ATMOSPHERIC IMPACT REPORT

In support of the Department of Rural Development and Agrarian Reform (DRDAR) to conduct an environmental assessment process and Atmospheric Emission License (AEL) application for the proposed replacement and use of an incinerator at their State Veterinary Laboratory located in Queenstown, Eastern Cape

Report issued by:

uMoya-NILU Consulting (Pty) Ltd
P O Box 20622
Durban North, 4016
South Africa

Report issued to:

SRK Consulting (South Africa) (Pty) Ltd
Ground Floor, Bay Suites
1a Humewood Rd, Humerail
Port Elizabeth, 6001
South Africa

Report Details

Client:	Department of Rural Development and Agrarian Reform (DRDAR)
Report title:	Atmospheric Impact Report in support of the Department of Rural Development and Agrarian Reform (DRDAR) to conduct an environmental assessment process and Atmospheric Emission License (AEL) application for the proposed replacement and use of an incinerator at their State Veterinary Laboratory located in Queenstown, Eastern Cape
Project:	uMN135-17
Report number:	uMN087-2017
Version: Prepared by: Authors: Internal reviewer:	30 June 2017 uMoya-NILU Consulting (Pty) Ltd, P O Box 20622, Durban North 4016, South Africa Atham Raghunandan and Mark Zunckel Farryn Moodley

When used in a reference this document should be cited as follows:
uMoya-NILU (2017): Atmospheric Impact Report in support of the Department of Rural Development and Agrarian Reform (DRDAR) to conduct an environmental assessment process and Atmospheric Emission License (AEL) application for the proposed replacement and use of an incinerator at their State Veterinary Laboratory located in Queenstown, Eastern Cape, Report No. uMN087-2017, June 2017.

EXECUTIVE SUMMARY

SRK Consulting (PLZ) has been appointed by the Department of Rural Development and Agrarian Reform (DRDAR) to conduct an environmental assessment process and Atmospheric Emission License (AEL) application for the proposed replacement and use of incinerators at three of their State Veterinary Laboratories located in Queenstown, Middleburg and Grahamstown. The incinerators are used for incinerating waste at these Laboratories. All three incinerators were installed between 1975 and 1980. They have been operational for more than 30 years and as a result have become unserviceable and need to be replaced. An Atmospheric Impact Report (AIR) (as contemplated in Section 30 of the National Environmental Management: Air Quality Act 39 of 2004) is required for the above-mentioned facility. uMoya-NILU Consulting has in turn been appointed to conduct the AIR aspect of the project.

USEPA AP42 emission factors are used to estimate emissions of particulates (PM_{10} and $PM_{2.5}$), oxides of nitrogen (NO_X), sulphur dioxide (SO_2) and carbon monoxide (CO) from the proposed new incinerator at the DRDAR State Veterinary Laboratory, for three burn rates (45 kg/hour, 60 kg/hour and 75 kg/hour) to take account of a range of incinerator loads, under normal operating conditions.

It is evident that resultant emission rates are relatively low, even with no emission control devices in place. Emission concentrations also comply with the Minimum Emission Standards (MES) for existing plants. However, emission concentrations exceed the MES for new plants for particulates for all three burn rates and for CO for the 60 kg/hour and 75 kg/hour burn rates. It is therefore recommended that a combination of control mechanisms are used to target specific pollutants to achieve compliance with the respective MES.

The DEA recommended and USEPA-approved SCREEN3 dispersion model is used to assess the effects and potential consequences of uncontrolled emissions from the proposed new incinerator in the surrounding environment. Modelled ambient concentrations of PM_{10}, $PM_{2.5}$, NO_2, SO_2 and CO are considerably less than the respective health-based ambient air quality standards and the highest concentrations are predicted 200 m from the incinerator.

The significance rating for impacts during construction and decommissioning (with or without mitigation) is insignificant, implying that the potential impact is negligible and will not have an influence on the decision regarding the proposed development. The significance rating for impacts during operations (with or without mitigation) is low, implying that the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed development. From an air quality perspective, it is therefore recommended that the project should go ahead.

GLOSSARY OF TERMS AND ACRONYMS

AEL	Atmospheric Emission License
AIR	Atmospheric Impact Report
DEA	Department of Environmental Affairs
DRDAR	Department of Rural Development and Agrarian Reform
g/s	Grams per second
kPa	Kilo Pascal
MES	Minimum Emission Standards
mg/hr	Milligrams per hour refers to emission rate, i.e. mass per time
mg/Nm^3	Milligrams per normal cubic meter refers to emission concentration, i.e. mass per volume at normal temperature and pressure, defined as air at 20^oC (293.15 K) and 1 atm (101.325 kPa)
NAAQS	National Ambient Air Quality Standards
NEM-AQA	National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
USEPA	United States Environmental Protection Agency
µm	1 µm = Micro meter 1 µm = 10^{-6} m
WHO	World Health Organization

TABLE OF CONTENTS

EXECUTIVE SUMMARY .... **i**
TABLE OF CONTENTS .... **iii**
LIST OF TABLES .... **v**
LIST OF FIGURES .... **vi**
1. ENTERPRISE DETAILS **1**
1.1 Enterprise Details *1*
1.2 Location and Extent of the Plant *2*
1.3 Atmospheric Emission License (AEL) and Other Authorisations *3*
2. NATURE OF THE PROCESS **4**
2.1 Listed Activity or Activities *4*
2.2 Process Description *5*
2.3 Unit Processes *7*
3. TECHNICAL INFORMATION **7**
3.1 Raw Materials Used *7*
3.2 Appliances and Abatement Equipment Control Technology .. ***Error! Bookmark not defined.***
4. ATMOSPHERIC EMISSIONS **8**
4.1 Point Source Parameters *8*
4.2 Point Source Maximum Emission Rates (Normal Operating Conditions) .. ***Error! Bookmark not defined.***
4.3 Point Source Maximum Emission Rates (Start Up, Shut-Down, Upset and Maintenance Conditions) *13*
4.4 Fugitive Emissions *13*
4.5 Emergency Incidents *13*
5. IMPACT OF ENTERPRISE ON THE RECEIVING ENVIRONMENT **14**
5.1 Analysis of Emissions' Impact on Human Health *14*
5.1.1 Prevailing Climatic Conditions 14
Temperature and Rainfall 14
Wind 15
5.1.2 National Ambient Air Quality Standards and Guidelines 16
5.1.3 Current Status of Ambient Air Quality 20
5.1.4 Dispersion Modelling 21
Operating Scenarios for Emission Units 21
Dispersion Modelling Procedures 21
Dispersion Modelling Domain and Grid Receptors 22
Model Parameterisation 22
Model Accuracy 23
Background Concentrations and Other Sources 23
Sensitive Receptors 24
Dispersion Modelling Results 24
Construction and Decommissioning 32
Impact Assessment 32

5.2 Analysis of Emissions' Impact on the Environment 37
6. COMPLAINTS 37
7. CURRENT OR PLANNED AIR QUALITY MANAGEMENT INTERVENTIONS 37
8. COMPLIANCE AND ENFORCEMENT ACTIONS 37
9. SUMMARY AND CONCLUSION 37
10. REFERENCES 38
11. FORMAL DECLARATIONS 40

LIST OF TABLES

Table 1: Enterprise details 1
Table 2: Site information 2
Table 3: Current authorisations related to air quality 3
Table 4: Details of the Listed Activities carried out at the DRDAR State Veterinary Laboratory located in Queenstown, according to GN 248 (DEA, 2013) 4
Table 5: Minimum Emission Standards for Subcategory 8.2 Listed Activities according to GN 248 (DEA, 2013) 5
Table 6: Unit processes at the DRDAR State Veterinary Laboratory located in Queenstown 7
Table 7: Design burn rate of incinerator 8
Table 8: Materials and quantities used in energy sources 8
Table 9: Appliances and abatement equipment and control technology 8
Table 10: Location of proposed new incinerator stack and stack parameters 8
Table 11: Point source maximum emission rates, based on USEPA uncontrolled emission factors for normal operating conditions 11
Table 12: Comparison of emission concentrations for four control mechanisms (based on USEPA uncontrolled and controlled emission factors) with MES for new plants – emission concentrations in red indicate non-compliance with the MES 12
Table 13: Ambient air quality standards and guidelines 17
Table 14: Parameterisation of key variables for SCREEN3 22
Table 15: Sensitive receptors in the vicinity of the DRDAR State Veterinary Laboratory located in Queenstown 24
Table 16: Maximum predicted ambient concentrations for the proposed new incinerator 26
Table 17: Criteria used to determine the Consequence of the Impact 32
Table 18: Method used to determine the Consequence Score 33
Table 19: Probability Classification 33
Table 20: Impact Significance Ratings 33
Table 21: Impact status and confidence classification 34
Table 22: Impact Assessment for the construction, operational and decommissioning phase of the proposed new incinerator 36

LIST OF FIGURES

Figure 1: Relative location of the DRDAR State Veterinary Laboratory located in Queenstown, to the surrounding residential, commercial and industrial areas, within a 5 km radius around the site (Google Earth, 2017) 3
Figure 2: Controlled Air Incinerator 6
Figure 3: A typical waste-incineration flow diagram 7
Figure 4: Average monthly maximum and minimum temperature at Queenstown. The average monthly rainfall is in mm (SAWS, 1998) 15
Figure 5: Annual windrose at Queenstown with wind speed in m/s and frequency bands of 500 hours 16
Figure 6: Predicted 24-hour average (top) and annual average (bottom) PM_{10} ambient concentrations in μg/m^3 resulting from emissions from the incinerator in isolation 27
Figure 7: Predicted 24-hour average (top) and annual average (bottom) $PM_{2.5}$ ambient concentrations in μg/m^3 resulting from emissions from the incinerator in isolation 28
Figure 8: Predicted 1-hour average (top) and annual average (bottom) NO_2 ambient concentrations in μg/m^3 resulting from emissions from the incinerator in isolation 29
Figure 9: Predicted 1-hour average (top), 24-hour average (middle) and annual average (bottom) SO_2 ambient concentrations in μg/m^3 resulting from emissions from the incinerator in isolation 30
Figure 10: Predicted 1-hour average (top) and 8-hour average (bottom) CO ambient concentrations in μg/m^3 resulting from emissions from the incinerator in isolation 31

1. ENTERPRISE DETAILS

1.1 Enterprise Details

The enterprise details relating to the Department of Rural Development and Agrarian Reform (DRDAR) State Veterinary Laboratory located in Queenstown are listed in Table 1.

Table 1: Enterprise details

Entity Name:	Queenstown State Veterinary Laboratory
Trading as:	Queenstown State Veterinary Laboratory
Type of Enterprise, e.g. Company/Close Corporation/Trust, etc.:	
Company/Close Corporation/Trust Registration Number (Registration Numbers if Joint Venture):	
Registered Address:	Private Bag x7093, Queenstown, 5320
Postal Address:	Private Bag x7093, Queenstown, 5320
Telephone Number (General):	045 839 2030
Fax Number (General):	045 839 2059
Company Website:	
Industry Type/Nature of Trade:	Veterinary Laboratory
Land Use Zoning as per Town Planning Scheme:	
Land Use Rights if outside Town Planning Scheme:	
Responsible Person:	Dr. A. Fisher
Emissions Control Officer:	Dr. A. Fisher
Telephone Number:	045 839 2030
Cell Phone Number:	
Fax Number:	045 839 2059
Email Address:	**Alan.Fisher@drdar.gov.za**
After Hours Contact Details:	

1.2 Location and Extent of the Plant

The site information relating to the DRDAR State Veterinary Laboratory located in Queenstown are listed in Table 2.

Table 2: Site information

Physical Address of the Licensed Premises:	
Description of Site:	
Property Registration Number (Surveyor-General Code):	
Coordinates (latitude, longitude) of Approximate Centre of Operations (Decimal Degrees):	Latitude: -31.901164° Longitude: 26.859842°
Coordinates (UTM) of Approximate Centre of Operations:	Easting: 486747.11 m E Northing: 6470510.89 m S
Extent (km²):	
Elevation Above Mean Sea Level (m):	1 070
Province:	Eastern Cape
District/Metropolitan Municipality:	Chris Hani District Municipality
Local Municipality:	Lukhanji Municipality
Designated Priority Area (if applicable):	Not Applicable

Description of surrounding landuse (within 5 km radius)

The DRDAR State Veterinary Laboratory in Queenstown is located within the Lukhanji Municipality of the Chris Hani District. The Laboratory is surrounded by many residential, commercial and industrial areas. The relative location of the Laboratory is shown in Figure 1. The closest residential areas to the DRDAR State Veterinary Laboratory within a 5 km radius are Wesbourne, Stuttaford, Bergsig, Windsor, Queenstown, Sandringham, New Rest Komani Park, Queensview Park, Aloevale, Mlungisi and Amberdale. These areas have been selected as sensitive receptors for the study area and are listed in Table 15, in terms of distance and direction from the Laboratory.

