AIR QUALITY

Baseline study

Proposed Richards Bay Harbour Expansion

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CONTENTS

1. INTRODUCTION

Kijani Green Energy (Pty) Ltd (Kijani) was approached by BKS (Pty) Ltd to provide specialist air quality input into the Environmental Impact Assessment (EIA) of the proposed expansion of the terminals at the Port of Richards Bay, KwaZulu-Natal.

Kijani is a specialist air quality consultancy with extensive experience in the provision of specialist input into mining related EIAs in South Africa. All relevant staff are fully trained in all aspects of air quality analysis and modelling and are competent to undertake such work in a professional and timely manner.

Furthermore, Kijani hereby declares their independence on this matter, in keeping with the requirements of specialist professionals as outlined by the National Environmental Management Act (NEMA), 107 of 1998.

2. METHODOLOGY AND ASSUMPTIONS

Emissions to air during the construction and operation of a port/harbour of this nature can be extensive, from dust associated with the disturbance of material in construction or loading of ships, to particulate and sulphur dioxide (SO_2) emissions from ships engines, and a wide range of trace gases given off during the drying of solvents and similar processes resulting from activities associated with routine construction and maintenance.

Of these, dust, particulate matter and SO_2 are expected to be the greatest potential polluters.

2.1 Meteorological data

Following discussions with the South African Weather Services (SAWS), the nearest available hourly sequential dataset was identified as being that of Richards Bay Airport for the year 2011. This is considered to be a reasonable proxy for the region's climate.

2.2 Pollutants

Richards Bay harbour is a bulk terminal, so much of the material is stored and loaded from open, unprotected stockpiles. Pollutants to air from the harbour as proposed are likely to fall into two main categories:

- Dust
- Fuel emissions

Fuel emissions could be significant considering the increase in ship traffic expected and will be predominantly made up of:

- Particulates
- SO_2

2.2.1 Dust

The degree to which dust becomes a polluter is in direct relation to four factors:

- The nature of the area to be exposed by surface clearing or material in stockpiles awaiting loading (including total area, shape relative to prevailing winds and height of stockpiles etc.).
- The moisture content of the soil and by association, the average rainfall for the area
- The silt content and grading of the material exposed to the elements
- Activities taking place on that surface (transport, loading, and entrainment by the passage of vehicles)

Dust is considered in two broad categories, namely Total Suspended Particulates (TSP) and Particulate Matter with a Diameter less than 10µm (PM_{10}).

TSP is also referred to as 'nuisance dust' and accounts for the visible dust that may settle and cause the clogging of machinery as well as have an adverse effect on local flora through the clogging of stomata. Due to the wide range of particles that make up TSP, modelling of this material is considered impractical. Rather, PM_{10} dispersion is modelled and the flow fields derived from that run are used as indicators of potential problem areas for TSP deposition.

The second category of dust is made up of those particles smaller than 10µm (PM_{10}). PM_{10} particles are small enough to be inhaled and are thus a significant contributing factor to respirable illness associated with air pollution. PM_{10} is usually a product of incomplete fuel combustion.

Emissions to air from a facility such as this have the potential to be significant if appropriate mitigation and management measures are not undertaken or are implemented ineffectively. Under normal, responsible operation, a number of areas of potential emissions are readily identified:

- Dust and associated emissions during building, operational and decommissioning phases specifically linked to those activities;
- Dust emissions during operation, particularly associated with loading and offloading of bulk cargo and the transport of material via either truck, train or conveyor;

- Fugitive dust emissions associated with the wind entrainment of large areas of exposed earth and stockpiles of different materials that will be created during the project with specific reference to loading dumps of coal and other material;
- Fugitive emissions associated with the storage of hydrocarbons on site and;
- Ship funnel emissions associated with the operation phase, in particular, an expected increase in such emissions as a result of the increased capacity of the terminal.

The area is characterised by large, open coal stores that can be a significant source of fugitive dust. However, an analysis of the complaints and incidents registers from the National Ports Authority (Richards Bay) suggest that most dust complaints are related to specific incidents within the bulk handling area of the harbour and are not specifically linked to coal storage.

3. AREA DESCRIPTION

3.1 Project areas

The port is considering expanding the general freight bulk area (GFB Port) which will require an amendment to the existing air emissions licence. Other proposed changes are for the development of the new coal terminal which considers the development of the 500 Series, with a further sub-option being the Swaziland Rail Link. A study is also requested for the South Dunes area of the harbour.

