AIRSHED PLANNING PROFESSIONALS (Pty) Ltd

Reg. No.: 2002/023269/07

30 SMUTS DRIVE
HALFWAY GARDENS
P O BOX 5260, HALFWAY HOUSE, 1685

TEL +27 (0)11 805 1940
FAX +27 (0)11 805 7010
e-mail hanlie@airshed.co.za

Ref: APP/12/AGE-02 Rev2

10 October 2012

Air Quality Specialist Opinion on the potential Air Quality related concerns from the proposed Foskor Rock Phosphate Storage Facility in Richards Bay

1. Introduction

Foskor proposes the development of an additional new Rock Phosphate Storage Facility on portions 55 and 56 of Erf 5355 in Richards Bay. The facility is close to the existing production facility and will include a storage bunker that can accommodate approximately 200 000 tons of rock phosphate.

As part of a Basic Assessment conducted for the proposed storage facility, an air quality specialist input is required to cover the following scope:

- Providing specialist input into the Basic Assessment Report (assessment and mitigation) and associated Environmental Management Programme – this should be done in a form of a brief report.
- Incorporating the information on potential emissions into the air emission modelling in order to provide outputs that would satisfy the requirements for information that SRK may need for the Air Emission License applications.

Airshed Planning Professionals (Pty) Ltd (Airshed) was asked to provide a specialist opinion on the potential air quality impacts associated with Foskor project. The specialist opinion follows a qualitative assessment based on the proposed design of the Foskor Rock Phosphate Storage Facility.

2. Proposed Design Specifications

The phosphate rock is railed from Phalaborwa to Richards Bay where it is off-loaded at the neighbouring Grindrod rail tippling facility. From there it will either be transferred via enclosed pipe conveyor to the existing store or the proposed storage facility. An enclosed pipe conveyor will also be used to transfer the rock between the proposed storage facility and existing store if necessary. The conveyor system is designed as such to mininise the number of transfer points and subsequently the potential emission points.

The main pollutant of concern from the storage facility is particulate matter. Particulate matter would be a result of activities such as tipping at the Grindrod rail tippler, conveyor transfer points, tippling into the storage bunker and moving the rock phosphate within the storage facility.

The John Ross Highway servitude borders the proposed site to the north with the Hillside Aluminium industrial complex located opposite the John Ross Highway. On the eastern side is the West Central Arterial road servitude of ~100 m wide with the Hillside conveyor situated in it. Both areas to the south and west of the proposed site are underdeveloped.

The enclosed pipe conveyor is designed as such to ensure minimum transfer points and the storage bunker will be enclosed to mitigate dust emissions released to air.

3. Legal Requirements

The National Environmental Management: Air Quality Act (Act no.39 of 2004) commenced with on the 11th of September 2005 as published in the Government Gazette on the 9th of September 2005. Sections omitted from the implementation are Sections 21, 22, 36 to 49, 51(1)(e),51(1)(f), 51(3),60 and 61.

The Air Quality Act (AQA) was developed to reform and update air quality legislation in South Africa with the intention to reflect the overarching principles within the National Environmental Management Act. It also aims to comply with general environmental policies and to bring legislation in line with local and international good air quality management practices.

The most significant change under AQA to the previous approach in air quality management (as under the APPA of 1965) is the control of impacts on the receiving environment. Previously APPA focussed on managing air quality from a national government level by controlling specific sources. Under AQA this responsibility has been delegated down to district and metropolitan municipality level with the Air Quality Officer responsible for issuing Atmospheric Emissions Licenses. Thus, the implication for industry is that all Listed Activities (previously known as scheduled processes) will require Atmospheric Emissions Licences (AEL).

3.1 Emission Limits

Storage and handling of coal and ore is a Listed Activity under the NEM AQA of 2004 with minimum national emission limits developed for the process. All new applications have to apply for an Atmospheric Emissions Licence (AEL) to the District Municipality Air Quality Officer. This certificate requires provision of all point and non-point emissions deriving from the project.

In addition, National Ambient Air Quality Standards have been included in the Act. Any facility has to comply with both the emission limits for that process and the ambient air quality standards.

