



# **Environmental Assessment for the Despatch Crematorium**

**OCTOBER 2022**

*In support of the Amendment to an Atmospheric Emissions License*



## Proportio Divina Environmental Services

E Jacobs (Pr. Sci. Nat)  
Tel +27 87 702 5996

25 Belfast Drive, Fernglen, Port Elizabeth

[www.proportiodivina.co.za](http://www.proportiodivina.co.za)  
[admin@proportiodivina.co.za](mailto:admin@proportiodivina.co.za)

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## List Acronyms

|         |   |   |
|---------|---|---|
| AEL     | – | Atmospheric Emissions License   |
| CAEC    | – | Crematorium Authority East Cape                                       |
| DC      | – | Despatch Crematorium  |
| DEDEAT  | – | Department of Economic Development, Environmental Affairs and Tourism |
| EA      | – | Environmental Authorisation   |
| EIA     | – | Environmental Impact Assessment                                       |
| IAP     | – | Interested and Affected Parties                                       |
| LAQS    | – | Lethabo Air Quality Specialists                                       |
| NEM:AQA | – | National Environmental Management: Air Quality Act                    |

## 1. Introduction

The Crematorium Authority East Cape (CAEC), trading as Despatch Crematorium (DC) operates a crematorium in Despatch in the Eastern Cape. The Despatch Crematorium has engaged in a process to have its Atmospheric Emissions License (AEL) renewed with the Nelson Mandela Bay Municipality. In terms of the requirements for the renewal of the AEL, the application (Despatch Crematorium) is required to submit an environmental report in support of the AEL renewal. Proportio Divina Environmental Consultants have been employed by the Despatch Crematorium to complete this environmental report and this document has been compiled in fulfilment of the requirements.

### Applicant Details

The applicant details are as follow:

|                   |                      |
|-------------------|----------------------|
| Organisation Name | Despatch Crematorium |
| Contact Person    | Hannes Marais        |
| Tel               | 081 708 6766         |
| Address           | Voortrekker Road     |
| Town              | Despatch             |
| Province          | Eastern Cape         |

### Purpose of this Report

This report forms part of the submission for amendment of the AEL for the facility. In terms of the regulations published under the National Environmental Management: Air Quality Act (NEM:AQA), act no 39 of 2004, the AEL amendment must include a report detailing the environmental effects of the proposed amendment. In addition to the technical reports, the applicant must also show the associated public process followed demonstrating that interested and affected parties were notified of the proposed amendment. This report provides the environmental assessment as well as the public participation performed.

### Assumptions and Limitations

The report findings are subject to the following:

- Φ The information provided by the applicant and specialists are accurate
- Φ The technical assumptions made as part of the development proposal are accurate

## 2. Study Approach

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Although the activity is not undergoing an assessment in terms of the EIA regulations, the study approach broadly follows the EIA guidelines in terms of the content provided in this report and the study methodology followed and transparency. The steps followed were as follow:

### **Project Initiation and Site Visit**

Following appointment, PDES were provided with background information to date and a review of the environmental requirements were undertaken. A site visit was undertaken with the applicant and the air quality specialist team on 5 September 2022 to observe the current site infrastructure and discuss the proposed changes.

Photographs of the facility was taken to document the existing infrastructure. The surrounding areas were visited to obtain an understanding of the potential area of influence.

### **Public Participation**

The public participation process was conducted between 5 September 2022 and 30 October 2022. The process included the placement of site notices near and on the site location to notify any Interested and Affected Parties (IAPs) of the proposed AEL amendment. IAPs that complained to the local authorities and the Despatch Crematorium as also contacted directly to gather comments.

### **Environmental Assessment**

The report includes a description of the need and desirability of the proposed project as well as a description of the environment and the anticipated impacts. The environmental information was obtained from direct site visits where the surrounding were observed and categorised following which and assessment was conducted of the potential impacts that may arise.

### **Environmental Management Plan**

The EMP included has been developed taking the DC activities into account. Construction impacts are not relevant in the context of the existing facilities as the installation of the new equipment will be limited to the existing structures.

### 3. Project Description

As a result of the Covid-19 pandemic, emergency authorisation was granted to DC in 2020 to increase the number of cremation retorts to four units, two of which were destined for the cremation of human remains, one was reserved for the cremation of companion animals and the fourth unit would serve as backup unit. The authorisation allowed the following capacities:

- Φ An additional retort with the same capacity as the existing unit, thus allowing a maximum capacity of 36 cremations per day.
- Φ A small animal cremation retort capable of cremating a maximum of 12 carcasses per day.
- Φ The current operating schedule will be maintained, i.e. 24 hours per day for 6 days per week and 330 days annually.

As a result of the increased capacity, DC added a fifth retort, but experienced several problems with continued and efficient operation of the retorts, possibly due to the increase in demand for cremation, thus limiting down time for proper maintenance of the units.

In addition, some design flaws may have been included in the hurry to expand the crematorium's capacity. Increased emissions from the crematorium resulted in several complaints of particulate and odour concentrations from residents in the area with the result that the Nelson Mandela Bay Municipality (NMBM), the licensing authority, issued a compliance notice to DC which detailed the steps that were required to be met prior to DC being allowed to start up the cremation process again. One of the requirements is an updated air quality impact assessment.

The dispersion of emissions resulting from the DC was modelled to estimate ground-level concentrations of pollutants and compared the outcome against official ambient air quality standards where possible. Special attention was paid to the potential emissions and dispersion of odorous compounds from the crematorium.