Figure 1: Study areas for the proposed project

3.2 Legislative framework

The project is situated on the hot, wet and humid KwaZulu-Natal coast, in the uThungulu district municipality and the uMhlathuze local municipality. The harbour is situated on a large lagoon at the mouth of the Umhlatuze River into the Indian Ocean. The town of Richards Bay has built up around the harbour which is a large bulk terminal, providing services to both solid and liquid bulk carriers.

The National Ambient Air Quality Standards were published in *The Government Gazette*, Volume 534, 24 December 2009. Proposed guidelines for PM_{10} and SO_2 are outlined below:

Table 1: National Ambient Air Quality Standards – AQA Schedule 2 Particulate Matter < 10µm (PM_{10})

Averaging Period	Concentration	Frequency of Exceedence	Compliance Date
24 hours	120 µg/m^3	4	Immediate – 31 Dec 2014
24 hours	75 µg/m^3	4	1 Jan 2015
1 year	50 µg/m^3	0	Immediate – 31 Dec 2014
1 year	40 µg/m^3	0	1 Jan 2015

Table 2: National Ambient Air Quality Standards – AQA Schedule 2 Sulphur dioxide (SO_2)

Averaging Period	Concentration	Frequency of Exceedence	Compliance Date
24 hours	500 µg/m^3	526	Immediate
1 hour	350 µg/m^3	88	Immediate
24 hours	125 µg/m^3	4	Immediate
1 year	50 µg/m^3	0	Immediate

3.2.1 Air emissions licence

The port has a valid Air Emissions Licence (AEL) number UDM/11-12/AEL0005/1 in the name of Transnet Port Terminal, valid until 21 March 2017. The requirement for an AEL is triggered by listed activity number 14, Category 5, sub-category 5.1: Storage and Handling of ore and coal. The licence is issued by the uThungulu District Municipality.

The projections listed in the AEL indicate a steady increase in activity over the coming years, with a commensurate increase in potential emissions.

Listed emissions sources include infrastructure associated with the handling and loading of ore and coal (storage piles, conveyors etc.) and emission mitigation is limited to the monitoring and mitigation of dust. The proposed port expansions require an amendment to this AEL.

3.2.2 Complaints register

Two complaints registers are maintained for the port, a public complaints register and an internal incidents register.

The public complaints register was made available for the period from October 2009 to August of 2012. It is not known whether this constitutes a complete record for 2012. Complaints were overwhelmingly related to dust, usually as a result of poor housekeeping or spills.

