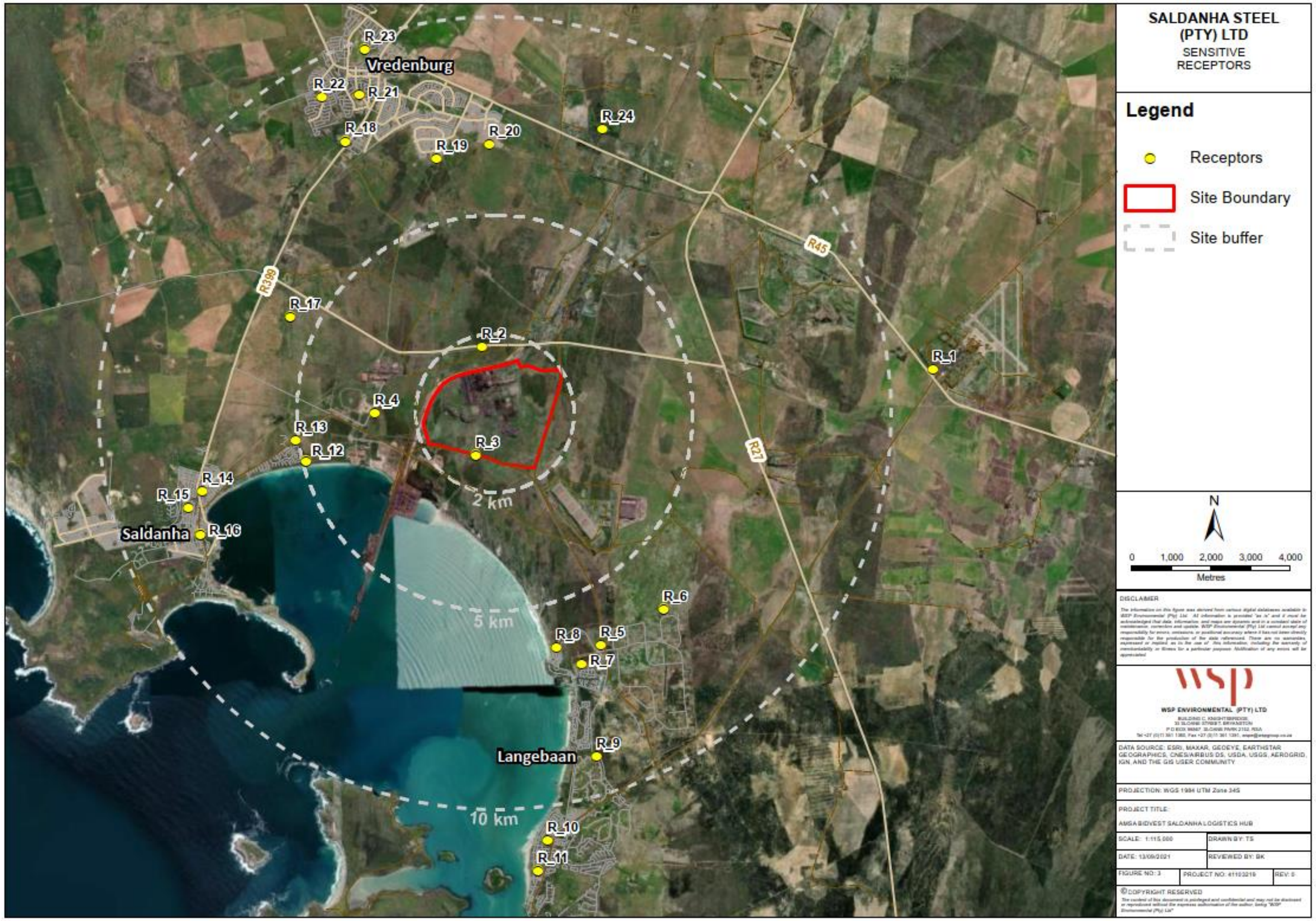


Figure 6-1: Sensitive receptors

6.2.2 FACILITY FENCE LINE

As defined in the Modelling Regulations, ambient air quality objectives are applied to areas outside the facility fence line. Within the facility boundary, environmental conditions are prescribed by occupational health and safety criteria. The facility boundary is defined based on these criteria:

- The facility fence line or the perimeter where public access is restricted.
- If the facility is located within a larger facility, the facility boundary is that of the encompassing facility.
- If a public access road passes through the facility, the facility boundary is the perimeter of the road.

For the purposes of dispersion modelling, and to provide a fine resolution grid nearest the site, plant boundary receptors will be utilised. As per the Modelling Regulations, a 50 m plant boundary receptor resolution was utilised as the area of maximum impact will occur on the Saldanha Steel fence line.

6.2.3 MODELLING SCENARIOS

Three modelling scenarios were completed, assessing existing and proposed operations for TSP (reported as dust fallout), PM_{10} and $PM_{2.5}$ for short-term (24-hour, and 30-day average) and long-term (annual) averaging periods for comparison with applicable NAAQS, as applicable to each pollutant. The modelling scenarios assess the proposed stockpiling, storage and handling of hazardous material (Mn) for $PM_{2.5}$ for short-term (24-hour average) and long-term (annual) averaging periods for comparison with applicable international ambient air quality guidelines, as applicable.

7 AMBIENT IMPACT RESULTS

The following section presents the dispersion modelling predictions associated with modelled scenarios. Ground level concentration predictions are presented in receptor tables and isopleths.

7.1 SENARIO 1: SALDANHA STEEL

7.1.1 PM_{10} CONCENTRATION PREDICTIONS

Table 7-1 presents predicted PM_{10} concentrations at receptors during steelmaking operations at Saldanha Steel, while **Figure 7-1** illustrates PM_{10} 24-hour average concentrations and **Figure 7-2** illustrates long-term PM_{10} predicted concentrations. Key findings include:

- All residential sensitive receptor concentrations remain well below the 24-hour average and annual standards, with highest concentrations predicted at Vredenburg (Ongegund), although remaining well below the relevant NAAQS.
- Of the nearest, publicly accessible areas (Main Road), PM_{10} 24-hour concentrations are predicted to exceed the 24-hour average standard, although long-term concentrations remain below the annual standard. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent non-compliant PM_{10} 24-hour average concentrations.

- The maximum 24-hour average fence line concentration predicted was 302 µg/m^3, with a long-term concentration of 103 µg/m^3 predicted, both occurring on the northern fence line of Saldanha Steel, both of which exceed their relevant NAAQS. Importantly, predicted concentrations disperse substantially with distance from this fence line, with all residential receptor concentrations predicted to be low.
- Concentrations are predicted to disperse predominantly towards the north of Saldanha Steel, with the area of predicted non-compliance extending to Main Road, located north of the plant. Notably, the Saldanha Steel plant is located on the northern fence line of the property, with emissions having little time to disperse prior to reaching the fence line. Further, the area immediately north of Saldanha Steel is uninhabited, and comprises predominantly open land and railways.

Table 7-1: Scenario 1 predicted PM_{10} receptor concentrations

ID	Receptor Name	24-Hour NAAQS (µg/m^3)	24-Hour Average (µg/m^3)	Annual NAAQS (µg/m^3)	Long-Term Average (µg/m^3)
R_1	Langebaan Weg		3.36		0.24
R_2	Main Rd (R399)		**77.30**		22.86
R_3	Camp St		37.70		4.19
R_4	Saldanha Industrial Development		14.99		1·37
R_5	Curro School Langebaan		5.41		0.53
R_6	Long Acres Country Estate		5.82		0.54
R_7	Mykonos	75	6.04	40	0.54
R_8	Paradise Beach		7.88		0.68
R_9	Langebaan Country Estate		3.71		0.35
R_10	Langebaan Clinic		4.40		0.29
R_11	Gerimed Langebaan (Retirement)		3.90		0.26
R_12	Blue Water Bay Lodge		7.49		0.58
R_13	Blue Water Bay		6.42		0.56

ID	Receptor Name	24-Hour NAAQS (µg/m³)	24-Hour Average (µg/m³)	Annual NAAQS (µg/m³)	Long-Term Average (µg/m³)
R_14	Saldanha Continuous Station		3.89		0.30
R_15	Olive Manor Nursing Home		3.75		0.27
R_16	Saldanha FamMed		3.54		0.27
R_17	Saldanha Aerodrome		8.14		0.76
R_18	Vredenburg (Weskus Mall)		7.47		1.17
R_19	Vredenburg (Witteklip)		11.88		1.93
R_20	Vredenburg (Ongegund)		13.44		2.05
R_21	Life West Coast Private Hospital		7.68		1.05
R_22	Huis Wittekruin (Vredenburg Old Age Home)		5.94		0.89
R_23	Vredenburg Continuous Station		5.79		0.88
R_24	Vredenburg Golf Club		9.27		1.07
	Maximum Fence line Concentration – 24Hr [X: 221841m; Y:6347559m]		**302.13**		-
	Maximum Fence line Concentration – LT [X: 221326m; Y:6347444m]		-		**102.93**
Note: Bold, red highlight indicates exceedance of NAAQS					

Figure 7-1: Scenario 1 predicted PM_{10} 24-hour concentrations

Figure 7-2: Scenario 1 predicted PM_{10} long-term concentrations

7.1.2 $PM_{2.5}$ CONCENTRATION PREDICTIONS

Table 7-2 presents predicted $PM_{2.5}$ concentrations at receptors during steelmaking operations at Saldanha Steel, while **Figure 7-3** illustrates $PM_{2.5}$ 24-hour average concentrations and **Figure 7-4** illustrates long-term $PM_{2.5}$ predicted concentrations. Key findings include:

- All residential sensitive receptor concentrations remain well below the 24-hour average and annual standards, with highest concentrations predicted at Vredenburg (Ongegund), although remaining well below the relevant NAAQS.
- Of the nearest, publicly accessible areas, highest $PM_{2.5}$ 24-hour average and long-term average (annual) concentrations are predicted at Main Road, although remaining below their relevant NAAQS. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent $PM_{2.5}$ concentrations.
- The maximum 24-hour average fence line concentration predicted was 67 µg/m^3, with a long-term concentration of 21 µg/m^3 predicted, both occurring on the northern fence line of Saldanha Steel, both of which exceed their relevant NAAQS. Importantly, predicted concentrations disperse substantially with distance from this fence line, with all residential receptor concentrations predicted to be low.
- Concentrations are predicted to disperse predominantly towards the north of Saldanha Steel, with the area of predicted 24-hour average non-compliance only extending marginally past the Saldanha Steel northern fence line. The predicted area of long-term concentrations exceeding the annual standard only occurs to the boundary of the Saldanha Steel fence line and does not extend past this fence line.

Table 7-2: Scenario 1 predicted $PM_{2.5}$ receptor concentrations

ID	Receptor Name	24-Hour NAAQS (µg/m^3)	24-Hour Average (µg/m^3)	Annual NAAQS (µg/m^3)	Long-Term Average (µg/m^3)
R_1	Langebaan Weg	40	1.42	20	0.10
R_2	Main Rd (R399)		31.11		8.25
R_3	Camp St		14.36		1.51
R_4	Saldanha Industrial Development		5.69		0.51
R_5	Curro School Langebaan		2.31		0.22
R_6	Long Acres Country Estate		2.42		0.22
R_7	Mykonos		2.61		0.23
R_8	Paradise Beach		3.49		0.28
R_9	Langebaan Country Estate		1.62		0.15
R_10	Langebaan Clinic		1.80		0.12
R_11	Gerimed Langebaan (Retirement)		1.60		0.11
R_12	Blue Water Bay Lodge		3.02		0.23
R_13	Blue Water Bay		2.57		0.22
R_14	Saldanha Continuous Station		1.53		0.12
R_15	Olive Manor Nursing Home		1.53		0.11

ID	Receptor Name	24-Hour NAAQS (µg/m³)	24-Hour Average (µg/m³)	Annual NAAQS (µg/m³)	Long-Term Average (µg/m³)
R_16	Saldanha FamMed		1.46		0.11
R_17	Saldanha Aerodrome		3.04		0.29
R_18	Vredenburg (Weskus Mall)		3.14		0.50
R_19	Vredenburg (Witteklip)		5.11		0.81
R_20	Vredenburg (Ongegund)		5.92		0.86
R_21	Life West Coast Private Hospital		3.35		0.45
R_22	Huis Wittekruin (Vredenburg Old Age Home)		2.62		0.38
R_23	Vredenburg Continuous Station		2.49		0.38
R_24	Vredenburg Golf Club		3.84		0.45
	Maximum Fence line Concentration – 24Hr [X: 221841m; Y:6347559m]		**66.91**		-
	Maximum Fence line Concentration – LT [X: 221326m; Y:6347444m]		-		**21.46**
Note: Bold, red highlight indicates exceedance of NAAQS					

Figure 7-3: Scenario 1 predicted $PM_{2.5}$ 24-hour concentrations

Figure 7-4: Scenario 1 predicted $PM_{2.5}$ long-term concentrations

7.1.3 DUST FALLOUT PREDICTIONS

Table 7-3 presents predicted 30-day average dust fallout rates at receptors during steelmaking operations at Saldanha Steel, while **Figure 7-5** illustrates dust fallout rate predictions. Key findings include:

- All residential sensitive receptor fallout rates remain well below the residential standard (600 mg/m^2/day), with highest fallout rates predicted at Vredenburg (Ongegund), with a rate of 14 mg/m^2/day predicted, remaining well below the standard. A fallout rate of 16 mg/m^2/day is predicted at the Saldanha Industrial Development, although notably this is not a residential area, although remains well below the standard.
- Of the nearest, publicly accessible areas, highest dust fallout rates are predicted at Main Road (467 mg/m^2/day), although importantly remains below the Residential Standard. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent, elevated dust fallout rates.
- The maximum fence line dust fallout rate predicted was 2,471 mg/m^2/day, occurring along the northern fence line of Saldanha Steel, exceeding the Non-Residential Standard of 1,200 mg/m^2/day.
- Concentrations are predicted to disperse predominantly towards the north of Saldanha Steel, with the area of predicted non-compliance extending past the fence line. Importantly, this area of non-compliance does not impact any sensitive receptor, with the nearest publicly accessible area (Main Road), remaining below the Residential Standard. Notably, the Saldanha Steel plant is located on the northern fence line of the property, with emissions having little time to disperse prior to reaching the fence line. Further, the area immediately north of Saldanha Steel is uninhabited, and comprises predominantly open land and railways.