The two nearest significant residential areas are located approximately 360 metres south-east and approximately 490 metres north of the centre of the DC's site and this is where most of the complaints arose.

The process for cremation followed by the DC is as follows:

- Φ Jewellery, prosthetic limbs and other personal effects are removed from the body prior to placing the casket into the retort and cremated at a temperature ranging from between 850°C and 950°C for a period of 2 to 3 hours.
- Φ A multiple chamber incinerator is used to reduce a human corpse through burning.

- Φ The secondary chamber is heated first by igniting the afterburner and heating to an operating temperature of at or above 990°C.
- Φ A “cremation case charge” (human remains enclosed in a coffin) is introduced in the primary chamber, called a retort, and the retort door is closed.
- Φ The charge is placed on the hearth in a manner that provides for maximum exposure to the flame or the primary burner.
- Φ Control timers are set and power switches are activated.
- Φ The low fire ignition burner in the primary chamber begins a controlled cycling range of 870 - 980°C.
- Φ This cycling continues until the cremation process is complete.
- Φ During the cremation process, a large part of the body (especially the organs) and other soft tissue are vaporized and oxidised due to the heat, and the gases are discharged through the exhaust system.
- Φ All that remains after cremation are dry bone fragments (mostly calcium phosphates and minor minerals).
- Φ The approximate time for the complete cremation is 2-3 hours depending on charge weight.
- Φ After the incineration is completed, the bone fragments are swept out of the retort and the operator uses a pulveriser called a cremulator to process them into what are known as remains which exhibit the appearance of grains of sand and recognisable chips of very dry bone.
- Φ Companion animals follow the same process. Cremation time varies between 0.5 and 3 hours.

DC's current AEL allows for four retorts, but DC currently has five retorts in operation. Three retorts serve to cremate human remains while a fourth is used to cremate companion animals. All retorts are connected to a single stack through which emissions may be emitted to atmosphere. A fifth retort serves as stand-by unit and is brought into service when one of the four units needs to be overhauled. The overhauled unit will then become the stand-by unit until another unit must be overhauled. There are thus always four units in operation.



Figure 1: Site locality of the DC.



Figure 2: (left) External view of the DC and combined stack. (Right) Internal burner units.

## 4. Need and Desirability

The need and desirability of the project described below follows the guidelines as set out by the Department of Environmental Affairs (DEA 2017) in the Guideline on Need and Desirability. The intent of determining the need and desirability of a development provides the authorities with important inputs into considering the approval of projects. Following a review of the project and the components, the need and desirability of this project is discussed under the two overarching themes namely:

1. Impacts on the ecological integrity of the area.
  - a. Impacts on the ecological integrity of the area have been considered based on the proposed activities that will take place.
  - b. Because no clearing of land will take place and no activities will result in impacts on biodiversity, no further assessment was conducted in relation to the ecological context.
  - c. Potential pollution will result from stack emissions.
2. The socio-economic and social context of the area.
  - a. The DC is located in an area where there are no direct neighbours to the facility although residential properties are within close proximity.
  - b. From the public participation process, issues raised related to the location of the facility, specifically the distance to residential areas within the spatial planning requirements of the NMBM.
  - c. The DC is located adjacent to the Despatch Cemetery with only the R75 freeway separating the two sites.
  - d. The site is midway between poorer communities and more affluent communities although it should be noted that the DC serves the larger NMBM area as well.
  - e. The DC has seen an increase in demand from the local and regional surroundings to deal with the outfall of the COVID-19 pandemic related mortality spikes.

The need and desirability outcome is presented in **Table 1** below.

**Table 1: Need and desirability determination.**

| <b>Ecological Integrity</b>  |                 |   |
|--|-----------------|---|
| <b>Question to be addressed</b>  | <b>Response</b> | <b>Justification</b>  |
| <b>Does the development avoid ecological impacts by using existing facilities and cleared areas?</b>       | Yes             | <ol style="list-style-type: none"> <li>1. The proposed AEL amendment is restricted to the existing footprint and requires no additional land clearing.</li> <li>2. The impacts arising from the facility will not have an impact on the ecology within the surroundings.</li> </ol>   |
| <b>Does the facility carry a risk if pollution to the natural surroundings?</b>                            | Partially       | <ol style="list-style-type: none"> <li>1. Although the facility will have emissions release through the stack, environmental pollution will be limited and is not expected to result in any pollution of surrounding environments.</li> <li>2. Fuel supplies on site are limited to small volumes of LPG that does not pose a major spill risk.</li> <li>3. Waste generated is mainly domestic waste, process waste is emitted through stacks and any remains are either taken off site by clients or disposed in the regular municipal waste management system.</li> </ol> |
| <b>Does the facility make use of natural resources or have the risk of compromising natural resources?</b> | No              | <ol style="list-style-type: none"> <li>1. Although LPG is used in the burning process, the volumes used is considered insignificant in terms of the supply available.</li> <li>2. Natural Resources will not be compromised by the facility.</li> <li>3. The cremation process is beneficial in the sense that it reduces impacts of cemetery space use and potential contamination from burials.</li> </ol>  |
| <b>Socio-economic and social context</b>   |                 |   |
| <b>Is the facility location consistent with the spatial development framework?</b>                         | Yes             | <ol style="list-style-type: none"> <li>1. The zoning of the facility was approved by the NMBM.</li> <li>2. The facility is located adjacent to the Despatch cemetery.</li> </ol>  |
| <b>Was the original placement of the facility correct?</b>   | Partially       | <ol style="list-style-type: none"> <li>1. Considering the proximity to the Despatch cemetery, the facility was correctly placed.</li> <li>2. The approved crematorium and cemetery is consistent with the municipal bylaws.</li> <li>3. Proximity to residential areas have been the cause for complaints from local residents if emissions are visible or odours are detected.</li> </ol>  |
| <b>Does the facility provide equal access to all communities.</b>  | Yes             | <ol style="list-style-type: none"> <li>1. The DC serves the greater NMBM area at present as well as areas further afield.</li> <li>2. The DC have been providing a beneficial service following the commencement of the COVID-19 pandemic.</li> </ol>   |