The "Minimum Emission Standards" applicable to the proposed Foskor Rock Phosphate Storage Facility are: provided in Table 1.

Note that "New Plant" relates per definition to any plant or process where the application for authorisation in terms of the National Environmental Management Act, 1998 (Act No 107 of 1998) (as amended) was made within the 12 months before the date on which the Notice was published (i.e.31 March 2010).

Table 1: **Minimum emission standards: Storage and Handling of Ore and Coal.**

Category:	**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 by the Mines Health and Safety Act 29/1996		
Application:	Locations designed to hold more than 100 000 tons.		
Substance or Mixture of Substances		**Plant Status**	**mg/Nm³ under normal conditions of 6% O_2, 273 K and 101.3 kPa**
Common Name	**Chemical Symbol**		
Dustfall	N/A	New	a
		Existing	a
a: three months running average not to exceed limit value for adjacent land use according to dust fallout promulgated in terms of section 32 of the NEM: AQA, 2004 (Act No. 39 of 2004), in eight principal wind directions			

3.2 Ambient Air Quality Standards

The National Framework provided a stepped approach in setting ambient air quality standards. Based on this the standard for a specific pollutant must include limit values for specific exposures, the number of allowed exceedances and a timetable for compliance. The limit values (concentrations) are based on scientific evidence. National Ambient Air Quality Standards (NAAQS) were determined based on international best practice for particulate matter less than 10 µm in aerodynamic diameter (PM_{10}), dustfall, sulphur dioxide, nitrogen dioxide, ozone, carbon monoxide, lead and benzene. These standards were published for comment in the Government Gazette on 9 June 2007 with the new standards, which include frequency of exceedance and implementation timeframes, published on the 24th of December 2009 (***Government Gazette 32816*)**. $PM_{2.5}$ NAAQS were gazetted and passed in June 2012. The NAAQS for PM_{10} and $PM_{2.5}$ are listed in Table 2**.**

Table 2: National Ambient Air Quality Standards.

Pollutant	Averaging Period	Limit Value (µg/m³)	Frequency of Exceedance	Compliance Date
PM_{10}	24 hour	120	4	Immediate – 31 Dec 2014
		75	4	1 Jan 2015
	1 year	50	0	Immediate – 31 Dec 2014
		40	0	1 Jan 2015
$PM_{2.5}$	24 hour	65	4	Immediate – 31 Dec 2015
		40	4	1 Jan 2016 – 31 Dec 2029
		25	4	1 Jan 2030
	1 year	25	0	Immediate – 31 Dec 2015
		20	0	1 Jan 2016 – 31 Dec 2029
		15	0	1 Jan 2030

Notes:

(a) Calculated on 1 hour averages.

(b) Running average.

In the South African context, widespread dust deposition impacts occur as a result of fugitive dust sources. Draft National Dust Control Regulations were published on the 27th of May 2011 (Government Gazette, Notice 309 of 2011). According to these regulations the dust fall at the boundary or beyond the boundary of the premises where it originates cannot exceed 600 mg/m²/day in residential and light commercial areas; or 1 200 mg/m²/day in areas other than residential and light commercial areas. Only three exceedances of these limits are allowed in a year with no two sequential months allowed to exceed. This will be based on the measuring reference method ASTM 01739 averaged over 30 days.

4. Semi-quantitative Evaluation of the Potential Air Quality Risks

A semi-quantitative evaluation was made based on the proposed operational design specifications, the existing legislation and the area where the proposed Rock Phosphate Storage Facility will be located. This includes quantification of emissions from the proposed facility and qualitatively evaluating the potential for impacts from the activities associated with the Rock Phosphate Storage Facility.

The main pollutant of concern from the proposed Rock Phosphate facility is particulates due to mechanical operations such as loading and off-loading. Based on the design specifications indicating that the conveyor will be an enclosed pipe conveyor and the storage bunker will be enclosed, this would minimise the potential for any particulate emission releases to ambient air.

4.1 Emissions quantification of proposed Rock Phosphate Facility

Information on the design of the proposed pipe conveyor, transfer points and storage bunker were provided by Foskor. A representation of the proposed layout is provided in Figure 1.

