AIR QUALITY IMPACT ASESSMENT FOR THE ACTIVITIES ASSOCIATED WITH PROPOSED DEVELOPMENT OF THE SUN CENTRAL CLUSTER 300 MW SOLAR PV FACILITY BETWEEN DE AAR & HANOVER, EMTHANJENI LOCAL MUNICIPALITY, PIXLEY KA SEME DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

Report details

Client:	Ecoleges Environmental Consultants
Report title:	Air Quality Impact Assessment for the Activities Associated with the Proposed Development of the Sun Central Cluster 300 MW Solar PV Facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province
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DECLARATION OF INDEPENDENCE

This report was compiled by Dr Mark Zunckel of uMoya-NILU Consulting (Pty) Ltd, who hereby declares that he acted as an independent consultant and has no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of performing such work.

Dr Zunckel's CV is appended in Annexure A.

Mark Zunckel

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1. INTRODUCTION

Ecoleges are processing additional authorisations on behalf of SolarAfrica Energy (Pty) Ltd for the Sun Central Cluster 1 Solar PV Project between Hanover & De Aar in the Northern Cape (Figure 1-1). The additional authorisations are required due to the road requirements for transport of transformers to the site, the increased Main Transmission Sub-station (MTS), the requirement for additional groundwater to facilitate concrete batching on-site, amongst others. Ecoleges is conducting a Basic Assessment and has appointed uMoya-NILU Consulting (Pty) Ltd to conduct an air quality impact assessment to support the application process.

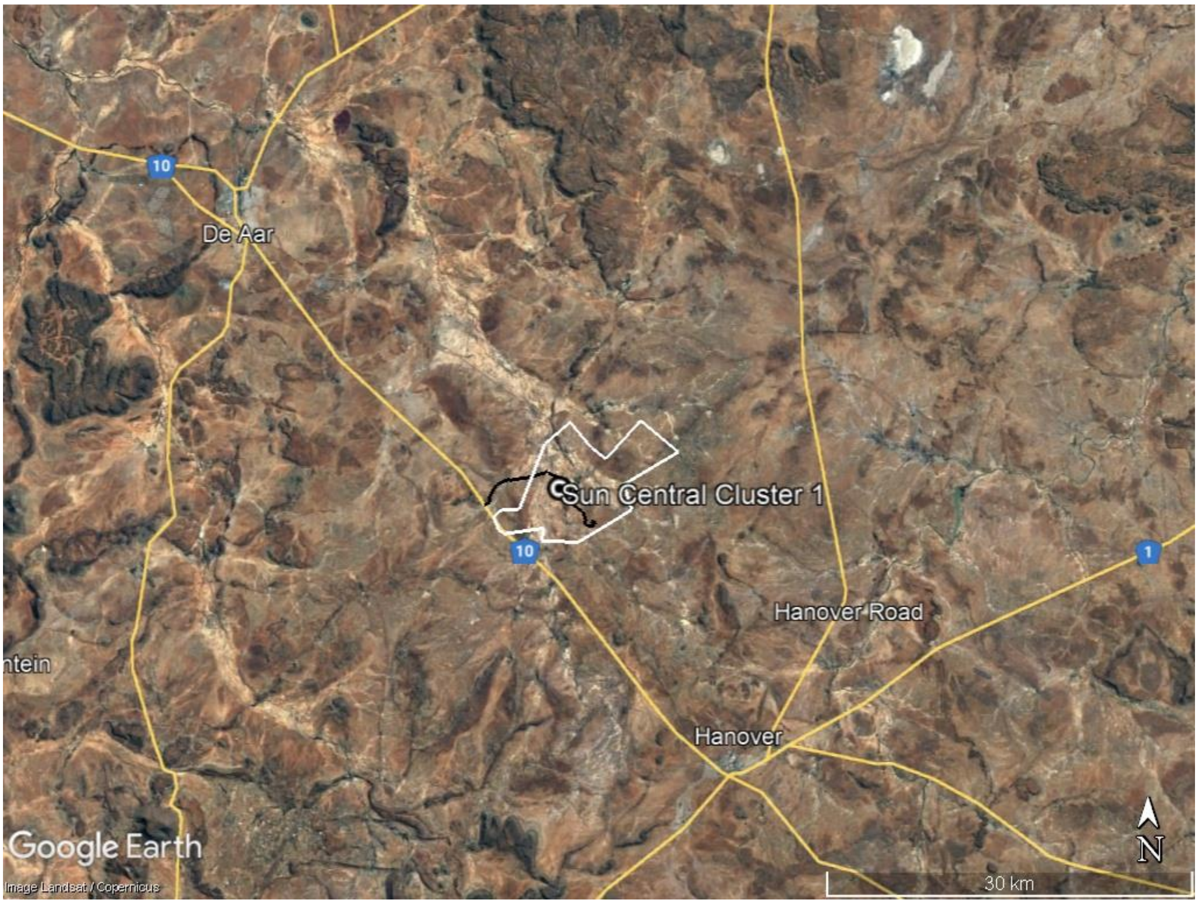

Figure 1-1: Location of the Sun Central Cluster 1 between De Aar and Hanover (Google Earth, 2023)

2. THE PROJECT

2.1 Project description

The Sun Central Cluster 1 project involves the construction of a Main Transmission Substation (MTS) to feed electricity into the National Grid via a new 400 kV electricity transmission line. Eskom has dictated that the MTS be designed for up to 2 GW capacity so that it has the capacity to receive 300 MW of electricity generated by SolarAfrica Energy (Pty) Ltd Solar PV Facility, known as Sun Central Cluster 1, and any future electricity generation facilities that would apply to feed into the grid at the same location.

The 2 GW MTS includes *inter alia* sufficient feeder bay for up to four (4) 500 MVA transformers. Each transformer must be transported on a 270 tonne and 40 to 60 m long trucks. Given the weight and length of the trucks delivering the abnormal loads to site, an Access Road must meet Eskom and District Road specifications to ensure the safe delivery of equipment to site.

Equipment will be transported to site using the left, north-bound lane of the N10 from Hanover and then turn right onto the site Access Road. The Access Road comprises (1) the existing Burgerville District Road (2448) turn-off from the N10, (2) an existing private road where the District Road intersects the boundary of Farm Riet Fountain No. 39C and continues to the fenceline of Sun Central Cluster 1 (300 MW) Solar PV Facility, and (3) the development of a new road to the Switching Station and Main Transmission Substation. Once completed, the Access Road will be used by delivery vehicles and contractors during the construction of the MTS and Cluster 1 Project.

2.2 Project site

The project site is adjacent to the N10, approximately 35 km southeast of De Aar and approximately 25 km northwest of Hanover (Figure 2-1). Although the area is rural and sparsely populated two sensitive receptors should be noted. Receptor 1 is 150 m from the District Road not far from the intersection with the N10, and Receptor 2 is 250 m from the proposed Access Road, being Mr Willem Retief's homestead with farm worker accommodation.