## 5. Applicable Legislation

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### **NEMA: EIA Regulations and Listing Notices (7 April 2017)**

The DC was inundated with mortal remains during the second wave of the COVID-19 pandemic in the Eastern Cape. The local Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) indicated that several cemetery facilities saw an increase in the demand for burial services and likewise the DC indicated an increase in 250% exhausting their capacity. This led to the DC applying to the DEDEAT to obtain a section 30A Directive that would grant the DC with approval to commence with construction and development of the required upgraded facilities.

The listed activity applied for was GNR. 327 (Listing Notice 1) Activity 34: The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or license or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution.

The facility was therefore in need of an amended AEL. DEDEAT granted the approval subject to the conditions stipulated, one of which is the need to obtain an amended AEL prior to commencement of commissioning.

### **National Environment Management: Air Quality Act 39 of 2004**

The cremation activity carried out by DC is included in the *National List of Activities Which Result in Atmospheric Emissions* as published in Government Notice No. 893 on 22 November 2013 (GN893). The activity falls under the following category: -- Sub-category 8.2, "*Cremation and Veterinary Waste Incineration*" with a general description of "*Cremation of human remains, companion animals (pets) and the incineration of veterinary waste*". The official emission limits associated with this sub-category are given in Section 6.7 of the air quality report.

## 6. Affected Environment

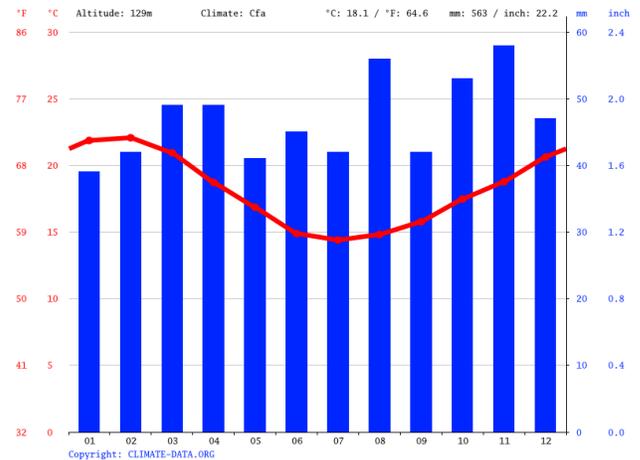
The receiving environment has been described using a combination of on-site observations and published literature and datasets obtained from the South African Weather Service through their Eastern Cape offices.

### Biophysical Environment Climate

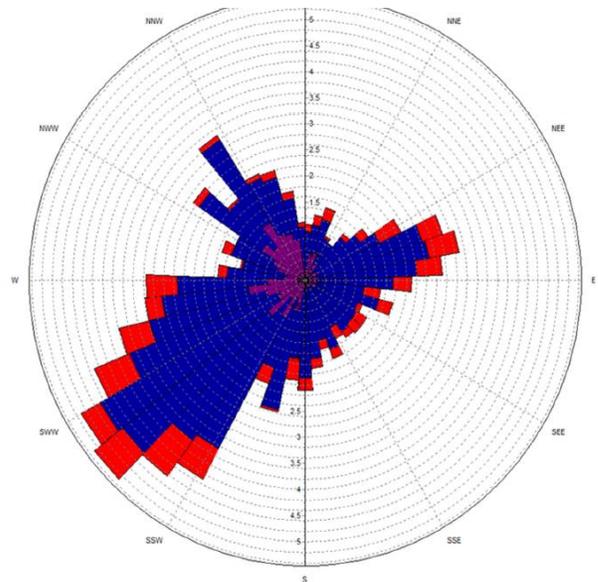
The climate of the Eastern Cape is complex, it spans over the confluence of several climatic regimes, most importantly the temperate and subtropical regions. The climate of NMBM is warm temperate, mild, and temperature fluctuations are not extreme. Monthly average temperatures and rainfall is shown in **Figure 3** with the temperature data for the last 30 years measured over the NMBM area and rainfall extremes shown in **Table 2**.

The weather patterns in the region are substantially influenced by the sea and surrounding topography which is flat with low mountain ranges. The Nelson Mandela Bay area, which includes Despatch, has a bimodal rainfall pattern, with peaks in Spring and Autumn. Rainfall for the metropolitan area can range between 400 mm to 800 mm in a year with regular cycles of wet and dry periods. Although the majority of the rainfall events occur in Spring and Autumn, rainfall occurs throughout the year as a result of convective summer rain and winter rain associated with the passage of frontal troughs.