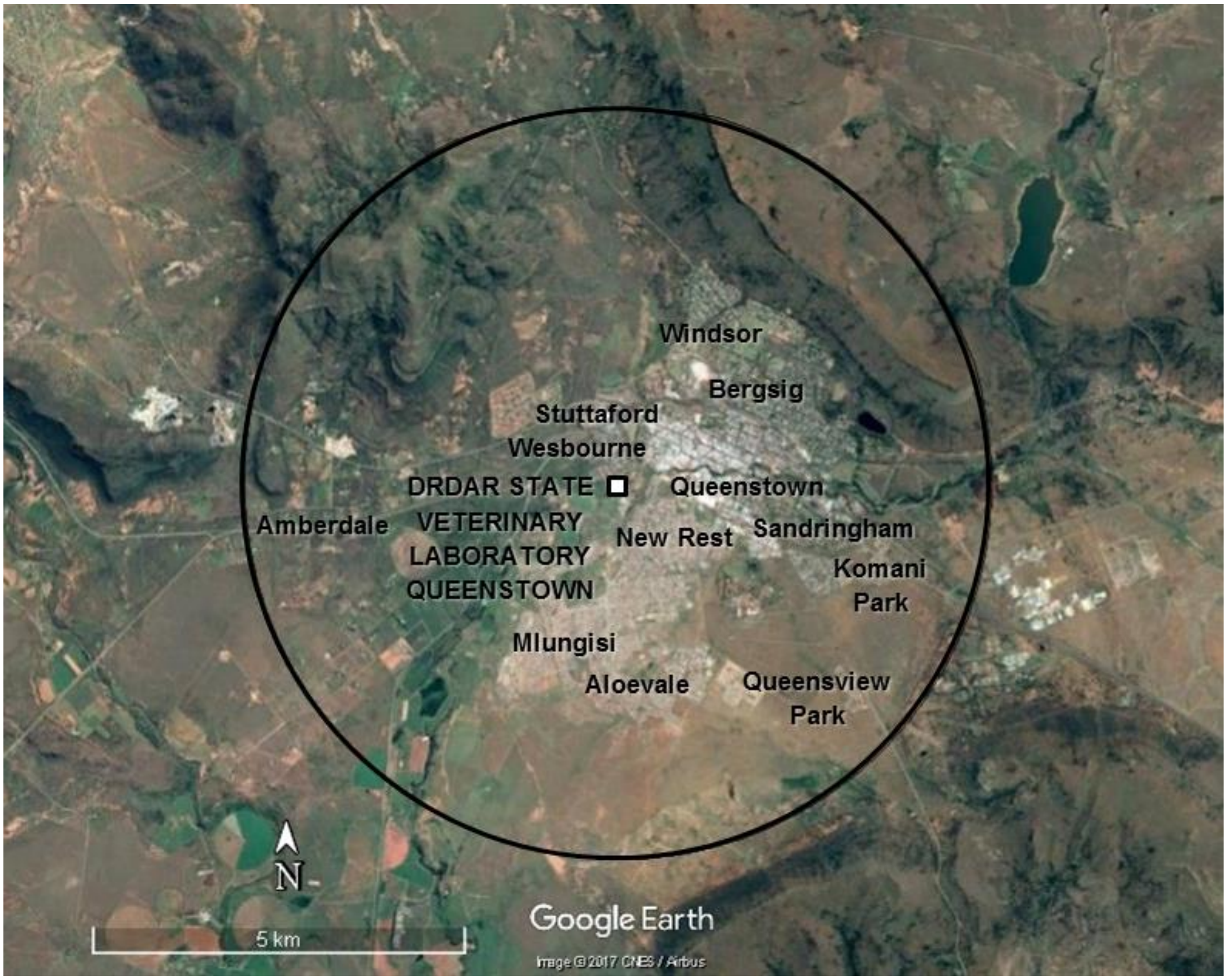

Figure 1: Relative location of the DRDAR State Veterinary Laboratory located in Queenstown, to the surrounding residential, commercial and industrial areas, within a 5 km radius around the site (Google Earth, 2017)

1.3 Atmospheric Emission License (AEL) and Other Authorisations

The DRDAR State Veterinary Laboratory located in Queenstown is not in possession of an Atmospheric Emissions License (AEL) or any other authorisations (Table 3).

Table 3: Current authorisations related to air quality

Atmospheric Emission License	Date of Registration Certificate	Listed Activity Subcategory	Category of Listed Activity	Listed Activity Process Description
No record				

2. NATURE OF THE PROCESS

2.1 Listed Activity or Activities

As a measure to reduce emissions from industrial sources and to improve ambient air quality, Listed Activities and associated Minimum Emission Standards (MES) were published in 2010 in Government Notice 248 (DEA, 2010) and revised in Government Notice 893 (DEA, 2013). The processes at the DRDAR State Veterinary Laboratory located in Queenstown include one Listed Activity. The Listed Activity with the respective MES is shown in Table 4. The proposed new incinerator will be used for the incineration of veterinary waste (animal carcases); human remains are not part of waste stream.

According to the MES, existing industrial facilities must comply with the MES for 'new plants' by 1 April 2020 (Table 5). New facilities must immediately comply with the MES for new plants. The DRDAR State Veterinary Laboratory located in Queenstown should comply with the MES for new plants when the proposed new incinerator is in operation. However, according to minutes of a meeting held with the Department of Environmental Affairs on 23 January 2017, consensus was reached that the incinerator is regarded as an existing plant and that the MES for existing plants are applicable until April 2020. It was suggested that DRDAR install the incinerator without abatement equipment assuming that they will meet the Minimum Emission Standards for existing plants. The design and installation of abatement equipment will then be planned as a second phase of the project before April 2020.

Mercury, as indicated in the MES, is applicable to human cremation only, and will therefore not be considered in this assessment.

Table 4: Details of the Listed Activities carried out at the DRDAR State Veterinary Laboratory located in Queenstown, according to GN 248 (DEA, 2013)

Category of Listed Activity	Sub-category of the Listed Activity	Description of the Listed Activity
Category 8: Thermal Treatment of Hazardous and General Waste	Sub-category 8.2: Crematoria and Veterinary Waste Incineration	Cremation of human remains, companion animals (pets) and the incineration of veterinary waste[a]

a The proposed new incinerator will be used for the incineration of veterinary waste (animal carcases); human remains are not part of waste stream

Table 5: Minimum Emission Standards for Subcategory 8.2 Listed Activities according to GN 248 (DEA, 2013)

Substance or mixture of substances		Plant Status	Minimum Emission Standards (mg/Nm^3) under normal conditions of 273 Kelvin and 101.3 kPa.
Common name	**Chemical symbol**		
Particulate matter	N/A	New	40
		Existing	250
Carbon monoxide	CO	New	75
		Existing	150
Oxides of nitrogen	NO_X expressed as NO_2	New	500
		Existing	1000
Mercury (Applicable to human cremation only) [a]	Hg	New	0.05
		Existing	0.05

a Mercury, which is applicable to human cremation only, will not be considered in this assessment

2.2 Process Description

The incineration process will be carried out by placing the veterinary waste (animal carcases) in the proposed new incinerator, adding diesel and igniting the diesel using an electrical burner. Incineration is done once or more times a week depending on the accumulated volume of material for disposal. The resulting ash is placed in containers and disposed of at the municipal landfill site.

The process description is based on controlled-air incineration, which is the most widely used medical waste incinerator technology, and now dominates the market for new systems at hospitals and similar medical facilities. This technology is also known as starved-air incineration, two-stage incineration, or modular combustion. Figure 2 presents a typical schematic diagram of a controlled air unit.

Combustion of waste in controlled air incinerators occurs in two stages. In the first stage, waste is fed into the primary, or lower, combustion chamber, which is operated with less than the stoichiometric amount of air required for combustion. Combustion air enters the primary chamber from beneath the incinerator hearth (below the burning bed of waste). This air is called primary or underfire air. In the primary (starved-air) chamber, the low air-to-fuel ratio dries and facilitates volatilization of the waste, and most of the residual carbon in the ash burns. At these conditions, combustion gas temperatures are relatively low (760 to 980 °C).

In the second stage, excess air is added to the volatile gases formed in the primary chamber to complete combustion. Secondary chamber temperatures are higher than primary chamber temperatures, typically 980 to 1 095 °C. Depending on the heating value and moisture content of the waste, additional heat may be needed. This can be provided by auxiliary burners located at the entrance to the secondary (upper) chamber to maintain desired temperatures.

Waste feed and ash removal can be manual or automatic, depending on the unit size and options purchased. Because of the low air addition rates in the primary chamber, and corresponding low flue gas velocities (and turbulence), the amount of solids entrained in the gases leaving the primary chamber is low. Therefore, the majority of controlled air incinerators do not have add-on gas cleaning devices. Several air pollutants are emitted from the incineration process due to the combustion of fuel and waste material within the furnace. Emission rates depend on the design of the incinerator, combustion temperature, gas retention time, duct design, duct temperature and any control devices.

The inputs and outputs of a typical waste-incineration process is illustrated with the aid of a simplified block diagram in Figure 3.