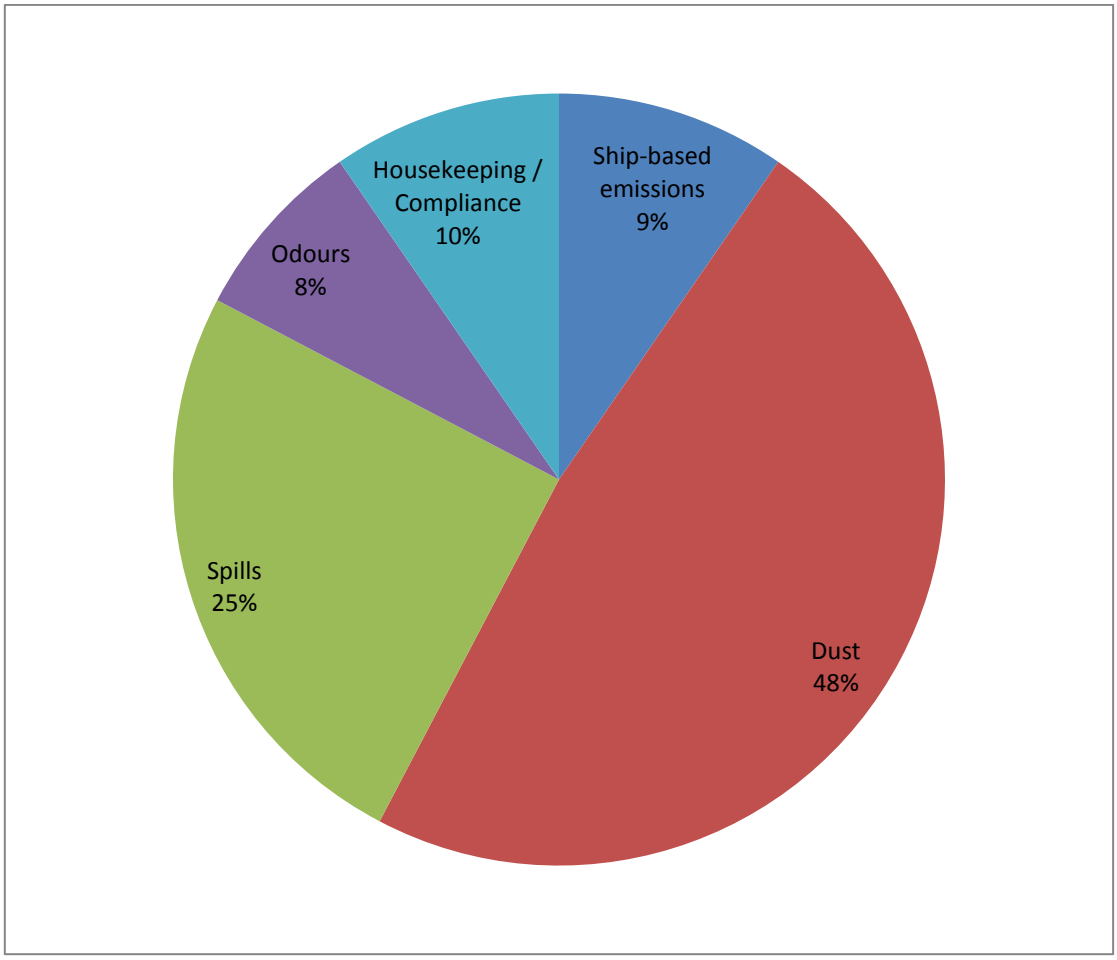

Figure 2: Breakdown of public environmental complaints for the Transnet Port Terminal, Oct 2009 to August 2012 (Richards Bay Ports Authority, 2009-2012).

By contrast, the internal incident reports focused more on spills and compliance issues, as would befit the reports from environmental personnel (Figure 3). The internal incidents register was made available for the period from May 2008 to November of 2012. Again, it is not known whether this constitutes a complete record for the period 2008 to 2012.