Prevailing winds along the coast tend to follow the coastline and the winds in the Port Elizabeth area are typically from the West-South West and East-North East. **Figure 4** shows the wind rose for the



**Figure 3: Rainfall and temperatures for the general NMBM area (climate-data.org).**



**Figure 4: Wind rose as generated in the air quality assessment.**

NMBM area generated by LAQS as part of the air quality specialist study for 2022 showing that the dominant prevailing winds are west to south-south westerly (> 50 % of the time) occasionally changing to east or north easterly winds < 15 % of the time. East to east north easterly winds prevail during the summer months (December to February). Light winds are more variable in direction due to topographical influences and cold air drainage at night, especially in winter.

**Table 2: Annual temperature showing seasons marked by shaded cells (Weather SA data).**

| Month | AVERAGE OF DAILY TEMPERATURE |      |      |       | TOTAL RAIN PER MONTH / YEAR | YEAR | MIN  | YEAR |
|-------|------------------------------|------|------|-------|-----------------------------|------|------|------|
|       | MAX                          | MIN  | MEAN | RANGE | MAX                         |      |      |      |
| Jan   | 25,7                         | 17,4 | 21,6 | 8,3   | 112,2                       | 2000 | 8,2  | 2018 |
| Feb   | 26,1                         | 17,6 | 21,9 | 8,5   | 154,0                       | 2000 | 4,2  | 1998 |
| Mar   | 25                           | 16,2 | 20,6 | 8,8   | 129,3                       | 1998 | 6,9  | 1993 |
| Apr   | 23,3                         | 13,6 | 18,5 | 9,7   | 132,0                       | 2014 | 3,6  | 2018 |
| May   | 22,1                         | 11   | 16,6 | 11,1  | 165,0                       | 2007 | 2,7  | 1996 |
| Jun   | 20,6                         | 8,3  | 14,5 | 12,3  | 183,0                       | 2012 | 2,0  | 2000 |
| Jul   | 20,2                         | 7,9  | 14,1 | 12,3  | 202,0                       | 2012 | 1,6  | 2005 |
| Aug   | 20                           | 9,1  | 14,6 | 10,9  | 247,5                       | 2006 | 3,0  | 2019 |
| Sep   | 20,4                         | 10,7 | 15,6 | 9,7   | 110,3                       | 1993 | 11,0 | 2007 |
| Oct   | 21,4                         | 12,8 | 17,1 | 8,6   | 204,2                       | 2012 | 9,2  | 2002 |
| Nov   | 22,7                         | 14,2 | 18,5 | 8,5   | 238,1                       | 1996 | 6,9  | 2003 |
| Dec   | 24,4                         | 16   | 20,2 | 8,4   | 182,0                       | 1994 | 5,4  | 2000 |
| YR    | 22,6                         | 12,9 | 17,8 | 9,7   | 247,5                       | 2006 | 1,6  | 2005 |

### Surface water

The closest surface water is located approximately 1 kilometre east and south of the DC and is a tributary of the Swartkops River system. This is a highly transformed system although the DC is not anticipated to impact on the surface water.

### Ecology

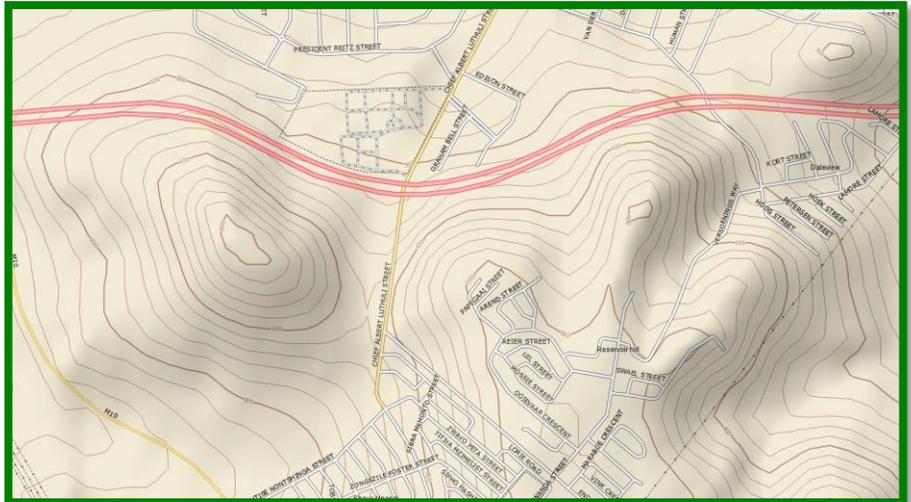
The site is located on a cleared plot with urban development to the north and south of the DC. On the property's eastern and western borders, the site is cleared for approximately 100 meters and dense Sundays Valley thicket is present beyond this. To the north site has a cleared area between the R75 national road and the site boundary. On the eastern side, a similar cleared area is present following which dense Sundays valley

thicket is present at a distance of 100 – 150 meters. No ecological features are present on the property where the DC is operating.

According to the NMBM bioregional plan, the site is not within any critical biodiversity areas and the Sundays Vallye thicket is classified as least threatened (Mucina and Rutherford 2006)

### Topography

The site is characterised by gentle rolling hills surrounding the crematorium to the south east and south west. To the north the site drops in elevation towards the Swartkops River flood plain.



*Figure 5: Topography of the site (Garmin Explore, 2022).*

### Air quality

According to the NMBM Air Quality Management Plan (NMBM 2010) historically, very little data or information on the quality of the ambient air in the municipal area is available. Due to the industrial nature of the area, the Department of Environmental Affairs and Tourism (DEAT) rates the air quality in the area as “poor” which is a category for areas observing large numbers of exceedances.