Table 7-3: Scenario 1 predicted dust fallout rates

ID	Receptor Name	Non-Residential Standard (mg/m^2/day)	Residential Standard (mg/m^2/day)	Dust Fallout Rate (mg/m^2/day)
R_1	Langebaan Weg	-	600	0.9
R_2	Main Rd (R399)	-	600	467.2
R_3	Camp St	-	600	94.4
R_4	Saldanha Industrial Development	-	600	15.9
R_5	Curro School Langebaan	-	600	6.5
R_6	Long Acres Country Estate	-	600	5.1
R_7	Mykonos	-	600	5.3
R_8	Paradise Beach	-	600	6.4
R_9	Langebaan Country Estate	-	600	3.2
R_10	Langebaan Clinic	-	600	2.4
R_11	Gerimed Langebaan (Retirement)	-	600	2.3

ID	Receptor Name	Non-Residential Standard (mg/m^2/day)	Residential Standard (mg/m^2/day)	Dust Fallout Rate (mg/m^2/day)
R_12	Blue Water Bay Lodge	-	600	5.0
R_13	Blue Water Bay	-	600	4.8
R_14	Saldanha Continuous Station	-	600	1.8
R_15	Olive Manor Nursing Home	-	600	1.4
R_16	Saldanha FamMed	-	600	1.3
R_17	Saldanha Aerodrome	-	600	4.5
R_18	Vredenburg (Weskus Mall)	-	600	8.0
R_19	Vredenburg (Witteklip)	-	600	12.7
R_20	Vredenburg (Ongegund)	-	600	13.7
R_21	Life West Coast Private Hospital	-	600	5.7
R_22	Huis Wittekruin (Vredenburg Old Age Home)	-	600	5.4
R_23	Vredenburg Continuous Station	-	600	4.0
R_24	Vredenburg Golf Club	-	600	5.9
	Maximum Fence line Concentration [X: 221841m; Y:6347559m]	1,200	-	**2,471.4**
Note: Bold, red highlight indicates exceedance of the National Dust Control Regulations Standard				

Figure 7-5: Scenario 1 predicted dust fallout rates

7.2 SENARIO 2: LOGISTICS HUB OPERATIONS

7.2.1 PM_{10} CONCENTRATION PREDICTIONS

Table 7-4 presents predicted PM_{10} concentrations at receptors during Logistics Hub operations at Saldanha Steel, while **Figure 7-6** illustrates PM_{10} 24-hour average concentrations and **Figure 7-7** illustrates long-term PM_{10} predicted concentrations. Key findings include:

- All residential sensitive receptor concentrations remain well below the 24-hour average and annual standards, with highest concentrations predicted at Vredenburg (Ongegund), although remaining well below the relevant NAAQS.
- Of the nearest, publicly accessible areas (Main Road), PM_{10} 24-hour concentrations are predicted to remain below the 24-hour average and annual standards. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent PM_{10} 24-hour average concentrations.
- The maximum 24-hour average fence line concentration predicted was 137 µg/m^3, exceeding the 24-hour NAAQS, with a long-term concentration of 13 µg/m^3 predicted, remaining below the annual NAAQS, both occurring at the same location on the northern fence line of Saldanha Steel. Importantly, predicted concentrations disperse substantially with distance from this fence line, with all residential receptor concentrations predicted to be low.
- Concentrations are predicted to disperse predominantly within the Saldanha Steel fence line boundary, with the area of predicted non-compliance focused along the unpaved roads. Notably, the emissions from the roads are non-buoyant and disperse close to the source.

Table 7-4: Scenario 2 predicted PM_{10} receptor concentrations

ID	Receptor Name	24-Hour NAAQS (µg/m^3)	24-Hour Average (µg/m^3)	Annual NAAQS (µg/m^3)	Long-Term Average (µg/m^3)
R_1	Langebaan Weg		0.49		0.04
R_2	Main Rd (R399)		5.63		1.54
R_3	Camp St		14.75		1.87
R_4	Saldanha Industrial Development		3.38		0.31
R_5	Curro School Langebaan		0.82		0.10
R_6	Long Acres Country Estate		0.92		0.10
R_7	Mykonos		0.76		0.10
R_8	Paradise Beach		1.03		0.11
R_9	Langebaan Country Estate	75	0.50	40	0.06
R_10	Langebaan Clinic		0.43		0.04
R_11	Gerimed Langebaan (Retirement)		0.43		0.04
R_12	Blue Water Bay Lodge		1.35		0.12
R_13	Blue Water Bay		1.18		0.11
R_14	Saldanha Continuous Station		0.59		0.05
R_15	Olive Manor Nursing Home		0.58		0.05
R_16	Saldanha FamMed		0.57		0.05
R_17	Saldanha Aerodrome		1.60		0.14

ID	Receptor Name	24-Hour NAAQS (µg/m³)	24-Hour Average (µg/m³)	Annual NAAQS (µg/m³)	Long-Term Average (µg/m³)
R_18	Vredenburg (Weskus Mall)		0.57		0.10
R_19	Vredenburg (Witteklip)		0.69		0.16
R_20	Vredenburg (Ongegund)		0.73		0.17
R_21	Life West Coast Private Hospital		0.50		0.10
R_22	Huis Wittekruin (Vredenburg Old Age Home)		0.48		0.08
R_23	Vredenburg Continuous Station		0.38		0.08
R_24	Vredenburg Golf Club		0.85		0.14
	Maximum Fence line Concentration – 24Hr [X: 223293m; Y:6346124m]		**137.14**		-
	Maximum Fence line Concentration – LT [X: 223293m; Y:6346124m]		-		12.91
Note: Bold, red highlight indicates exceedance of NAAQS					

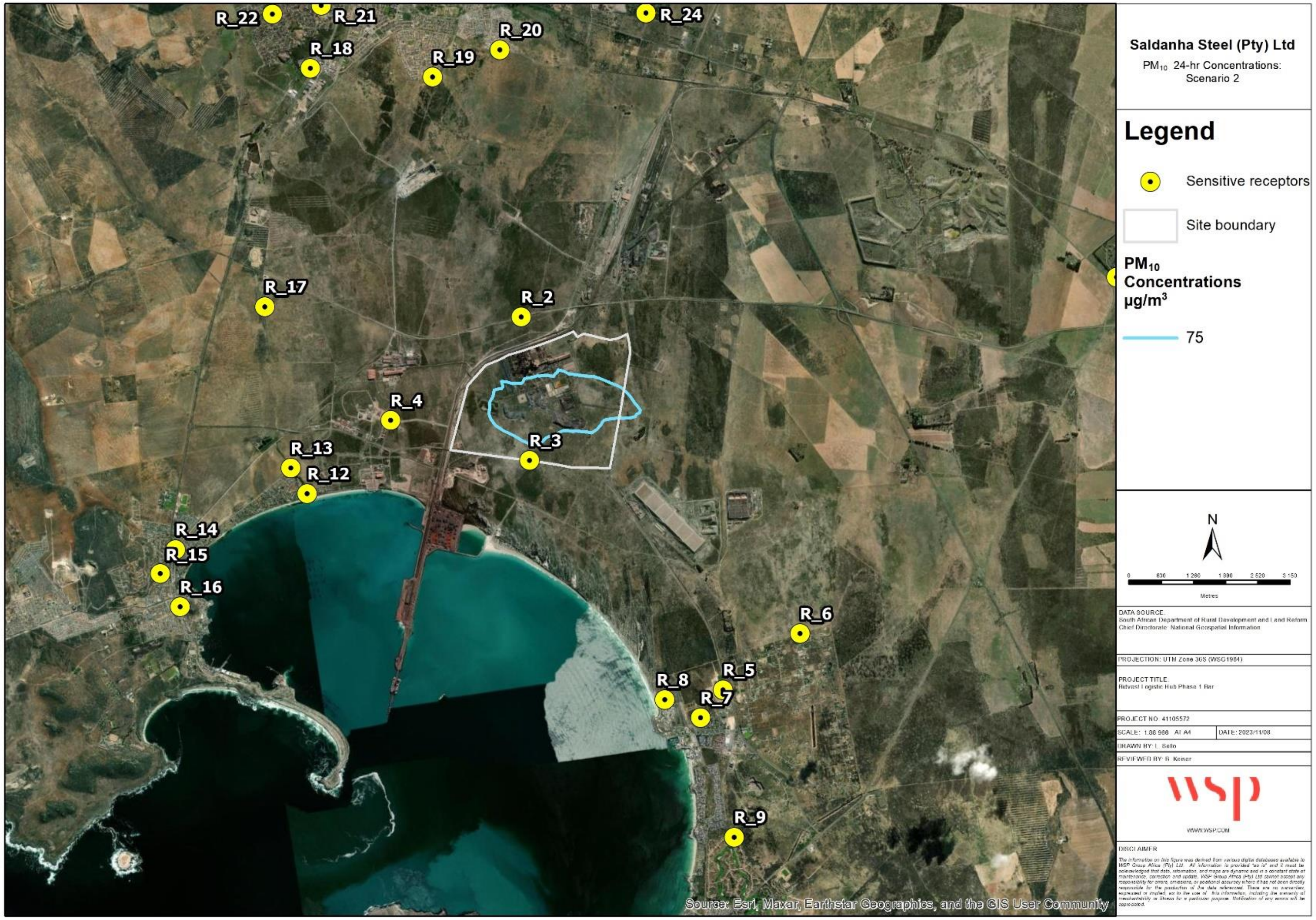


Figure 7-6: Scenario 2 predicted PM_{10} 24-hour concentrations

Figure 7-7: Scenario 2 predicted PM_{10} long-term concentrations

7.2.2 $PM_{2.5}$ CONCENTRATION PREDICTIONS

Table 7-5 presents predicted $PM_{2.5}$ concentrations at receptors during Logistics Hub operations at Saldanha Steel, while **Figure 7-8** illustrates $PM_{2.5}$ 24-hour average concentrations and **Figure 7-9** illustrates long-term $PM_{2.5}$ predicted concentrations. Key findings include:

- All residential sensitive receptor concentrations remain well below the 24-hour average and annual standards, with highest concentrations predicted at Vredenburg (Ongegund), although remaining well below the relevant NAAQS.
- Of the nearest, publicly accessible areas, highest $PM_{2.5}$ 24-hour average and long-term average (annual) concentrations are predicted at Main Road, although remaining below their relevant NAAQS. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent $PM_{2.5}$ concentrations.
- The maximum 24-hour average fence line concentration predicted was 14 µg/m³, with a long-term concentration of 2 µg/m³ predicted, both occurring at the same location on the northern fence line of Saldanha Steel, both of which are below their relevant NAAQS. Importantly, predicted concentrations disperse substantially with distance from this fence line, with all residential receptor concentrations predicted to be low.
- Concentrations are predicted to disperse predominantly within the Saldanha Steel fence line boundary, with the area of predicted non-compliance focused along the unpaved roads. Notably, the emissions from the roads are non-buoyant and disperse close to the source.

Table 7-5: Scenario 2 predicted $PM_{2.5}$ receptor concentrations

ID	Receptor Name	24-Hour NAAQS (µg/m³)	24-Hour Average (µg/m³)	Annual NAAQS (µg/m³)	Long-Term Average (µg/m³)
R_1	Langebaan Weg	40	0.05	20	0.00
R_2	Main Rd (R399)		0.59		0.16
R_3	Camp St		1.53		0.19
R_4	Saldanha Industrial Development		0.36		0.03
R_5	Curro School Langebaan		0.09		0.01
R_6	Long Acres Country Estate		0.10		0.01
R_7	Mykonos		0.08		0.01
R_8	Paradise Beach		0.11		0.01
R_9	Langebaan Country Estate		0.05		0.01
R_10	Langebaan Clinic		0.05		0.00
R_11	Gerimed Langebaan (Retirement)		0.05		0.00
R_12	Blue Water Bay Lodge		0.14		0.01
R_13	Blue Water Bay		0.12		0.01
R_14	Saldanha Continuous Station		0.06		0.01
R_15	Olive Manor Nursing Home		0.06		0.01
R_16	Saldanha FamMed		0.06		0.01

ID	Receptor Name	24-Hour NAAQS (µg/m³)	24-Hour Average (µg/m³)	Annual NAAQS (µg/m³)	Long-Term Average (µg/m³)
R_17	Saldanha Aerodrome		0.17		0.01
R_18	Vredenburg (Weskus Mall)		0.06		0.01
R_19	Vredenburg (Witteklip)		0.07		0.02
R_20	Vredenburg (Ongegund)		0.08		0.02
R_21	Life West Coast Private Hospital		0.05		0.01
R_22	Huis Wittekruin (Vredenburg Old Age Home)		0.05		0.01
R_23	Vredenburg Continuous Station		0.04		0.01
R_24	Vredenburg Golf Club		0.09		0.01
	Maximum Fence line Concentration – 24Hr [X: 223293m; Y:6346124m]		14.17		-
	Maximum Fence line Concentration – LT [X: 223293m; Y:6346124m]		-		1.33
Note: Bold, red highlight indicates exceedance of NAAQS					

Figure 7-8: Scenario 2 predicted $PM_{2.5}$ 24-hour concentrations

Figure 7-9: Scenario 2 predicted $PM_{2.5}$ long-term concentrations

7.2.3 DUST FALLOUT PREDICTIONS

Table 7-6 presents predicted 30-day average particulate matter dust fallout rates at receptors during Logistics Hub operations at Saldanha Steel, while **Figure 7-10** illustrates dust fallout rate predictions. Key findings include:

- All residential sensitive receptor fallout rates remain well below the residential standard (600 mg/m^2/day), with highest fallout rates predicted at Vredenburg (Ongegund), with a rate of 13 mg/m^2/day predicted, remaining well below the standard. A fallout rate of 16 mg/m^2/day is predicted at the Saldanha Industrial Development, although notably this is not a residential area, although remains well below the standard.
- Of the nearest, publicly accessible areas, highest dust fallout rates are predicted at Camp Street (637 mg/m^2/day), which exceeds the Residential Standard. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent, elevated dust fallout rates.
- The maximum fence line dust fallout rate predicted was 1,902 mg/m^2/day, occurring along the northern fence line of Saldanha Steel, exceeding the Non-Residential Standard of 1,200 mg/m^2/day.
- Concentrations are predicted to disperse predominantly towards the east of Saldanha Steel, with the area of predicted non-compliance extending past the fence line. Importantly, this area of non-compliance does not impact any sensitive receptor, with the nearest publicly accessible area (Camp Street), remaining below the Residential Standard. Notably, the Saldanha Steel plant is located on the northern fence line of the property, with emissions having little time to disperse prior to reaching the fence line. Further, the area immediately north of Saldanha Steel is uninhabited, and comprises predominantly open land and railways.

Table 7-6: Scenario 2 predicted dust fallout rates

ID	Receptor Name	Non-Residential Standard (mg/m^2/day)	Residential Standard (mg/m^2/day)	Dust Fallout Rate (mg/m^2/day)
R_1	Langebaan Weg	-	600	11.36
R_2	Main Rd (R399)	-	600	141.68
R_3	Camp St	-	600	**637.03**
R_4	Saldanha Industrial Development	-	600	93.56
R_5	Curro School Langebaan	-	600	20.22
R_6	Long Acres Country Estate	-	600	22.71
R_7	Mykonos	-	600	22.37
R_8	Paradise Beach	-	600	36.50
R_9	Langebaan Country Estate	-	600	14.61
R_10	Langebaan Clinic	-	600	13.25
R_11	Gerimed Langebaan (Retirement)	-	600	11.36

ID	Receptor Name	Non-Residential Standard (mg/m²/day)	Residential Standard (mg/m²/day)	Dust Fallout Rate (mg/m²/day)
R_12	Blue Water Bay Lodge	-	600	26.61
R_13	Blue Water Bay	-	600	48.05
R_14	Saldanha Continuous Station	-	600	15.19
R_15	Olive Manor Nursing Home	-	600	15.82
R_16	Saldanha FamMed	-	600	15.73
R_17	Saldanha Aerodrome	-	600	39.44
R_18	Vredenburg (Weskus Mall)	-	600	11.47
R_19	Vredenburg (Witteklip)	-	600	14.32
R_20	Vredenburg (Ongegund)	-	600	15.42
R_21	Life West Coast Private Hospital	-	600	11.20
R_22	Huis Wittekruin (Vredenburg Old Age Home)	-	600	9.61
R_23	Vredenburg Continuous Station	-	600	8.23
R_24	Vredenburg Golf Club	-	600	22.47
	Maximum Fence line Concentration [X: 223293m; Y:6346124m]	1,200	-	**1902.00**
Note: Bold, red highlight indicates exceedance of the National Dust Control Regulations Standard				

Figure 7-10: Scenario 2 predicted dust fallout rates

7.2.4 MN CONCENTRATION PREDICTIONS (FINE FRACTIONS)

Table 7-7 presents predicted Mn concentrations (Mn_{10}) at receptors during the Logistics Hub operations at Saldanha Steel, while **Figure 7-11** illustrates Mn_{10} 24-hour average concentrations and **Figure 7-12** illustrates long-term Mn_{10} concentrations. Importantly, it must be noted that the predicted Mn_{10} concentrations present an environmentally conservative approach as it was assumed that all predicted PM emissions associated with Mn handling comprise Mn dust. Key findings include:

- All residential sensitive receptor concentrations remain well below the 24-hour average Ontario guideline and annual WHO guideline, with highest concentrations predicted at Vredenburg (Ongegund), although remaining well below the relevant guidelines.
- Of the nearest, publicly accessible areas, highest Mn_{10} 24-hour average and long-term average (annual) concentrations are predicted at Main Road, although remaining well below their relevant guidelines. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent Mn concentrations.
- The maximum 24-hour average fence line concentration predicted was 0.097 µg/m^3, remaining well below the Ontario, Canada ambient Mn_{10} guideline of 0.2 µg/m^3, while also remaining below the strictest Mn guideline for $Mn_{2.5}$ of 0.1 µg/m^3.
- The maximum long-term fenceline concentration predicted was 0.058 µg/m^3, remaining well below the WHO annual guideline of 0.15 µg/m^3.
- Concentrations are predicted to disperse predominantly within the Saldanha Steel fence line boundary.