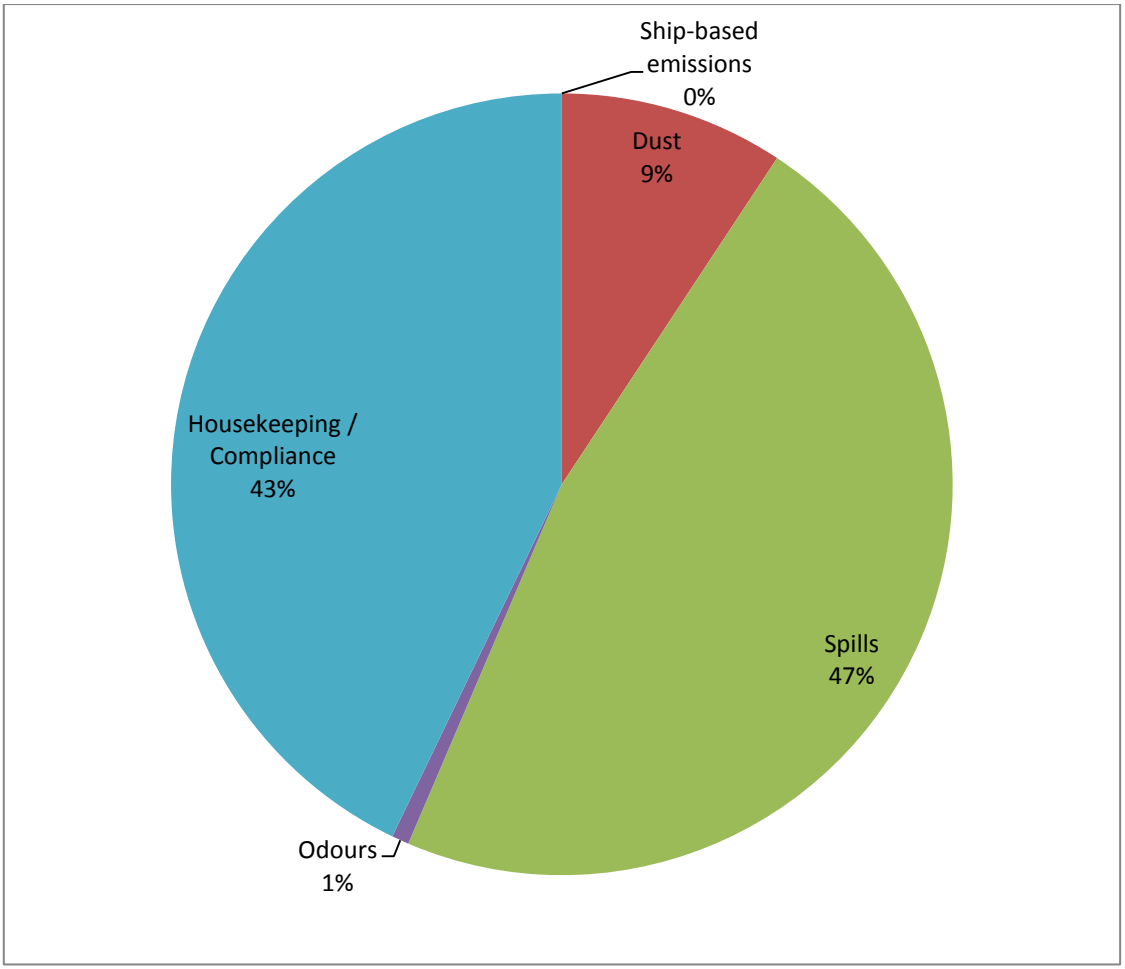

Figure 3: Breakdown of internal environmental incidents reported for the Transnet Port Terminal, Oct 2009 to August 2012 (Richards Bay Ports Authority, 2009-2012a).

Not too much should be read into these differences as they likely arise from the general public reporting on effects (dust, odours etc.) while the environmental officers tend to report on causes (spills, housekeeping etc.).

There is some evidence that air quality complaints peak during the winter months (RBCAA, 2012) which would be in keeping with the dry, windy conditions that would be expected to contribute to increased dust entrainment. This relationship is far from definitive however. Fugitive dust should not be seen as a seasonal event in Richards Bay, but rather as linked to activity and rainfall.

3.3 Climate description and qualitative baseline assessment

A long term weather dataset was identified for the Richards Bay airport (SAWS, 2013). Following comparison to the Arboretum weather station situated at Harbour West (RBCAA, 2012), the South African Weather Services (SAWS) dataset was selected as an acceptable proxy for the study area (RBCAA, 2012).

Dust emissions are a function of the makeup of the exposed material (particularly silt and small particle content), wind and moisture. Conditions of fine, dry, exposed material in windy weather will result in the greatest emissions. Thus, in analysing potential dust from a source, it is these factors on which the focus lies.