Figure 2-1: The Sun Central Cluster 1 project area (green) the Access Road (white) and the two sensitive receptors (Google Earth, 2022)

3. TERMS OF REFERENCE

For the establishment of the Sun Central Cluster 1 (300 MW) Solar PV Facility the Air Quality Impact Assessment should investigate:

i) The air quality impacts associated with the construction of the Access Road, such as grading, importing road material, compaction, and stabilisation using cement powder, and qualitative assessment of the potential impacts associated with the concrete batching plant and recommendations for mitigation.
ii) Once the construction of the Access Road is complete it will be in use during the construction of the Solar PV Facility (Cluster 1) and is therefore in operation.
iii) Extrapolate the findings or impacts for remaining sections of the District Road that will be used to access Clusters 2 and 3, either in isolation or cumulatively (if the construction of each Cluster were to overlap, e.g., worst case scenario).

4. METHODOLOGY

The methodology for the air quality assessment includes three phases, described here:

4.1 Emission inventory

The development of the emissions inventory for vehicle entrained particulates on the Access Road during the construction, operational and decommissioning phases is based on the predicted average daily traffic (ADT) obtained from the Traffic Impact Assessment (Sturgeon Consulting, 2022). USEPA emission factors for vehicle entrainment on gravel roads for the different vehicles are applied (USEPA, 1995a: http://www.epa.gov/ttn/chief/ap42/ch13/). Particulate emissions from construction equipment and activities depend on the specific equipment and the nature and duration of the activities. These emissions are not estimated.

4.2 Dispersion modelling

Dispersion modelling is undertaken to estimate the ambient concentrations that may result from vehicle entrainment during construction, operations and decommissioning phases. The USEPA approved SCREEN-3 (USEPA, 1995b) dispersion model is used to predict maximum ground-level ambient concentrations of particulate matter (PM_{10}) and dust fallout. SCREEN-3 has been adopted by the USEPA in its 'Guideline on Air Quality Models' as the preferred model for screening studies (DEA, 2014).

SCREEN 3 uses a matrix of meteorological conditions covering a range of wind speed and stability class categories. The model is designed to estimate the worst-case ground-level concentrations. Maximum ground level PM_{10} concentrations and maximum dust fallout are predicted for a wind blowing at 90° to the Access Road. This scenario presents a worse case.

4.3 Impact assessment

The rating scale and description criteria to assess impacts on air quality are defined in Figure 4-1. The magnitude is based on the predicted ambient concentrations and dust fallout rates relative to the National Ambient Air Quality Standards (NAAQS) for PM_{10} (DEA, 2009) and the National Dust Control Regulations Standard for Dustfall (DEA, 2013) (Table 4-2).

Table 4-1: Definition of impact criteria and rating scale

Evaluation Component	**Rating Scale and Description/criteria**
MAGNITUDE of negative impact (at the indicated spatial scale)	**10 - Very high**: Bio-physical and/or social functions and/or processes might be *severely* altered, i.e. NAAQS exceeded by more than four times the permitted tolerance. **8 - High**: Bio-physical and/or social functions and/or processes might be *considerably* altered, i.e. NAAQS exceeded by three times the permitted tolerance. **6 - Medium**: Bio-physical and/or social functions and/or processes might be *notably* altered, i.e. NAAQS exceeded by two times the permitted tolerance. **4 - Low**: Bio-physical and/or social functions and/or processes might be *slightly* altered, i.e. NAAQS exceeded by one time the permitted tolerance. **2 - Very Low**: Bio-physical and/or social functions and/or processes might be *negligibly* altered, i.e. NAAQS not exceeded. **0 - Zero**: Bio-physical and/or social functions and/or processes will remain *unaltered,* i.e. predicted ambient concentrations are zero.
DURATION	**5 - Permanent** **4 - Long term**: Impact ceases after operational phase/life of the activity > 60 years. **3 - Medium term**: Impact might occur during the operational phase/life of the activity – 60 years. **2 - Short term**: Impact might occur during the construction phase - < 3 years. **1 - Immediate**
EXTENT (or spatial scale/influence of impact)	**5 - International**: Beyond National boundaries. **4 - National**: Beyond Provincial boundaries and within National boundaries. **3 - Regional**: Beyond 5 km of the proposed development and within Provincial boundaries. **2 - Local**: Within 5 km of the proposed development. **1 - Site-specific**: On site or within 100 m of the site boundary. **0 - None**
IRREPLACEABLE loss of resources	**5 – Definite** loss of irreplaceable resources. **4 – High** potential for loss of irreplaceable resources. **3 – Moderate** potential for loss of irreplaceable resources. **2 – Low** potential for loss of irreplaceable resources. **1 – Very low** potential for loss of irreplaceable resources. **0 - None**
REVERSIBILITY of impact	**5 –** Impact **cannot** be reversed. **4 – Low** potential that impact might be reversed. **3 – Moderate** potential that impact might be reversed. **2 – High** potential that impact might be reversed. **1 –** Impact **will be** reversible. **0 – No impact**.
PROBABILITY (of occurrence)	**5 - Definite:** >95% chance of the potential impact occurring. **4 - High probability:** 75% - 95% chance of the potential impact occurring. **3 - Medium probability:** 25% - 75% chance of the potential impact occurring **2 - Low probability:** 5% - 25% chance of the potential impact occurring. **1 - Improbable:** <5% chance of the potential impact occurring.
CUMULATIVE impacts	**High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern. ***Medium****:* The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern. ***Low****:* The activity is localised and might have a negligible cumulative impact. ***None****:* No cumulative impact on the environment.

Table 4-2: NAAQS for PM_{10} and the National Dustfall Standard

Pollutant	Averaging Period	National standard
Dust fallout	Residential	600 mg/m^2/day
	Non-residential	1200 mg/m^2/day
PM_{10}	24 hour	75 µg/m^3
	1 year	40 µg/m^3

Once the Environmental Risk Ratings have been evaluated for each potential air quality impact, the Significance Score of each potential impact is calculated by using the following formula:

- **SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**

The maximum Significance Score value is 150.

The Significance Score is then used to rate the Significance of each potential air quality impact (Table 4-3). The Environmental Significance rating process is completed for all identified potential environmental impacts both before and after implementation of the recommended mitigation measures.

Table 4-3: Environmental significance

Significance Score	Environmental Significance	Description/criteria
125 – 150	**Very high (VH)**	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
100 – 124	**High (H)**	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
75 – 99	**Medium-high (MH)**	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked.
40 – 74	**Medium (M)**	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	**Low (L)**	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
+	**Positive impact (+)**	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.

5. PARTICULATE EMISSIONS

For this assessment emission of Total Suspended Particulates (TSP) and respireable particulate matter (PM_{10}) are considered.

TSP consists of all sizes of particles suspended within the air smaller than 100 micrometres (µm). TSP is useful for understanding nuisance effects of PM, e.g. settling on houses, deposition on and discolouration of buildings, and reduction in visibility.