There is also a limited amount of data available about air pollutant emissions in general, specifically from automotive and residential sources. While huge gaps exist in industrial emission data, current information shows that significant quantities of particulate matter, sulphur dioxide, nitrogen oxides, carbon monoxide and greenhouse gases (mainly carbon dioxide) are emitted by industries on an annual basis.



*Figure 6: Sensitive receptor areas. Receptor 1 (orange) is the low income Kyamnandi area and Receptor 2 (pink) is the Despatch southern suburbs.*

An introductory emission inventory has shown that some areas exist where the concentration of air pollutants may be higher than expected, but no interpretation of potential risks can be determined due to a lack of credible air quality information.

There is, therefore, a dire need to obtain relevant and representative air quality data in some locations within the municipal district before any remedial steps can be taken.

### **Social and Economic Environment**

The DC is located between neighborhoods of varying income levels but does not serve these neighborhoods directly. The employment opportunities are limited however the DC will serve the community in receiving next of kin intended for cremation.

To the North of the DC, the more affluent suburbs of Bothasrus and the Despatch town center is located. To the south of the DC are large underdeveloped portions of land with the Kyamnandi residential area also located directly south of the facility.

## 7. Public Process

### Process Followed

1. The public participation process followed were developed with the intent of informing direct neighbours and interested parties from the surroundings of the process underway.
2. Posters, notifying passers-by of the proposed amendment, were placed at two locations as follow:
  - a. A poster was placed at the entrance to the crematorium visible to vehicle and pedestrian traffic travelling to and from the Khayamnandi residential area along Voortrekker road (**Figure 7**).
  - b. A poster was attached to the cemetery fence at the entrance gate visible to passers-by travelling along Voortrekker road and the service road linking Voortrekker road to Pres Reitz street as well as visitors to the cemetery in Bothasrus.
3. Newspaper advertisements were placed in two Newspapers as follow:
  - a. An initial advertisement was placed in the legal section of The Eastern Cape Herald on 16 September 2022.
  - b. A second Advertisement was placed in The Eastern Cape Herald on 29 September 2022.
  - c. An advertisement was placed in the Port Elizabeth Express on 29 September 2022.
4. Comments received were recorded and collated.
  - a. Comments received telephonically were recorded in the IAP database.
  - b. The ward councillor for ward 52 contacted and complaints and comments were recorded as well as names of complainants.
  - c. IAPs contacting PDES requested if the newspaper advertisements can be shared by them on the Despatch Facebook page and this done shortly after the newspaper advertisements were placed.



**Figure 7: Site posters placed in Despatch.**

### APPLICATION FOR THE REVISION OF ATMOSPHERIC EMISSION LICENSE

Crematorium Authority East Cape operates a crematorium in Despatch which cremates human and companion animal remains. An atmospheric emission license (AEL) was issued to Crematorium Authority East Cape on 1 February 2021.

Notice is herewith given in terms of Article 44 of the National Environmental Management: Air Quality Act (Act 39 of 2004) that an application will be submitted to Nelson Mandela Bay Municipality for the revision of Crematorium Authority East Cape's Atmospheric Emission License.

The following activities listed in terms of the act are relevant to Crematorium Authority East Cape: **Category 8, Sub-category 8.2: Crematoria and Veterinary Waste Incineration: Cremation of human remains, companion animals (Pets) and the incineration of veterinary waste**

Persons wishing to comment on this application are requested to contact:

**Name: Evert Jacobs**  
**Email: admin@proportiodivina.co.za**  
**Contact No: 087 702 5996**

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**Name: Evert Jacobs**  
**Email: admin@proportiodivina.co.za**  
**Contact No: 087 702 5996**

*Figure 8: Advertisements placed in The Eastern Cape Herald and Port Elizabeth Express Newspapers on 29 September 2022.*

## Comments Received

**Table 3** lists a summary of the comments that were received during the 30 day public comment period. To protect private information of commenters, names and personal identification details have not been included in the report but has been recorded during the course of the study.

**Table 3: Comments Received**

| Theme                         | Comment  |
|-------------------------------|--|
| Location of the Crematorium   | The location of the crematorium does not conform to spatial planning requirements in that it is situated within 500 meters of residential properties.          |
| Visual emissions              | Smoke observed from the crematorium stack is perceived to contribute to pollution in the immediate surroundings  |
| Odours                        | Odours are a nuisance and result from poor management of the crematorium.  |
| Health risk                   | There is a general perceived health risk from the visual emissions from the crematorium.   |
| Delays in cremations (social) | The fact that diseased individuals cannot be cremated as a result of the inability of the crematorium to operate is causing emotional distress in next of kin. |
| Delays in cremations (health) | Delays in cremations are delaying cremations resulting in human remains accumulating posing a possible health risk.  |

## 8. Anticipated Environmental Impacts

The anticipated impacts of the DC have been evaluated in relation to the affected environment described in section 6. Although a full impact assessment is not complete, impacts identified are evaluated in terms of their geographical extent, the intensity and duration of the impact in relation to the probability of the impact occurring.

No biodiversity impacts are anticipated as no clearing is required and the facility is an existing structure. Waste generated is minimal and the small percentage of remaining residue from the furnace is returned to the next of kin with no impacts comparable to burials. The waste generated is largely exhumed through the stack and hence air quality impacts is expected to occur.