3.3.1 Wind

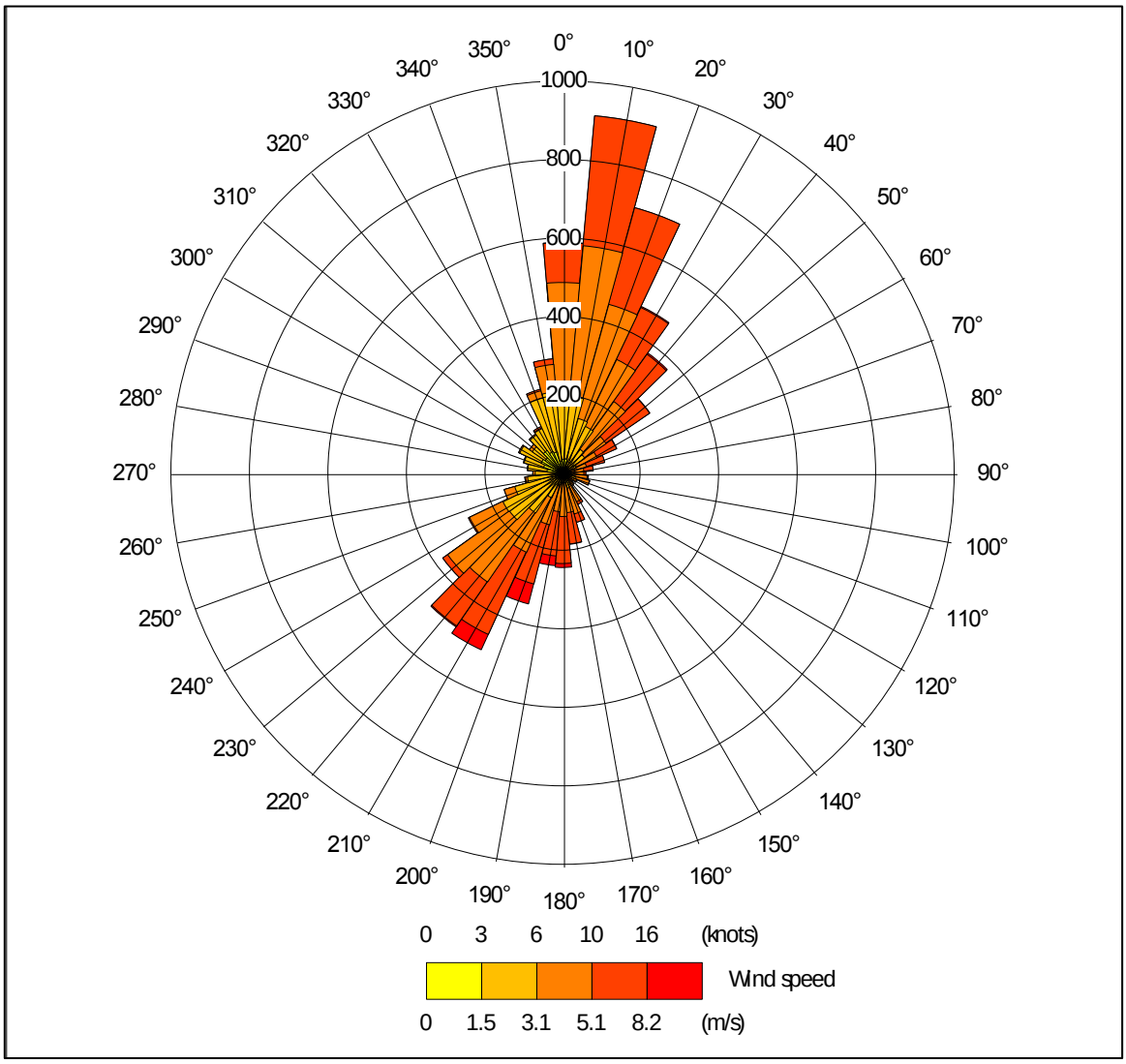

Figure 4: Annual wind rose for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 2011)