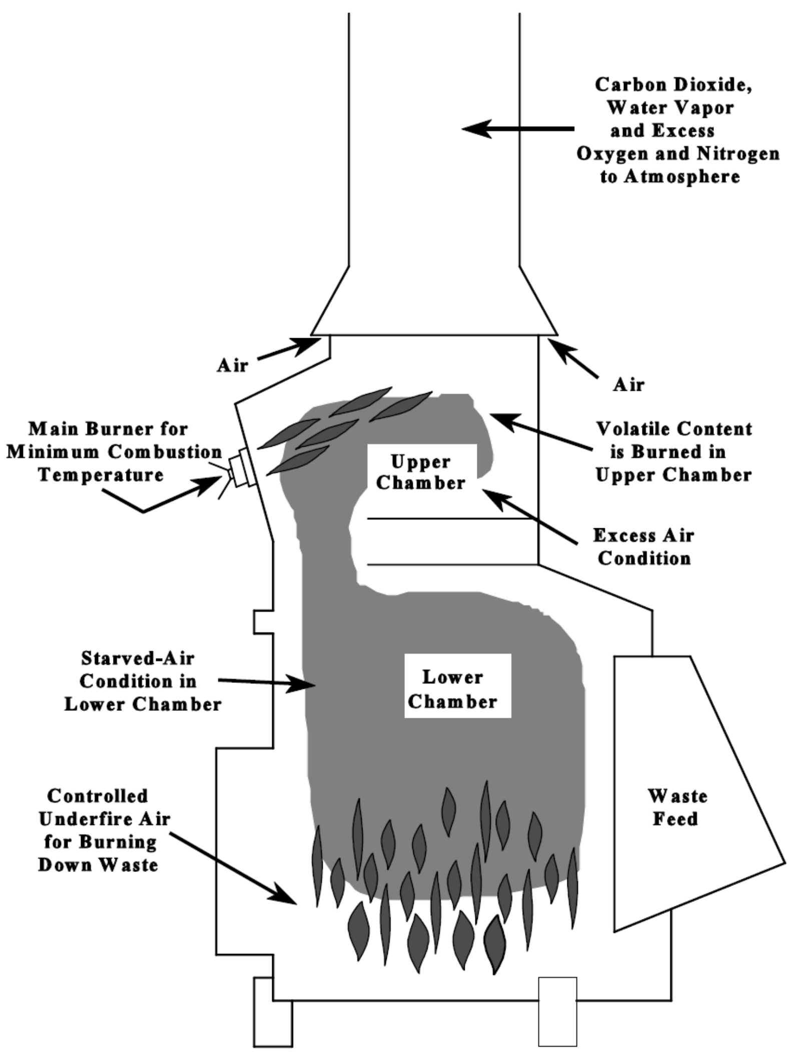

Figure 2: Controlled Air Incinerator

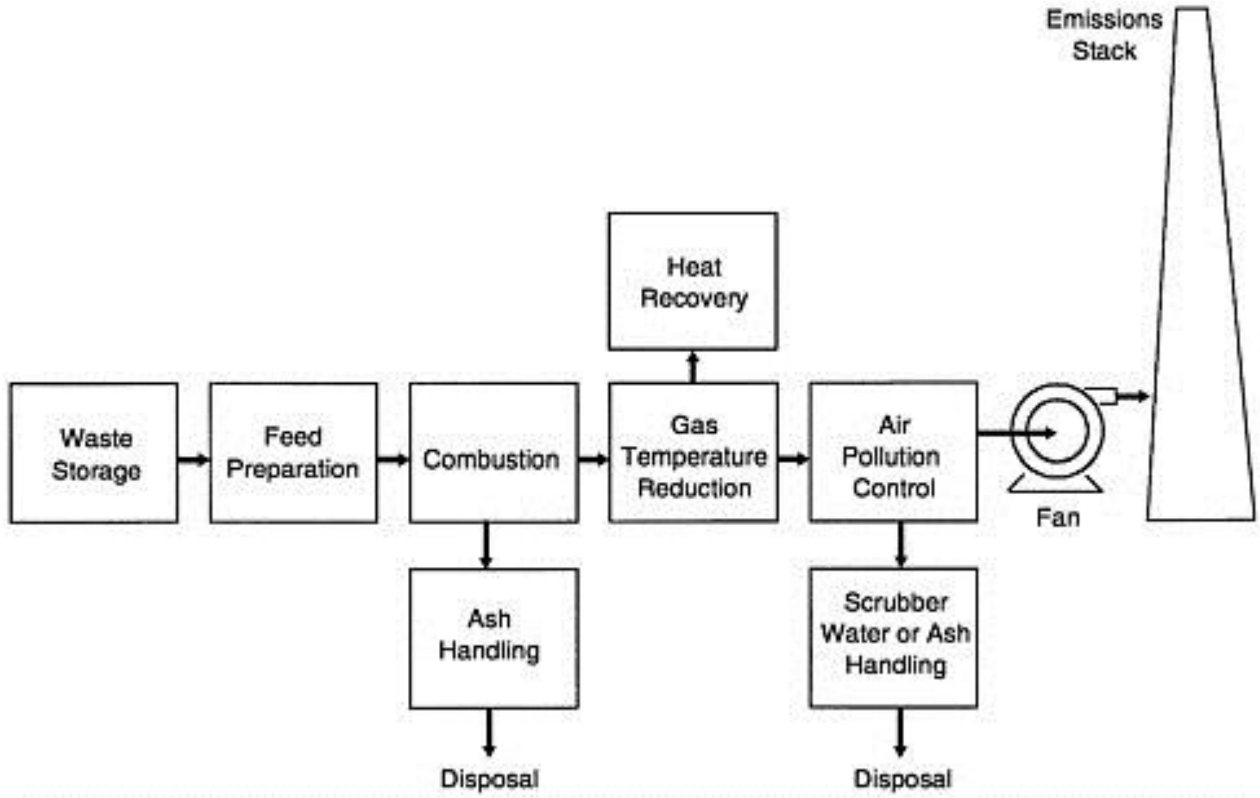

Figure 3: A typical waste-incineration flow diagram

2.3 Unit Processes

The unit processes at the DRDAR State Veterinary Laboratory located in Queenstown are listed in Table 6.

Table 6: Unit processes at the DRDAR State Veterinary Laboratory located in Queenstown

Name of the Unit Process	Unit Process Function	Batch or Continuous
Incinerator	Incineration of veterinary waste (animal carcases)	Batch

3. TECHNICAL INFORMATION

3.1 Raw Materials Used

The DRDAR State Veterinary Laboratory located in Queenstown is not a production facility, but a facility where veterinary waste (animal carcases) is incinerated. Therefore, the reporting of "raw material type" and "design consumption rate" (Table 7) has been replaced by "material type" and "design burn rate" respectively.

Table 7: Design burn rate of incinerator

Material Type	Design Burn Rate	Units
Veterinary waste (animal carcases)	45-75	kg/hour

No by-products are produced at the DRDAR State Veterinary Laboratory. Materials and quantities used in energy sources at the laboratory are presented in Table 8.

Table 8: Materials and quantities used in energy sources

Materials for Energy Source	Actual Consumption Rate (Quantity)	Units (quantity/period)
Diesel	11.42	Litres/hour

3.2 Appliances and Abatement Equipment Control Technology

Due of the low air addition rates in the primary chamber, and corresponding low flue gas velocities (and turbulence), the amount of solids entrained in the gases leaving the primary chamber is low. Therefore, the majority of controlled air incinerators do not have add-on gas cleaning devices. There are no air pollution control and abatement technology currently proposed at the DRDAR State Veterinary Laboratory (Table 9).

Table 9: Appliances and abatement equipment and control technology

Appliance Name	Appliance Type/Description	Appliance Function/Purpose
No air pollution control and abatement technology is currently proposed		

4. ATMOSPHERIC EMISSIONS

4.1 Point Source Parameters

The location of the proposed new incinerator stack and stack parameters are provided in Table 10.

Table 10: Location of proposed new incinerator stack and stack parameters

Point source name	Point source coordinates *	Height of release above ground (m)	Height above nearby building (m)	Diameter at stack tip/vent exit (m)	Actual gas exit temperature (°C)	Actual gas volumetric flow (m^3/hr)	Actual gas exit velocity (m/s)	Type of emission (continuous/ batch)
Incinerator Stack	Latitude: -31.901°; Longitude: 26.860°	12.175	>6	0.546	329	2107.3	2.5	Batch

* Decimal degrees

4.2 Point Source Maximum Emission Rates (Normal Operating Conditions)

Stack emission testing is generally considered to be the most accurate method for estimating emissions, as it entails the direct measurement of pollutant concentrations. In the absence of emission testing data, the alternate method is to use waste feed rate data and apply appropriate emission factors to estimate emissions. This section describes the methodology used to estimate emission rates of particulates (PM_{10} and $PM_{2.5}$), NO_X, SO_2 and CO resulting from emissions from the proposed new incinerator for each of the scenarios.

The emissions from the proposed new incinerator at the DRDAR State Veterinary Laboratory for three burn rates to take account of a range of incinerator loads, under normal operating conditions. These are:
Scenario 1: Burn rate of 45 kg/hour
Scenario 2: Burn rate of 60 kg/hour
Scenario 3: Burn rate of 75 kg/hour

Emission Factors

An emissions factor is a representative value that relates the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (e.g., kg of particulate emitted per ton of waste burned). Such factors facilitate estimation of emissions from various sources of air pollution. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category.
The general equation for emissions estimation is:

$$E = A \times EF \times (1-ER/100)$$

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

Medical waste incineration involves the burning of wastes produced by hospitals, veterinary facilities, and medical research facilities. These wastes include both infectious medical wastes as well as non-infectious, general housekeeping wastes. The primary pollutants from medical waste incinerators are particulate matter, metals, acid gases, NO_X, CO, organics and various other materials present in medical wastes, such as pathogens, cytotoxins, and radioactive diagnostic materials. Of these, only particulates (PM_{10} and $PM_{2.5}$), NO_X, SO_2 and CO will be considered in this assessment since the composition of material incinerated will specifically include veterinary waste (animal carcases) and diesel for combustion.

The emission factors used for the calculation of particulates (PM_{10} and $PM_{2.5}$), NO_X, SO_2 and CO from incinerators are the most recent factors 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. The chapters of interest include Chapter 2: Solid Waste Disposal (Section 2.3 Medical Waste Incineration) (USEPA, 1995a). Table 11 contains gaseous emission factors for the pollutants discussed above, expressed in units of kilograms per metric ton (kg/ton). These emission factors represent emissions when both infectious and non-infectious wastes are combusted; and are based on uncontrolled emission factors for controlled air medical waste incinerators.

Point source maximum emission rates for normal operating conditions are provided in Table 12, together with emission factors and emission concentrations. It is evident that resultant emission rates are relatively low, even with no emission control devices in place. Emission concentrations also comply with the MES for existing plants.

However, emission concentrations exceed the MES for new plants for particulates for all three burn rates and for CO for the 60 kg/hour and 75 kg/hour burn rates. In preparation for April 2020, where the MES for new plants apply, four control mechanisms are assessed for the proposed new incinerator (Table 12). Emission factors for Control Mechanism 1 – 3 are based on controlled emission factors for controlled air medical waste incinerators (USEPA, 1995a), but are not available for all the pollutants. Control mechanism 4 entails an increase in the volumetric flow rate of the stack.

In the case of Control Mechanism 1, where a combination of dry sorbent injection, fabric filter and scrubber are used, particulates and SO_2 are reduced for all burn rates. The emission reduction is still not adequate to achieve compliance with the MES for particulates. The MES for CO is still exceeded for the 60 kg/hour and 75 kg/hour burn rate.

In the case of Control Mechanism 2, where a low energy scrubber is used in combination with a fabric filter, it is only particulates that are reduced for all burn rates, and the emission reduction is adequate to achieve compliance with the MES. The MES for CO is still exceeded for the 60 kg/hour and 75 kg/hour burn rate.

In the case of Control Mechanism 3, where a low energy scrubber is used, particulates, SO_2 and CO are reduced for all burn rates. The emission reduction is adequate to achieve compliance with the MES for CO for all burn rates. The emission reduction is not adequate to achieve compliance with the MES for particulates for the 60 kg/hour and 75 kg/hour burn rate.

In the case of Control Mechanism 4, the volumetric flow rate of the stack is adjusted to 1 195 Nm^3/hr and 1494 Nm^3/hr for the 60 kg/hour and 75 kg/hour burn rate, respectively. The reasoning here is that an increase in volumetric flow rate results in a decrease in emission concentration, provided that all other stack parameters remain the same. An emission reduction is subsequently achieved for all pollutants of concern. This mechanism is adequate to achieve compliance with the MES for CO for all burn rates, but not enough to achieve compliance with the MES for particulates for all burn rates.

It is therefore recommended that a combination of control mechanisms are used to target specific pollutants to achieve compliance with the respective MES for new plants, in preparation for April 2020.

Table 11: Point source maximum emission rates, based on USEPA uncontrolled emission factors for normal operating conditions

Point Source Name	Pollutant Name	Emission Factor	Average Emission Rate		Emission Concentration		Avg. Period	Duration of Emissions
		kg/ton	g/s	tons/year	mg/Nm³			
					MES for existing plant	Uncontrolled		
Burn Rate - 45 kg/hour								
Stack 1	PM (total)	2.33	0.029	0.92	250	117.00	hourly	3-8 hours/day
	PM_{10}	1.51	0.019	0.60		76.05	hourly	3-8 hours/day
	$PM_{2.5}$	1.01	0.013	0.40		50.66	hourly	3-8 hours/day
	NO_x	1.78	0.022	0.70	1000	89.38	hourly	3-8 hours/day
	SO_2	1.09	0.014	0.43		54.73	hourly	3-8 hours/day
	CO	1.48	0.019	0.58	150	74.31	hourly	3-8 hours/day
Burn Rate - 60 kg/hour								
Stack 1	PM (total)	2.33	0.039	1.22	250	155.99	hourly	3-8 hours/day
	PM_{10}	1.51	0.025	0.80		101.40	hourly	3-8 hours/day
	$PM_{2.5}$	1.01	0.017	0.53		67.55	hourly	3-8 hours/day
	NO_x	1.78	0.030	0.94	1000	119.17	hourly	3-8 hours/day
	SO_2	1.09	0.018	0.57		72.98	hourly	3-8 hours/day
	CO	1.48	0.025	0.78	150	99.09	hourly	3-8 hours/day
Burn Rate - 75 kg/hour								
Stack 1	PM (total)	2.33	0.049	1.53	250	194.99	hourly	3-8 hours/day
	PM_{10}	1.51	0.032	1.00		126.75	hourly	3-8 hours/day
	$PM_{2.5}$	1.01	0.021	0.66		84.43	hourly	3-8 hours/day
	NO_x	1.78	0.037	1.17	1000	148.96	hourly	3-8 hours/day
	SO_2	1.09	0.023	0.72		91.22	hourly	3-8 hours/day
	CO	1.48	0.031	0.97	150	123.86	hourly	3-8 hours/day

Table 12: Comparison of emission concentrations for four control mechanisms (based on USEPA uncontrolled and controlled emission factors) with MES for new plants – emission concentrations in red indicate non-compliance with the MES

	MES for new plants	Un-controlled emissions	Control 1: Dry Sorbent Injection, Fabric Filter and Scrubber	Control 2: Low energy scrubber and Fabric Filter	Control 3: High Energy Scrubber	Control 4: Increased Volumetric Flow Rate
	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3
Burn Rate - 45 kg/hour						
PM (total)	40	**117.00**	**67.29**	22.85	37.21	**37.21**
PM_{10}		76.05	43.74	14.85	24.19	24.19
$PM_{2.5}$		50.66	29.13	9.89	16.11	16.11
NO_x	500	89.38	89.38	89.38	89.38	89.38
SO_2		54.73	0.38	54.73	0.65	0.65
CO	75	74.31	74.31	74.31	1.51	1.51
Burn Rate - 60 kg/hour						
PM (total)	40	**155.99**	**89.71**	30.46	**49.61**	**37.21**
PM_{10}		101.40	58.31	19.80	32.25	24.19
$PM_{2.5}$		67.55	38.85	13.19	21.48	16.11
NO_x	500	119.17	119.17	119.17	119.17	89.38
SO_2		72.98	0.51	72.98	0.86	0.65
CO	75	**99.09**	**99.09**	**99.09**	2.01	1.51
Burn Rate - 75 kg/hour						
PM (total)	40	**194.99**	**112.14**	38.08	**62.01**	**37.21**
PM_{10}		126.75	72.89	24.75	40.31	24.19
$PM_{2.5}$		84.43	48.56	16.49	26.85	16.11
NO_x	500	148.96	148.96	148.96	148.96	89.38
SO_2		91.22	0.63	91.22	1.08	0.65
CO	75	**123.86**	**123.86**	**123.86**	2.51	1.51

4.3 Point Source Maximum Emission Rates (Start Up, Shut-Down, Upset and Maintenance Conditions)

A description of start-up, shut-down, upset and maintenance operating conditions with specific reference to the emissions profile that will be expected for the pollutant/s identified for the specific listed activity is not currently available for the proposed new incinerator. An estimated raw gas emission rate for each of these operating conditions is also not available.