The proposed Rock Phosphate Storage facility is designed to store 200 000 metric tonnes (MT) of material. The storage bunker will be enclosed to mitigate dust emissions to air.

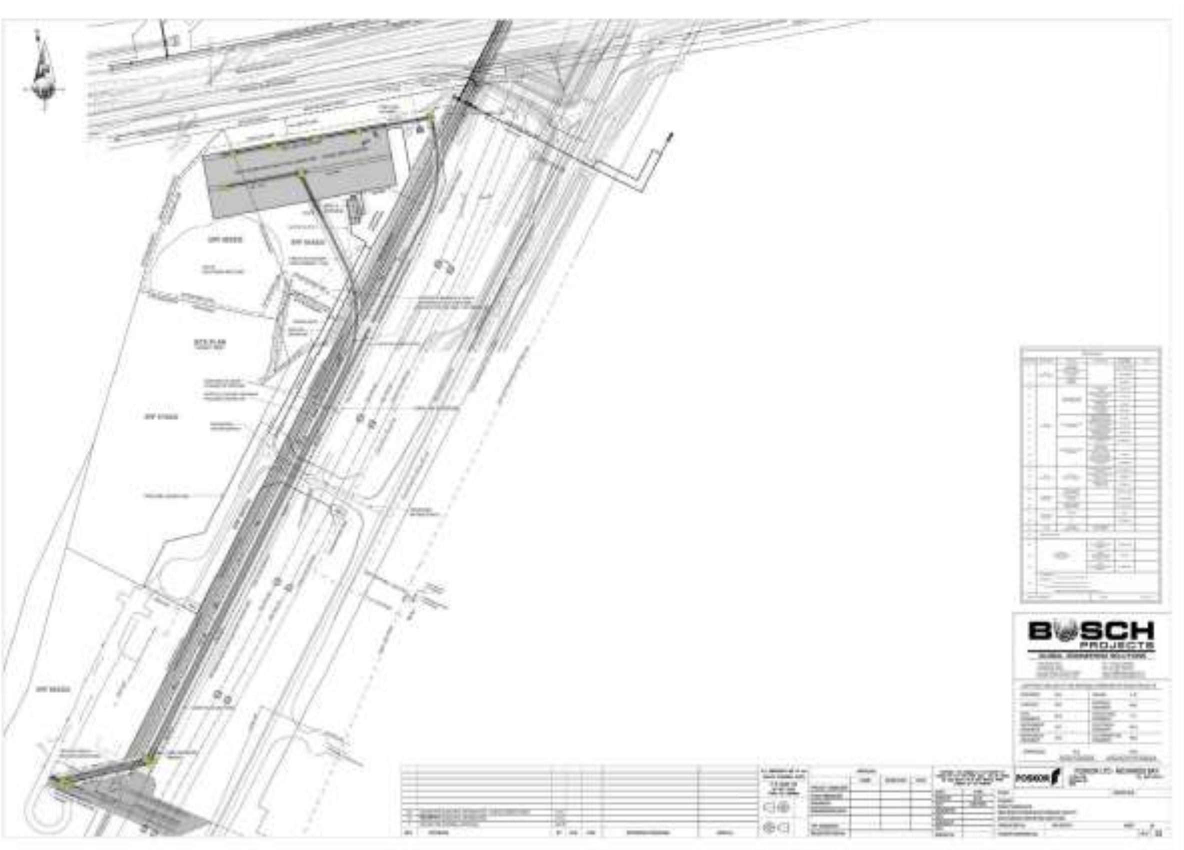

Figure 1: Site layout of the proposed Rock Phosphate facility at Foskor (after Bosch Projects)

The amount of Rock Phosphate to be conveyed from the Grindrod loading facility to the Rock Phosphate storage bunker will be 42 750 MT per week, for a period of 10 weeks per year resulting in a total of 427 500 MT per annum. Based on the layout in Figure 1, 254.46 MT of rock phosphate per hour (only to be applied to 10 weeks per year) will be loaded onto the FC1 conveyor at the Navitrade Transfer Tower. The material will be transferred onto the FC2 conveyor at the New Transfer Tower 1 and then into the new storage bunker onto conveyor FC3. A total of four transfer points have been identified on the incoming rock phosphate.