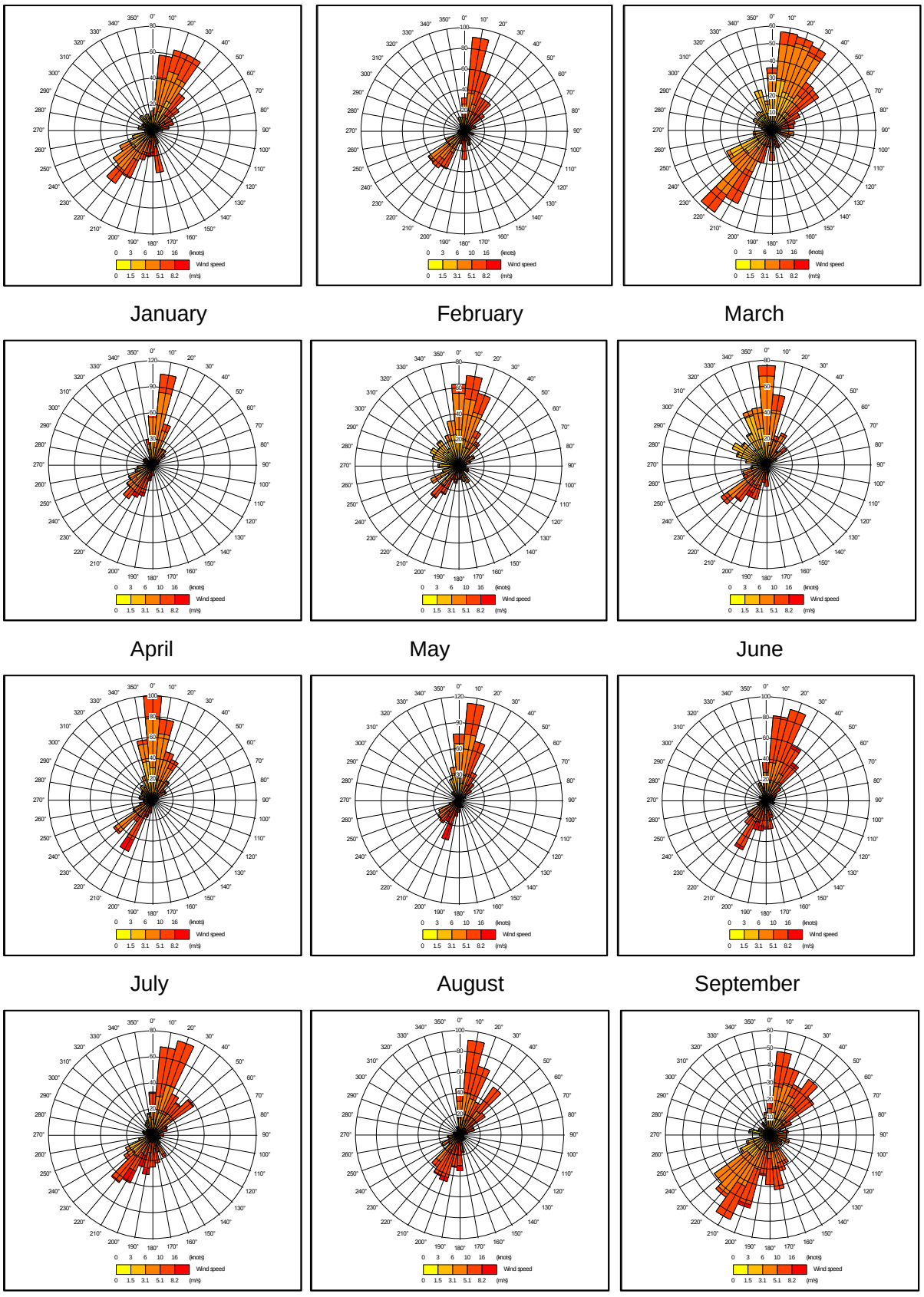

Figure 5: Monthly wind roses for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 2011)

The prevailing winds are from the north and north northeast, with an occasional southerly component, strengthening in mid-summer. As a result, any dispersion from the site is likely to vary with the passage of weather systems up the coast but will be primarily to the south of the site.

4.1.1 Precipitation

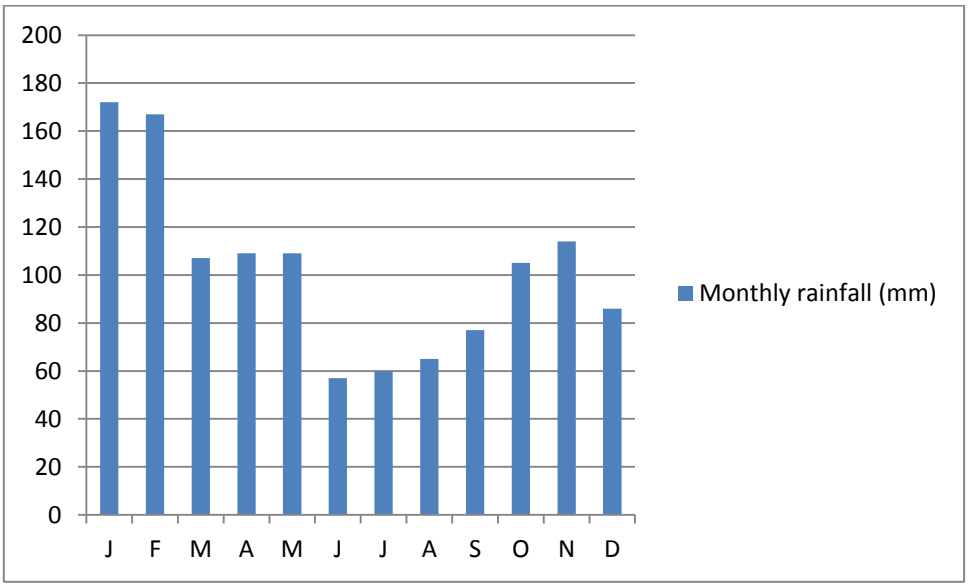

Figure 6: Average monthly rainfall figures for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (mm per month)

The site is on the northeast coast of South Africa, in an area known for its warm, moist sub-tropical climate. The region is known colloquially as the KwaZulu-Natal north coast. This region is characterised by regular, year round rain and spells of very hot and humid weather. The annual average rainfall for the region is just over 1200 mm per year (approximately twice the rain received by Johannesburg). Rain peaks in late to mid-summer, in January and February, but the region is also likely to receive rain all year round.