Table 7-7: Scenario 2 predicted Mn receptor concentrations

ID	Receptor Name	Ontario, Canada 24-Hour Guideline	24-Hour Average (µg/m^3)	WHO Annual Guideline (µg/m^3)	Long-Term Average (µg/m^3)
R_1	Langebaan Weg	0.1	0.00041	0.15	0.00003
R_2	Main Rd (R399)		0.02260		0.00310
R_3	Camp St		0.01315		0.00125
R_4	Saldanha Industrial Development		0.00501		0.00041
R_5	Curro School Langebaan		0.00072		0.00008
R_6	Long Acres Country Estate		0.00075		0.00007
R_7	Mykonos		0.00068		0.00008
R_8	Paradise Beach		0.00092		0.00010
R_9	Langebaan Country Estate		0.00045		0.00005
R_10	Langebaan Clinic		0.00042		0.00004
R_11	Gerimed Langebaan (Retirement)		0.00038		0.00003
R_12	Blue Water Bay Lodge		0.00135		0.00014
R_13	Blue Water Bay		0.00134		0.00014
R_14	Saldanha Continuous Station		0.00086		0.00007

ID	Receptor Name	Ontario, Canada 24-Hour Guideline	24-Hour Average (µg/m³)	WHO Annual Guideline (µg/m³)	Long-Term Average (µg/m³)
R_15	Olive Manor Nursing Home		0.00070		0.00006
R_16	Saldanha FamMed		0.00068		0.00005
R_17	Saldanha Aerodrome		0.00267		0.00021
R_18	Vredenburg (Weskus Mall)		0.00095		0.00014
R_19	Vredenburg (Witteklip)		0.00117		0.00022
R_20	Vredenburg (Ongegund)		0.00140		0.00021
R_21	Life West Coast Private Hospital		0.00070		0.00011
R_22	Huis Wittekruin (Vredenburg Old Age Home)		0.00081		0.00011
R_23	Vredenburg Continuous Station		0.00060		0.00009
R_24	Vredenburg Golf Club		0.00121		0.00012
	Maximum Fence line Concentration – 24Hr [X: 221093m; Y:6347386]		0.097		-
	Maximum Fence line Concentration – LT [X: 221093m; Y:6347386m]		-		0.0581
Note: Bold, red highlight indicates exceedance of Guideline.					

Figure 7-11: Scenario 2 predicted Mn 24-hour concentrations

Figure 7-12: Scenario 2 predicted Mn long-term concentrations

7.3 SENARIO 3: FUTURE CUMULATIVE OPERATIONS

In the future, and depending on market requirements, the start-up of the steelmaking process may be required. Under this scenario, both Saldanha Steel and the Logistics Hub will operate.

7.3.1 PM_{10} CONCENTRATION PREDICTIONS

Table 7-8 presents predicted PM_{10} concentrations at receptors during Logistics Hub operations with steelmaking operations at Saldanha Steel, while **Figure 7-13** illustrates PM_{10} 24-hour average concentrations and **Figure 7-14** illustrates long-term PM_{10} predicted concentrations. Key findings include:

- All residential sensitive receptor concentrations remain well below the 24-hour average and annual standards, with highest concentrations predicted at Vredenburg (Ongegund), although remaining well below the relevant NAAQS.
- Of the nearest, publicly accessible areas (Main Road), PM_{10} 24-hour concentrations are predicted to exceed the 24-hour average standard, although long-term concentrations remain below the annual standard. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent non-compliant PM_{10} 24-hour average concentrations.
- The maximum 24-hour average fence line concentration predicted was 393 $\mu g/m^3$, with a long-term concentration of 114 $\mu g/m^3$ predicted, both occurring at the same location on the northern fence line of Saldanha Steel, both of which exceed their relevant NAAQS. Importantly, predicted concentrations disperse substantially with distance from this fence line, with all residential receptor concentrations predicted to be low.
- The Logistics Hub contributes 0.27% of the maximum 24-hour average fence line concentration predicted, and 3.34% of the long-term concentration predicted.
- Concentrations are predicted to disperse predominantly towards the north of Saldanha Steel, with the area of predicted non-compliance extending to Main Road, located north of the plant. Notably, the Saldanha Steel plant is located on the northern fence line of the property, with emissions having little time to disperse prior to reaching the fence line. Further, the area immediately north of Saldanha Steel is uninhabited, and comprises predominantly open land and railways.

Table 7-8: Scenario 3 predicted PM_{10} receptor concentrations

ID	Receptor Name	24-Hour NAAQS (µg/m³)	24-Hour Average (µg/m³)	Annual NAAQS (µg/m³)	Long-Term Average (µg/m³)
R_1	Langebaan Weg	75	3.68	40	0.32
R_2	Main Rd (R399)		80.93		25.94
R_3	Camp St		52.54		6.40
R_4	Saldanha Industrial Development		17.45		1.86
R_5	Curro School Langebaan		5.85		0.74
R_6	Long Acres Country Estate		6.47		0.72
R_7	Mykonos		7.09		0.73
R_8	Paradise Beach		8.67		0.90
R_9	Langebaan Country Estate		4.12		0.44
R_10	Langebaan Clinic		4.95		0.37
R_11	Gerimed Langebaan (Retirement)		4.36		0.33
R_12	Blue Water Bay Lodge		8.50		0.82
R_13	Blue Water Bay		6.91		0.78
R_14	Saldanha Continuous Station		4.16		0.42
R_15	Olive Manor Nursing Home		4.15		0.37
R_16	Saldanha FamMed		4.05		0.35
R_17	Saldanha Aerodrome		9.00		0.94
R_18	Vredenburg (Weskus Mall)		8.01		1.40
R_19	Vredenburg (Witteklip)		12.29		2.15
R_20	Vredenburg (Ongegund)		14.20		2.40
R_21	Life West Coast Private Hospital		8.04		1.30
R_22	Huis Wittekruin (Vredenburg Old Age Home)		6.23		1.08
R_23	Vredenburg Continuous Station		6.09		0.99
R_24	Vredenburg Golf Club		9.89		1.31
	Maximum Fence line Concentration – 24Hr [X: 221182m; Y:6347412m]		**392.66**		-
	Maximum Fence line Concentration – LT [X: 221326m; Y:6347445m]		-		**113.66**
Note: Bold, red highlight indicates exceedance of NAAQS					

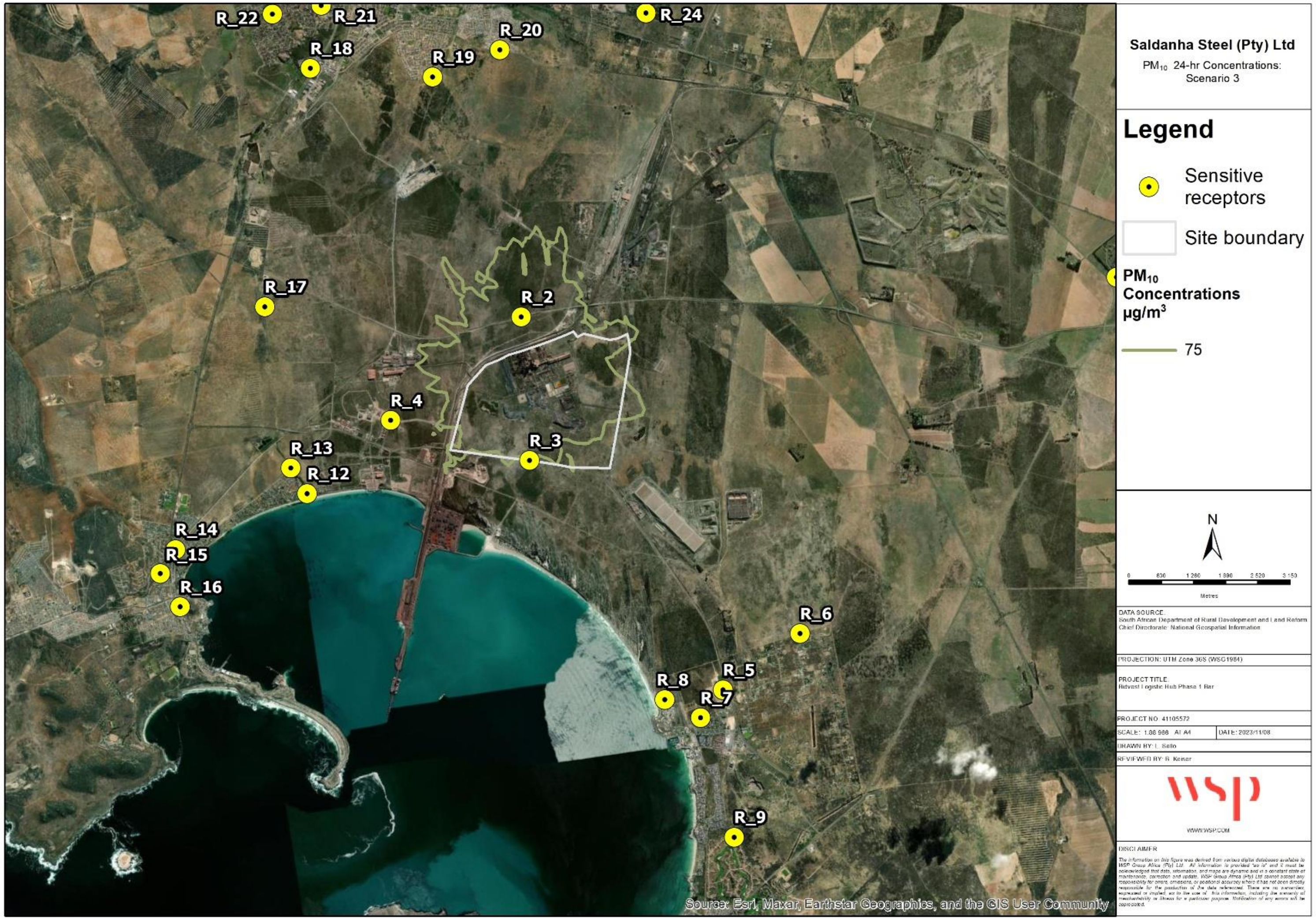


Figure 7-13: Scenario 3 predicted PM_{10} 24-hour concentrations

Figure 7-14: Scenario 3 predicted PM_{10} long-term concentrations

7.3.2 $PM_{2.5}$ CONCENTRATION PREDICTIONS

Table 7-9 presents predicted $PM_{2.5}$ concentrations at receptors during Logistics Hub operations with steelmaking operations at Saldanha Steel, while **Figure 7-15** illustrates $PM_{2.5}$ 24-hour average concentrations and **Figure 7-16** illustrates long-term $PM_{2.5}$ predicted concentrations. Key findings include:

- All residential sensitive receptor concentrations remain well below the 24-hour average and annual standards, with highest concentrations predicted at Vredenburg (Ongegund), although remaining well below the relevant NAAQS.
- Of the nearest, publicly accessible areas, highest $PM_{2.5}$ 24-hour average and long-term average (annual) concentrations are predicted at Main Road, although remaining below their relevant NAAQS. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent $PM_{2.5}$ concentrations.
- The maximum 24-hour average fence line concentration predicted was 94 µg/m^3, with a long-term concentration of 23 µg/m^3 predicted, both occurring at the same location on the northern fence line of Saldanha Steel, both of which exceed their relevant NAAQS. Importantly, predicted concentrations disperse substantially with distance from this fence line, with all residential receptor concentrations predicted to be low.
- The Logistics Hub contributes 3.30% of the maximum 24-hour average fence line concentration predicted, and 1.74% of the long-term concentration predicted.
- Concentrations are predicted to disperse predominantly towards the north of Saldanha Steel, with the area of predicted 24-hour average non-compliance only extending marginally past the Saldanha Steel northern fence line. The predicted area of long-term concentrations exceeding the annual standard only occurs to the north of the Saldanha Steel fence line and extends within close proximity of the fence line.

Table 7-9: Scenario 3 predicted $PM_{2.5}$ receptor concentrations

ID	Receptor Name	24-Hour NAAQS (µg/m^3)	24-Hour Average (µg/m^3)	Annual NAAQS (µg/m^3)	Long-Term Average (µg/m^3)
R_1	Langebaan Weg	40	1.45	20	0.12
R_2	Main Rd (R399)		31.40		8.98
R_3	Camp St		15.28		1.85
R_4	Saldanha Industrial Development		5.86		0.62
R_5	Curro School Langebaan		2.37		0.28
R_6	Long Acres Country Estate		2.48		0.27
R_7	Mykonos		2.67		0.28
R_8	Paradise Beach		3.57		0.34
R_9	Langebaan Country Estate		1.67		0.17
R_10	Langebaan Clinic		1.85		0.14
R_11	Gerimed Langebaan (Retirement)		1.65		0.13
R_12	Blue Water Bay Lodge		3.11		0.29
R_13	Blue Water Bay		2.58		0.28

ID	Receptor Name	24-Hour NAAQS (µg/m³)	24-Hour Average (µg/m³)	Annual NAAQS (µg/m³)	Long-Term Average (µg/m³)
R_14	Saldanha Continuous Station		1.54		0.15
R_15	Olive Manor Nursing Home		1.56		0.13
R_16	Saldanha FamMed		1.50		0.13
R_17	Saldanha Aerodrome		3.19		0.32
R_18	Vredenburg (Weskus Mall)		3.18		0.56
R_19	Vredenburg (Witteklip)		5.16		0.87
R_20	Vredenburg (Ongegund)		6.00		0.96
R_21	Life West Coast Private Hospital		3.39		0.53
R_22	Huis Wittekruin (Vredenburg Old Age Home)		2.62		0.44
R_23	Vredenburg Continuous Station		2.52		0.40
R_24	Vredenburg Golf Club		3.94		0.50
	Maximum Fence line Concentration – 24Hr [X: 221326m; Y:6347445m]		**94.15**		-
	Maximum Fence line Concentration – LT [X: 221326m; Y:6347445m]		-		**23.20**

Note: Bold, red highlight indicates exceedance of NAAQS

Figure 7-15: Scenario 3 predicted $PM_{2.5}$ 24-hour concentrations

Figure 7-16: Scenario 3 predicted $PM_{2.5}$ long-term concentrations

7.3.3 DUST FALLOUT PREDICTIONS

Table 7-10 presents predicted 30-day average particulate matter dust fallout rates at receptors during Logistics Hub operations with steelmaking operations at Saldanha Steel, while **Figure 7-17** illustrates dust fallout rate predictions. Key findings include:

- All residential sensitive receptor fallout rates remain well below the residential standard (600 mg/m^2/day), with highest fallout rates predicted at Vredenburg (Witteklip), with a rate of 205 mg/m^2/day predicted, remaining well below the standard. A fallout rate of 354 mg/m^2/day is predicted at the Saldanha Industrial Development, although notably this is not a residential area, although remains well below the standard.
- Of the nearest, publicly accessible areas, highest dust fallout rates are predicted at Main Road (1,240 mg/m^2/day), which exceeds the Residential Standard. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent, elevated dust fallout rates.
- The maximum fence line dust fallout rate predicted was 3,838 mg/m^2/day, occurring along the northern fence line of Saldanha Steel, exceeding the Non-Residential Standard of 1,200 mg/m^2/day.
- The Logistics Hub contributes 10.79% of the maximum fence line dust fallout rate predicted.
- Concentrations are predicted to disperse predominantly towards the north of Saldanha Steel, with the area of predicted non-compliance extending past the fence line. Importantly, this area of non-compliance does not impact any sensitive receptor. Notably, the Saldanha Steel plant is located on the northern fence line of the property, with emissions having little time to disperse prior to reaching the fence line. Further, the area immediately north of Saldanha Steel is uninhabited, and comprises predominantly open land and railways.