PM_{10} describes all particulate matter in the atmosphere with a diameter equal to or less than 10 µm. Sometimes referred to simply as coarse particles, they are generally emitted from motor vehicles (primarily those using diesel engines), factory and utility smokestacks, construction sites, tilled fields, unpaved roads, stone crushing, and burning of wood. Natural sources include sea spray, windblown dust and volcanoes. Coarse particles tend to have relatively short residence times as they settle out rapidly and PM_{10} is generally found relatively close to the source except in strong winds.

The main source of particulate emissions will be entrainment of dust by vehicles on the unpaved Access Road. Some particulates will be generated by the construction equipment and construction activities, including the concrete batching plant and stone crushing for aggregate for construction of the road.

5.1 Vehicle entrainment

Average daily traffic (ADT) is taken from the traffic impact assessment for a similar 400 MW project in the same area (Sturgeon Consulting, 2022). These trips are assumed for the duration of the construction period and decommissioning phase (48 months) and for the operational phase of the project.

Construction and Decommissioning Phases - 78 Daily Trips (two-way)

- 6 daily truck trips
- 26 daily light load trips
- 44 daily staff transport trips
- 2 daily water truck trips

Operational Phase - 18 Daily Trips (two-way)

- 4 daily light load truck trips
- 12 daily staff transport trips
- 2 daily water truck trips

The methodology for the estimation of emissions of TSP and PM_{10} is described in "USEPA Fifth Edition, Volume I Chapter 11, section 11.19: Introduction to Construction and Aggregate Processing" and "USEPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources" (USEPA, 2009a; 2009b). There are also a number of light and heavy duty vehicles on site, where emission factors are applied.

The general equation for emissions estimation is: E = A x EF x (1-ER/100) where:

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

Vehicle entrained dust is a function of the vehicle mass, the vehicle kilometres travelled and the characteristics of the road surface. The emission factor is a representative value that relates the quantity of a pollutant released to the atmosphere with the associated activity that releases the pollutant. These factors are expressed as the mass of pollutant divided by a unit mass, area, distance, or duration of the activity emitting the pollutant.

The emission factors used for the calculation of PM_{10} and TSP in this study are published in the United States Environmental Protection Agency (USEPA), AP 42, Fifth Edition, Compilation of

Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Chapter 13: Miscellaneous Sources (Section 13.2.2 Unpaved Roads).

To estimate vehicle entrained particulate emissions from the Access Road it is assumed that the characteristics of the road and the ADT are consistent over the entire length of the road. Emissions are estimated for a 100 m length of the Access Road. This road length is generic and represents any section of the Access Road.

Parameters that are applied for the calculation of particulate entrainment emissions are listed in Table 5-1. It is assumed that dust is controlled on the Access Road by wetting once a day during all phases. The estimated emissions of TSP and PM_{10} in tonnes per annum are listed in Table 5-2 for the construction, operational and decommissioning phases.

Table 5-1: Parameters for particulate entrainment emissions

Parameter	Value	Unit	Reference
Number of operating days per year	312	Days	Sturgeon Consulting, 2022
Silt Content	8.5	%	USEPA AP42 (Ch 13.2.2)
Estimated working days with precipitation exceeding 0.2 mm	28.2	Days	https://www.meteoblue.com/
Dust control by watering	1	Per day	Assumption

Table 5-2: Emissions of TSP and PM_{10} from vehicle entrainment in tonnes/annum for a 100 m length of the Access Road

	TSP		PM_{10}	
Phase	**Uncontrolled[1]**	**Controlled[2]**	**Uncontrolled[1]**	**Controlled[2]**
Construction & decommissioning	20.20	16.68	7.49	4.77
Operational	5.50	5.01	1.57	1.43
1: Uncontrolled: No dust control or mitigation measures				
2: Controlled: Dust control or mitigation by watering once per day				

5.2 Construction activities and equipment

Particulates generated by construction equipment and activities are generally coarse. These emission depend on the nature and duration of the activity and on the dust control measures that are implemented.

Construction equipment is likely to include drilling rigs, piling machines, crushers, excavators and TLBs and the concrete batch plant. The main construction activities are likely to include the clearing of vegetation, the establishment of an equipment laydown area, the stockpiling of topsoil and cleared vegetation, excavations; and the construction of the solar field, the power line and additional infrastructure.

Particulate emission from these activities are expected to be relatively low and are not estimated.

6. PREDICTED AMBIENT AIR QUALITY

The maximum dust fallout and maximum ambient PM_{10} concentrations resulting from vehicle entrained dust were predicted using the USEPA SCREEN-3 Model (USEPA, 1995b). The results are presented as line graphs increasing in distance from the centre of the Access Road to 5 km downwind, in Figure 6-1 for dust fallout and in Figure 6-3 for PM_{10}. Model predictions are presented for i) construction and decommissioning and ii) operations. Model predictions are also presented for uncontrolled emissions and controlled emissions. Control of dust emissions control assumes that the Access Road is sprayed once a day with water (see Table 5-1).

6.1 Dust fallout

The highest predicted dust fallout rates occurs during the construction/decommissioning phases when the ADT is highest with no dust control measures (Figure 6-1). During construction/decommissioning, the maximum predicted dust fallout rate is 302 mg/m^2/day and occurs 100 m downwind of the Access Road. It is well below the National Dust Standard of 600 mg/m^2/day for non-industrial areas. From the point of maximum the predicted fallout rates decrease steadily with increasing distance from the Access Road. The predicted dust fallout rates for the construction/decommission phases are considerably lower when the dust control measures are implemented, i.e. spraying the Access Road with water once a day.

The highest predicted dust fallout rates during the operational phase are considerably lower than the construction/decommissioning phases due to a marked decrease in ADT. During the operational phase, the maximum predicted dust fallout rate is 23.8 mg/m^2/day without dust control measures and occurs 100 m downwind of the Access Road. It is also well below the National Dust Standard of 600 mg/m^2/day for non-industrial areas. From the point of maximum the predicted fallout rates decrease steadily with increasing distance from the Access Road. The predicted dust fallout rates the operational phase are somewhat lower when the dust control measures are implemented.