A summary of the frequency of start-up, shut-down, upset and maintenance operating conditions experienced over the last 2 years is not available for the proposed new incinerator as it has not been commissioned.

4.4 Fugitive Emissions

The primary fugitive emission source expected at the DRDAR State Veterinary Laboratory are the existing diesel storage tanks. Emissions of VOCs from storage tanks occur because of evaporative losses of the liquid during its storage and as a result of changes in the liquid level. The emission rates are dependent on whether the tank is of fixed roof or floating roof configuration. The existing diesel storage tank at the DRDAR State Veterinary Laboratory is of the fixed roof type. The two significant types of emissions from fixed roof tanks are standing storage losses and working losses. Standing storage loss is the expulsion of vapour from tanks through vapour expansion and contraction, which is the result of changes in temperature and barometric pressure. This loss occurs without any change in liquid level in the tank. The loss from filling and emptying the tank is called working loss. Evaporation during filling operations is a result of an increase in the liquid level in the tank. As the liquid level increases, the pressure inside the tank exceeds the relief pressure and vapours are expelled from the tank. Evaporative loss during emptying occurs when air drawn into the tank during liquid removal becomes saturated with organic vapour and expands, thus exceeding the capacity of the vapour space.

Due to the relatively small storage capacity and low volatility of the diesel, fugitive emissions from the diesel storage tank is expected to be very low. Emissions from storage tanks are therefore not considered in this assessment.

4.5 Emergency Incidents

There have been no incidents related to the incinerator at DRDAR State Veterinary Laboratory in Queenstown in the last 2 years resulting in uncontrolled atmospheric emissions.

5. IMPACT OF ENTERPRISE ON THE RECEIVING ENVIRONMENT

5.1 Analysis of Emissions' Impact on Human Health

In order to assess the atmospheric impact of the facility on human health, a dispersion modelling study was undertaken in accordance with the regulations regarding air dispersion modelling specified for regulatory purposes – developed in terms of section 53 of AQA. The impact assessment only takes the emissions of the facility under consideration as well as prevailing ambient air concentrations into account during this assessment. A compliance assessment was undertaken using the National Ambient Air Quality Standards (NAAQS) and internationally recognised guidelines, specifically in residential areas and other areas where human exposure could occur.

This section first provides a background on the prevailing climatic conditions at the DRDAR State Veterinary Laboratory in Queenstown in terms of temperature, rainfall and wind; NAAQS and guidelines; and the current status of ambient air quality in the vicinity of the Laboratory. This is then followed by the dispersion modelling procedure, results of the dispersion modelling and an air quality impact assessment.

5.1.1 Prevailing Climatic Conditions

Temperature and Rainfall

The climate of a location is affected by its latitude, terrain, and altitude, as well as nearby water bodies and their currents. Climates can be classified according to the average and typical ranges of different variables, most commonly temperature and precipitation. The DRDAR State Veterinary Laboratory in Queenstown is located at approximately 31°54'4.19"S and 26°51'35.43"E, and approximately 1070 m above sea level. It experiences a cold semi-arid climate according to the Köppen Climate Classification system. Temperature and rainfall at Queenstown are best illustrated by long-term measurements at the SAWS meteorological station at Queenstown.

Winters are mild with average maximum temperatures dropping below 21 ºC between May and August, but are relatively cold at night dropping below 6°C (Figure 4). Summers are hot and the average maximums exceed 24.5°C from October to March, with extremes reaching more than 29°C in January.

Queenstown receives an average of 551 mm of rainfall annually, with 76% of the rainfall occurring in the summer months from October to March (Figure 4). Rainfall seldom occurs in winter between April and September.

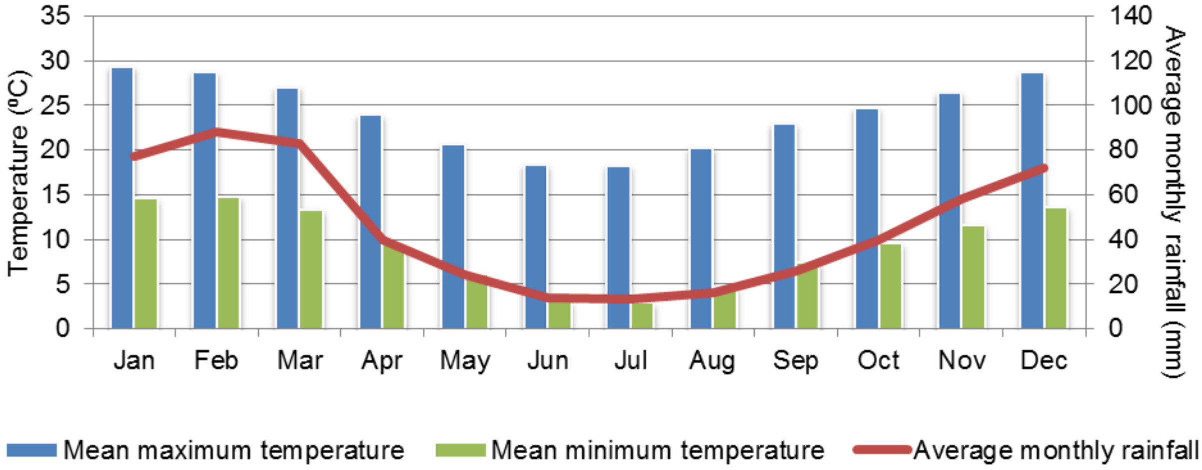

Figure 4: Average monthly maximum and minimum temperature at Queenstown. The average monthly rainfall is in mm (SAWS, 1998)

Wind

The topography of the Eastern Cape rises gently from sea level in the southeast to the plains of the Great Karoo, and rises dramatically to the Drakensburg-Maluti escarpment of over 3 000 m in the northeast. The escarpment bisects inland areas while the southern parts are defined by a series of rolling hills and river valleys. The Queenstown area is relatively flat with some influence from topography on the wind flow, particularly from the north, south and east.

The hourly wind speed and wind direction data at Queenstown are presented in the annual windrose in Figure 5. A windrose illustrates the frequency of hourly wind from the 16 cardinal wind directions, with wind indicated from the direction it blows, i.e. easterly winds blow from the east. It also illustrates the frequency of average hourly wind speed in six wind speed classes in m/s. The windrose data is derived from a global weather model at approximately 30 km resolution.

In general, winds are light to fairly strong with the majority of hourly winds between 1.6 m/s and 8 m/s. Stronger winds reaching more than 8 m/s do occur, mostly from the northwest to west-southwest sector. The predominant wind direction is northwesterly and east-southerly accounting for about 35% of all hourly winds.

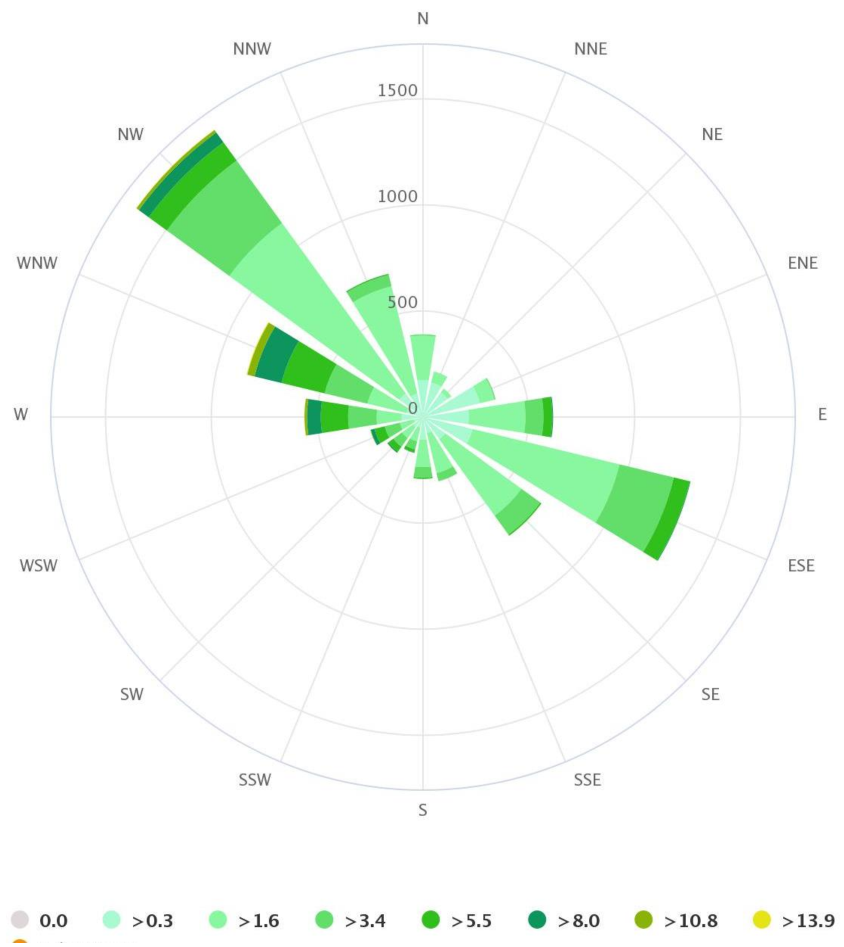

Figure 5: Annual windrose at Queenstown with wind speed in m/s and frequency bands of 500 hours (https://www.meteoblue.com/en/weather/forecast/modelclimate)

5.1.2 National Ambient Air Quality Standards and Guidelines

The effects of air pollutants on human health occur in a number of ways with short-term, or acute effects, and chronic, or long-term, effects. Different groups of people are affected differently, depending on their level of sensitivity, with the elderly and young children being more susceptible. Factors that link the concentration of an air pollutant to an observed health effect are the concentration and the duration of the exposure to that particular air pollutant.

Criteria pollutants occur ubiquitously in urban and industrial environments. Their effects on human health and the environment are well documented by the World Health Organisation (WHO) (e.g. WHO, 1999; 2003; 2005). South Africa has accordingly established NAAQS for the criteria pollutants, i.e. SO_2, NO_2, CO, respirable particulate matter (PM_{10}), ozone (O_3), Pb and benzene (C_6H_6) (DEA, 2009) and $PM_{2.5}$ (DEA, 2012).

The NAAQS consists of a 'limit' value and a permitted frequency of exceedance. The limit value is the fixed concentration level aimed at reducing the harmful effects of a pollutant. The permitted frequency of exceedance represents the acceptable number of exceedances of the limit value expressed as the 99th percentile. Compliance with the ambient standard implies that the frequency of exceedance of the limit value does not exceed the permitted tolerance. Being a health-based standard, ambient concentrations below the standard imply that air quality poses an acceptable risk to human health, while exposure to ambient concentrations above the standard implies that there is an unacceptable risk to human health.

The NAAQS for particulates (PM_{10} and $PM_{2.5}$), NO_2, SO_2 and CO are presented in Table 13.

Table 13: Ambient air quality standards and guidelines

Pollutant	Averaging period	Limit value (µg/m^3)	Tolerance
PM_{10}	24 hour	75	4
	1 year	40	0
$PM_{2.5}$	24 hour	40	4
	1 year	20	0
NO_2	1 hour	200	88
	1 year	40	0
SO_2	1 hour	350	88
	24 hour	125	4
	1 year	50	0
CO	1-hour	30 000	88
	8-hour running mean	10 000	11

The sections below provide a literature review of particulates (PM_{10} and $PM_{2.5}$), NO_X, SO_2 and CO from an air quality and human health perspective.

Particulate Matter

Particulate Matter (PM) is a broad term used to describe the fine particles found in the atmosphere, including soil dust, dirt, soot, smoke, pollen, ash, aerosols and liquid droplets. With PM, it is not just the chemical composition that is important but also the particle size. Particle size has the greatest influence on the behaviour of PM in the atmosphere with smaller particles tending to have longer residence times than larger ones. PM is categorised, according to particle size, into TSP, PM_{10} and $PM_{2.5}$.

Total suspended particulates (TSP) consist of all particles smaller than 100 µm suspended within the air. 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, 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.