Table 7-10: Scenario 3 predicted dust fallout rates

ID	Receptor Name	Non-Residential Standard (mg/m^2/day)	Residential Standard (mg/m^2/day)	Dust Fallout Rate (mg/m^2/day)
R_1	Langebaan Weg	-	600	75.938
R_2	Main Rd (R399)	-	600	**1 240.4**
R_3	Camp St	-	600	**642.48**
R_4	Saldanha Industrial Development	-	600	354.07
R_5	Curro School Langebaan	-	600	94.552
R_6	Long Acres Country Estate	-	600	119.23
R_7	Mykonos	-	600	104.74
R_8	Paradise Beach	-	600	127.64
R_9	Langebaan Country Estate	-	600	74.985
R_10	Langebaan Clinic	-	600	76.225
R_11	Gerimed Langebaan (Retirement)	-	600	68.354
R_12	Blue Water Bay Lodge	-	600	158.35

ID	Receptor Name	Non-Residential Standard (mg/m²/day)	Residential Standard (mg/m²/day)	Dust Fallout Rate (mg/m²/day)
R_13	Blue Water Bay	-	600	152.62
R_14	Saldanha Continuous Station	-	600	75.784
R_15	Olive Manor Nursing Home	-	600	62.107
R_16	Saldanha FamMed	-	600	105.08
R_17	Saldanha Aerodrome	-	600	144.16
R_18	Vredenburg (Weskus Mall)	-	600	125.55
R_19	Vredenburg (Witteklip)	-	600	204.82
R_20	Vredenburg (Ongegund)	-	600	197.07
R_21	Life West Coast Private Hospital	-	600	108.54
R_22	Huis Wittekruin (Vredenburg Old Age Home)	-	600	97.729
R_23	Vredenburg Continuous Station	-	600	88.049
R_24	Vredenburg Golf Club	-	600	168.9
	Maximum Fence line Concentration [X: 221182m; Y:6347412m]	1,200	-	**3 838.10**
Note: Bold, red highlight indicates exceedance of the National Dust Control Regulations Standard				

Figure 7-17: Scenario 3 predicted dust fallout rates

7.3.4 MN CONCENTRATION PREDICTIONS (FINE FRACTIONS)

Table 7-11 presents predicted Mn concentrations (Mn_{10}) at receptors during the Logistics Hub operations at Saldanha Steel, while **Figure 7-18** illustrates Mn_{10} 24-hour average concentrations and **Figure 7-19** illustrates long-term Mn_{10} concentrations. Importantly, it must be noted that the predicted Mn_{10} concentrations present an environmentally conservative approach as it was assumed that all predicted PM emissions associated with Mn handling comprise Mn dust. Key findings include:

- All residential sensitive receptor concentrations remain well below the 24-hour average Ontario guideline and annual WHO guideline, with highest concentrations predicted at Vredenburg (Ongegund), although remaining well below the relevant guidelines.
- Of the nearest, publicly accessible areas, highest Mn_{10} 24-hour average and long-term average (annual) concentrations are predicted at Main Road, although remaining well below their relevant guidelines. Importantly, this selected receptor does not represent a residential receptor, but is rather a nearby road where the public may be exposed to intermittent Mn concentrations.
- The maximum 24-hour average fence line concentration predicted was 0.097 µg/m^3, remaining well below the Ontario, Canada ambient Mn_{10} guideline of 0.2 µg/m^3, while also remaining below the strictest Mn guideline for $Mn_{2.5}$ of 0.1 µg/m^3.
- The maximum long-term fenceline concentration predicted was 0.058 µg/m^3, remaining well below the WHO annual guideline of 0.15 µg/m^3.
- Concentrations are predicted to disperse predominantly within the Saldanha Steel fence line boundary.

Table 7-11: Scenario 3 predicted Mn receptor concentrations

ID	Receptor Name	Ontario, Canada 24-Hour Guideline	24-Hour Average (µg/m^3)	WHO Annual Guideline (µg/m^3)	Long-Term Average (µg/m^3)
R_1	Langebaan Weg	0.1	0.00041	0.15	0.00003
R_2	Main Rd (R399)		0.02260		0.00310
R_3	Camp St		0.01315		0.00125
R_4	Saldanha Industrial Development		0.00501		0.00041
R_5	Curro School Langebaan		0.00072		0.00008
R_6	Long Acres Country Estate		0.00075		0.00007
R_7	Mykonos		0.00068		0.00008
R_8	Paradise Beach		0.00092		0.00010
R_9	Langebaan Country Estate		0.00045		0.00005
R_10	Langebaan Clinic		0.00042		0.00004
R_11	Gerimed Langebaan (Retirement)		0.00038		0.00003
R_12	Blue Water Bay Lodge		0.00135		0.00014
R_13	Blue Water Bay		0.00134		0.00014
R_14	Saldanha Continuous Station		0.00086		0.00007
R_15	Olive Manor Nursing Home		0.00070		0.00006

ID	Receptor Name	Ontario, Canada 24-Hour Guideline	24-Hour Average (µg/m³)	WHO Annual Guideline (µg/m³)	Long-Term Average (µg/m³)
R_16	Saldanha FamMed		0.00068		0.00005
R_17	Saldanha Aerodrome		0.00267		0.00021
R_18	Vredenburg (Weskus Mall)		0.00095		0.00014
R_19	Vredenburg (Witteklip)		0.00117		0.00022
R_20	Vredenburg (Ongegund)		0.00140		0.00021
R_21	Life West Coast Private Hospital		0.00070		0.00011
R_22	Huis Wittekruin (Vredenburg Old Age Home)		0.00081		0.00011
R_23	Vredenburg Continuous Station		0.00060		0.00009
R_24	Vredenburg Golf Club		0.00121		0.00012
	Maximum Fence line Concentration – 24Hr [X: 221093m; Y:6347386]		0.097		-
	Maximum Fence line Concentration – LT [X: 221093m; Y:6347386m]		-		0.0581
Note: Bold, red highlight indicates exceedance of Guideline.					

Figure 7-18: Scenario 3 predicted Mn 24-hour concentrations

Figure 7-19: Scenario 3 predicted Mn long-term concentrations

7.4 CUMULATIVE ASSESSMENT (INCLUSION OF BASELINE DATA)

The National Framework for Air Quality Management in South Africa calls for air quality assessment in terms of cumulative impacts rather than the contributions from an individual facility. Compliance with the NAAQS is to be determined by considering all local and regional contributions to background concentrations. For each averaging time, the sum of the model predicted concentration (CP) and the background concentration (CB) must be compared with the NAAQS. The background concentrations CB must be the sum of contributions from non-modelled local sources and regional background air quality. If the sum of background and predicted concentrations (CB + CP) is more than the NAAQS, the design of the facility must be reviewed (including pollution control equipment) to ensure compliance with NAAQS. Compliance assessments must provide room for future permits to new emissions sources, while maintaining overall compliance with NAAQS. For the different facility locations and averaging times, the comparisons with NAAQS must be based on recommendations in **Table 7-12**.

Table 7-12: Summary of recommended procedures for assessing compliance with NAAQS

Facility Location	Annual NAAQS	Short-term NAAQS (24 hours or less)
Isolated facility not influenced by other sources; CB insignificant*.	Highest CP must be less than the NAAQS, no exceedances allowed.	99th percentile concentrations must be less than the NAAQS. Wherever one year is modelled, the highest concentrations shall be considered.
Facilities influenced by background sources e.g., in urban areas and priority areas.	Sum of the highest CP and background concentrations must be less that the NAAQS, no exceedances allowed.	Sum of the 99th percentile concentrations and background CB must be less than the NAAQS. Wherever one year is modelled, the highest concentrations shall be considered.
*For an isolated facility influenced by regional background pollution CB must be considered.		

A cumulative assessment, as defined above, could not be undertaken in this AIR as the ambient monitoring data presented in this AIR (**Section 5)** already includes concentrations as a direct result of Saldanha Steel emissions, with these measured concentrations showing full compliance with their respective standards. Since the measured concentrations already account for Saldanha Steel emissions, the measured data is to be viewed as cumulative data. If this data was to be combined with the Saldanha Steel concentration predictions presented in this AIR, the resultant concentrations would be over-stated due to the double accounting of Saldanha Steel emissions.

7.5 IMPACTS ON THE RECEIVING ENVIRONMENT

As pollutants disperse into the air, workers and people close to the source might be exposed directly through inhalation, or indirectly through consumption of food or water contaminated by deposition of the pollutants to soil and vegetation (NRC, 2000). Others can be exposed through a different mix of environmental pathways after the particles travel some distance in the atmosphere. This includes, going through various chemical and physical transformations, or passing through soil, water, or food. Inhalation has shown to be the most direct path for exposure to pollutants emitted from stacks and dispersed into the atmosphere. However, the combination of long-range transport, deposition, and uptake of the pollutants by the food chain, appears to be a significant mode of exposure (NRC, 2000).

The main contribution of manganese concentrations within the atmosphere is crustal rock sources, ocean spray, forest fires, vegetation decay and volcanic activity. Manganese atmospheric concentrations are mainly dependent on wind parameters (wind speed and wind direction), proximity to source and the compound particle sizes. These concentrations tend to be greater near the source with the highest concentrations generally experienced within industrial areas. Manganese, up to a certain concentration, is a nutritional element required by a variety of microorganisms, plants and animals. The requirement of nutritional manganese differs with each species. In some species manganese concentrations are in excess of 2,000mg/kg (WHO, 2004). When evaluating the anthropogenic contribution of manganese to the terrestrial environment it is important to account for the background concentration levels which vary within communities and ecosystems.

7.5.1 EFFECTS ON VEGETATION

Air pollution in South Africa was first identified as a potential threat to vegetation in 1988 (Tyson et al., 1988). The commercial forests of the eastern escarpment were highlighted as a threatened resource due to their proximity to the heavily industrialised Highveld. Marshal et al., (1998) also identified concerns around the potential impacts on crop yields on the Highveld. Air pollutants that could impact on vegetation include PM, SO_2, O_3, NO_x and Hydrogen Fluoride (HF).

The effects of pollution on plants include mottled foliage, 'burning' at leaf tips or margins, twig dieback, stunted growth, premature leaf drop, delayed maturity, abortion or early drop of blossoms, and reduced yield or quality. In general, the visible injury to plants is of three types: (1) collapse of leaf tissue with the development of necrotic patterns, (2) yellowing or other colour changes, and (3) alterations in growth or premature loss of foliage (Sikora and Chappelka, 2004).

Factors that govern the extent of damage and the region where air pollution is a problem are (1) type and concentration of pollutants, (2) distance from the source, (3) length of exposure, and (4) meteorological conditions. Other important factors are city size and location, land topography, soil moisture and nutrient supply, maturity of plant tissues, time of year, and species and variety of plants. A soil moisture deficit or extremes of temperature, humidity, and light often alter a plant's response to an air pollutant (Sikora and Chappelka, 2004).

The main contributions of manganese in soil are direct injection from atmospheric deposition, leaching from decomposing plant and animal matter, wash-off from facilities handling manganese material and plant and animal waste. Symptoms of manganese toxicity vary widely within plant species, including, but are not limited to necrotic lesions, distorted leaf development, stunted growth. There is a wide variation in tolerance to manganese between plant species (WHO, 2004).

7.5.2 EFFECTS ON ANIMALS

Air pollution is a recognized health hazard to domestic animals and wildlife. Industrial air pollutants effect both wild birds and mammals, causing notable decreases in local populations (Newman, 1979). The major effects include direct mortality, debilitating injury and disease, stress, anaemia, and bioaccumulation (Newman, 1979). Certain air pollutants are also known to cause variation in the distribution of certain wildlife species (Schreiber, and Newman, 1988). Animals are typically exposed to air pollution through a) inhalation of gases or small particles, b) ingestion of particles suspended in food or water, or c) absorption of gases through the skin (Burdo, 2018). Soft-bodied invertebrates (such as earthworms), or animals with thin, moist skin (such as amphibians) are the most susceptible to absorption of pollutants. Individual responses to pollutants are dependent on the type of pollutant involved, the duration and time of exposure, and the concentration taken up by the animal (Wong and Candolin, 2015). The individual's age, sex, health, and reproductive condition also determines its response. There is much variability observed between animal classes, species, and even genotypes, in terms of the level of tolerance to a specific pollutant (Wong and Candolin, 2015).

7.6 IMPACT FINDINGS SUMMARY

Based on the dispersion modelling predictions, the following key, summary findings are noted:

- Concentrations associated with the Saldanha Steel steelmaking operations are predicted to exceed the 24-hour average PM_{10} NAAQS past the Saldanha Steel fence line, extending towards the north. However, importantly, these concentrations do not impact residential sensitive receptors, with all sensitive receptor concentrations predicted to remain low.
- Concentrations associated with the Logistics Hub operations are predicted to exceed the 24-hour average PM_{10} NAAQS past the Saldanha Steel fence line, extending towards the east. However, importantly, these concentrations do not impact residential sensitive receptors, with all sensitive receptor concentrations predicted to remain low.
- Mn concentrations associated with the Logistics Hub operations are predicted to remain well below respective international guidelines, with no impacts on sensitive receptors, nor the receiving environment.
- Predicted annual PM_{10}, 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ concentrations associated with Saldanha Steel remain low at all sensitive receptors, with no exceedances predicted, although maximum fence line concentrations are predicted to exceed their respective NAAQS. Notably, the Saldanha Steel operational areas border the northern fence line with emissions having very little time to disperse. However, the area north of Saldanha Steel is uninhabited and predominantly open lands and railways.
- Dust fallout rates are predicted to remain low at all sensitive receptors, below the Residential Standard. However, exceedances of the non-residential standard are predicted on the northern fence line of Saldanha Steel. Importantly, the Saldanha Steel operations are located alongside the northern fence line, with emissions having little time to disperse sufficiently prior to reaching the fence line. Importantly, compliance with the residential standard is predicted approximately 400m from the fence line, with the area potentially impacted comprising a railway and open lands, with no inhabitants in the area.

8 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are applicable to this AIR:

- All stack specifications were provided and approved by Saldanha Steel.
- Unless otherwise stated, operational information was provided by Saldanha Steel and BPO. Any errors, limitations, or assumptions inherent in these datasets extend to this study.
- Given the low data recovery from the Saldanha Bay Municipality continuous monitoring station, this data must be viewed with caution.
- In the absence of PM_{10} and $PM_{2.5}$ specific emissions data, various assumptions for these fractions were applied, as detailed in the applicable sections of Section 3.

- It is assumed the modelled MM5 CALMET Ready Dataset accurately represents prevailing meteorological conditions in the Saldanha area.
- The Midrex Sludge Granulation Plant was excluded from this AIR as this is a wet process, as confirmed by Saldanha Steel.
- The Corex and Conarc furnaces were assumed to be similar to blast furnaces, therefore emission factors contained within the US EPA AP42 Section 12.5 Iron and Steel Production were applied.
- It is assumed that all vehicles will be covered with a standard tarpaulin during transport of materials both on and off site.
- Chemical sprayers are used within the warehouse to supress dust emissions.
- The warehouse will be an enclosed unit with no extraction systems, as a result it is predicted that there will be no wind erosion from bulk material stockpiles.
- It is assumed that a 50% split of Manganese ore will be received via road and rail. It is anticipated that this will be a temporary measure during rail infrastructure upgrades, with rail haulage predicted to increase after 2026. Notably, a percentage of ore will be transported via road due to mining facilities rail accessibility.
- All commodities transported via road will make up to 43% of the maximum bulk commodities handled (up to 5,000,000 tpa).
- A conservative approach of 98% control efficiency has been applied for enclosures. Ausi NPi Emission technique Manual for Mining, 2012 states that enclosures have a 100% control efficiency.
- A control efficiency of 90% has been applied to the roads as chemical suppressants are used as a palliative control.
- It is assumed that the new conveyor will be partially enclosed with chemical sprayers used as an emission suppressant, as per Ausi NPi Emission technique Manual for Mining, 2012.