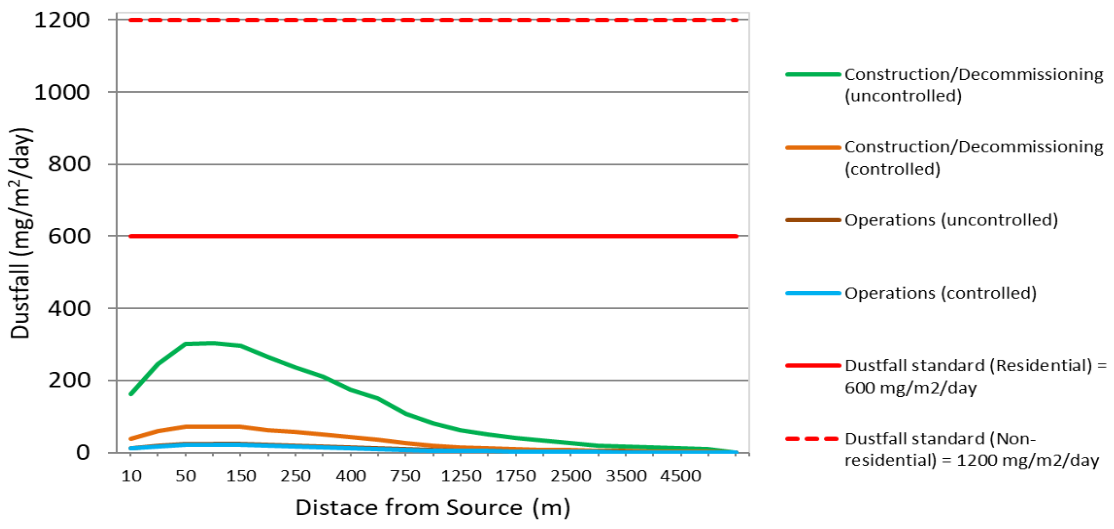

Figure 6-1: Predicted dust fallout resulting from vehicle entrainment on the Access Road in mg/m^2/day compared with the National Dust Standard

6.2 PM_{10}

The highest predicted ambient PM_{10} concentrations occur during the construction/decommissioning phases when the ADT is highest with no dust control measures (Figure 6-3 and Figure 6-3). During construction/decommissioning the maximum predicted annual ambient PM_{10} concentration is 84 µg/m^3 and occurs 100 m downwind of the Access

Road. It is above the NAAQS of 40 µg/m^3 up to 550 m downwind of the Access Road and predicted to be below the NAAQS beyond this.

The predicted annual ambient PM_{10} concentrations for the construction/decommission phases are considerably lower when the dust control measures are implemented and are predicted to be below the NAAQS, i.e. spraying the Access Road once a day with water. The maximum predicted concentration for this scenario is 20 µg/m^3.

The predicted annual ambient PM_{10} concentrations during the operational phase are low and well below the NAAQS. There is little difference between the predicted annual average PM_{10} concentrations for the uncontrolled and controlled scenario during the operational phase.

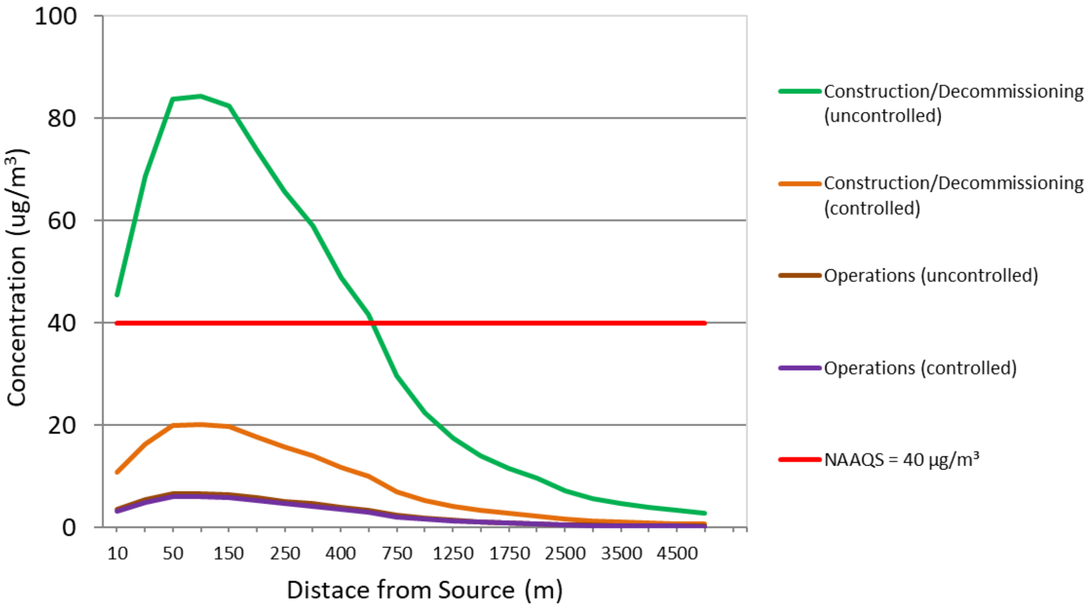

Figure 6-2: Predicted annual PM_{10} concentrations resulting from vehicle entrainment on the Access Road in µg/m^3 compared with the NAAQS

During construction/decommissioning the maximum predicted 24-hour ambient PM_{10} concentration is 421 µg/m^3 and occurs 100 m downwind of the Access Road. It is above the NAAQS of 75 µg/m^3 up to 1 500 m downwind of the Access Road and predicted to be below the NAAQS beyond this.

The predicted 24-hour ambient PM_{10} concentrations for the construction/decommission phases are considerably lower when the dust control measures are implemented, but are above the NAAQS up to 300 m from the Access Road. The maximum predicted concentration for this scenario is 101 µg/m^3 and occurs 100 m from the Access Road.

The predicted 24-hour ambient PM_{10} concentrations during the operational phase are low with little difference between the uncontrolled and controlled scenarios.

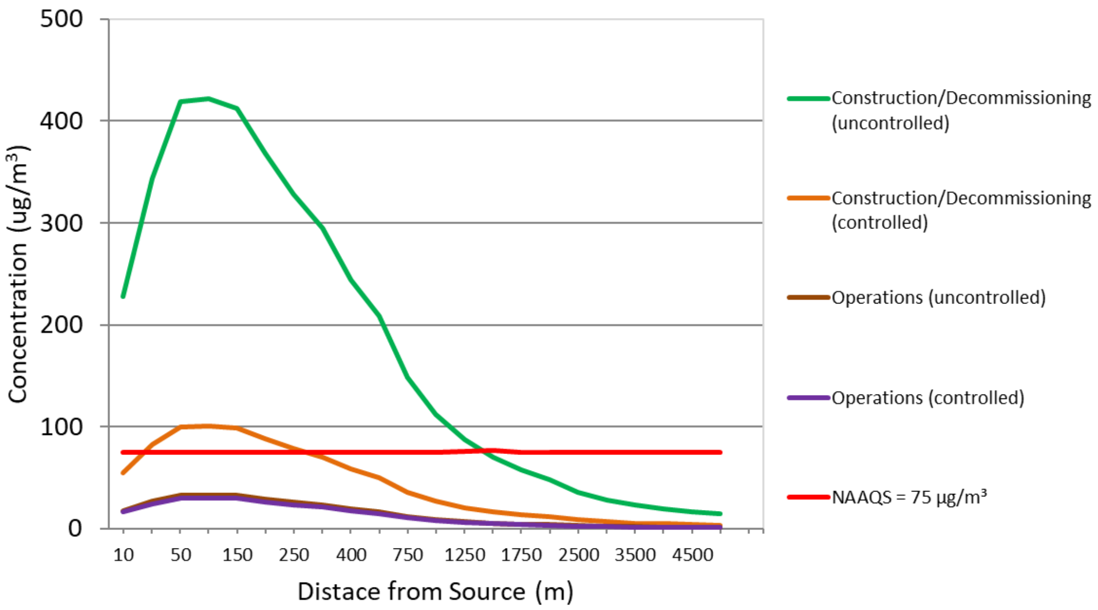

Figure 6-3: Predicted 24-hour PM_{10} concentrations resulting from vehicle entrainment on the Access Road in µg/m³ compared with the NAAQS

7. IMPACT ASSESSMENT

The methodology that is applied to assess the impact is described in Section 4.3. The air quality impact is assessed for the construction and decommissioning phases and during the operational phase of the Access Road. The impact is described in the following paragraphs and the scores are presented in Table 7-1 and Table 7-2.