$PM_{2.5}$ describes all particulate matter in the atmosphere with a diameter equal to or less than 2.5 µm. They are often called fine particles, and are mostly related to combustion (motor vehicles, smelting, incinerators), rather than mechanical processes as is the case with PM_{10}. $PM_{2.5}$ may be suspended in the atmosphere for long periods and can be transported over large distances. Fine particles can form in the atmosphere in three ways: when particles form from the gas phase, when gas molecules aggregate or cluster together without the aid of an existing surface to form a new particle, or from reactions of gases to form vapours that nucleate to form particles.

Particulate matter may contain both organic and inorganic pollutants. The extent to which particulates are considered harmful depends on their chemical composition and size, e.g. particulates emitted from diesel vehicle exhausts mainly contain unburned fuel oil and hydrocarbons that are known to be carcinogenic. Very fine particulates pose the greatest health risk as they can penetrate deep into the lung, as opposed to larger particles that may be filtered out through the airways' natural mechanisms.

In normal nasal breathing, particles larger than 10 µm are typically removed from the air stream as it passes through the nose and upper respiratory airways, and particles between 3 µm and 10 µm are deposited on the mucociliary escalator in the upper airways. Only particles in the range of 1 µm to 2 µm penetrate deeper where deposition in the alveoli of the lung can occur (WHO, 2003). Coarse particles (PM_{10} to $PM_{2.5}$) can accumulate in the respiratory system and aggravate health problems such as asthma. $PM_{2.5}$, which can penetrate deeply into the lungs, are more likely to contribute to the health effects (e.g. premature mortality and hospital admissions) than coarse particles (WHO, 2003).

The WHO has reviewed many studies since 2005 to update information on health effects on PM (WHO, 2013). Studies have once again confirmed that PM (not only PM_{10} but fine and ultra-fine PM as well), has short and long-term (both immediate and delayed) adverse health effects such as cardiovascular effects, but new associations with diseases such as atherosclerosis (thickening of artery walls), birth defects and respiratory illness in children have also been found (WHO, 2013). In addition, some studies have suggested a possible link between PM and diabetes and effects on the central nervous system (WHO, 2013). The increase in daily mortality (between 0.4% and 1%) from exposure to PM_{10} was also confirmed in several studies since 2005 (WHO, 2013).

Nitrogen dioxide (NO_2)

Nitrogen dioxide (NO_2) and nitric oxide (NO) are formed simultaneously in combustion processes and other high temperature operations such as metallurgical furnaces, blast furnaces, plasma furnaces, and kilns. NO_X is a term commonly used to refer to the combination of NO and NO_2. NO_X can also be released from nitric acid plants and other types of industrial processes involving the generation and/or use of nitric acid. NO_X also forms naturally through de-nitrification by anaerobic bacteria in soils and plants. Lightning is also a source of NO_X.

The route of exposure to NO_2 is inhalation and the seriousness of the effects depend more on the concentration than on the length of exposure. The site of deposition for NO_2 is the distal lung where NO_2 reacts with moisture in the fluids of the respiratory tract to form nitrous and nitric acids. About 80 to 90% of inhaled nitrogen dioxide is absorbed through the lungs (CCINFO, 1998). Nitrogen dioxide (present in the blood as the nitrite ion) oxidises unsaturated membrane lipids and proteins, which then results in the loss of control of cell permeability. Nitrogen dioxide causes decrements in lung function, particularly increased airway resistance. Inflammatory reactions were observed at NO_2 concentrations between 200 and 1000 ppb (380 to 1880 $\mu g/m^3$) when individuals were exposed under controlled conditions for periods that varied between 15 minutes and six hours (WHO, 2013). However, the results had been inconsistent below 1000 ppb but were much more evident at concentrations higher than 1000 ppb (1880 $\mu g/m^3$) (WHO, 2013). Below 1000 ppb healthy individuals did not show inflammatory reactions and for those with respiratory diseases (asthma and chronic obstructive pulmonary disease), inflammation was not induced below 600 ppb, except for one study that reported individuals responded at 260 ppb (500 $\mu g/m^3$) (Hesterberg et al., 2009). A review study (on 50 publications) published in 2009 by Hesterberg et al. focussed on short-term exposure to NO_2 and adverse health effects on humans. The authors came to the conclusion that a short-term exposure standard of not more than 200 ppb would protect all individuals, including sensitive individuals. People with chronic respiratory problems and people who work or exercise outside will be more at risk to NO_2 exposure.

Chronic exposure to NO_2 increases susceptibility to respiratory infections (WHO, 1997). However, a review study of 50 publications found no consistent evidence that short-term exposure below 200 ppb increased susceptibility to viral infections (Hesterberg et al., 2009). The WHO has reviewed hundreds of studies published between 2004 and 2011 on adverse health effects after short-term and long-term exposure to NO_2 (WHO, 2013). The health effects from short-term exposure are more evident than those from long-term (chronic) exposure, because in many studies a high correlation was found between NO_2 and other pollutants (WHO, 2013). However, some epidemiology studies suggested an association between NO_2 and respiratory mortality and an association with respiratory effects in children, including effects on children's lung function (WHO, 2013).

Sulphur dioxide (SO_2)

Dominant sources of SO_2 include fossil fuel combustion from industry and power plants. SO_2 is emitted when coal is burnt for energy. The combustion of fuel oil also results in high SO_2 emissions. Domestic coal or kerosene burning can thus also result in the release of SO_2. Motor vehicles also emit SO_2, in particular diesel vehicles due to the higher sulphur content of diesel fuel. Smelting of mineral ores can also result in the production of SO_2, because metals usually exist as sulphides within the ore.

On inhalation, most SO_2 only penetrates as far as the nose and throat, with minimal amounts reaching the lungs, unless the person is breathing heavily, breathing only through the mouth, or if the concentration of SO_2 is high (CCINFO, 1998). The acute response to SO_2 is rapid, within 10 minutes in people suffering from asthma (WHO, 2005). Effects such as a reduction in lung function, an increase in airway resistance, wheezing and shortness of breath, are enhanced by exercise that increases the volume of air inspired, as it allows SO_2 to penetrate further into the respiratory tract (WHO, 1999). SO_2 reacts with cell moisture in the respiratory system to form sulphuric acid. This can lead to impaired cell function and effects such as coughing, broncho-constriction, exacerbation of asthma and reduced lung function. For example an exposure of 5 to 10 min to 200 to 300 ppb (520 to 780 $\mu g/m^3$) may reduce lung function (measured as Forced Expiratory Volume in the first second (FEV_1)) by more than 15% (USEPA, 2009). There is however, uncertainty about exposure-response effects below concentrations of 200 ppb (520 $\mu g/m^3$). For SO_2 exposure short-term peak concentrations are therefore important (USEPA, 2009). Re-analysis of the effects of SO_2 done post-2005 has found evidence to suggest that the point of departure for setting the 10-minute guideline needs an additional uncertainty factor, which indicates that the guideline may have to be lowered when it is re-evaluated (WHO, 2013).

Carbon monoxide

CO is an odourless, colourless and toxic gas. People with pre-existing heart and respiratory conditions, blood disorders and anaemia are sensitive to the effects of CO. Health effects of CO are mainly experienced in the neurological system and the cardiovascular system (WHO, 1999). The binding of CO with haemoglobin reduces the oxygen-carrying capacity of the blood and impairs the release of oxygen from haemoglobin to extravascular tissues. These are the main causes of tissue hypoxia produced by CO at low exposure levels. The toxic effects of CO become evident in organs and tissues with high oxygen consumption such as the brain, the heart, exercising skeletal muscle and the developing fetus.

5.1.3 Current Status of Ambient Air Quality

There are no monitoring programs for particulates (PM_{10} and $PM_{2.5}$), NO_X, SO_2 and CO in the municipality or in the vicinity of the DRDAR State Veterinary Laboratory located in Queenstown. It is therefore not possible to provide the current status of ambient air quality in terms of these selected pollutants in the vicinity of the Laboratory. Ambient air quality in Queenstown is influenced by a number of sources of air pollution, including large and smaller industry, transportation, agricultural burning, mining and the long range transport of pollutants from the interior. Emissions from industrial facilities include SO_2, NO_X and particulate matter. Emissions from vehicles travelling on nearby roads and the small-scale aviation industry are important sources of NO_X, SO_2, CO, CO_2, Pb, particulates and volatile organic compounds (VOCs). Biomass burning is an important source of atmospheric emissions in the province. Uncontrolled and controlled burning of natural vegetation, agricultural residue and waste burning are the main types of biomass burning that occur in the province. Fires can emit large quantities of particulate matter, ranging from coarse smut that deposit on surfaces (a nuisance) to fine inhalable particulate matter (PM_{10}). Gases emitted from biomass burning include CO, NOx and VOCs. Other activities in the area include the handling of petrochemical products which mainly emit VOCs.

5.1.4 Dispersion Modelling

Dispersion modelling is used to predict ambient concentrations of particulates (PM_{10} and $PM_{2.5}$), NO_2, SO_2 and CO resulting from emissions from the proposed new incinerator at the DRDAR State Veterinary Laboratory. The approach to the dispersion modelling in this assessment is based on the requirements of the DEA guideline for dispersion modelling (DEA, 2014).

According to the DEA guideline for dispersion modelling, a Level 1 air quality assessment is conducted in situations where the purpose of the assessment is to provide an estimate of the worst-case air quality impacts. As such, screening models are sufficient for this level. In the case of this study, a Level 1 assessment is appropriate since the focus of the study is on a licence approval decision; and it deals with the preliminary identification of air quality issues associated with proposed new sources or modifications to existing sources. The DEA recommend the USEPA approved SCREEN3 model for Level 1 assessments (DEA, 2014).

Operating Scenarios for Emission Units

The proposed new incinerator at the DRDAR State Veterinary Laboratory is modelled for three burn rates to take account of a range of incinerator loads, under normal operating conditions. These are:

Scenario 1: Burn rate of 45 kg/hour

Scenario 2: Burn rate of 60 kg/hour

Scenario 3: Burn rate of 75 kg/hour

Dispersion Modelling Procedures

SCREEN3 is the US EPA's current regulatory screening model for many air permitting applications. It is the recommended tool to calculate screening-level impact estimates for stationary sources. The model is based on steady-state Gaussian plume algorithms and is applicable for estimating ambient impacts from point, area, and volume sources out to a distance of about 50 km. In addition, SCREEN3 can be used to model flares. SCREEN3 also includes algorithms for addressing building downwash influences, including the cavity recirculation region, and incorporates the valley 24-hour screening algorithm for estimating complex terrain impacts. The SCREEN3 model uses a matrix of meteorological conditions covering a range of wind speed and stability categories. The model is designed to estimate the worst-case impact based on the meteorological matrix for use as a conservative screening technique. The SCREEN3 model does not use hourly meteorological data. Instead, the user can select one of the following options:

- Full Meteorology – model uses a predefined matrix of meteorological conditions that references all stability classes (A through F) and associated wind speeds, where the maximum wind speed is stability-dependent;

- Single Stability Class – user selects a single stability category, and the model automatically examines all wind speeds appropriate for that category; or
- Single Stability Class and Wind Speed – user selects a single stability category and wind speed combination.

The Full Meteorology option is used for routine application of the SCREEN3 model.

SCREEN3 is a single source model. Nevertheless, the impacts from multiple SCREEN3 model runs can be summed to conservatively estimate the impact from several sources. The SCREEN3 Model User's Guide (US EPA, 1995b) can be consulted for more technical information on the model.

SCREEN3 does not take wind direction and topography into account. The model calculates maximum concentrations at specified distances, but these may occur in any direction from the source. The prevailing wind directions are used to obtain an indication of the general direction in which the pollution plume would travel.

Dispersion Modelling Domain and Grid Receptors

In SCREEN3, the model domain is defined on the basis of the distance from the sources of concern to the receptors of interest. In this study a modelling domain of 25 km^2 which is 5 km (west-east) by 5 km (north-south), centred on the proposed new incinerator at the DRDAR State Veterinary Laboratory is used for the model runs. Receptor points are spaced 100 m apart from the source to 3 km away, and then every 500 m apart between 3 km and 5 km away from the source.

Model Parameterisation

The parameterisation of key variables used in SCREEN3 are listed in Table 14.

Table 14: Parameterisation of key variables for SCREEN3

Parameter	Model value
Source type	point
Stack height (m)	12.175
Stack inside diameter (m)	0.546
Stack exit velocity (m/s)	2.5
Stack gas exit temp (K)	602
Ambient air temp (k)	293
Receptor height (m)	0
Automated distances (m)	1 – 5 000
Buoyancy flux (m^4/s^3)	0.938
Momentum flux m^4/s^2)	0.227
Anemometer height (m)	10
Mixing height option	Regulatory
Urban/rural option	Rural

Parameter	Model value
Meteorology	Full meteorology
Terrain	Simple terrain

Model Accuracy

Air quality models attempt to predict ambient concentrations based on "known" or measured parameters, such as wind speed, temperature profiles, solar radiation and emissions. There are however, variations in the parameters that are not measured, the so-called "unknown" parameters as well as unresolved details of atmospheric turbulent flow. Variations in these "unknown" parameters can result in deviations of the predicted concentrations of the same event, even though the "known" parameters are fixed.