### Air Quality Impacts

The air quality impacts were determined by Lethabo Air Quality Specialists (LAQS). The Air Quality impacts were assessed against the Ambient Air Quality Standards as published by the Department of Environmental Affairs (DEA) in Government Notice No. 1210 on 24 March 2009 (GN1210) as shown in **Table 4**.

**Table 4: Guideline limits as per GN1210.**

| Particulate Matter (PM <sub>10</sub> )                |  |                |
|---|--|----------------|
| Annual average:                                       | 40 µg/m <sup>3</sup>                               | no exceedances |
| Maximum daily concentration:                          | 75 µg/m <sup>3</sup>                               | 4 exceedances  |
| Carbon Monoxide (CO)                                  |  |                |
| 8-hour running average                                | 10 mg/m <sup>3</sup> (10 000 µg/m <sup>3</sup> )   | 11 exceedances |
| 1-hour maximum  | 30 mg/m <sup>3</sup> , (30 000 µg/m <sup>3</sup> ) | 88 exceedances |
| Nitrogen Oxides (NO <sub>x</sub> as NO <sub>2</sub> ) |  |                |
| Annual average limit                                  | 40 µg/m <sup>3</sup>                               | no exceedances |
| 1-hour maximum  | 200 µg/m <sup>3</sup>                              | 88 exceedances |

### Maximum Concentrations

As the dispersion model does not differentiate between the various pollutants, and the mathematical model used to calculate the dispersion of pollutants into atmosphere does not rely on the type of pollutant, the points of maximum annual average and 99- percentile concentrations are identical for all pollutants. In DC's case,

the point of maximum annual average concentration is estimated to be located approximately 40 metres east of the centre of DC's property. The point of maximum 99-percentile concentration is estimated to be located approximately 63 metres east of south-east of the centre of DC's property.

### Particulate Matter

Particulate Matter is discussed as PM<sub>10</sub> which denotes the respirable component of the emissions (i.e. particulate matter with a size fraction of less than 10 micrometers). The highest annual average concentration of PM<sub>10</sub> is estimated to be less than current values that results from average climate conditions and existing infrastructure (generated by windblown dust and other industries, fires etc.) This ambient value of 14 µg/m<sup>3</sup> is well below the current ambient air quality level.

The maximum 99-percentile daily concentration was shown to be 155 µg/m<sup>3</sup>, i.e. well in excess of current ambient air quality level.

For the sensitive receptor areas (refer to **Figure 6**) the findings were as follow (**Figure 9**):

- Φ **South-eastern residential area (Receptor 1):** The highest annual average concentrations of PM<sub>10</sub> at the nearest residential area is well below the guideline levels (estimated to be 0.062 µg/m<sup>3</sup> and the corresponding maximum 99-percentile daily concentration was shown to be 1.7 µg/m<sup>3</sup>).
- Φ **Northern residential area (Receptor 2):** The highest annual average concentrations of PM<sub>10</sub> at the nearest residential area is lower than for Receptor 1 and thus well below the guideline limits (estimated to be 0.3 µg/m<sup>3</sup> and the corresponding maximum 99-percentile daily concentration was shown to be 1.6 µg/m<sup>3</sup>.)
- Φ Therefore neither of these receptors is expected to experience exceedances of the maximum concentrations as determined by the official ambient air quality standards as published in GN1210.



**Figure 9: PM<sub>10</sub> Concentrations at 40µg/m<sup>3</sup> (left) and 75 µg/m<sup>3</sup> (right).**

### Carbon Monoxide Emissions (CO)

Carbon monoxide (CO) will be emitted as a result of the burning process and the fuel used. The highest 8-hourly average concentration of CO is estimated to be less than  $85.1 \mu\text{g}/\text{m}^3$  and the maximum 99-percentile daily concentration was shown to be  $1\,360 \mu\text{g}/\text{m}^3$ . Both of these maxima are well below the current ambient air quality level.

For the sensitive receptor areas (refer to **Figure 6**) the findings were as follow (**Figure 10**):

- Φ South-eastern residential area (Receptor 1): The highest annual average concentrations of CO at the nearest residential area is estimated to be  $0.4 \mu\text{g}/\text{m}^3$  and the corresponding maximum 99-percentile daily concentration was shown to be  $14.0 \mu\text{g}/\text{m}^3$ .
- Φ Northern residential area (Receptor 2): The highest annual average concentrations of CO at the nearest residential area is estimated to be  $1.1 \mu\text{g}/\text{m}^3$  and the corresponding maximum 99-percentile daily concentration was shown to be  $10.0 \mu\text{g}/\text{m}^3$ .
- Φ None of these maxima for CO exceed the official ambient air quality standards as published in GN1210 and therefore fall well within the guideline limits.



**Figure 10: Carbon monoxide concentrations at 8-hour maximum levels (left) and 99th percentile (right)**

### NITROGEN DIOXIDE

The highest annual average concentration of Nitrogen Dioxide ( $\text{NO}_2$ ) is estimated to be less than  $7.8 \mu\text{g}/\text{m}^3$  and the maximum 99-percentile daily concentration was shown to be  $125 \mu\text{g}/\text{m}^3$ . Both of these maxima are below the current ambient air quality level.