9 COMPLAINTS

As noted previously, Saldanha Steel is currently in C&M, with the ironmaking operations ceasing 15 January 2020 and the remaining operations ceasing 26 March 2020 due to challenges in the global steel market. Given this, no air quality related complaints have been received since 2020. **Table 9-1** presents the number of complaints received for each source identified for the period 2015 – 2022, while **Table 9-2** presents a summary description of each complaint. The full complaints register, as held by Saldanha Steel, is available on request from Saldanha Steel.

Of the complaints received since 2015, most complaints are related to visible building emissions associated with the Corex (nine complaints) and Conarc (six complaints) furnaces, followed by fugitive emissions associated with roads and open areas (stockyard and the Solid Waste Disposal Site (SWDS)). The number of complaints received due to the Corex and Conarc building fugitive emissions, supported by calculated emissions and model predictions for these sources, mean these are critical sources of emissions, requiring focus to reduce overall impacts of Saldanha Steel operations on the receiving environment.

Table 9-1: Summary of air quality related complaints (2015 – 2022)

Year	Corex	Conarc	Tube City	Stockyard	Roads & Open Areas	Slag Plant	Scrap Handling	SWDS	Unknown
2015	1	-	1	-	-	1	-	-	-

Year	Corex	Conarc	Tube City	Stockyard	Roads & Open Areas	Slag Plant	Scrap Handling	SWDS	Unknown
2016	4	-	-	2	-	-	1	1	-
2017	2	4	-	-	1	-	-	1	-
2018	1	2	-	1	2	-	-	1	2
2019	1	-	1	-	-	-	-	-	-
2020	-	-	-	-	-	-	-	-	-
2021	-	-	-	-	-	-	-	-	-
2022	-	-	-	-	-	-	-	-	-
TOTAL	**9**	**6**	**2**	**3**	**3**	**1**	**1**	**3**	**2**

Table 9-2: Air quality related complaints (2015 – 2022)

Complaint Date	Complaint	Identified Source	Cause	Plant Condition	Action
02 Mar'15	Odour detected at night, under low wind speed conditions, in the Vredenburg area.	Slag plant	Water sprayed on slag for cooling and dust suppression converts sulphur to hydrogen sulphide emissions	Abnormal	Control water flow spray more effectively
08 Sept'15	Dark brown emissions visible from the Corex building roof.	Corex cast house B	Due to deviation from normal furnace conditions. Furnace temperature was cold resulting in iron overflow into the "trog".	Abnormal	Furnace quality deviation (flow and temperature) was addressed.
24 Sept'15	Visible brown emissions from the south side of the plant.	Tube City (pooling)	Process deviations at Meltshop resulted in hot liquid iron pooling at the Tube City Iron Pooling area.	Abnormal	Meltshop breakdown was resolved.
29 Feb'16	Grey, visible dust emissions from the stockyard	Stockyard	Caused by fine particle size of DRI, with application of water not possible due to the chemical reaction with water potentially resulting in a fire.	Ad hoc Activity	Various measures implemented: moving screen closer to the heap, stockpile heights to remain high reducing the drop height, install a hood at the screen, reducing height of stockpile being screened.
07 Feb'16	Subjected to toxic fumes while driving past the site.	Corex	Hydraulic problems for granulating slag	Abnormal	Attempt to achieve desired spec for products. Repaired and returned to normal conditions
12 Apr'16	Cloud of brown emissions clearly visible above facility	Scrap handling yard	Breakdown causing pooling of iron	Ad hoc Activity	Consider plant operations during breakdowns and reschedule.
06 May'16	Visible, red dust from Corex cast-house A	Corex	Difficulty to close tap hole due to a skull build-up	Abnormal	Corex plant switched off to allow for closing of tap hole.
28 May'16	Red staining of property	Stockyard	Possibly from stockyard and neighbouring entities handling iron ore	Unknown (unlikely Saldanha Steel)	Complaint investigated and viewed the stained property.
29 Jun'16	Brown visible emissions from cast-house B	Corex	Cast-house B not used for a long period, resulting in cold "trog" conditions when tapping.	Abnormal	Normalised Corex furnace conditions
07 Nov'16	Brown and black emissions visible from cast-house A and B	Corex	Start-up of Corex after 3-month shutdown	Abnormal	Normalised Corex furnace conditions

Complaint Date	Complaint	Identified Source	Cause	Plant Condition	Action
08 Nov'16	Visible dust emissions from the solid waste disposal site	Solid waste disposal site (SWDS)	Movement of vehicles at the SWDS	Normal	Additional wetting of open areas and vehicle movements limited
06 Jun'17	Fugitive emissions observed from the Corex area	Corex	Damaged splash covers due to abnormal furnace conditions	Abnormal	Planned to replace splash covers
21 Jun'17	Plume visible from Corex emissions	Corex	Lancing activities due to unplanned shutdown	Abnormal	Corex team informed to be more vigilant in terms of emissions due to unplanned shutdowns
17 Jul'17	Visible dust emissions from Meltshop roof	Conarc	Door left open by cleaners	Abnormal (human error)	Door will be kept closed, cleaners informed
07 Sept'17	Visible dust emissions from Meltshop roof	Conarc	Furnace shell changed, requiring the removal of the large side, resulting in dust emissions	Abnormal (human error)	Mitigation actions will be identified prior to removing furnace shells
30 Oct'17	Visible dust emissions from Meltshop roof	Conarc	All conditions normal within Conarc, exact cause of emissions unknown	Normal	Recommended to upgrade dedusting system
07 Nov'17	Visible dust emissions from the plant	Road surfaces and open areas	High ambient temperature and fast winds resulted in water spraying not be effective	Normal	Continue routine dust suppression and identify additional mitigation actions during adverse weather
29 Nov'17	Red / brown emissions observed from the plant	Conarc	Defective fume elbow and damage to one of the bellows to baghouse	Abnormal	No actions identified
06 Dec'17	Plumes of dust observed, emitted from the stockyard at SWDS	SWDS	Strong winds prevailed during the day	Normal	Stop work during adverse weather conditions
09 May'18	Odour reported, detected approximately 10km west of the plant	Unknown	Plant was not operating during period of complaint, therefore likely unrelated to AMSA	Unknown (unlikely Saldanha Steel)	None
04 Jun'18	Visible dust from the reclaiming area	Stockyard	FEL operating in extended stockyard.	Ad hoc Activity	FEL operations ceased immediately
10 Aug'18	Brown emissions visible from Saldanha Steel	Conarc	Unknown	Abnormal (human error)	None

Complaint Date	Complaint	Identified Source	Cause	Plant Condition	Action
10 Aug'18	Trucks using road opposite entrance gate causing large amounts of dust	Road surfaces and open areas	Dust emissions caused due to ineffective suppression on road	Normal	None
11 Aug'18	Brown emissions visible from Saldanha Steel	Corex	Taphole spray severe when opening tap on cast-house B, resulting in high dust emissions	Abnormal	None
13 Aug'18	Staining of yacht in Port of Saldanha	Unknown	No root cause could be traced	Unknown (unlikely Saldanha Steel)	Inspection of yacht conducted, staining confirmed negligible
11 Aug'18	Dark, dense dust visible at SWDS and from steelmaking building	Road surfaces and open areas	Emissions caused by ineffective dust suppression on roads	Normal	None
01 Sept'18	Red dust escaping from plastic bags at SWDS	SWDS	Emission from bags not evident after inspection	Ad hoc Activity	None (inspection undertaken by DEADP)
12 Mar'19	Brown emissions visible from Saldanha Steel	Pooling at Tube City	Confirmed cause due to pooling at Tube City	Ad hoc Activity	None
26 Sept'19	Large plumes of iron oxide pollution coming from Saldanha Steel	Corex	First taps of Corex start-up after long shutdown period	Abnormal	Repair splash cover and operate Corex at normal conditions

10 CURRENT OR PLANNED AIR QUALITY INTERVENTIONS

Current air quality interventions are only applicable to the steelmaking operations, with most of these operations' shutdown due to Saldanha Steel being on C&M, with the exception of the chemical suppressant being applied to the unpaved truck entrance road. Prior to Saldanha Steel restarting operations, should this be required, all existing mitigation systems will be repaired (where required) and tested thoroughly to ensure their efficient operation. This will include all extraction systems, baghouse and stack emission abatement systems and sprayers on conveyors and transfer stations.

10.1 RECOMMENDATIONS

Additional to the above current or planned air quality interventions, the following sections provides detail on how fugitive emissions can be mitigated at Saldanha Steel. Recommendations includes a fugitive dust management plan (FDMP) that incorporates general housekeeping and activity specific interventions.

10.1.1 FUGITIVE DUST MANAGEMENT PLAN

Aim

The overall aim of the Fugitive Dust Management Plan (FDMP) is to:

Identify all significant sources of fugitive dust, existing controls applied on these sources, and proposed improvements in controls to further reduce dust emissions and the impact thereof on the receiving environment.

It is envisaged the above aim will be achieved through:

- Goal 1: Reduction of dust emissions.
- Goal 2: Monitoring of dust emissions to determine effectiveness of controls and impacts on the receiving environment.
- Goal 3: Effective internal and external communications, inclusive of management of a complaints register.

Line Management and Responsibility

The successful implementation of the FDMP requires a clear structure of responsibility. Importantly, the structure presented herein relates only to the team responsible for the successful implementation of the FDMP. However, this successful implementation relies on all employees at AMSA, ensuring the required mitigation measures are appropriately implemented and tracked. **Table 10-1** presents the roles and responsibilities to ensure the successful implementation of the FDMP.

Table 10-1: Roles and responsibilities of FDMP

Role	Responsibility
Accounting Officer (ACO): Aldrich Louis	▪ Final approval of information shared externally, e.g. submissions to the Licensing Authority (LA). ▪ Air quality performance feedback to the broader Saldanha Steel / AMSA business, inclusive of EXCO. ▪ Ensuring the FDMP is implemented accordingly.
Emission Control Officer (ECO): Shoenay Siebritz	▪ Reporting of ambient monitoring data to ACO, specifically identifying areas of concern. ▪ Reporting of the FDMP performance and compliance to the ACO. ▪ Review of complaints investigations, and provision of feedback to complainants, following approval of ACO. ▪ Sharing complaints within the Saldanha Steel team raising awareness of impacts on the receiving environment. ▪ Engagement with the LA, ensuring communication channels are always open and LA informed of any changes onsite. ▪ Management of subcontractors relating to provision of air quality services. ▪ Ensure the FDMP remains relevant to operations onsite. Any changes onsite, or increases in measured data, must trigger the need for a review of the FDMP. ▪ Provision of training / awareness campaigns to be rolled out ensuring all employees are aware of dust generating activities, and the expectations of controlling these sources. ▪ Should monitoring data indicate potential impacts on the receiving environment, ensure the FDMP is updated to address sources of concern e.g. any non-compliance with the National Dust Control Regulations standards requires the FDMP be updated.
Environmental Coordinator: Shoenay Siebritz	▪ Day to day implementation of the FDMP, ensuring each operational area is implementing applicable control measures. ▪ Completion of weekly inspections of key sources of emissions. ▪ Undertake complaints investigations aligned with AEL requirements. ▪ Continuous communication with operational areas ensuring raised awareness of the FDMP requirements and addressing shortcomings in implementation. ▪ Development of inspection sheets, log sheets etc and the database for saving of these to ensure availability for LA and / or independent AEL audits. ▪ Undertake routine reviews of inspection logs to ensure these are completed as required.
Process and Plant Managers	▪ Implementation of the FDMP controls applicable to their particular area of operation. ▪ Completion of all inspection sheets and / or implementation logs to be held as evidence of implementation of the FDMP.

Dust Management and Implementation

The dust management plan defines specific objectives for each of the above goals, with specific actions defined for each key source of emissions. Each action is assigned an implementation timeframe and an implementation tracker assigned to assess and manage progress. Importantly, a log sheet must be completed and saved for all items, including for visible inspections, ensuring evidence of implementation and performance is available for auditing purposes. **Table 10-2** below provides mitigation measures and an implementation schedule for Saldanha Steel. **Table 10-3** and **Table 10-4** below provides details on dust monitoring, control effectiveness and effective communication measures.

Table 10-2: **Goal 1 - Dust mitigation and implementation schedule**

Source	Specific Measures	Timeframe	Implementation Tracker
Furnace Building Fugitives	A review of the current dust extraction systems to ensure these are appropriate in design and operating efficiently. Should upgrades be required, implement accordingly e.g. extraction fan and baghouse capacity.	Prior to re-commissioning	Records of investigation and upgrades
	Following upgrade, test building fugitive emissions to fully understand actual emissions from buildings.	Immediately following re-commissioning	Test reports
	Improve building enclosures to improve the containment of fugitive emissions.	Prior to re-commissioning	Maintenance records
	Improve efficiency of extraction hoods e.g. during Conarc tapping.	Prior to re-commissioning	Test reports and visual inspections
	Improve general housekeeping within buildings.	On re-commissioning	Weekly inspections
	Install abatement system specific to slag and metal pooling.	Prior to re-commissioning	Proof of installations, visual inspections relating to extraction performance
	Ensure all extraction equipment is maintained and serviced according to manufacturer's specifications, ensuring required extraction flow is maintained, as well as all leaks in extraction system are timeously repaired.	Prior to re-commissioning and ongoing	Maintenance logs and monthly inspections of extraction system
	Ensure baghouses are maintained according to manufacturer's specifications, with emission tests undertaken to confirm control efficiency remains high and emission standards (where applicable) are met.	Prior to re-commissioning and ongoing	Maintenance logs, monthly inspections and stack emissions tests
	Installation of rooftop cameras enabling operators to identify when rooftop emissions are excessive. These cameras must be fit for purpose and maintained regularly as per manufacturers recommendations.	Prior to re-commissioning and ongoing	Maintenance and inspections logs
	Ensure operational inefficiencies of the furnace are reduced e.g. blocking of the tap hole.	Ongoing	Monthly operational performance reviews
Stock Houses (incl. drying plant, blending	Ensure all extraction equipment is maintained and serviced according to manufacturer's specifications, ensuring required extraction flow is maintained, as well as all leaks in extraction system are timeously repaired	Prior to re-commissioning and ongoing	Maintenance logs and monthly inspections of extraction system