There are also "reducible" uncertainties that result from inaccuracies in the model, errors in input values and errors in the measured concentrations. These might include poor quality or unrepresentative meteorological, geophysical and source emission data, errors in the measured concentrations that are used to compare with model predictions and inadequate model physics and formulation used to predict the concentrations. "Reducible" uncertainties can be controlled or minimised. This is achieved by making use of the most appropriate input data, preparing the input files correctly, checking and re-checking for errors, correcting for odd model behaviour, ensuring that the errors in the measured data are minimised and applying appropriate model physics.

Models recommended in the DEA dispersion modelling guideline (DEA, 2014) have been evaluated using a range of modelling test kits (http://www.epa.gov./scram001). It is therefore not mandatory to perform any modelling evaluations. Rather the accuracy of the modelling in this assessment is enhanced by every effort to minimise the "reducible" uncertainties in input data and model parameterisation.

For the proposed new incinerator at the DRDAR State Veterinary Laboratory the reducible uncertainty in SCREEN3 is minimised by:

- Applying appropriate parameterisation of the model;
- Using representative emission data; and
- Using a competent modelling team with considerable experience using SCREEN3.

The limitations of SCREEN3 being a one dimensional model need to be borne in mind when evaluating the model outputs.

Background Concentrations and Other Sources

A background concentration is the portion of the ambient concentration of a pollutant due to sources, both natural and anthropogenic, other than the source being assessed. Other sources of particulates (PM_{10} and $PM_{2.5}$), NO_2, SO_2 and CO will not be characterised and included in the model run. The proposed new incinerator at the DRDAR State Veterinary Laboratory is modelled in isolation of other sources.

Sensitive Receptors

According to the USEPA, sensitive receptors include, but are not limited to, hospitals, schools, day care facilities, elderly housing and convalescent facilities. These are areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides, and other pollutants. Extra care must be taken when dealing with contaminants and pollutants in close proximity to areas recognised as sensitive receptors.

In this assessment, all neighbouring residential and commercial areas (Figure 1) are treated as sensitive areas as they as expected to include sensitive areas as identified by the USEPA. The sensitive receptors in the vicinity of the DRDAR State Veterinary Laboratory are listed in Table 15, in terms of distance and direction from the Laboratory.

Table 15: Sensitive receptors in the vicinity of the DRDAR State Veterinary Laboratory located in Queenstown

Sensitive Receptor	Distance from Laboratory (km)	Direction from Laboratory
Wesbourne	0.1	north
Stuttaford	0.8	north
Bergsig	2	northeast
Windsor	2.2	northeast
Queenstown	0.5	east
Sandringham	2.3	east-southeast
New Rest	1.2	southeast
Komani Park	3.4	southeast
Queensview Park	3.8	southeast
Aloevale	2.5	south
Mlungisi	1.6	south
Amberdale	4.4	west

Dispersion Modelling Results

The dispersion modelling results for the predicted 1-hour, 24-hour and annual average ambient concentrations of particulates (PM_{10} and $PM_{2.5}$), NO_2, SO_2 and CO resulting from emissions from the proposed new incinerator are presented in Figure 6 to Figure 10. The predicted ambient concentrations are based on uncontrolled emissions and are assessed against the respective National Ambient Air Quality Standards. The highest predicted ambient concentrations from the dispersion modelling exercise is presented in Table 16.

Particulate Matter - PM_{10}

The predicted 24-hour average and annual average PM_{10} ambient concentrations resulting from emissions from the incinerator for the 45 kg/hour, 60 kg/hour and 75 kg/hour burn rates are presented in Figure 6. The predicted 24-hour average and annual average PM_{10} concentrations are very low and well below the NAAQS of 75 µg/m^3 and 40 µg/m^3

respectively, for the three burn rates. In all cases, ambient concentrations are very low on site and reach a maximum approximately 200 m downwind of the site. The highest predicted ambient concentrations are presented in Table 16. No exceedance of the NAAQS is predicted within the site or in residential and sensitive receptor areas around the site. The predicted PM_{10} concentrations therefore comply with the NAAQS in the ambient environment.

Particulate Matter - $PM_{2.5}$

The predicted 24-hour average and annual average $PM_{2.5}$ ambient concentrations resulting from emissions from the incinerator for the 45 kg/hour, 60 kg/hour and 75 kg/hour burn rates are presented in Figure 7. The predicted 24-hour average and annual average $PM_{2.5}$ concentrations are very low and well below the NAAQS of 40 $\mu g/m^3$ and 20 $\mu g/m^3$ respectively, for the three burn rates. In all cases, ambient concentrations are very low on site and reach a maximum approximately 200 m downwind of the site. The highest predicted ambient concentrations are presented in Table 16. No exceedance of the NAAQS is predicted within the site or in residential and sensitive receptor areas around the site. The predicted $PM_{2.5}$ concentrations therefore comply with the NAAQS in the ambient environment.

Oxides of Nitrogen (NO_X)

For the purpose of this assessment, the modelled NO_X concentrations (NO and NO_2) were assumed to be equal to NO_2 as NO is rapidly converted to NO_2 in the atmosphere.

The predicted 1-hour average and annual average NO_2 ambient concentrations resulting from emissions from the incinerator for the 45 kg/hour, 60 kg/hour and 75 kg/hour burn rates are presented in Figure 8. The predicted 1-hour average and annual average NO_2 concentrations are very low and well below the NAAQS of 200 $\mu g/m^3$ and 40 $\mu g/m^3$ respectively, for the three burn rates. In all cases, ambient concentrations are very low on site and reach a maximum approximately 200 m downwind of the site. The highest predicted ambient concentrations are presented in Table 16. No exceedance of the NAAQS is predicted within the site or in residential and sensitive receptor areas around the site. The predicted NO_2 concentrations therefore comply with the NAAQS in the ambient environment.

Sulphur Dioxide (SO_2)

The predicted 1-hour average, 24-hour average and annual average SO_2 ambient concentrations resulting from emissions from the incinerator for the 45 kg/hour, 60 kg/hour and 75 kg/hour burn rates are presented in Figure 9. The predicted 1-hour, 24-hour and annual average SO_2 concentrations are very low and well below the NAAQS of 350 $\mu g/m^3$, 125 $\mu g/m^3$ and 50 $\mu g/m^3$ respectively, for the three burn rates. In all cases, ambient concentrations are very low on site and reach a maximum approximately 200 m downwind of the site. The highest predicted ambient concentrations are presented in Table 16. No exceedance of the NAAQS is predicted within the site or in residential and sensitive receptor areas around the site. The predicted SO_2 concentrations therefore comply with the NAAQS in the ambient environment.

Carbon Monoxide (CO)

The predicted 1-hour average and 8-hour average CO ambient concentrations resulting from emissions from the incinerator for the 45 kg/hour, 60 kg/hour and 75 kg/hour burn rates are presented in Figure 10. The predicted 1-hour and 24-hour average CO concentrations are very low and well below the NAAQS of 30 000 µg/m^3 and 10 000 µg/m^3 respectively, for the three burn rates. In all cases, ambient concentrations are very low on site and reach a maximum approximately 200 m downwind of the site. The highest predicted ambient concentrations are presented in Table 16. No exceedance of the NAAQS is predicted within the site or in residential and sensitive receptor areas around the site. The predicted CO concentrations therefore comply with the NAAQS in the ambient environment.

Table 16: Maximum predicted ambient concentrations for the proposed new incinerator

Ambient Concentration (µg/m^3)	Burn Rate (kg/hour)								
	45	60	75	45	60	75	45	60	75
	1-hour Average			24-hour Average			Annual Average		
PM_{10}	2.70	3.60	4.51	1.08	1.44	1.80	0.22	0.29	0.36
$PM_{2.5}$	1.80	2.40	3.00	0.72	0.96	1.20	0.14	0.19	0.24
NO_2	3.18	4.24	5.30	1.27	1.69	2.12	0.25	0.34	0.42
SO_2	1.95	2.59	3.24	0.78	1.04	1.30	0.16	0.21	0.26
CO	2.64	3.52	4.40	1.85	2.47	3.08	0.21	0.28	0.35

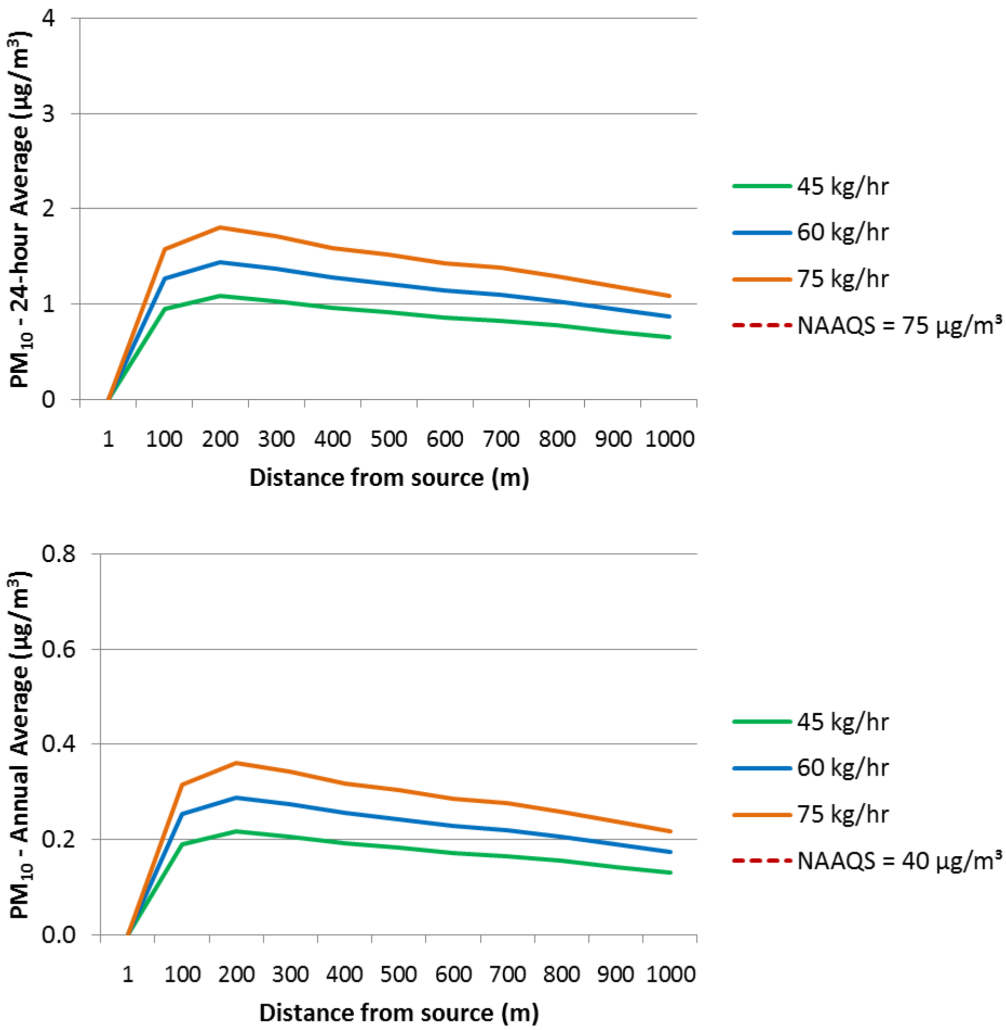

Figure 6: Predicted 24-hour average (top) and annual average (bottom) PM_{10} ambient concentrations in µg/m³ resulting from emissions from the incinerator in isolation