The same rock phosphate will be reclaimed back to the store on-site through the RC conveyors (see Figure 1). Within the storage bunker there are four loading points on RC1 from where the material will be transferred at the New Transfer Tower 2 onto RC2. At the New Transfer Tower 1 the material will be transferred onto RC3 which runs to the Navitrade Transfer Tower. The reclaimed throughput will also be 42 750 MT per week, but only for eight weeks of the year resulting in a total of 342 500 MT per annum. A total of seven transfer points will be in place on the return conveyor.

The material transfer points, where the rock phosphate is transferred onto and from the conveyors, were calculated using the following equation (NPI, 2012):

$$E = k0.0016\left(\frac{U}{2.2}\right)^{1.3}\left(\frac{M}{2}\right)^{1.4}$$

where:

E	=	emission factor (kg dust / ton transferred)
k	=	0.35 for particles less than 10 µm
U	=	mean wind speed (m/s)
M	=	material moisture content (%)

The conveyor transfer points are listed in Table 1 with the associated emission rates from each point. The moisture content of the rock phosphate was given to be between 1.5% and 1.8%, with the lower estimate applied in the calculations. The throughput as provide was applied to 10 weeks for the incoming material and eight weeks for the outgoing material. The average wind speed of 2.8 m/s was obtained from the Scorpio weather data for the year 2011.

The pipe conveyor is designed as such to ensure that no dust should be generated from the conveyor. A picture of a conventional conveyor in relation to a pipe conveyor is supplied in Figure 2. As a conservative approach, emissions from the conveyors were calculated assuming control efficiencies as provided for conveyors with enclosed sides and a roof.

The dust emissions from conventional conveyors are wind speed dependent with stronger wind speeds causing dust particles to be entrained by the wind. The degree of entrained dust also depends on the level of enclosure, i.e. roof cover and/or sides. The wind speed dependence has been based on the recommendations of Parrett (1992) where the dust emission rate (as grams per metre of conveyor) is equivalent to a constant multiplied by the difference between the friction velocity (u^*) and the threshold friction velocity of the coal (u^*_t):

$$E = c(u^* - u_t^*)$$

An estimate for the constant (*c*) has been made on data reported by GHD/Oceanics (1975) for measured conveyor emissions at a wind speed of 10 m/s. The PM_{10} fraction has been estimated as 45% of the TSP.

The logarithmic wind speed profile may be used to estimate friction velocities from wind speed data recorded at a reference anemometer height of 10 m (EPA, 1999): $u^* = 0.053\ u_{10}$. This equation assumes a typical roughness height of 0.5 cm for open terrain, and is restricted to large relatively flat piles or exposed areas with little penetration into the surface layer. Parrett's (1992) estimate of u* over coal surfaces was determined as typically 0.11 times the 10 metre level wind speed. Furthermore, the threshold wind speed (u^*_t) for coal dust to be lifted (particles in the 20-30 μm range) is 3.1 m/s. The value for u^*_t therefore is typically 0.34 m/s. Emissions for wind speeds below 3.1 m/s are likely to be negligible.

The emissions calculated are provided in Table 2. As indicated, the approach is conservative since it assumed emissions as from a conventional conveyor and based on emission factors provided for coal dust. Control efficiencies for conveyors with roofs and covered on both sides are given as 70%.