Source	Specific Measures	Timeframe	Implementation Tracker
plant & screen house)	Ensure baghouses are maintained according to manufacturer's specifications, with emission tests undertaken to confirm control efficiency remains high and emission standards (where applicable) are met	Prior to re-commissioning and ongoing	Maintenance logs, monthly inspections and stack emissions tests
	General inspections of all activities within the furnace buildings identifying any activity contributing to fugitive dust and reporting this accordingly to ensure timely resolution	Ongoing	Weekly inspections
Transfer Stations	Ensure chemical additive sprayer on Transfer Station 3 (TS3) is operational at all times and maintained accordingly. Operations to stop if sprayer is not operational. Undertake weekly inspections of all sprayers to confirm operational status.	Prior to re-commissioning and ongoing	Maintenance logs and weekly inspections
	Where possible, add strip curtains to transfer stations and / or improve station enclosures to contain fugitive emissions. Weekly inspections to identify leaks / substantial emissions from transfer stations.	Prior to re-commissioning and ongoing	Weekly inspections
Side and Rotary Tipplers	Where possible, add strip curtains to reduce fugitive emissions from tipplers, especially from the main openings. During unloading, undertake inspections of emissions identifying any substantial releases.	Prior to re-commissioning and ongoing	Inspections during unloading
	Ensure all extraction equipment is maintained and serviced according to manufacturer's specifications, ensuring required extraction flow is maintained, as well as all leaks in extraction system are timeously repaired. Unloading to only occur when extraction system is operational.	Prior to re-commissioning and ongoing	Maintenance logs and monthly inspections of extraction system
	Ensure chemical additive sprayer on the Rotary Tippler is always operational and maintained accordingly. Unloading to stop if sprayer is not operational. Undertake weekly inspections of all sprayers to confirm operational status.	Prior to re-commissioning and ongoing	Maintenance logs and weekly inspections
	Ensure water sprayer on Side Tippler is always operational and maintained accordingly. Unloading to stop if sprayer is not operational. Undertake weekly inspections of all sprayers to confirm operational status.	Prior to re-commissioning and ongoing	Maintenance logs and weekly inspections
Stockpiles / Dumps and Exposed Areas	Identify exposed areas, not used for operations, and revegetate to reduce the amount of dust available for wind entrainment. Ensure vehicles cannot access these areas.	Prior to re-commissioning and ongoing	Quarterly inspections of exposed areas
	Install sprayers within stockpile areas focusing on those stockpiles prone to wind entrainment. This will only apply to materials that do not react to water.	Ongoing	Weekly inspection of sprayer systems

Source	Specific Measures	Timeframe	Implementation Tracker
	Implement front end loader (FEL) operational improvements, such as reduced drop heights of materials, reduced FEL speeds, and reduced disturbance of stockpiles.	Ongoing	FEL operator training, weekly inspections.
	Implement access restrictions at stockpile yards reducing the number of vehicles within the areas e.g. light vehicles using the stockpile yards as thoroughfares.	Ongoing	Permission system for stockpile yard access
	Where vehicles are permitted to access the stockpile yards, ensure speed controls are implemented and enforced.	Ongoing	Implement speed control protocol, and reporting system
	Where possible, do not undertake material handling activities during windy conditions. Conditions exceeding 10 m/s, and blowing directly towards the nearest receptors, should be considered as windy.	Ongoing	Visible inspections
	Where material will not be required for the foreseeable future, and the stockpile is of a size that allows covering, cover the stockpile with hessian sheets to reduce the impact of wind on the stockpile.	Ongoing	Visible inspections
	Where possible, and relating to fine material stockpiles, install barriers around the stockpiles to reduce the impact of winds on stockpiles.	Prior to re-commissioning and ongoing	Quarterly inspections of stockpiles
	Install cameras in stockyard enabling control rooms to identify events of high dust emissions resulting in either water tankers being directed to the area of emissions, or instruction to stop operations until windy conditions subsided.	Prior to re-commissioning and ongoing	Maintenance and inspections as per manufacturers recommendations
	Ensure water tanker deployed to stockyard during windy events.	Ongoing	Log sheets maintained, and routes clearly captured for auditing purposes.
	Establish vehicle routes within stockyards allowing dust control measures to be focused on these areas.	Prior to re-commissioning	Operator training and implementation of access-controlled areas
	Recommend use of chemical dust suppressant on stockyard roads and open areas. Prior to application, ensure all loose material is collected allowing the chemical suppressant to work effectively, e.g. road sweeping.	Ongoing	Weekly inspections
Reclaimer and Stacker	Ensure water sprayer on reclaimer is always operational and maintained accordingly. Operations to stop if sprayers are not operational. Undertake weekly inspections of sprayer to confirm operational status.	Prior to re-commissioning and ongoing	Maintenance logs and weekly inspections

Source	Specific Measures	Timeframe	Implementation Tracker
	Where possible, reduce drop heights of stacker, and cease operations during windy conditions.	Ongoing	Visible inspections
Conveyors	Ensure all conveyor enclosures are maintained and any leaks from enclosures sealed.	Ongoing	Visible inspections
	Ensure all longitudinal sprayers on CV102, CV103, CV105 and CV112 are operational at all times, and maintained accordingly. Conveyor operations to cease when these are not operational.	Prior to re-commissioning and ongoing	Maintenance logs and weekly inspections
	Ensure conveyor belts are maintained to reduce spillages.	Prior to re-commissioning and ongoing	Maintenance logs and weekly inspections
Paved and Unpaved Roads	Implement and enforce speed limits and controls onsite.	Ongoing	Personnel training, visible inspections, and reporting program
	Implement access control for areas that are out of operation.	Ongoing	Quarterly review
	Conduct road sweeping and spillage collections, applicable to both paved and unpaved roads.	Ongoing	Visible inspections, and setup of reporting program for spillages
	Application of chemical dust suppressants to all unpaved roads, inclusive of stockyard roads for FEL operations.	Ongoing	Weekly inspections and application logs
	Frequent maintenance of vehicle fleet, inclusive of FELs, ensuring vehicle exhaust emissions are controlled.	Ongoing	Maintenance schedules, visible inspections and reporting system
	Ensure all truck loads are covered.	Ongoing	Visible inspections by security when trucks are entering / leaving premises, with logs kept
General	Improve general housekeeping, specifically focusing on the collection of all spilled material e.g. within furnace buildings, transfer stations, tipplers, around conveyors, spilled materials along roads, and spilled materials within stockpile yards etc.	On re-commissioning	Weekly inspections, with establishment of a clear reporting system when spillages are identified
	General inspections of all activities onsite, including within buildings, e.g. furnace buildings, identifying any activity contributing to fugitive dust and reporting this accordingly to ensure timely resolution.	Ongoing	Weekly inspections, with establishment of a clear reporting system when spillages are identified

Source	Specific Measures	Timeframe	Implementation Tracker
	Ensure all abatement equipment e.g. baghouses and scrubbers, are maintained according to manufacturer's specifications, with emission tests undertaken to confirm control efficiency remains high and emission standards (where applicable) are met.	Prior to re-commissioning and ongoing	Maintenance logs, monthly inspections and stack emissions tests
	Installation and maintenance of a weather station, capable of providing live data and alerts enabling operators to stop operations during windy conditions e.g. within the stockpile yards.	Ongoing	Monthly maintenance, and establishing training and reporting program for weather conditions
	Installation of a windsock within the stockpile yard providing operators with immediate information relating to wind direction and wind speed.	On re-commissioning	N/A
	Ensure spare parts are available for all dust suppression systems. Where possible, should dust suppression systems fail, operations to cease until repairs have been completed.	Ongoing	N/A
	Employee training and awareness raising ensuring e.g. visible fugitive emissions, spillages, or poor operator behaviour, are immediately reported to relevant personnel for addressing.	Ongoing	Training program

Table 10-3: Goal 2 – Dust monitoring and control effectiveness

Description	Action	Timeframe	Performance Indicator
Control Inspections	Inspection logs to be developed and training provided to all relevant personnel, applicable to all control measures where inspections are required. Ensure systems are developed for storing of logs to ensure availability for future audits.	On commissioning and ongoing	Review of inspection logs
	Ensure all equipment maintenance logs are compiled and saved, inclusive of all calibrations of equipment.	Ongoing	Review of maintenance records
Dust Fallout Monitoring	Continue monitoring existing sampling locations according to the National Dust Control Regulations (NDCR). Ensure monthly reports are compiled meeting the NDCR requirements.	Ongoing	Review of monitoring reports
	Submit monthly monitoring reports to the WCDM according to the agreed schedule.	Ongoing	Proof of submissions
	Immediately notify the WCDM when non-compliance occurs and implement a review of the FDMP and submit the revised plan to the WCDM for approval.	On occurrence of non-compliance	Review of dust fallout rates
	As mentioned previously, installation and maintenance of an onsite meteorological station, recognising the NDCR requires site representative data to be presented in dust fallout reports.	Ongoing	N/A
Ambient Continuous Monitoring	Install and commission a new continuous monitoring station, or re-commission the existing continuous monitoring station. Importantly, consider relocating the existing station to an area representative of ambient conditions i.e. offsite.	Prior to startup of steelmaking	N/A
	Should non-compliant dust fallout rates occur, establish a PM_{10} and $PM_{2.5}$ monitoring network to confirm particulate fractions potentially impacting health remain within legal limits.	On occurrence of non-compliance	Review of dust fallout rates
	Ensure all monitors are maintained and calibrated according to supplier's specifications.	Ongoing	Maintenance and calibration certificates

Table 10-4: Goal 3 – Effective internal and external communications

Description	Action	Timeframe	Performance Indicator
Internal Communications	Ensure all personnel are trained appropriately to identify fugitive sources of dust emissions and understand the requirements to report elevated emissions.	Ongoing	Evidence of training and reporting structure
	Report to plant / process managers occurrences where the FDMP and its requirements or not being implemented.	Ongoing	Establish formal reporting structure / process
	Report to plant / process managers, Saldanha Steel EXCO and AMSA, dust monitoring performance and compliance status.	Ongoing	Establish formal reporting structure / process
	Report to plant / process managers, Saldanha Steel EXCO and AMSA, complaints received and findings of complaints investigations.	Ongoing	Establish formal reporting structure / process
External Communications	Ensure all reporting to the WCDM is conducted according to legislation, the AEL, or the WCDM requirements.	Ongoing	Evidence of submissions
	Ensure all reporting, such as to NAEIS, is undertaken as per the requirements of the AEL and relevant regulations.	Ongoing (annual)	Evidence of submissions
	Ensure a clear process / platform is available for complainants to log complaints.	Ongoing (review)	N/A
	Ensure all complaints are investigated timeously and according to the requirements of the AEL. Ensure all investigations are saved for future review.	Ongoing	Complaints investigations
	Provide feedback to complainants on findings of complaints investigations.	Ongoing	Evidence of feedback
	Where the complaints investigation identifies the cause occurred from onsite activities, ensure that relevant personnel are made aware and identify any deficiencies with the prescribed control measures, and revise accordingly.	Ongoing	Evidence of internal reporting
	Schedule routine meetings with the WCDM representatives to provide updates on operations onsite, future plans, and overall air quality performance. This will foster a strong relationship with the WCDM.	Ongoing	Recommend quarterly, or biannual
	Raise awareness of air quality performance, such as sharing of compliance status, fostering a strong relationship with stakeholders. Annual stakeholder engagement meetings should be considered or similar initiatives.	Ongoing	Annual sharing of summarised air quality data and status of operations.

Monitoring, evaluation and review

This Fugitive Dust Management Plan must be viewed as a live, working document, with revisions occurring:

- At a minimum, the plan should be reviewed annually, ensuring it remains representative of activities occurring onsite, or
- Where deficiencies in control measures are identified, or where a new source of fugitive emissions is identified, this plan must be reviewed and updated accordingly, or
- When non-compliance with the dust fallout regulations occurs.

Importantly, when the plan is revised:

- The revised plan must be submitted to the WCDM notifying of the amendments and requesting approval of the plan.
- Following receipt of the approved plan, revisions must be implemented onsite.
- All relevant onsite personnel must be made aware of the revisions, and especially important that training is provided to those who may be impacted by the changes.

11 COMPLIANCE AND ENFORCEMENT ACTIONS

As confirmed by Saldanha Steel, no compliance or enforcement actions relating to air quality or the Saldanha Steel AEL have been received.

12 ADDITIONAL INFORMATION

All relevant details are presented in this AIR; therefore, no additional information is required.

APPENDIX TITLE

Bradley Keiser

Earth & Environment, Director, Air Quality and Climate Change

CAREER SUMMARY

Brad is currently employed as a Director at WSP Group Africa, Earth & Environment. Brad has a BSc Honours degree in Geography and Environmental Management from the University of KwaZulu-Natal. Since completing his studies, Brad has worked as an Air Quality Specialist for seventeen years. Brad's key areas of expertise include ambient air quality monitoring, emissions inventories, dispersion modelling (AERMOD and CALPUFF) and licensing, having completed numerous Air Quality Impact Assessments, Atmospheric Impact Reports, Air Quality Management Plans and Atmospheric Emission License applications. Sectors in which Brad has substantial experience include mining, oil and gas, power and industrial.

Countries of work experience include South Africa, Botswana, Mozambique, Swaziland, Tanzania, Saudi Arabi and Australia.

13 years with WSP

17 years of experience

Area of expertise

Ambient Air Quality Monitoring

Emission Inventories and Dispersion Modelling

Air Quality Impact Assessments, Atmospheric Impact Reports, and Air Quality Management Plans

Licensing

Language

English - Fluent

EDUCATION

Bachelor of Science (Honours), Environmental Management, University of KwaZulu-Natal, Pietermaritzburg, South Africa	2006
Bachelor of Science, Geography, University of KwaZulu-Natal, Pietermaritzburg, South Africa	2005

ADDITIONAL TRAINING

Hazard Identification & Risk Assessment	2016
Snake Awareness and First Aid for Snakebite and Scorpion Sting, African Snakebite	2016
Legal Liability	2016
Project Management, Graduate School of Business UCT	2013

PROFESSIONAL MEMBERSHIPS

National Association for Clean Air	2007 - Current

Bradley Keiser

Earth & Environment, Director, Air Quality and Climate Change

PROFESSIONAL HISTORY

WSP Group Africa (Pty) Ltd	July 2011 - present
Gondwana Environmental Solutions (Pty) Ltd	January 2007 – June 2011

PROFESSIONAL EXPERIENCE – MINING

AIR QUALITY

Genmin Limited, Air Quality Impact Assessment for the Proposed Baniaka Iron Ore Project, Gabon
2022 - 2023
Project Director
The assessment included the supply and installation of monitoring equipment forming the baseline study, with a comprehensive emissions inventory and dispersion model (CALPUFF) for the proposed iron ore mine.

AfriSam South Africa (Pty) Ltd, Roodepoort Operations Particulate Matter Monitoring, South Africa
2017 - Current
Project Director
The monthly maintenance, management and compliance reporting of a continuous particulate monitor (TOPAS).

AfriSam South Africa (Pty) Ltd, Dust Fallout and Water Compliance Monitoring, South Africa
2020 – Current
Project Director and Project Manager
WSP were appointed to undertake dust fallout, meteorological, environmental noise, surface water and groundwater sampling at 16 AfriSam quarries located nationally. The monitoring included routine monthly reports to determine compliance with relevant dust fallout standards and WUL conditions, as well as annual reporting of environmental noise levels.

Seriti Coal SA, Ambient Monitoring, South Africa
2018 – 2023
Project Director
The monthly maintenance, management and compliance reporting of continuous particulate monitors and dust fallout networks for the Kriel, New Vaal, New Denmark and New Largo collieries.

Thungela Resources (prev. Anglo American Coal SA), Ambient Monitoring, South Africa
2014 - 2023
Project Director
The monthly maintenance, management and compliance reporting of continuous particulate monitors and dust fallout networks for the Isibonelo, Greenside, Zibulo, Goedehoop and Khwezela collieries.

G&W Base and Industrial Minerals, Dust Fallout Monitoring, South Africa
2016 – 2023
Project Director
Dust fallout monitoring was undertaken at a minerals processing facility for compliance purposes.

Stonewall Mining (Pty) Ltd, Air Quality Impact Assessment for the Theta Hill Mining Right Amendment Application, South Africa
2021
Project Manager and Lead Consultant
Compilation of an Air Quality Impact Assessment for the proposed Environmental Authorisation amendment for the Theta Hill Project, inclusive of a comprehensive emissions inventory and dispersion modelling.

Two Rivers Platinum Mine, Air Quality Impact Assessment, South Africa
2021
Project Director

WSP was appointed to undertake an AQIA for the proposed TSF expansion located at their existing operations. The study comprised a regulatory review, baseline air quality assessment, and emissions assessment with recommendations for impact mitigation.

Assmang Black Rock Mine, Operations Compliance Monitoring, Northern Cape, South Africa
2012, 2021
Project Director and Project Manager
The environmental monitoring comprised noise monitoring, continuous particulates monitoring and vehicle noise and emissions testing.