Figure 7: Average relative humidity at 08h00, 14h00 and 20h00 for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (%)

The KwaZulu-Natal north coast is known for its periods of high humidity with the summer months particularly susceptible to this weather. Winter is progressively dryer with a return to high humidity by October.

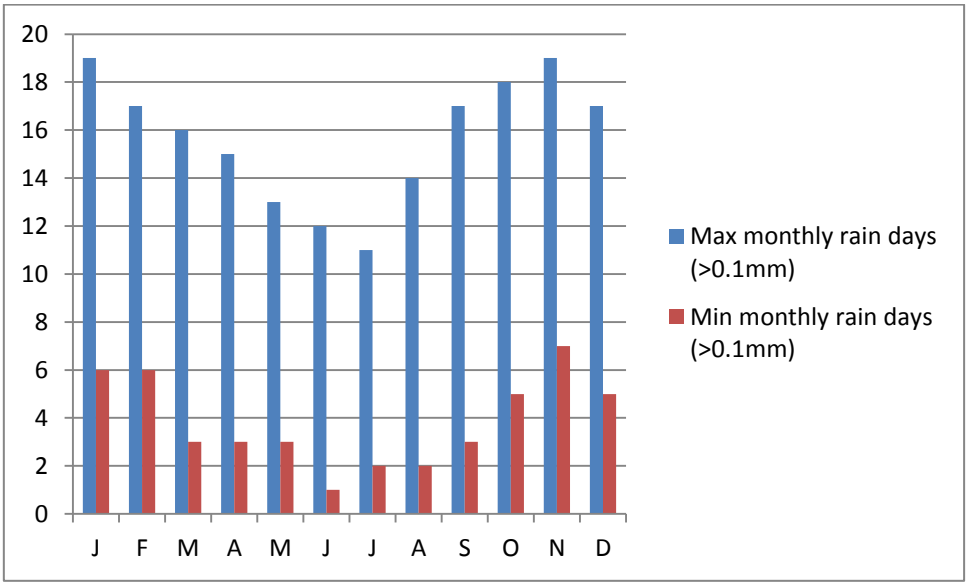

Figure 8: Average monthly rain days (days where precipitation exceeds 0.1mm) for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (number of days per month)

The region is characterised by consistently good rainfall, with even the driest winter months receiving at least one day of rain. In summer, rain can be an almost daily occurrence.

4.1.2 Temperature

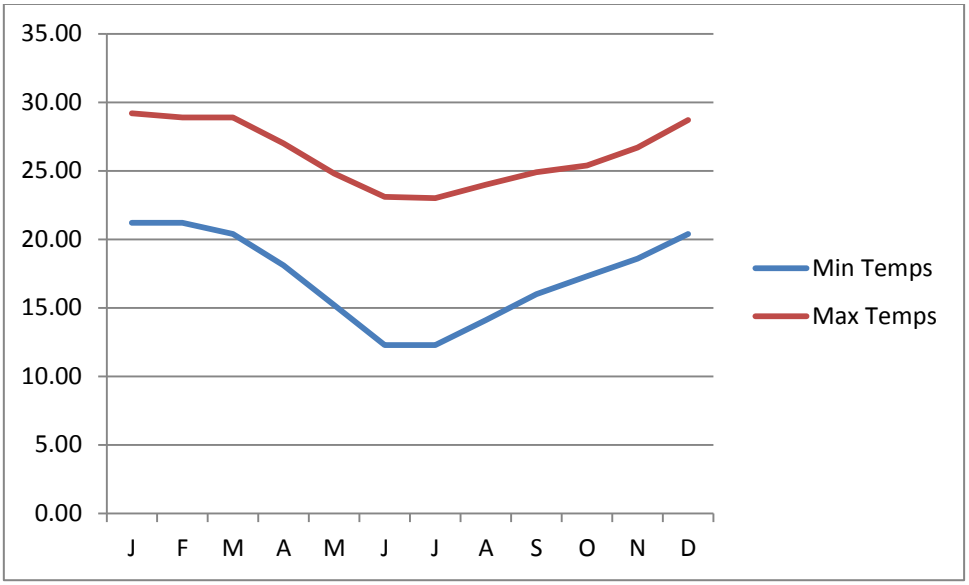

Figure 9: Average daily minimum and maximum temperatures for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (°C)