For the sensitive receptor areas (refer to **Figure 6**) the findings were as follow:

- Φ **South-eastern residential area (Receptor 1):** The highest annual average concentrations of NO<sub>2</sub> at the nearest residential area is estimated to be 0.03 µg/m<sup>3</sup> and the corresponding maximum 99-percentile daily concentration was shown to be 1.1 µg/m<sup>3</sup>.
- Φ **Northern residential area (Receptor 2):** The highest annual average concentrations of NO<sub>2</sub> at the nearest residential area is estimated to be 0.15 µg/m<sup>3</sup> and the corresponding maximum 99-percentile daily concentration was shown to be 1.0 µg/m<sup>3</sup>.
- Φ None of these maxima exceed the official ambient air quality standards as published in GN1210 and fall well within the guideline limits.

Φ



**Figure 11: Annual average concentration for Nitrogen Oxide (left) and 99th percentile average hourly concentrations (right).**

### Mercury Emissions

Mercury emissions are observed in crematoria where human remains are cremated, and mercury amalgam dental fillings are present in the population. During the incineration process, mercury is vaporized and emitted through the stack. LAQS measured mercury concentrations during the operations to determine the current rates and then extrapolated the rates based on the emissions modelling performed.

The mercury depositions in nearby areas would be within the particulate matter and the concentration of mercury in the PM<sub>10</sub> was therefore used as a proxy to determine the rates of deposition expected.

The highest daily average concentration of PM<sub>10</sub> is estimated to be 28.1 ng/m<sup>3</sup>. The highest daily concentration of Hg in the south-eastern and northern residential areas are estimated to be 0.1 and 0.4 ng/m<sup>3</sup> respectively. The United States of America Environmental Protection Agency's National Center for Environmental Assessment operates the Integrated Risk Information System (IRIS). The IRIS system defines reference dosages (RfD) and reference concentrations (RfC) for various substances. The inhalation Reference Concentration (RfC) is analogous to the oral RfD and is likewise based on the assumption that

thresholds exist for certain toxic effects such as cellular necrosis. The inhalation RfC considers toxic effects for both the respiratory system (portal-of-entry) and for effects peripheral to the respiratory system (extra-respiratory effects). It is expressed in units of  $\text{mg}/\text{m}^3$ . In general, the RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure of the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Inhalation RfCs were derived according to the Interim Methods for Development of Inhalation Reference Doses (EPA/600/8-88/066F August 1989) and subsequently, according to Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry (EPA/600/8-90/066F October 1994).

The RfC for mercury, based on daily inhalation exposure, is stated as  $3 \times 10^{-4} \text{ mg}/\text{m}^3$  which is equivalent to

$0.3 \mu\text{g}/\text{m}^3$  or  $300 \text{ ng}/\text{m}^3$ . IRIS defined the following basis for the RfC value:

*“Based on inadequate human and animal data. Epidemiologic studies failed to show a correlation between exposure to elemental mercury vapor and carcinogenicity; the findings in these studies were confounded by possible or known concurrent exposures to other chemicals, including human carcinogens, as well as lifestyle factors (e.g., smoking). Findings from genotoxicity tests are severely limited and provide equivocal evidence that mercury adversely affects the number or structure of chromosomes in human somatic cells.”*



- Φ Pollutants can only disperse directly downwind at any given time. Pollutants cannot disperse in any other directions than that in which the wind is blowing. The distance of any dispersion is a function of the wind speed. The higher the wind speed, the further pollutants will be dispersed.
- Φ The ground-level concentration is an exponential function of time and air turbulence. The longer the time and/or the higher the turbulence, the greater the degree of dispersion of pollutants into the atmosphere. It implies that during periods of low wind speed, the air will not be as turbulent as at high wind speeds and ground-level concentrations will be higher than at high wind speeds, but the point of maximum impact will be closer to the source. During high wind speeds the air is more turbulent, dispersion occurs over a greater distance, but the groundlevel concentrations will be lower.
- Φ Air temperature plays a role in the stability of the air. Generally, the lower the temperature, the more stable the air and dispersion will be low. Together with low wind speeds, as is typical during winter mornings, this implies that the point of maximum impact can be expected to occur closer to the source and at higher concentrations. During periods of higher air temperature, the air will be unstable, implying a greater degree of dispersion with maxima occurring further from the source and at lower concentrations.
- Φ Aermid is a Gaussian plume dispersion model that assumes a constant wind speed and direction for any given hour and these will change from hour to hour. Therefore, pollutants emitted from a source will disperse downwind from the source in a straight line for a period of one hour. At a wind speed of 1 m/s, this implies that the pollutants will disperse in a straight line over a distance of 3.6 km, at a wind speed of 2 m/s the distance will be 7.2 km, etc.
- Φ The annual average concentration is the average that can be expected over a 12- month period. Hourly and daily variations will occur but will all contribute to an annual average concentration.
- Φ The maximum 99-percentile hourly concentration is the concentration below which all other hourly concentrations will be for 99% of the time. Alternatively, for 1% of the time the average hourly concentrations will exceed this level. Therefore, at any given point of the map, pollutants emitted from any source will not impact on that point continuously, 24 hours per day and 7 seven days per week. Emissions will only impact on that point if the wind blows from the source towards that point.

The graphical results of odorous dispersion are shown in the following time scales:

- Φ Annual average
- Φ 99-percentile
- Φ 200 worst hours
- Φ 100 worst hours
- Φ 50 worst hours

It will be noticed that the situation worsens as the time period decreases in duration. In calculating these concentrations, the dispersion model gathers the worst number of incidents, based on prevailing weather conditions, in each of sixty 6-degree sectors from north, through east, south, west and back to north.