7.1 Construction and decommissioning

7.1.1 Dust fallout

The predicted dust fallout is low and well below the limit value for acceptable dust fallout in non-residential areas. The ***magnitude*** of the current impact is therefore ***very low***. The ***duration*** of the impact will be for the duration of the construction and decommissioning phases and are therefore ***short term***. The ***extent*** of the impact is small and is limited to within 1 km of the site and mainly along the Access Road and is therefore classified as ***local***.

There is a ***low probability*** of the potential impacts occurring as a result of the proposed project considering the low predicted dust fallout and generally low measured dust fallout.

The ***significance*** of the impact of dust fallout resulting during construction and decommissioning of the Access Road is ***low*** with a score of 16. The impact scores for the proposed operations are shown in Table 7-1.

This assessment considers the current dust control measures, i.e. spraying the Access Road once a day with water. It is however recommended that these are expanded in order to reduce the emission and ensure that the significance of the impact remains ***low***. Recommendations for mitigation are made in Section 8.

7.1.2 PM_{10}

For the ***uncontrolled scenario*** the predicted ambient PM_{10} concentrations exceed the annual average and 24-hour NAAQS for PM_{10} up to 1 500 m from the Access Road. Sensitive receptors have been noted within this zone.

For the uncontrolled case the ***magnitude*** of the impact is therefore ***medium***. The ***duration*** of the impact will be for the proposed 48 months of the construction and decommissioning phases and is therefore ***short term***. The ***extent*** of the impact is limited to within 1.5 km of the Access Road and is therefore classified as ***local.***

For the ***controlled scenario*** the predicted ambient PM_{10} concentrations are below the annual average NAAQS for PM_{10}, but exceed the 24-hour NAAQS for PM_{10} up to 300 m from the Access Road. Sensitive receptors have been noted within this zone.

For the controlled case the ***magnitude*** of the impact is therefore ***low***. The ***duration*** of the impact will be for the 48 months of the construction and decommissioning phases and is therefore ***short term***. The **extent** of the impact is limited to within 300 m of the Access Road and is therefore classified as ***local.***

There is a ***high probability*** of the potential impacts occurring considering the predicted extent and magnitude of the high concentrations. The ***significance*** of the impact of operations on air quality is ***medium*** with a score of 48. The impact scores for the proposed operations are shown in Table 7-1.

This assessment considers the dust control measures of watering once per day. These however need to be expanded in order to reduce the emission and lower the impact significance to ***low*** with mitigation. Recommendations are made in Section 8.

7.2 Operational phase

7.2.1 Dust fallout

The predicted dust fallout is low and well below the limit value for acceptable dust fallout in non-residential areas. The ***magnitude*** of the current impact is therefore ***very low***. The ***duration*** of the impact will be for the life of the operations and is therefore ***long term***. The **extent** of the impact is small and limited mainly along the Access Road and is therefore classified as ***local***.

There is a ***low probability*** of the potential impacts occurring as a result of the proposed project considering the low predicted dust fallout and generally low measured dust fallout.

The ***significance*** of the impact of operations on air quality is ***low*** with a score of 20. The impact scores for the proposed operations are shown in Table 7-2. This assessment considers proposed dust control measures. It is however recommended that these are expanded in order to reduce the emission and ensure that significance of the impact remains ***low***. Recommendations for mitigation are made in Section 8.

7.2.1 Respirable particulates (PM_{10})

The predicted ambient PM_{10} concentrations are relatively low and well below the annual and 24-hour NAAQS. The ***magnitude*** of the impact is therefore ***low***. The ***duration*** of the impact will be for the life of the operations and is therefore ***long term***. The **extent** of the impact is limited to within 1 km of the Access Roads and is therefore classified as ***local.***

There is a ***low probability*** of the potential impacts occurring considering the predicted extent and magnitude of the concentrations.

Wind blow dust from open areas and entrainment from non-project vehicles are the only other source of PM_{10} in the area. The extent of the predicted impact is localised. It is therefore unlikely that emissions from operations on the Access Road will add significantly to ambient concentrations beyond the project area. The ***cumulative impact*** is therefore considered to be negligible and is scored ***low***.

The ***significance*** of the impact of operations on air quality is ***low*** with a score of 20. The impact scores for the proposed operations are shown in Table 7-2. This assessment considers the current dust control measures. It is however recommended that these are expanded in order to reduce the emission and ensure that significance of the impact remains ***low***. Recommendations for mitigation are made in Section 8.

7.3 Remaining sections of the District Road

The air quality impacts associated with the construction, operation and decommissioning of the Access Road for Cluster 1 are based on ADT for a similar, but larger project (300 MW vs 400 MW), without and with dust control measures, i.e. watering the road surface once a day. The scenario without dust control is a worst case scenario for Cluster 1. Assuming similar activities for the construction, operation and decommissioning of Cluster 2 and Cluster 3, the impacts presented in Table 7-1 and Table 7-2 will apply if the development of the respective clusters is sequential.

7.4 Cumulative assessment

The cumulative impacts of the simultaneous construction, operation and decommissioning of Cluster 1, Cluster 2 and Cluster 3 are discussed here. The three clusters are not co-located so the impact scores for the cumulative assessment may be applied to the individual clusters. The probability of cumulative impacts occurring however increases. The impact scores are presented in Table 7-3 for construction and decommissioning and in and Table 7-4 for operations.

7.4.1 Dust fallout

The predicted dust fallout for all three phases is expected to be low and well below the limit value for acceptable dust fallout in non-residential areas. The ***magnitude*** of the impact is therefore ***very low***. The ***duration*** of the impact will be for the life of the operations and is therefore ***long term***. The **extent** of the impact is small and limited to the project areas and is therefore classified as ***local***.

With the simultaneous construction and decommissioning of the three projects there is a potentially ***high probability*** of the potential impacts occurring. The probability is expected to ***moderate*** during operations.