The climate is consistently warm and moist, with minimum temperatures seldom, if ever dropping below the 10 degree mark. The area experiences hot conditions during the summer, with the warmest period in December and January, when maximum temperatures average close to 30°C . Winters are mild with daytime temperatures reaching into the mid-twenties on most days and overnight temperatures never dropping below freezing. Despite it being nominally the dry season, winter remains consistently wet with occasional rain.

All of these factors will mitigate against the widespread dispersion of airborne dust.

4.2 Volatile organic compounds (VOCs)

A 2011 study was undertaken of various VOCs, in particular benzene, toluene, nonane, octane and xylene in the vicinity of the Delkor Waste Water Treatment plant. All levels were well below the standard of 5µg/m^3 prescribed by the National Environmental Management: Air Quality Act, 39 of 2004 (NEMAQA). An odour impact was noted in the vicinity (WSP, 2011).

Table 3. Results obtained from the monitoring of selected VOCs at STP (20°C, 1013hpa) in the vicinity of the Delkor Waster Water Treatment Plant (WSP, 2011).

	Benzene	Toluene	Octane	Ethyl-benzene	Xylene	Nonane
	µg/m^3					
Average on-site	0.12	0.71	0.09	0.27	1.25	2.47
Background	0.16	0.9	0.07	0.28	1.26	1.94

4.3 Dust fall

A dust monitoring program has been operational at the site from 2008 to at least March 2012 (last available records). The current land use of the site (bulk handling of coal for ocean transport) is typically associated with the generation of high dust loads, from vehicle entrained dust and exposure of areas exposed to wind erosion to the handling of materials in dry, windy conditions.

4.3.1 Transnet Richards Bay network

Figure 10: Transnet Richards Bay dust monitoring network (WSP 2012).

The Transnet network as run by WSP reports occasional incidences of high dust load well in excess of recommended guidelines. The network is split into three broad categories, fence line monitoring (TF1-8), internal dust fall out (TI1-9) and PM_{10} monitoring (Topaz sampler).

From this data, two clear areas of current impact are highlighted (Figure 11):

- High Dust Fall Out (DFO) along the north-eastern border of the monitoring area, as measured at sites TF3, TF3B and TF4 (yellow area)
- Extremely high levels of DFO in the central and southern operational area as measured at sites TI1, TI6, TI8 and TI9 (red area)

Figure 11: Broad analysis of areas of high dust impact for Transnet Terminal dust monitoring network (WSP, 2008, 2012). Includes approximate location of Bayside SO_2 monitoring site (red triangle) (RBCAA, 2012).

4.4 Sulphur dioxide (SO_2)

An SO_2 study was undertaken for Richards Bay town which included SO_2 monitoring at Bayside (see Figure 11 above). SO_2 levels for this site were registered as between 45% and 58% of NEMAQA guidelines for all time periods.

5. RECOMMENDATIONS

It is recommended that the current dust mitigation methods and monitoring remain in place throughout the course of the project.

5.1 Dust monitoring

In addition, further dust monitoring is recommended to establish a baseline impact on sensitive receptors near the Coal 500 Series, Swazi Coal Link and South Dunes sites, based on expected wind flow.

Figure 12: Proposed dust fall out monitoring areas near sensitive receptors to establish baseline levels prior to expanded operations.

Three areas of monitoring are recommended as per Figure 12:

1. Agricultural land south of Coal 500 Series site
2. Alton light industrial area, possibly north to Brackendowns residential area adjacent to proposed Coal Swazi Link site
3. Meer-en-See residential area

5.2 Modelling

It is recommended that the changes in operational activity be accurately assessed and the proposed resultant increases in emissions be modelled. This applies specifically to increased particulate and SO2 emissions resulting from increased ship traffic into the port.

6. BIBLIOGRAPHY

RBCAA. (2012). *Ambient Air Quality Report .* Richards Bay: Richards Bay Clean Air Association.

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