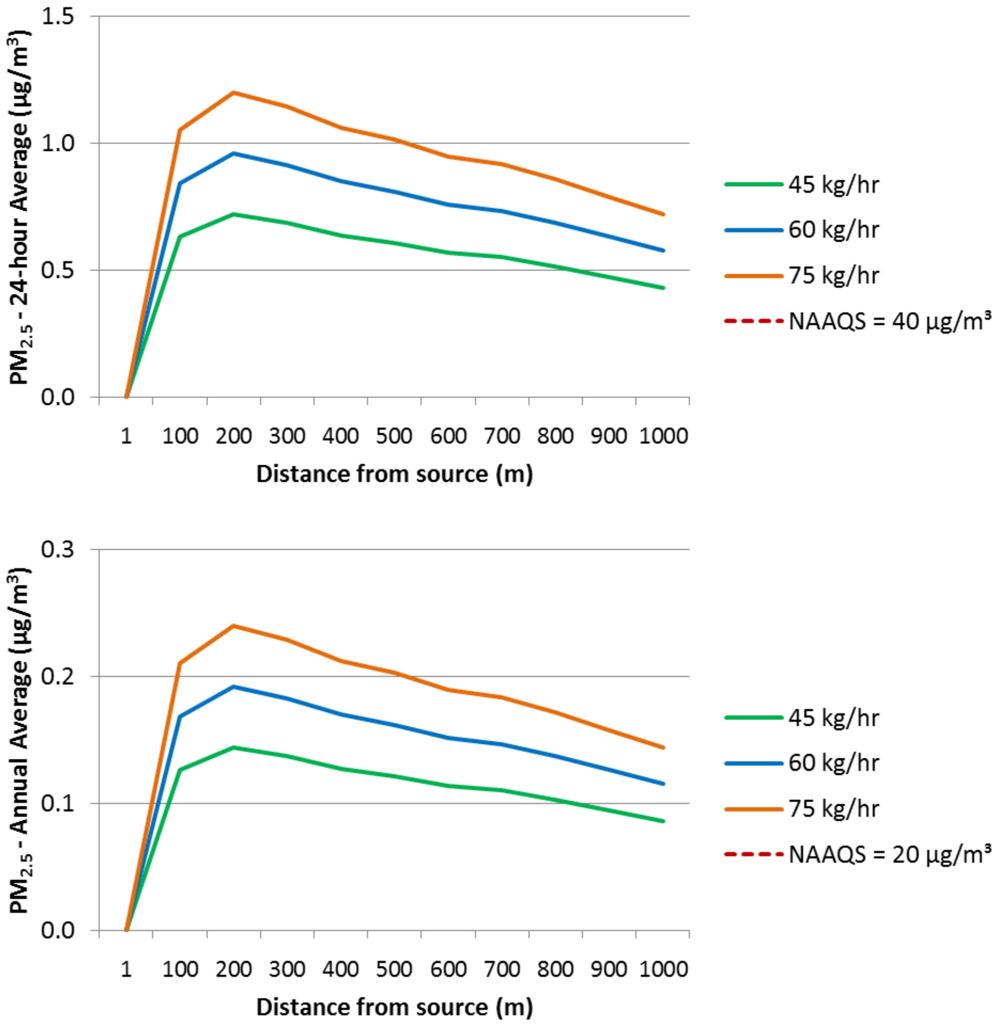

Figure 7: Predicted 24-hour average (top) and annual average (bottom) $PM_{2.5}$ ambient concentrations in µg/m³ resulting from emissions from the incinerator in isolation

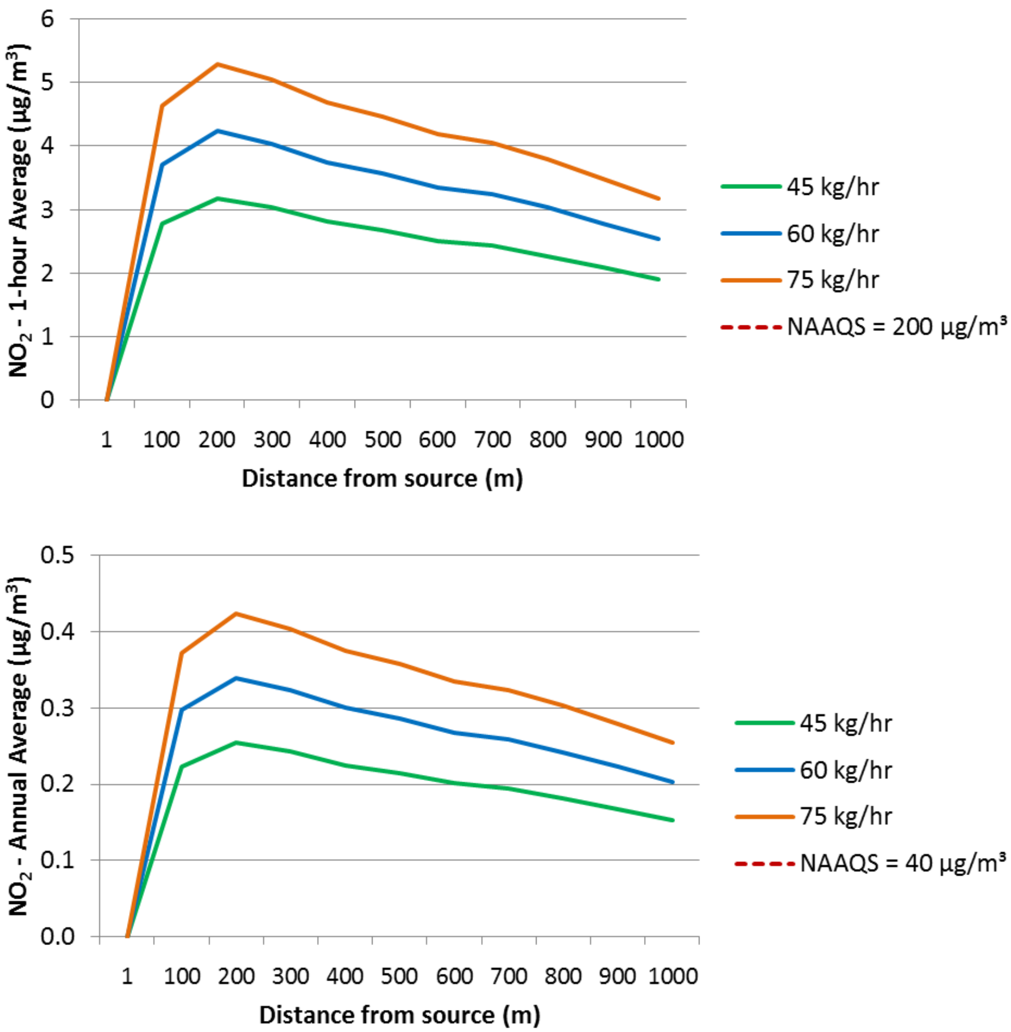

Figure 8: Predicted 1-hour average (top) and annual average (bottom) NO_2 ambient concentrations in µg/m^3 resulting from emissions from the incinerator in isolation

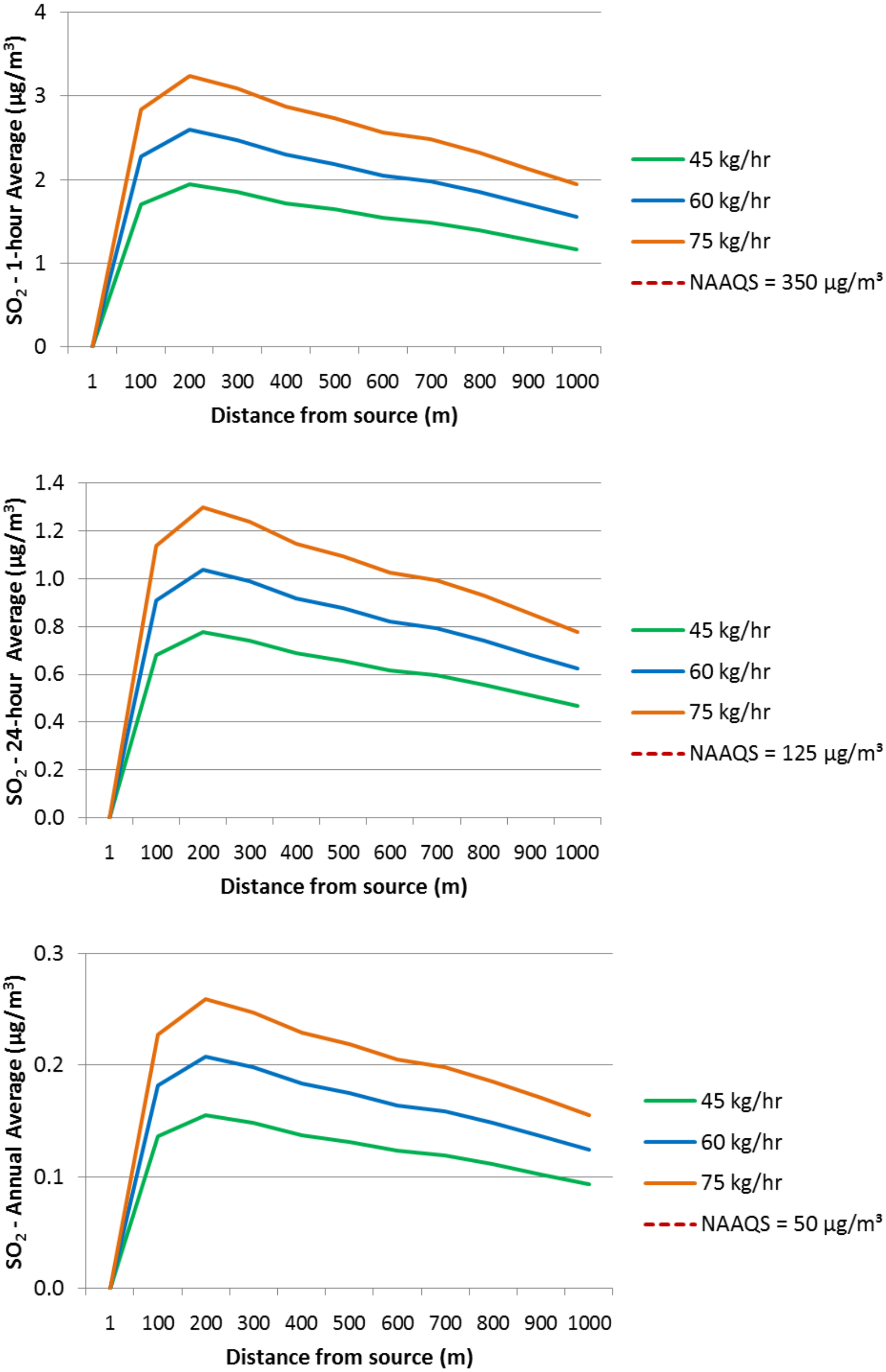

Figure 9: Predicted 1-hour average (top), 24-hour average (middle) and annual average (bottom) SO_2 ambient concentrations in µg/m^3 resulting from emissions from the incinerator in isolation

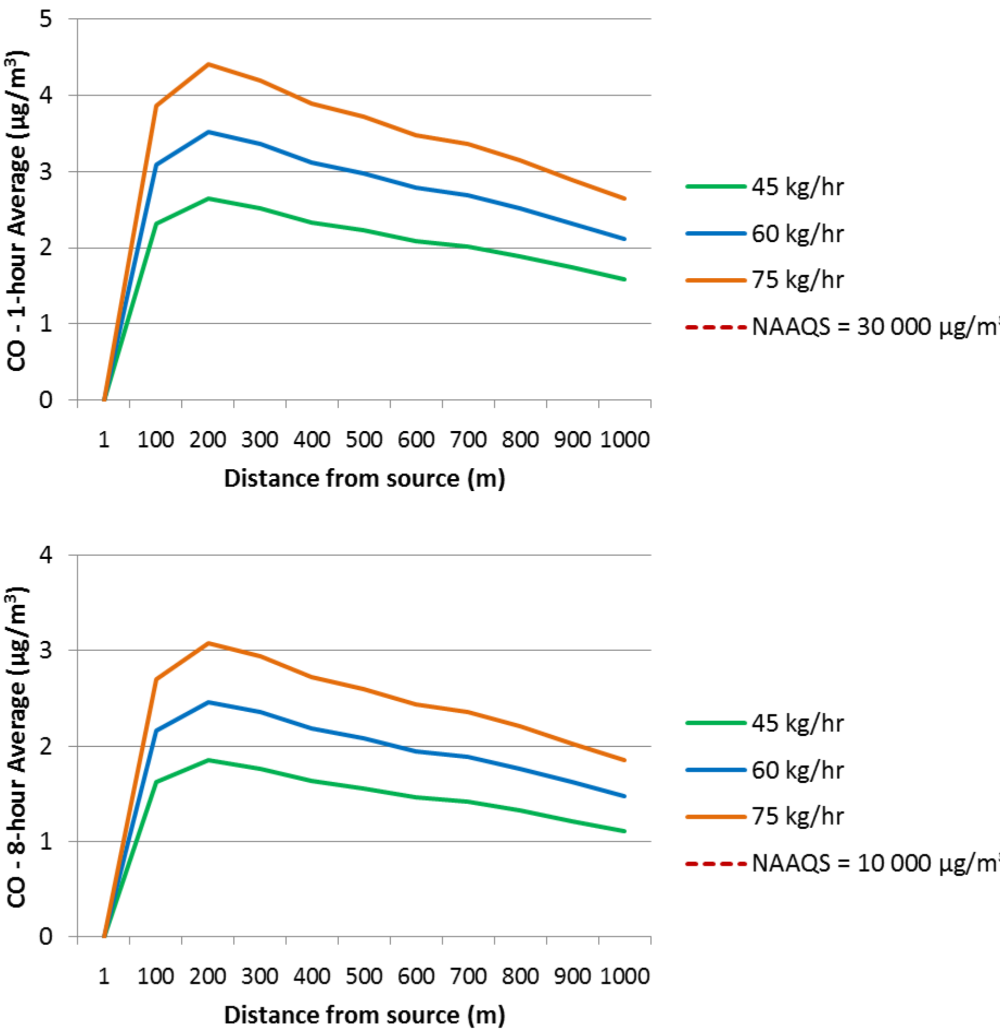

Figure 10: Predicted 1-hour average (top) and 8-hour average (bottom) CO ambient concentrations in µg/m³ resulting from emissions from the incinerator in isolation

Construction and Decommissioning

Prior to construction of the proposed new incinerator at the DRDAR State Veterinary Laboratory, the old incinerator structures will be disassembled and moved off site. The proposed new incinerator and associated structures will be brought to site by truck and assembled at the same location where the current incinerator is located. Dust emissions and other emissions are not expected to be high during this process as the site is not located in a dusty environment. No additional construction or clearing of vegetation is foreseen and the site would remain in its current condition No mitigation measures are therefore proposed.