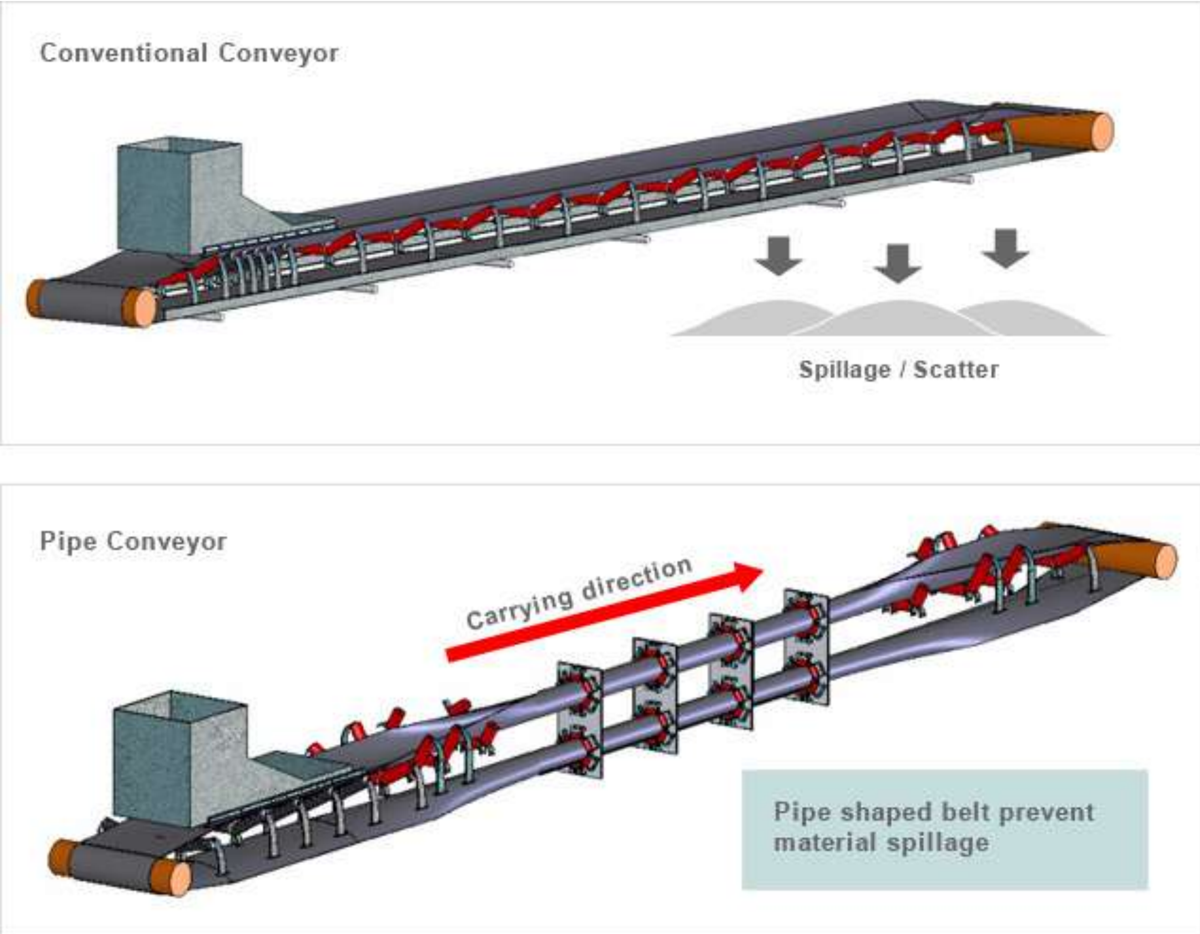

Figure 2: Example of a conventional conveyor in relation to a pipe conveyor (after Bridgestone, http://www.bridgestone.com/products/diversified/conveyorbelt/products/pipe_conveyor_belt.html)

Table 3: Material transfer points along the conveyors to and from the new Rock Phosphate storage bunker

Source description	Source code	Moisture (%)	Ave wsp (m/s)	Tph	Unmitigated		Mitigated		
					TSP (kg/ann)	PM_{10} (kg/ann)	TSP (kg/ann)	PM_{10} (kg/ann)	CE
Incoming material onto conveyor at Navitrade Transfer Tower	FC1	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Incoming material transfer at New Transfer Tower 1	TT1F	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Incoming material transfer at new Storage Bunker	FC2	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Off-loading of Incoming material at new Storage Bunker	FC3	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Loading of outgoing material at new Storage Bunker	RC1a	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Transfer of outgoing material at new Storage Bunker	RC1b	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Transfer of outgoing material at new Storage Bunker	RC1c	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Transfer of outgoing material at new Storage Bunker	RC1d	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Outgoing material transfer at New Transfer Tower 2	TT2R	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Outgoing material transfer at New Transfer Tower 1	TT1R	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
Off-loading of outgoing material at Navitrade Transfer Tower	RC3	1.5	2.8	254.46	1411.64	494.07	423.50	148.22	70%
TOTAL					**15528.01**	**5434.80**	**4658.40**	**1630.44**	

Notes: CE is the control efficiency for the enclosed material transfer points (NPI, 2012).