Tshukudu (Sandfire), Supply and Installation of a Particulate Monitor and Weather Station, Botswana
2021
Project Manager and Lead Consultant
Supply and installation of a TOPAS particulate monitor and Davis weather station at the Thsukudu Mine in Botswana, including remote equipment support.

WSP Australia (on behalf of Williamsdale Quarry), Air Quality Impact Assessment, Australia
2019 – 2020
Project Director (Lead Consultant on Project Updates)
An AQIA was undertaken to determine impacts associated with expansions of a quarry in Melbourne, Australia. Project included CALPUFF modelling to predict these impacts.

Envirogistics – Dwarsrivier Chrome Mine, Air Quality Impact Assessment for the proposed TSF at Dwarsrivier Chrome Mine, South Africa
2018
Project Director
WSP undertook an Air Quality Impact Assessment for a proposed Tailings Storage Facility (TSF) at Dwarsrivier Chrome Mine. The assessment included a baseline assessment, emissions inventory, dispersion modelling using AERMOD and comparison of the predicted concentrations with the National Ambient Air Quality Standards.

Anglo Operations, Operational Risk Assurance Audit, South Africa
2018 – 2019
Lead Consultant and Project Manager
Undertaking the Operational Risk Assurance (ORA) audit as part of the internal Anglo American ORA team at the Kumba Iron Ore Sishen Mine. The audit focused on risks associated with air quality non-compliance and recommendations for improvements to reach compliance with local standards as well as the Global Anglo-American Performance Standards.

Foskor (Pty) Ltd, Ambient Monitoring, Air Quality Management Plan and Air Quality Impact Assessment, South Africa
2016 – 2020
Project Director
The monthly maintenance and management of a continuous particulate monitor and dust fallout network and compilation of an annual AQMP and Air Quality Impact Assessment.

Anglo American, Coal SA Air Quality Management Plan, Mpumalanga, South Africa
2014
Project Manager
A combined AQMP was developed assessing emissions associated with the Landau, Kleinkopje and Greenside collieries using the CALPUFF modelling platform.

AfriSam South Africa (Pty) Ltd, Dudfield Plant Passive Diffusive Monitoring, North-West, South Africa
2011 - 2014
Lead Consultant and Project Manager

Radiello passive diffusive samplers were deployed to monitor for SO2, NO2 and BTEX.

AfriSam South Africa (Pty) Ltd, Ulco Plant Particulates Monitoring, Northern Cape, South Africa
2013 – 2014
Lead Consultant and Project Manager
The installation, management and reporting for one TOPAS monitor on a custom designed solar system trailer, capable of simultaneously monitoring TSP, PM10, PM2.5 and PM1, wind speed and direction.

Anglo American Coal SA Landau Colliery, Particulates Monitoring, Mpumalanga, South Africa
2013 – 2014
Lead Consultant and Project Manager
Installation, management and reporting for two TOPAS and ETL monitors installed on custom designed solar system trailers, capable of simultaneously monitoring TSP, PM10, PM2.5 and PM1, benzene, nitrogen dioxide, wind speed and direction.

BHP Billiton Samancor Meyerton Works, Air Quality Impact Assessment, Gauteng, South Africa
2013
Lead Consultant and Project Manager
An AQIA and associated AEL amendment was undertaken for the proposed upgrade of the fugitive emissions extraction system at the Samancor Meyerton Works using AERMOD.

Anglo American Platinum Lt, Air Quality Impact Assessment, Northwest, South Africa
2013
Lead Consultant and Project Manager
As part of a larger EIA, WSP was contracted to compile an AQIA for the Waterval Tailings Re-mining Project using ADMS v4.2.

Rustenburg Platinum Mines Limited, Air Quality Impact Assessment, Limpopo, South Africa
2013
Lead Consultant and Project Manager
As part of a larger EIA, WSP was commissioned to compile an AQIA for the proposed Tumela Five Shaft and associated infrastructure at the existing Tumela mine using ADMS v5.

Anglo American Coal SA Isibonelo Colliery, Air Quality Impact Assessment, Mpumalanga, South Africa
2013
Project Manager
An AQIA was undertaken for a proposed tanks farm comprising a baseline review, emissions inventory and dispersion modelling using ADMS v4.2.

Anglo American Coal SA Kriel Colliery, Particulates Monitoring, Mpumalanga, South Africa
2013
Lead Consultant and Project Manager
One TOPAS monitor was supplied on a custom designed solar system trailer, capable of simultaneously monitoring TSP, PM10, PM2.5, PM1, wind speed and wind direction. The project included maintenance of the monitor, data management and verification and reporting on a monthly basis.

Anglo American Coal SA Kleinkopje Colliery, Passive Diffusive Monitoring, Mpumalanga, South Africa
2012 – 2013
Lead Consultant and Project Manager
Radiello passive diffusive samplers were deployed to monitor SO2, NO2 and BTEX.

Anglo American Coal SA Kleinkopje Colliery, Air Quality Management Plan, Mpumalanga, South Africa
2012
Lead Consultant and Project Manager
An AQMP was developed for the Kleinkopje Colliery, accounting for all sources of emissions at the colliery.

AfriSam South Africa (Pty) Ltd. Dudfield Plant, Air Quality Management Plan, North-West, South Africa

2012
Lead Consultant and Project Manager
An AQMP was developed for a cement plant, accounting for all sources of emissions at the plant.

Anglo American Coal SA Landau Colliery, Air Quality Management Plan, Mpumalanga, South Africa
2012
Project Manager
An AQMP was developed accounting for all sources at the colliery, with dispersion modelling undertaken to determine pollution hotspots at the colliery, as well as potential impacts on the receiving environment.

Anglo American Coal SA Kleinkopje Colliery, Particulates Monitoring, Mpumalanga, South Africa
2012
Project Manager
One TOPAS monitor was supplied on a custom designed solar system trailer, capable of simultaneously monitoring TSP, PM10, PM2.5, PM1, wind speed and wind direction. The project included maintenance of the station, data management and verification and reporting on a monthly basis.

Orica Mining Services, Passive Diffusive and Fugitive Emissions Monitoring, Tanzania, Africa
2011-2012
Lead Consultant and Project Manager
Radiello passive diffusive samplers were deployed to monitor SO2, NO2 and BTEX. Samples extracted directly from the process were analysed for SO2, NO2, VOC's and formaldehyde.

Kumba Iron Ore Sishen Mine, Ambient Monitoring, Northern Cape, South Africa [prior employment]
2011
Lead Consultant and Project Manager
Siting, supply, installation and management of six PM10 E-SAMPLERS, three PM10 BAM 1020 monitors and three meteorological stations. The project included the realtime reporting of data and quarterly maintenance visits.

Exxaro Resources Ltd Grootegeluk Mine Char Plant, Stack Monitoring, Limpopo, South Africa [prior employment]
2010-2011
Lead Consultant and Project Manager
Quarterly stack monitoring was conducted for SO2, NO2, CO, O2, CO2, PM and PAH's.

Lonmin Platinum, Ambient Monitoring, Northwest, South Africa [prior employment]
2010-2011
Project Manager
Management of the technical team tasked with the calibration and onsite maintenance of five full ambient air quality monitoring stations, including reporting

Anglo American Coal SA Kleinkopje Colliery, Particulates Monitoring, Mpumalanga, South Africa [prior employment]
2010 – 2011
Lead Consultant and Project Manager
One EBAM particulate monitor was supplied and installed with the project involving monthly maintenance of the unit and routine compliance reporting.

Lonmin Platinum, Dust Fallout Monitoring, North-West, South Africa [prior employment]
2010 – 2011
Project Manager
Management of the dust fallout network comprising 120 samplers. The project included monthly collection of units, gravimetric analysis, monthly reporting and adhoc network audits.

Exxaro Resources Grootegeluk Mine Char Plant, Fugitive Dust Assessment, Limpopo, South Africa [prior employment]

2010
Project Manager
An assessment was undertaken to determine fugitive sources of dust emissions at the Char Plant providing recommendations to mitigate key sources.

Kumba Iron Ore Sishen Mine, Particulates Monitoring, Northern Cape, South Africa [prior employment]
2010
Lead Consultant and Project Manager
Two PM10 monitors were installed onsite on a short-term basis to inform the siting of the larger, permanent monitoring network.

Anglo Gold Ashanti Vaal River Operations, Ambient Monitoring, Orkney, South Africa [prior employment]
2009-2010
Project Manager
Management of the technical team tasked with the calibration and onsite maintenance of continuous, real-time monitoring equipment, comprising one full monitoring station, one continuous stack monitor, two meteorological stations and four PM10 monitors, including monthly reporting.

Exxaro Resources Grootegeluk Mine, Particulates Monitoring, Limpopo, South Africa [prior employment]
2009
Project Manager
Two PM10 monitors were managed and maintained on a quarterly basis, including compilation of quarterly compliance monitoring reports.

Exxaro Resources Grootegeluk Mine, Passive Monitoring, Limpopo, South Africa [prior employment]
2009
Project Manager
Radiello passive diffusive samplers were deployed at the mine for SO2, NO2 and BTEX, including the submission of monthly monitoring reports for a period of six months.

Kumba Iron Ore Sishen Mine, Meteorological Monitoring, Northern Cape, South Africa [prior employment]
2008 – 2011
Project Manager
Management of one meteorological station, including data management and quarterly maintenance of the station.

PROFESSIONAL EXPERIENCE – POWER GENERATION

GCS Water and Environmental (Pty) Ltd, Air Quality Impact Assessment for a Proposed Solar PV Facility, South Africa
2021
Project Director and Project Manager
WSP was appointed to compile an AQIA assessing the air quality impacts associated with the construction of the proposed Lephalale Solar PV facility. The study comprised a regulatory review, baseline air quality assessment, and emissions assessment for the construction phase of the project with recommendations for impact mitigation.

WSP Group Africa, Air Quality Review and Support, South Africa
2018
Project Director

Review of air quality work undertaken for a proposed power station and recommendations for improvements to the studies.

Parsons Brinckerhoff Africa, Air Quality Impact Assessment, Botswana
2015
Lead Consultant and Project Manager
A Screening AQIA was undertaken to determine the impacts associated with a proposed 320MW coal fired power station.

Eskom Majuba Power Station, Dust Fallout Monitoring, Mpumalanga, South Africa
2013-2015
Project Manager
Management of the dust fallout monitoring network at the Majuba Power Station.

Sasol New Energy Holdings, Dust Fallout Monitoring, Mozambique, South Africa
2013-2015
Lead Consultant and Project Manager
Management of the CTRG gas engine power plant dust fallout monitoring network in the Ressano Garcia area, Mozambique.

Gledhow Sugar Company, Air Quality Impact Assessment, KwaZulu-Natal, South Africa
2013
Lead Consultant and Project Manager
An AQIA and associated AEL amendment was undertaken for a proposed biomass boiler at the Gledhow Mill using ADMS v4.2.

Sappi Southern Africa Limited Lomati Mill, Air Quality Impact Assessment, Mpumalanga, South Africa
2012
Lead Consultant and Project Manager
An AQIA was undertaken to determine the impact of emissions associated with a proposed biomass boiler using ADMS v4.2, including amendment of the AEL.

Sappi Southern Africa Limited Ngodwana Mill, Air Quality Impact Assessment, Mpumalanga, South Africa
2012
Lead Consultant and Project Manager
An AQIA was undertaken to determine the impact of emissions associated with a proposed biomass boiler using ADMS v4.2, including amendment of the AEL.

Sasol New Energy Holdings, Air Quality Impact Assessment, Mozambique, Africa
2012
Lead Consultant and Project Manager
This AQIA included baseline monitoring of NO2, SO2, BTEX, dust fallout and meteorology. The AQIA assessed emissions associated with a proposed gas engine power plant using ADMS v4.2.

Group Five Construction, Dust Fallout Monitoring, Northern Cape, South Africa
2011 – 2012
Project Manager
Dust fallout monitoring at the proposed solar power plant in the Kathu area.

PROFESSIONAL EXPERIENCE – OIL & GAS

Vopak Durban Terminal, Environmental Advisory Role, South Africa
2022 – 2023
Project Director and Lead Consultant

Provision of guidance and support to Vopak focusing on areas of key non-compliance and developing plans of actions to address this until compliance is reached, inclusive of air quality and general environmental compliance with authorisations.

Vopak Durban Terminal, AEL Compliance Support, South Africa
2020 – 2023
Project Manager and Lead Consultant
Provision of AEL compliance support inclusive of fenceline monitoring, leak detection and repair, annual emissions inventory compilations with the use of emission factors and the US EPA TANKs model, AEL auditing, and annual reporting to NAEIS and eThekwini Metropolitan Municipality.

FFS Refiners, Atmospheric Impact Report for proposed expansions at the Maydon Wharf Tank Terminal South Africa
2023
Project Director
Compilation of an Atmospheric Impact Report, inclusive of an emissions inventory, AERMOD dispersion model, and recommendations to manage fugitive emissions due to the proposed expansions.

Bidvest Tank Terminals, Annual Emissions Inventory and NAEIS Reporting, South Africa
2021 – 2023
Project Director
Compilation of an annual emissions inventory for the Richards Bay, Isando and Durban Island View tank farms using emission factors and the US EPA TANKs model for reporting to NAEIS.

FFS Refiners, Atmospheric Screening Assessment for proposed product changes at the Cape Town Harbour Tank Farm, South Africa
2022
Project Manager and Lead Consultant
WSP undertook a screening assessment of the proposed changes in products to be stored when compared to a previous assessment to determine any substantial changes in emissions and impacts on the receiving environment.

NATREF, Passive Diffusive Monitoring at the NATREF Refinery, Free State, South Africa
2017 – 2023
Project Director
Radiello passive diffusive sampling was undertaken for BTEX, determining fenceline concentrations for compliance purposes and onsite concentrations for management purposes.

NATREF, Passive Diffusive Monitoring at NATCOS, KwaZulu-Natal, South Africa
2017 – 2023
Project Director
Radiello passive diffusive sampling was undertaken for BTEX, determining fenceline concentrations for compliance purposes and onsite concentrations for management purposes.

Total SA, Leak Detection and Repair, National, South Africa
2017
Project Manager
A leak detection and repair program was implemented at nine Total SA fuel depots with all flanges, valves and connections etc. being tested to identify leaks requiring maintenance.

Transnet Pipelines, Compliance Monitoring, National, South Africa
2014 – 2015
Project Manager
Radiello passive diffusive sampling for BTEX and leak detection and repair programs were undertaken at various depots across the country, inclusive of a number of air quality management reports to ensure compliance with AEL conditions.

FFS Refiners Evander, Passive Monitoring, Mpumalanga, South Africa
2012
Project Manager
Radiello passive diffusive monitoring was undertaken for BTEX as required within the facility AEL.

PROFESSIONAL EXPERIENCE - INDUSTRIAL

Foskor (Pty) Ltd, Atmospheric Emission License Audit at the Richards Bay Operation, South Africa
2023
Project Director, Project Manager, and Lead Consultant
Audit of the Atmospheric Emission License for the Richards Bay operation, inclusive of the review and gap analysis of a number of management plans and procedures.

Foskor (Pty) Ltd, Input to the Strategic Environmental Performance Assessment for the Richards Bay Operation, South Africa
2022 - 2023
Lead Consultant (Air Quality)
Various specialists assessed the current environmental performance at the Foskor Richards Bay operation, with a key focus provided to those items identified as non-compliant.

Grindrod (Pty) Ltd, Atmospheric Emission License Audit at Navitrade, South Africa
2022 - 2023
Project Director, Project Manager, and Lead Consultant
Audit of the Atmospheric Emission License for the Navitrade operation.