The ***significance*** of the cumulative impact during construction and decommissioning is ***medium*** with a score of 64. With dust control measures the significance remains medium, although the score decreases to 48. The ***significance*** of the cumulative impact during operations is ***low*** with a score of 30.

In this assessment dust control measures are assumed to be limited to watering the road surface once a day. In the event of simultaneous construction and decommissioning of Cluster 1, Cluster 2 and Cluster 3 it is recommended that additional dust control measures are implemented to reduce the emission and ensure that significance of the impact is ***low***. Recommendations for mitigation are made in Section 8.

7.4.2 Respirable particulates (PM_{10})

The predicted PM_{10} concentrations for all three phases is expected to be low and well below the NAAQS. The ***magnitude*** of the impact is expected to be ***low***. The ***duration*** of the impact will be for the life of the operations and is therefore ***long term***. The **extent** of the impact is limited to within 1 km of the respective project areas and is therefore classified as ***local.***

With the simultaneous construction and decommissioning of the three projects there is a ***low probability*** of the potential impacts occurring. The probability is also expected to be ***low*** during operations.

The ***significance*** of the cumulative impact on air quality is ***low*** with a score of 30. With dust control measures the significance is low, with a score of 30. In the event of simultaneous construction, operation and decommissioning of Cluster 1, Cluster 2 and Cluster 3 it is recommended that dust control measures are implemented to ensure the emission are controlled so that the significance of the impact remains ***low***. Recommendations for mitigation are made in Section 8.

Table 7-1: Impact assessment for construction and decommissioning phase

POTENTIAL ENVIRON-MENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		M	D	S	I	R	P	TOTAL	SP				M	D	S	I	R	P	TOTA L	SP
AIR QUALITY																				
Increase in ambient PM_{10} concentrations	PM_{10} emitted from vehicle entrainment	10	2	2	1	1	3	48	M	L	-ve	• Increase frequency of road wetting during times of high expected traffic loads • Reduce vehicle speeds • Apply an organic dust suppressant to the road surface	10	2	2	1	1	2	32	L
	PM_{10} emitted from construction	2	2	1	1	1	2	14	L	L	-ve	• Wetting of open areas and erection of wind shields	2	2	1	1	1	2	14	L
Increase in dust fallout	TSP emitted from vehicle entrainment	2	2	2	1	1	2	16	L	L	-ve	• Increase frequency of road wetting during times of high expected traffic loads • Reduce vehicle speed • Apply an organic dust supressant to the road surface	2	2	2	1	1	2	16	L
	TSP emitted from construction	2	2	2	1	1	2	16	L	L	-ve	• Wetting of open areas and erection of wind shields	2	2	2	1	1	2	16	L

Table 7-2: Impact assessment for operational phase

POTENTIAL ENVIRON-MENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		M	D	S	I	R	P	TOTAL	SP				M	D	S	I	R	P	TOTAL	SP
AIR QUALITY																				
Increase in ambient PM_{10} concentrations	PM_{10} emitted from vehicle entrainment	2	4	2	1	1	2	20	L	L	-ve	• Increase frequency of road wetting during times of high expected traffic loads • Reduce vehicle speed	2	4	2	1	1	2	20	L
Increase in dust fallout	TSP emitted from vehicle entrainment	2	4	2	1	1	2	20	L	L	-ve	• Increase frequency of road wetting during times of high expected traffic loads • Reduce vehicle speed	2	4	2	1	1	2	20	L

Table 7-3: Cumulative assessment for construction and decommissioning phase

POTENTIAL ENVIRON-MENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		M	D	S	I	R	P	TOTAL	SP				M	D	S	I	R	P	TOTA L	SP
AIR QUALITY																				
Increase in ambient PM_{10} concentrations	PM_{10} emitted from vehicle entrainment	10	2	2	1	1	4	64	M	L	-ve	• Increase frequency of road wetting during times of high expected traffic loads • Reduce vehicle speeds • Apply an organic dust suppressant to the road surface	10	2	2	1	1	3	48	M
	PM_{10} emitted from construction	2	2	1	1	1	3	21	L	L	-ve	• Wetting of open areas and erection of wind shields	2	2	1	1	1	3	21	L
Increase in dust fallout	TSP emitted from vehicle entrainment	2	2	2	1	1	3	24	L	L	-ve	• Increase frequency of road wetting during times of high expected traffic loads • Reduce vehicle speed • Apply an organic dust supressant to the road surface	2	2	2	1	1	3	24	L
	TSP emitted from construction	2	2	2	1	1	3	24	L	L	-ve	• Wetting of open areas and erection of wind shields	2	2	2	1	1	3	24	L

Table 7-4: Cumulative impact assessment for operational phase

POTENTIAL ENVIRON-MENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		M	D	S	I	R	P	TOTAL	SP				M	D	S	I	R	P	TOTAL	SP
AIR QUALITY																				
Increase in ambient PM_{10} concentrations	PM_{10} emitted from vehicle entrainment	2	4	2	1	1	3	30	L	L	-ve	• Increase frequency of road wetting during times of high expected traffic loads • Reduce vehicle speed	2	4	2	1	1	3	30	L
Increase in dust fallout	TSP emitted from vehicle entrainment	2	4	2	1	1	3	30	L	L	-ve	• Increase frequency of road wetting during times of high expected traffic loads • Reduce vehicle speed	2	4	2	1	1	3	30	L

8. EMISSION MANAGEMENT

The predicted ambient concentrations resulting from dust emissions during construction, operations and decommissioning of the Sun Central Cluster 1 PV facility are predicted to be relatively low, particularly when mitigation measures are implemented. Even so, it is recommended that where possible dust is controlled. The following management measures are recommended to control dust emissions:

8.1 Management of Roads

- Implement a scheduled watering program by tanker.
- Implement a schedule of maintenance activities to reduce pot-holes and rough areas that could increase dust generation.
- Implement and enforce speed limits on project controlled roads.
- Ensure that vehicles always use the approved route and do not take shortcuts that may result in excess dust generation.

8.2 Storage of Materials

- Store fine aggregate materials such as cement and sand in such a manner that dust generation is avoided or minimized.
- Additional control measures may include enclosures and covering or increasing the moisture content of the material.
- Dampen the stockpiles during dry or windy conditions where aggregate materials are exposed and located close to sensitive receptors.
- Restrict the height of stockpiles of topsoil and dry materials and gently shape these as far as practicable to minimize wind erosion and dust generation.
- Remove materials first from the bottom of the piles to minimize the generation of dust.
- Keep the hatches on material storage containers closed when not in use.

8.3 Vegetation of Disturbed Areas

- Encourage natural vegetation growth in areas where a large amount of soils are exposed to the elements to reduce the amount of potential loose soil especially close to sensitive receptors.
- Adopt dust suppression such as watering in areas of the worksites in close proximity to dust sensitive receptors where earthworks have been completed,.
- Re-vegetate open areas with indigenous plants as soon as practicably possible to minimize the risk of wind erosion and dust generation.