Table 4: Fugitive dust emissions from the conveyors at the new Rock Phosphate storage bunker

Description	Length (m)	Duration	Unmitigated		Mitigated		
			TSP (kg/ann)	PM_{10} (kg/ann)	TSP (kg/ann)	PM_{10} (kg/ann)	CE
Incoming conveyor	200	10 weeks	0.134	0.060	0.04	0.06	70%
Outgoing conveyor	250	8 weeks	0.128	0.058	0.04	0.06	70%
Total			**0.262**	**0.118**	**0.08**	**0.12**	

Notes: CE is the control efficiency for conveyors with roof and two side covers.

4.2 Qualitative assessment of the potential for impacts from the proposed Rock Phosphate Facility

Taken into consideration the surrounding land use and the proposed design criteria, it is unlikely that the proposed Foskor Rock Phosphate Storage Facility would result in significant emissions to air. This is illustrated in Table 3 where the additional TSP and PM_{10} emissions from the conveyor transfer points (as reported in Table 3) and the conveyor emissions (as reported in Table 4) are compared to cumulative emissions from Foskor and from all RBCAA sources.

Table 5: Total emission rates, unmitigated and mitigated, for all current RBCAA sources with the proposed Rock Phosphate project included

Source Description	Emission Rate (tpa)	
	TSP	PM_{10}
Foskor (Current + UP, MAP and MCP/DCP + AHF/ATF)	445.30	445.30
All RBCAA sources (excluding Foskor)	4 643.80	4 643.80
TOTAL	**5 089.10**	**5 089.10**
Unmitigated		
Foskor (Current + UP, MAP and MCP/DCP + AHF/ATF + Rock Phosphate)	460.83	450.73
Percentage change from current Foskor emissions	3.40%	1.21%
Percentage change from all RBCAA emissions	0.30%	0.10%
Mitigated		
Foskor (Current + UP, MAP and MCP/DCP + AHF/ATF + Rock Phosphate)	449.96	446.93
Percentage change from current Foskor emissions	1.04%	0.36%
Percentage change from all RBCAA emissions	0.09%	0.03%

From table 5 it is clear that the proposed Rock Phosphate project will contribute less than 3.5% to the future Foskor emissions with no mitigation in place and less than 0.5% to the total RBCAA emissions. With mitigation in place, the contribution would be significantly lower resulting in approximately 1% to Foskor emissions and less than 0.1% to the total RBCAA emissions.

5. Conclusion

With no mitigation in place the quantified emissions are low and expected to have no significant impact on the surrounding environment and human health. With mitigation in place (based on the conveyor design), the quantified emissions will be insignificant.

6. Recommendations

The proposed storage facility will have to install and operate a dust fallout monitoring network comprising of at least eight single dust fallout units, placed in the direction of the eight cardinal wind directions as per the requirements of Listed Activity 5.1. The dust fallout units should follow the American Society for Testing and Materials standard method for collection and analysis of dust fall (ASTM D1739-98) as per the SANS requirements.

7. References

ASTM Standard D1739-70, 1998: *Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter)*, ASTM International: West Conshohocken, PA, 4 pp.

NPI (2012). Emission Estimation Technique Manual for Mining Version 3.1, Australian Government, Department of the Environment, Water, Heritage and the Arts

Parrett, FW (1992), “Dust emission – a review”, Applied Environmetrics (Balwyn).

SANS, 2009: *South African National Standard, Ambient air quality — Limits for common Pollutants*, SANS 1929:2009 Edition 2, Published by Standards South Africa, Pretoria, 2009.

____

Hanlie Liebenberg-Enslin

Director