Arcelor Mittal South Africa, Atmospheric Impact Report and Atmospheric Emission License Application for a proposed Iron Ore Logistics Hub, South Africa
2021 - 2023
Project Director, Project Manager, and Lead Consultant
WSP were appointed by Saldanha Steel, in conjunction with Bidvest Port Operations, to undertake an Atmospheric Impact Report and AEL Amendment for the proposed Iron Ore Logistics Hub to be commissioned at the Saldanha Steel Facility. The AIR comprised a baseline assessment, comprehensive emissions inventory inclusive of existing steelmaking operations and the proposed Logistics Hub, various dispersion modelling scenarios using CALPUFF and presentation of likely impacts on the receiving environment. Following Public Participation, the Saldanha Steel AEL was updated to include the Logistics Hub.

Dolphin Coast Landfill Management (Pty) Ltd, Atmospheric Impact Report, South Africa
2021 – 2023
Project Manager
WSP was appointed to compile an AIR for the KwaDukuza Landfill, a hazardous waste landfill identified as the source of potential health and odour nuisance impacts. Field investigations included fenceline BTEX and H2S monitoring as well as the collection of instantaneous grab samples for analysis of speciated VOCs, H2S and dynamic olfactometry. The impact assessment included a Level 2 (AERMOD) dispersion model with emissions rates based on site measured concentrations, to assess health and nuisance impacts for proximate communities.

Dekro Paints (Pty) Ltd, AEL Compliance Support, South Africa
2021 – 2023
Project Director
WSP provided compliance support for Dekro's Provisional Atmospheric Emission License (PAEL) for their facility in Cape Town. The scope of work included biannual reporting, compliance auditing, NAIES and SAAELIP assistance, BTEX monitoring, LDAR monitoring and dust fallout monitoring

Sonae Arauco (Pty) Ltd, Air Quality Management Program, South Africa
2011 – 2023

Bradley Keiser

Earth & Environment, Director, Air Quality and Climate Change

Project Director, Project Manager, and Lead Consultant
The monitoring program comprises dust fallout, continuous particulate matter, meteorology, formaldehyde, BTEX and environmental acoustics, with results presented to the community on a quarterly basis.

Safripol (Pty) Ltd, AEL Compliance Support, South Africa
2019 – 2023
Project Director
The scope of work comprises emissions inventory development (including emission rate modelling using TANKs), compilation of required reports and documents for submission to the online NAEIS and SAAELIP platforms, LDAR surveys, fenceline BTEX monitoring, and odour management planning.

Weir Minerals Heavy Bay Foundry (Pty) Ltd, Annual Reporting, South Africa
2018 - 2022
Project Director, Project Manager, and Lead Consultant
WSP was requested by Weir Heavy Bay Foundry to undertake the reporting of their emissions annually on the National Atmospheric Emission Inventory System (NAEIS). This included the development of an emissions inventory for the foundry and the subsequent reporting of this information onto NAEIS. An Annual Report for each reporting period was also compiled.

S**appi Southern Africa Limited Ngodwana Mill, Air Quality Impact Assessment, South Africa**
2019
Project Director
An AQIA was undertaken in support of the intended Minimum Emission Standard postponement application for the Ngodwana Mill.

Sappi Southern Africa Limited Ngodwana Mill Air Quality Impact Assessment, Mpumalanga, South Africa
2017
Lead Consultant and Project Manager
An AQIA was undertaken assessing impacts associated with various expansions proposed at the Ngodwana Mill using the CALPUFF modelling platform.

Sappi Southern Africa Limited Lomati Mill, Dust Fallout Monitoring, Mpumalanga, South Africa
2013 – 2023
Lead Consultant, Project Manager and Project Director
Management of the dust fallout monitoring network at the Lomati Mill.

York Timbers (Pty) Ltd Dust Fallout Monitoring, Mpumalanga, South Africa
2013 – 2016
Lead Consultant and Project Manager
Management of a dust fallout monitoring network in the Sabie area.

LeadCorp, Air Quality Impact Assessment, Gauteng, South Africa
2016
Lead Consultant and Project Manager
An AQIA was undertaken for a proposed lead processing facility using the AERMOD modelling platform.

Illovo Sugar Ltd. Ubombo Mill, Air Quality Impact Assessment, Swaziland
2015
Lead Consultant and Project Manager
An AQIA was compiled to determine the impacts of a proposed furfural plant and adjustments to boilers on the receiving environment through the application of AERMOD.

Sappi Southern Africa Limited. Ngodwana Mill, Air Quality Impact Assessment, Mpumalanga, South Africa
2015
Lead Consultant and Project Manager

An AQIA was undertaken to assess the impact of various expansions and process changes proposed at the Sappi Ngodwana Mill using CALPUFF.

Sappi Southern Africa Limited. Ngodwana Mill, Atmospheric Impact Report, Mpumalanga, South Africa
2014
Project Manager
An AIR was compiled for an MES Postponement to determine the impact should emission rates from certain boilers not meet the required Section 21 emission limits.

Evraz Highveld Steel & Vanadium Corporation Ltd Ambient Monitoring, Mpumalanga, South Africa
2011-2014
Project Manager
Management and reporting for six PM10 and PM2.5 monitors (MetOne E-Samplers), one meteorological station and one continuous multi-gas monitor (Aeroqual).

Columbus Stainless Fugitive, Dust Management Plan, Mpumalanga, South Africa
2013
Project Manager
Compilation of a fugitive dust management plan assessing all fugitive releases of dust onsite and providing mitigation recommendations to control these.

Sappi Southern Africa Limited Ngodwana Mill, Ambient Monitoring, Mpumalanga, South Africa
2012
Lead Consultant and Project Manager
A short-term continuous monitoring campaign was undertaken for PM10, PM2.5, SO2, NO2 and meteorological conditions, with dust fallout and passive sampling of NO2 and SO2 also being conducted. The purpose of the monitoring was to determine the impact of the facility on the receiving environment and to verify the dispersion model.

Evraz Highveld Steel and Vanadium, Passive Monitoring, Mpumalanga, South Africa
2011 – 2012
Lead Consultant and Project Manager
Radiello diffusive samplers were deployed for SO2, NO2 and BTEX, with monitoring reports compiled on a monthly basis.

Abalengeni, Air Quality Impact Assessment, North-West, South Africa
2012
Project Manager
An AQIA was undertaken to determine the impact of emissions associated with a proposed ferrochrome plant in Rustenburg using ADMS v4.2.

Evraz Highveld Steel and Vanadium, Dust Fallout Monitoring, Mpumalanga, South Africa
2011 – 2012
Lead Consultant and Project Manager
Dust fallout monitoring with a network comprising 13 samplers and monthly reporting for compliance purposes.

Sappi Southern Africa Lomati Mill, Air Quality Impact Assessment, Mpumalanga, South Africa
2011
Project Manager
An AQIA was undertaken to determine the impacts associated with the replacement of the wood drying kilns at the Lomati Mill. The AQIA was compiled in support of the Atmospheric Emission License application.

Sappi Southern Africa Limited Ngodwana Mill, Stack Monitoring, Mpumalanga, South Africa
2011
Lead Consultant and Project Manager
Once-off stack monitoring was conducted for SO2, NO2, CO, O2 and CO2 using a portable gas analyser.

Arcelor Mittal Newcastle Plant, Air Quality Impact Assessment, KwaZulu-Natal, South Africa
2009
Project Manager
An AQIA was undertaken to determine the impacts associated with an expansion of the chromium plant.

PROFESSIONAL EXPERIENCE – ROADS, RAIL & PORT

Airports Company South Africa, O.R. Tambo International Airport, Ambient Air Quality Monitoring, Somaliland
2021 - Current
Project Director
The monitoring includes monthly dust fallout monitoring at five fenceline locations at the ORTIA, active CO monitoring and passive monitoring for NO2, SO2 (Radiello) and BTEX (US EPA) conducted quarterly at twelve sites in and around the ORTIA.

DP World Berbera, Air Quality Impact Assessment for the Phase 2 Multipurpose Terminal Expansion, South Africa
2021 - 2022
Project Director
WSP was appointed to undertake a detailed Air Quality Impact Assessment for the Port of Berbera Multipurpose Terminal Phase 2 Expansion project, in Somaliland. The assessment included a baseline assessment, emissions inventory and dispersion modelling. Additionally, WSP also provided guidance in implementation of the Port's Masterplan from an air quality perspective.

Transnet Port Terminals, Ambient Monitoring, South Africa
2018-2019, 2022 - 2023
Project Director
The monthly maintenance and management of continuous particulate monitors and dust fallout samplers at the Maydon Wharf Terminal.

Transnet Port Terminals, Ambient Monitoring, South Africa
2018-2019, 2023
Project Director
The monthly maintenance and management of continuous particulate monitors and dust fallout samplers at the Richards Bay Terminal.

Transnet Port Terminals, Ambient Monitoring, South Africa
2018 – 2023
Project Director
Maintenance and management, including monthly reporting, of the meteorological stations located at various ports throughout South Africa.

Transnet Port Terminals, Air Quality Impact Assessment, South Africa
2018
Project Director
An AQIA was undertaken in support of an Atmospheric Emission License Application due to the proposed increase in throughputs at the Multi-Purpose Terminal at Saldanha Bay.

Transnet Port Terminals, Cape Town Harbour Terminal, Ambient Monitoring, Western Cape, South Africa
2017
Project Manager
Continuous particulates monitoring (PM10 and PM2.5) and dust fallout monitoring at the Cape Town Harbour Terminal, with compliance assessment reports submitted on a monthly basis.

Transnet Port Terminals Saldanha Bay Terminal, Ambient Monitoring, Western Cape, South Africa
2016 – 2017
Project Manager
Dust fallout and dust flux monitoring at the Saldanha Terminal, including compilation of monthly compliance reports, inclusive of analysis of continuous stack monitoring data, particulate concentrations and meteorological conditions.

Transnet Port Terminals Saldanha Bay Terminal, Particulates Monitoring, Western Cape, South Africa
2015
Project Manager
Supply, installation and management of one continuous particulates monitor, including compilation of monthly compliance reports.

Transnet Port Terminals Saldanha Bay Terminal, Air Quality Impact Assessment, Western Cape, South Africa
2014
Project Manager
An AQIA was undertaken to investigate the relationship between iron ore emissions originating from the Saldanha Bay Terminal and staining in the nearby residential areas using the CALPUFF dispersion modelling platform.

PROFESSIONAL EXPERIENCE - PUBLIC

JG Afrika (on behalf of SANRAL), Air Quality Impact Assessment, South Africa
2019
Project Director
An AQIA was undertaken to determine impacts associated with the re-alignment of the N3 Highway in KwaZulu-Natal, South Africa, with the use of the AERMOD dispersion modelling platform.

EcoSense on behalf of City of Cape Town, Atmospheric Impact Report, Western Cape, South Africa
2018
Project Manager and Lead Consultant
Compilation of an AIR for the proposed Atlantis Crematorium, inclusive of an emissions inventory, dispersion modelling (AERMOD) and impact assessment.

Mpumalanga Department of Land Affairs and Agriculture, Ambient Monitoring, Mpumalanga, South Africa
2009-2011
Project Manager
Management of the technical team tasked with the calibration and onsite maintenance of four full ambient air quality monitoring stations located within the Highveld Priority Area, including reporting.

City of Tshwane Metropolitan Municipality, Ambient Monitoring, Gauteng, South Africa
2010
Project Manager
Management of the technical team tasked with the calibration and onsite maintenance of six full ambient air quality monitoring stations, including reporting.

KwaZulu-Natal Department of Agriculture and Environmental Affairs, Ambient Monitoring, KwaZulu-Natal, South Africa
2010
Project Manager
Management of the technical team tasked with the calibration and onsite maintenance of six full ambient air quality monitoring stations, including reporting.

Bradley Keiser

Earth & Environment, Director, Air Quality and Climate Change

Department of Environmental Affairs, Ambient Monitoring, Gauteng, South Africa
2008-2010
Project Manager
Management of the technical team tasked with the calibration and onsite maintenance of six full ambient air quality monitoring stations located within the Vaal Triangle Priority Area, including monthly reporting.

Airports Company South Africa OR Tambo International Airport, Ambient Monitoring, Johannesburg, South Africa
2008
Project Manager
Management of the technical team tasked with the calibration and onsite maintenance of one real-time monitoring station, including reporting.

City of Johannesburg Metropolitan Municipality, Passive Diffusive Monitoring, Gauteng, South Africa
2007
Project Manager
Radiello passive diffusive samplers were deployed throughout the City of Johannesburg to monitor sulphur dioxide, nitrogen dioxide and volatile organic compounds (specifically the BTEX range).

City of Tshwane Metropolitan Municipality Bon Accord Quarry, Passive Diffusive Monitoring, Gauteng, South Africa
2008
Project Manager
Radiello passive diffusive samplers were deployed at the Bon Accord quarry for SO2, NO2 and BTEX. The purpose of the monitoring was to determine baseline concentrations for input into a dispersion model to assess cumulative impacts.

PROFESSIONAL EXPERIENCE - OTHER

Climatology Research Group (CRG Wits University), Rain Enhancement Research, Flight Scientist, Riyadh and Abha, Saudi Arabia
2008-2009
Data Operator and Science Team Manager
The research involved the use of aircraft penetrating storms to determine the impact of cloud seeding on individual weather systems. Furthermore, upper air monitoring of criteria pollutants using the aircraft was conducted to determine the location and concentrations within the plume associated with Riyadh.

Calgro M3 Holdings, Particulates Monitoring, Gauteng, South Africa
2008 – 2009
Project Manager
One PM10 monitor (E_SAMPLER) was installed and managed at a proposed residential development, including compilation of monthly compliance monitoring reports.

Calgro M3 Holdings, Baseline Assessment, Gauteng, South Africa
2007
Project Manager
An air quality baseline assessment was undertaken to determine potential air quality impacts on a nearby residential area during the construction of a low-cost housing development.

Bradley Keiser

Earth & Environment, Director, Air Quality and Climate Change

PROFESSIONAL EXPERIENCE – ENVIRONMENTAL ACOUSTICS

Sonae Arauco White River Plant, Noise Monitoring, Mpumalanga, South Africa
2011 – Current
Project Manager
Environmental noise monitoring is conducted on a quarterly basis at the plant to determine potential impacts on the receiving environment.

Sasol New Energy Holding (Pty) Ltd. Environmental Acoustic Monitoring, Ressano Garcia, Mozambique
2012 – 2013
Project Manager
WSP Environmental was commissioned by Sasol New Energy Holding (Pty) Ltd to undertake acoustic monitoring at the Central Termica De Ressano Garcia gas engine power plant site in order to assess the noise associated with the construction and operational phases of the plant.

Sonae Novobord (Pty) Ltd - Panbult Plant, Noise Monitoring, Mpumalanga, South Africa
2013
Project Manager
Environmental noise monitoring was conducted during the daytime and night-time at the Sonae Panbult Plant.

Rustenburg Platinum Mines Limited, Environmental Noise Impact Assessment for the Amandelbult Mine, Limpopo, South Africa
2013
Project Manager
As part of an environmental impact assessment, WSP Environmental was commissioned to conduct an environmental noise assessment for the sinking of a new shaft at the Tumela mine in the Limpopo Province.

Assmang Black Rock Mine Operations, Environmental Monitoring Assessment for a Manganese Mine, Hotazel, Northern Cape, South Africa
2012-2013
Project Manager
WSP Environmental was commissioned to conduct environmental monitoring for their underground manganese mining venture at Black Rock in the Northern Cape Province. The environmental monitoring consisted of both environmental noise monitoring and particulate monitoring. Vehicle noise and emissions testing was also performed on various Assmang-owned vehicles onsite.

Anglo American Coal SA, Community Environmental Acoustic Monitoring Survey, Vereeniging, Gauteng, South Africa
2012 – 2013
Project Manager
WSP was appointed to conduct community-based noise monitoring in a region adjacent to the New Vaal Colliery in order to assess the acoustic impacts of the colliery on the surrounding communities.

AngloGold Ashanti (Pty) Ltd, Noise Monitoring, Free State, South Africa
2012
Project Manager
Environmental noise monitoring was conducted during the daytime and night-time at various plants at the Anglo Gold Vaal River and West Wits Operations.