8.4 Concrete Batching Plant

- Store fine aggregate materials such as cement and sand in a manner so as to avoid or minimize dust generation, with water also being used as a dust suppressant.

- Fit cement silos with alarms to prevent over filling, air tight inspection hatches and automatic cut-off switches on the filler lines where appropriate.
- To minimize dust generation the following measures are recommended:
  - Drop heights from haulage trucks into bins and onto conveyors should be minimised as far as possible.
  - Work surfaces should be kept clean.
  - Duct work must be airtight as far as possible.
  - Vehicle movement and loading areas should be enclosed as much as is practicable.
  - Aggregate spills should be cleaned up.
  - Conveyor belts and hoppers must be covered or enclosed where practical and appropriate.

REFERENCES

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DEA (2014): Code of Practice for Air Dispersion Modelling in Air Quality Management in South Africa, Government Notice R.533, Government Gazette, no. 37804, 11 July 2014.

Sturgeon Consulting, (2022): Traffic Impact Assessment for the Proposed Development of a 400 MW Solar PV Facility and Associated Infrasturcture (Phase 3) on Several Portions of Farms Between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province, South Africa, Project No.: StUR0352, Final Report, September 2022.

USEPA (United States Environmental Protection Agency) (1995a): Compilation of Air Pollutant Emission Factors, AP-42 Fifth Edition, Volume l: Stationery Point and Area Sources, Chapter 13: Hot Mix Asphalt Plants and Chapter 13: Miscellaneous Sources.

United States Environmental Protection Agency (USEPA) (1995b): SCREEN3 Model User's Guide. EPA-454/B-95-004. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards Emissions, Monitoring, and Analysis Division, Research Triangle Park, North Carolina.

United States Environmental Protection Agency (USEPA) (2009a): Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources. Chapter 11: Mineral Products Industry. http://www.epa.gov/ttn/chief/ap42/ch11/index.html.

United States Environmental Protection Agency (USEPA) (2009b): Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources. Chapter 13: Miscellaneous Sources. http://www.epa.gov/ttn/chief/ap42/ch13/index.html.

ANNEXURE 1: CURRICULUM VITAE OF MARK ZUNCKEL

MARK ZUNCKEL

Firm	:	uMoya-NILU (Pty) Ltd
Profession	:	Air quality consultant
Specialization	:	Air quality assessment, air quality management planning, air dispersion modelling, boundary layer meteorology, project management
Position in Firm	:	Managing director and senior consultant
Years with Firm	:	Since 1 August 2007
Nationality	:	South African
Year of Birth	:	1959
Language Proficiency	:	English and Afrikaans

EDUCATION AND PROFESSIONAL STATUS

Qualification	Institution	Year
National Diploma (Meteorology)	Technikon Pretoria	1980
BSc (Meteorology)	Univ. of Pretoria	1984
BSc Hons (Meteorology)	Univ. of Pretoria	1988
MSc	Univ. of Natal	1992
PhD	Univ. Witwatersrand	1999

Registered Natural Scientist: South African Society for Natural Scientific Professionals

Ex-Council Member: National Association for Clean Air
Member: National Association for Clean Air

EMPLOYMENT AND EXPERIENCE RECORD

Period	**Organisation details and responsibilities/roles**
1976 – May 1992	*South African Weather Bureau :* Observer, junior forecaster, senior forecast, researcher, assistant director
June 1992 – July 2007	*CSIR:* Consultant and researcher, Research group Leader: Atmospheric Impacts
August 2007 to present	*uMoya-NILU Consulting:* Managing Director and senior air quality consultant

Key and Recent Project Experience:

1996	Project leader & Principal researcher: Atmospheric impact assessment for the proposed Mozal aluminium smelter in Maputo, Mozambique.

1996	Project leader & Principal researcher: Dry sulphur deposition during the Ben MacDhui High Altitude Trace Gas and Transport Experiment (BATTEX) in the Eastern Cape.
1997	Project leader & Principal researcher: Atmospheric impact assessment of the proposed capacity expansion project for Alusaf in Richards Bay.
1997	Project leader & Principal researcher: The Uruguayan ambient air quality project with LATU.
1997	Principal researcher on the Air quality specialist study for the Strategic Environmental Assessment on the industrial and urban hinterland of Richards Bay.
1997	Project leader & Principal researcher: Feasibility study for the implementation of a fog detection system in the Cape Metropolitan area: Meteorological aspects.
2001	Project leader & Principal researcher: Air quality specialist study for the Environmental Impact Assessment for the proposed expansion of the Hillside Aluminium Smelter, Richards Bay.
2001-2003	Researcher: The Cross Border air Pollution Impact (CAPIA) project. A 3-year modelling and impacts study in the SADC region.
2002	Project leader & Principal researcher: Air quality assessment specialist study for the proposed Pechiney Smelter at Coega.
2002	Project leader & Principal researcher: Air quality assessment specialist study for the proposed N2 Wild Coast Toll Road.
2002-2005	Project leader on the NRF project – development of a dynamic air pollution prediction system
2004	Project leader on the specialist study for expansion at the Natal Portland Cement plant at Simuma, KwaZulu-Natal.
2004-2005	Researcher: National Air Quality Management Plan implementation project for Department Environmental Affairs and Tourism.
2005	Researcher in the assessment of air quality impacts associated with the expansion of the Natal Portland Cement plant at Port Shepstone.
2006-2007	Project team leader of a multi-national team to develop the National Framework for Air Quality Management for the Department of Environment Affairs and Tourism
2007	Air quality assessment for Mutla Early Production System in Uganda for ERM Southern Africa on behalf of Tullow Oil.
2007-2010	Lead consultant on the development of a dust mitigation strategy fro the Bulk Terminal Saldanha and an ambient guideline for Fe_2O_3 dust for Transnet Projects and on-going monitoring.
2008	Lead consultant on the Air quality status quo assessment and scoping for the EIA for the Sonangol Refinery
2008-09	Lead consultant on the development of the air quality management plan for the Western Cape Provincial. Department of Environmental Affairs and Development Planning.
2008-10	Lead consultant on the development of the Highveld Priority Area air quality management plan for the Department of Environmental Affairs and Tourism.
2008	Lead consultant in the development of an odour management and implementation strategy for eThekwini, focussing on Wastewater Treatment Works and odourous industrial sources
2008 & 2010	Lead consultant on the Air Quality Specialist Study for the EIA for the proposed Kalagadi Manganese Smelter at Coega