During decommissioning of the incinerator, the incinerator structures will be disassembled and moved off site. Dust emissions and other emissions are not expected to be high during this process and the site would remain in its current condition. No mitigation measures are therefore proposed.

Impact Assessment

The potential impact of emissions of particulates (PM_{10} and $PM_{2.5}$), NO_X, SO_2 and CO resulting from emissions from the proposed new incinerator is assessed according to the SRK Impact Rating Procedure. The following criteria are applied:

Impact Rating Procedure

The significance of an impact is defined as a combination of the consequence of the impact occurring and the probability that the impact will occur. The criteria used to determine impact consequences are presented in Table 17.

Table 17: Criteria used to determine the Consequence of the Impact

Rating	Definition of Rating	Score
A. Extent– the area over which the impact will be experienced		
None		0
Local	Confined to project or study area or part thereof (e.g. site)	1
Regional	The region, which may be defined in various ways, e.g. cadastral, catchment, topographic	2
(Inter) national	Nationally or beyond	3
B. Intensity– the magnitude of the impact in relation to the sensitivity of the receiving environment		
None		0
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or	3

Rating	Definition of Rating	Score
	processes are severely altered	
C. Duration– the time frame for which the impact will be experienced		
None		0
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years	3

The combined score of these three criteria corresponds to a Consequence Rating (Table 18).

Table 18: Method used to determine the Consequence Score

Combined Score (A+B+C)	0 – 2	3 – 4	5	6	7	8 – 9
Consequence Rating	Not significant	Very low	Low	Medium	High	Very high

Once the consequence has been derived, the probability of the impact occurring will be considered using the probability classifications presented in Table 19.

Table 19: Probability Classification

Probability– the likelihood of the impact occurring	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

The overall significance of impacts will be determined by considering consequence and probability using the rating system prescribed in the Table20.

Table 20: Impact Significance Ratings

Significance Rating	**Possible Impact Combinations**		
	Consequence		**Probability**
Insignificant	Very Low	&	Improbable
	Very Low	&	Possible
Very Low	Very Low	&	Probable
	Very Low	&	Definite
	Low	&	Improbable
	Low	&	Possible
Low	Low	&	Probable
	Low	&	Definite
	Medium	&	Improbable
	Medium	&	Possible
Medium	Medium	&	Probable
	Medium	&	Definite

Significance Rating	Possible Impact Combinations		
	Consequence		Probability
	High	&	Improbable
	High	&	Possible
High	High	&	Probable
	High	&	Definite
	Very High	&	Improbable
	Very High	&	Possible
Very High	Very High	&	Probable
	Very High	&	Definite

Finally, the impacts will also be considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The system for considering impact status and confidence (in assessment) is laid out in the Table 21.

Table 21: Impact status and confidence classification

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK's judgment and/or specialist knowledge.	Low
	Medium
	High

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

Insignificant: the potential impact is negligible and will not have an influence on the decision regarding the proposed activity/development.

Very Low: the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed activity/development.

Low: the potential impact may not have any meaningful influence on the decision regarding the proposed activity/development.

Medium: the potential impact should influence the decision regarding the proposed activity/development.

High: the potential impact will affect the decision regarding the proposed activity/development.

Very High: The proposed activity should only be approved under special circumstances.

Practicable mitigation measures will be recommended and impacts will be rated in the prescribed way both with and without the assumed effective implementation of mitigation measures. Mitigation measures will be classified as either:

Essential: must be implemented and are non-negotiable; or

Optional: must be shown to have been considered and sound reasons provided by the proponent, if not implemented.

“No-Go” alternative

In the case of the “No-Go” alternative, the incinerator will not be replaced and the facility will not comply with the relevant air quality standards and the site would remain in its current condition until/ unless any other development is approved.

In most cases, the “No-Go” alternative approximates the baseline situation. In the sections assessing specific impacts below, the “No-Go” alternative is only assessed where the baseline descriptions do not fully capture current impacts.

Summary of Impacts

The potential impact of emissions of particulates (PM_{10} and $PM_{2.5}$), NO_X, SO_2 and CO resulting from emissions from the proposed new incinerator is summarised in Table 22.

Impacts during construction and decommissioning with or without mitigation will be local in extent, low intensity, of a short-term duration and therefore of very low consequence. The probability of impacts occurring is improbable. The significance rating is therefore insignificant, implying that the potential impact is negligible and will not have an influence on the decision regarding the proposed development. The construction and decommissioning phase, with or without mitigation, will not have a significant negative impact on the environment. There is a high confidence associated with the impacts and the reversibility of the impacts is high.

Impacts during operation with or without mitigation will be local in extent, low intensity, of a long-term duration and therefore of low consequence. The probability of impacts occurring is improbable. The significance rating is therefore very low, implying that the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed development. The operational phase, with or without mitigation, will not have a significant negative impact on the environment. There is a high confidence associated with the impacts and the reversibility of the impacts is high.

From an air quality perspective, it is therefore recommended that the project should go ahead.

Table 22: Impact Assessment for the construction, operational and decommissioning phase of the proposed new incinerator

	Impact	Mitigation	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence	Reversibility
Construction	Impacts on Air Quality	Without	Local	Low	Short-term	Very low	Improbable	Insignificant	- ve	High	High
		With	Local	Low	Short-term	Very low	Improbable	Insignificant	- ve	High	
Operation	Impacts on Air Quality	Without	Local	Low	Long - term	Low	Improbable	Very Low	- ve	High	High
		With	Local	Low	Long-term	Low	Improbable	Very Low	- ve	medium	
Decom-missioning	Impacts on Air Quality	Without	Local	Low	Short-term	Very low	Improbable	Insignificant	- ve	High	High
		With	Local	Low	Short-term	Very low	Improbable	Insignificant	- ve	High	

5.2 Analysis of Emissions' Impact on the Environment

An assessment of the atmospheric impact of the facility on the environment was not undertaken as part of this Atmospheric Impact Report.

6. COMPLAINTS

The DRDAR State Veterinary Laboratory has not received complaints in respect of air pollution in the last 2 years.

7. CURRENT OR PLANNED AIR QUALITY MANAGEMENT INTERVENTIONS

The DRDAR State Veterinary Laboratory does not have any approved air quality management improvement interventions currently being implemented for the facility; or scheduled for the next 5 years.

8. COMPLIANCE AND ENFORCEMENT ACTIONS

The DRDAR State Veterinary Laboratory does not have any air quality compliance and enforcement actions undertaken against the enterprise in the last 5 years.

9. SUMMARY AND CONCLUSION

USEPA AP42 emission factors are used to estimate emissions of particulates (PM_{10} and $PM_{2.5}$), oxides of nitrogen (NO_X), sulphur dioxide (SO_2) and carbon monoxide (CO) from the proposed new incinerator at the DRDAR State Veterinary Laboratory, for three burn rates (45 kg/hour, 60 kg/hour and 75 kg/hour) to take account of a range of incinerator loads, under normal operating conditions.

It is evident that resultant emission rates are relatively low, even with no emission control devices in place. Emission concentrations also comply with the Minimum Emission Standards (MES) for existing plants. However, emission concentrations exceed the MES for new plants for particulates for all three burn rates and for CO for the 60 kg/hour and 75 kg/hour burn rates. It is therefore recommended that a combination of control mechanisms are used to target specific pollutants to achieve compliance with the respective MES.

The DEA recommended and USEPA-approved SCREEN3 dispersion model is used to assess the effects and potential consequences of uncontrolled emissions from the proposed new incinerator in the surrounding environment. Modelled ambient concentrations of PM_{10}, $PM_{2.5}$, NO_2, SO_2 and CO are considerably less than the respective health-based ambient air quality standards and the highest concentrations are predicted 200 m from the incinerator.

The significance rating for impacts during construction and decommissioning (with or without mitigation) is insignificant, implying that the potential impact is negligible and will not have an influence on the decision regarding the proposed development. The significance rating for impacts during operations (with or without mitigation) is low, implying that the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed development. From an air quality perspective, it is therefore recommended that the project should go ahead.

10. REFERENCES

CCINFO, 1998 and 2000. The Canadian Centre for Occupational Health and Safety database. http://ccinfoweb.ccohs.ca visited on 21 July 2003.

DEA (2009): National Ambient Air Quality Standards, Government Gazette, 32861, Vol. 1210, 24 December 2009.

DEA (2010): Listed Activities and Associated Minimum Emission Standards identified in terms of Section 21 of the Air Quality Act, Act No. 39 of 2004, Government Gazette 33064, Notice No. 248 of 31 March 2010.

DEA (2012): National Ambient Air Quality Standard for Particulate Matter of Aerodynamic Diameter less than 2.5 micrometers, Notice 486, 29 June 2012, Government Gazette, 35463.

DEA (2013): Listed activities and associated Minimum Emission Standards identified in terms of Section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), Government Gazette Notice No. 893 of 22 November 2013.

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.

Hesterberg TW, Bunn WB, McClellan RO, Hamade AK, Long CM and Valberg PA. (2009). Critical Review of the Human Data on Short-term Nitrogen Dioxide (NO_2) Exposures: Evidence for NO_2 No-Effect Levels. Critical Reviews in Toxicology, 39(9): 743-81.

South African Weather Service, (1998): Climate of South Africa, Climate Statistics up to 1984.

USEPA (1995a): Compilation of Air Pollutant Emission Factors, AP-42 Fifth Edition, Volume l: Solid Waste Disposal, Chapter 2.

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.

USEPA United States Environmental Protection Agency. (2009). Risk and Exposure Assessment to Support the Review of the SO_2 National Ambient Air Quality Standards: Final Report. Available http://www.epa.gov/ttn/naaqs/standards/so2/data/200908SO2REAFinalReport.pdf (accessed September 2014).

WHO (1997). Environmental Health Criteria 188 Oxides of Nitrogen. Second edition. Available: http://www.inchem.org/documents/ehc/ehc/ehc188.htm (accessed August 2014).

WHO (1999): Guidelines for Air Quality, World Health Organisation, http://www.who.int/peh/air/Airqualitygd.htm.

WHO (2003): Health aspects of air pollution with particulate matter, ozone and nitrogen dioxide. Report on a WHO Working Group Bonn, Germany 13-15 January 2003, WHO Geneva.

WHO (2005): WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, Global update 2005, Summary of risk assessment, WHO/SDE/PHE/OEH/06.02.

WHO (2013). Review of evidence on health aspects of air pollution – REVIHAAP Project. Technical report. Available: http://www.euro.who.int/__data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf. (accessed September 2014).

11. FORMAL DECLARATIONS

A declaration of the accuracy of the information contained in this Atmospheric Impact Report is included here. A declaration of the independence of the practitioners in the uMoya-NILU consultancy team that compiled this AIR is also included.

DECLARATION OF ACCURACY OF INFORMATION – APPLICANT

Name of Enterprise: uMoya-NILU Consulting (Pty) Ltd

Declaration of accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act

I, Mark Zunckel [duly authorised], declare that the information provided in this atmospheric impact report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality office is a criminal office in terms of section 51(1)(g) of this Act.

Signed at Durban on this 30th day of June, 2017

____
SIGNATURE

Managing Director – uMoya-NILU Consulting
CAPACITY OF SIGNATORY

DECLARATION OF INDEPENDENCE – PRACTITIONER

Name of Practitioner: Mark Zunckel

Name of Registered Body: South African Council for Natural Scientific Professionals

Professional Registration Number: 400449/04

Declaration of independence and accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act

I, Mark Zunckel declare that I am independent of the applicant. I have the necessary expertise to conduct the assessment required for the report and will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant. I will disclose to the applicant and the air quality officer all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the air quality officer. The information provided in the atmospheric impact report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality office is a criminal office in terms of section 51(1)(g) of this Act.

Signed at Durban on this 30th day of June, 2017

SIGNATURE

Managing Director – uMoya-NILU Consulting
CAPACITY OF SIGNATORY