2008	Lead consultant on the Air Quality Assessment for the Proposed Construction and Operation of a Second Cement Mill at NPC-Cimpor, Simuma near Port Shepstone.
2008	Lead consultant on the Air Quality Specialist Study Report for the New Multi-Purpose Pipeline Project (NMPP) for Transnet Pipelines.
2008	Lead consultant on the Air quality assessment for the proposed UTE Power Plant and RMDZ coal mine at Moatize, Mozambique for Vale.
2009	Lead consultant on the Air quality assessment for the development of the ETA STAR coal mine at Moatize, Mozambique for Impacto.
2008-09	Lead consultant on the Dust source apportionment study for the Coedmore region in Durban for NPC-Cimpor.
2009	Consultant on the Air quality specialist study for the upgrade of the Kwadukuza Landfill, KwaZulu-Natal
2009-10	Lead consultant on the Audit of ambient air quality monitoring programme and air quality training for air quality personnel at PetroSA
2010	Lead consultant on the Qualitative assessment of impact of dust on solar power station at Saldanha Bay
2010	Lead consultant on the Air quality specialist study for the EIA for the Kalagadi Manganese Smelter at Coega
2010	Lead consultant on the Qualitative air quality assessment for the EIA for the Sechaba Aphalt plant, Ferrobank
2009 – 2010	Lead consultant on the Air quality specialist study for the Environmental Management Framework for the Port of Richards Bay
2010	Lead consultant on the Air quality status quo assessment and abatement planning at Idwala Carbonates, Port Shepstone
2010	Lead consultant on the Air quality status quo assessment and abatement planning at Sappi Tugela, Mandeni
2010 – 2011	Air quality status quo assessment and revision of the Air Quality Management Plan for City of Johannesburg
2010	Lead consultant on the Air quality status quo assessment and abatement planning at First Quantum Mining's Bwana Mkubwa and Kansanshi mines, Zambia
2010 – 2011	Lead consultant on the Air quality specialist study for the EIA for the Alternative Fuel and Resources Project at Simuma, Port Shepstone
2010 – 2011	Lead consultant on the Air quality specialist study for the EIA for the Coke Oven re-commissioning at ArcelorMittal Newcastle
2010	Qualitative air quality assessment for the EIA for the Mozpel sugar to ethanol project , Mozambique
2011	Development of the South African Air Quality Information System – Phase II The National Emission Inventory
2011	Ambient baseline monitoring for Riversdale's Zambezi Coal Project in Tete, Mozambique
2010 - 2011	Ambient quality baseline assessment for the Ncondeze Coal Project, Tete Mozambique
2011-12	Air quality assessment for the mining and processing facilities at Longmin Platinum in Marikana
2012	Air quality assessment for the proposed LNG and OLNG plants in Mozambique
2012	Modelling study in Abu Dhabi for the transport and deposition of radio nuclides
2012	Air quality assessment for the proposed manganese ore terminal at the Ngqura

	Port
2012-13	Air quality management plan development for Stellenbosch Municipality
2012-12	Air quality management plan development for the Eastern Cape Province
2013	Air quality specialist for Tullow Oil Waraga-D and Kinsinsi environmental audit in Uganda
2013	Air quality specialist study for the EIA for the Thabametsi IPP station
2013	Air quality specialist study for the EIA for the Mamathwane Common User facility
2013	Air quality management plan for the Ugu District Municipality
2013-14	Air quality specialist study for the application for postponement of the minimum emission standards for 9 Eskom power stations
2014	Air quality specialist study for the application for postponement applications of the minimum emission standards for the Engen Refinery in Merebank, Durban
2014-15	Baseline assessment and AQMP development for the uThungulu District Municipality
2013-15	Baseline assessment, AQMP and Threat Assessment for the Waterberg-Bojanala Priority Area
2014-15	Review of the 2007 AQMP for eThekwini Municipality, including metropolitan emission inventory development for all sectors, i.e. industrial, transport, waste management, biomass burning, residential fuel burning, dispersion modelling and strategy development
2014-14	Dispersion modelling study for Richards Bay Minerals
2015	Air quality assessment for Rainbow Chickens at Hammersdale
2015	Air quality status quo assessment and planning for TNPA ports in South Africa
2016 - 2017	Lead author of the National State of Air Report for 2005 to 2015, including national emission inventory development for all sectors, i.e. industrial, transport, waste management, biomass burning, residential fuel burning
2016	Air quality assessment for Kanshansi Mine, Solwesi, Zambia
2016	Assessment of air quality impacts associated with activities at the Venetia Mine, Limpopo Province
2016	Assessment of air quality impacts associated with activities at the Komati Anthracite Mine, Mpumalanga Province
2016	Air quality assessment for the proposed Powership Project at the Port of Nacala, Mozambique
2016	Air quality assessment for the proposed Richards Bay Gas to Power Project
2017	Baseline assessment and review of the 2009 AQMP for Gauteng Province, including emission inventory development for all sectors, i.e. industrial, transport, waste management, biomass burning, residential fuel burning, and dispersion modelling
2017	Baseline assessment and air quality management plan for Northern Cape Province
2017	Air quality assessment for the EIA for the Thabametsi Power Station in Limpopo Province
2017	Air quality assessment for the EIA for the proposed Tshivasho Power Station in Limpopo Province
2018	Air quality assessment for the EIA for the proposed Bellmall Thermal Plant in Ekurhuleni
2018	Air quality assessment for the EIA for the proposed Simba Oil mini Refinery in Tororo, Uganda

2018-19	Air dispersion modelling for input to the Atmospheric Reports for the postponement application for 14 Eskom power stations
2019	Air quality impact assessment for the proposed NamPower expansion project in Walvis Bay
2019	Air quality assessment for the mine expansion project at the Akanani Mine
2019	Air quality impact assessment for the proposed power plant at Nacala, Mozambique
2020	AIR for the KarpowershipSA proposal in the Ports of Ngqura, Richards Bay and Saldanha Bay
2020	AIR for the Coega Development Corporation gas-to-power project at 4 sites in the CDC
2020	AIRs for 10 Eskom coal-fired power plants on the Highveld to support their postponement application
2020	AIR for the proposed Azure Power gas-to-power project in the Western Cape
2021	Air quality assessment for the proposed optimisation project at Beeshoek Iron Ore Mine, Postmasburg, Northern Cape
2021	Air quality assessment for the proposed expansion at Akanani Mine in Limpopo
2021	AIR for the proposed Frontier Power Gas-to-Power project at Saldanha Bay, Western Cape
2021	AIR for the 2021 shutdown and start-up at Engen Refinery in Merebank
2021	AIR for the proposed expansion of the Swartkops Ore handling facility in Port Elizabeth, Eastern Cape
2016-2021	AEL compliance monitoring for Joseph Grieveson, Durban, including dust fallout monitoring and reporting
2018-2021	Dust fallout and HF monitoring and reporting for Hulamin, Richards Bay
2018-2021	Dust fallout and H_2S monitoring and reporting for at KwaDukuza Landfill for Dolphin Coast Landfill Management (DCLM)
2019-2021	AEL compliance monitoring for Umgeni Iron and Steel Foundry, including dust fallout monitoring and reporting

PUBLICATIONS

Author and co-author of 34 articles in scientific journals, chapters in books and conference proceedings. Author and co-author of more than 300 technical reports and presented 47 papers at local and international conferences.