The isopleths shown are, therefore, cumulative representations of this collected data, but does not mean that



**Figure 13: Dispersion plume indicating the 100 worst hours per year in terms of nuisance odours.**

those concentrations will prevail throughout the year. It only shows what the expected concentrations could have been during the selected number of hours during a year, e.g. 200 hours, 100 hours, etc.

The model does not define when these incidents actually may have occurred as the results are derived from 7 years' hourly weather parameters. At any given point of the map, the modelled hourly concentrations only occurred when weather parameters during a given hour were conducive to the dispersion of pollutants to the degree show graphically.

In short, if the graphical results cover a specific point of the map (wherever that point may be), it implies that odours may only be detected at that point when the wind was blowing from the source towards that point and the weather conditions resulted in the degree of dispersion to the degree where odours may be detected.

## 9. Environmental Management Plan

### Introduction

This Environmental Management Plan has been compiled for the upgrade of the DC in support of the amended AEL. Construction activities will be minimal and will require some minor brickworks with replacement of the ovens. Construction impacts are therefore not considered to be of significance although some items below will address construction management as well.

### References

The following references have been consulted in compiling this Environmental Management Plan:

- Φ DEDEAT, 2021 – Directive in terms of section 30A of the National Environmental Management Act, 1998 (act 107 of 1998), “NEMA” in response to the request for the expansion of the existing Crematorium Authority East Cape Facilities (t/a Despatch Crematorium) in Nelson Mandela Bay Municipality, Despatch.
- Φ Albertyn, C.H., 2022 – Air quality impact assessment prepared for the Crematorium Authority East Cape t/a Despatch Crematorium, Despatch, Lethabo Air Quality Consultants.

### Purpose of the EMP

The purpose of this Environmental Management Plan is to provide measures for environmental management on site in terms of the following:

- Φ Describe potential mitigation measures and management actions to reduce environmental impacts.
- Φ Provide guidance on the monitoring during implementation and operation.

### Objective of the EMP

The overall objective of this Environmental Management Plan is to provide pragmatic measures to manage impacts that may arise from the expansion of the DC.

### Scope of the EMP

The scope of this EMP is only applicable to the construction phase and operations and does not cover decommissioning of the facility. Although construction will be required to install the new ovens, the scale of the construction is considered to be minimal.

## **Roles and Responsibilities**

### **Operator / Owner**

Due to the size and nature of the expansion, which is limited to furnace replacement, the responsibility of implementation of this EMP fall on the DC Managing Director. In the event that the Managing Director delegates his responsibilities to subordinates or contractors, the Managing Director will remain responsible for overall compliance to the measures contained herein. The managing Director must ensure that an environmental auditor is appointed, at the cost of the DC to measure compliance to the authorisations and permits as stipulated in the Section 30A directive issued.

### **Environmental Auditor**

The environmental auditor will be responsible for measuring the compliance to this EMP and the Section 30A directive as well as the amended AEL issued.

## **Environmental Awareness and Induction**

The DC shall ensure that all employees are educated in terms of the requirements of this EMP. The DC must also conduct regular

## **Auditing and control**

The DC must appoint an independent environmental auditor to conduct compliance audit on the facility against the AEL and Section 30A approval

## **Management Measures**

The management measures have been determined to reduce the potential impacts resulting from the Despatch Crematorium and these are summarised in tabulated format below for ease of reference.

| Activity / Potential Impact   | Mitigation   | Responsible Party | Monitoring Frequency  |
|---|--|-------------------|---|
| <b>General</b>  |  |                   |   |
| <b>Auditing</b><br>Appointment of Environmental Control Officer   | An ECO must be appointed before the upgrade of the facility commences  | Managing Director | 30 Days prior to commencement of construction                       |
| <b>Awareness Training</b><br>Operators and employees who are not versed in the environmental requirements may cause poor operating conditions | The DC shall ensure that all employees are educated in terms of the requirements of this EMP. The DC must also conduct regular | Managing Director | Monthly Addressed to ensure all parties know their responsibilities |
| <b>Permit / Licenses</b><br>Atmospheric Emissions License   | The DC must be in possession of an AEL   | ECO               | 1 Week before start of commissioning                                |
|   | Submit a copy of the AEL to the local DEDEAT office  | ECO               | 1 Week before start of commissioning                                |
|   | Conduct a post construction audit 3 months after commissioning of the facilities   | ECO               | 3 Months after commissioning  |
| <b>Complaints Register</b><br>DC to maintain a register documenting complaints.   | A complaints register will be kept on site and will include complaints and responses and actions to address complaints.        | Managing Director | Ongoing   |
| <b>Construction Phase</b>   |  |                   |   |
| <b>Waste Management</b><br>Management of construction waste generated during the commissioning  | All construction waste must be disposed of at a registered landfill  | Managing Director | Monthly   |
|   | Verify monthly that construction waste has been removed to a registered facility   | ECO               | Monthly   |
| Cement mixing   | Cement mixing must be done in a controlled manner and all cement water contained on site.                                      | Managing Director | Monthly   |

|   |   |                   |   |
|---|---|-------------------|---|
| <b>Noise</b><br>Noise during construction                                     | Construction hours will be limited to the hours of 7am to 7 pm.   | Managing Director |   |
| <b>Operational Phase</b>  |   |                   |   |
| <b>Waste Management</b><br>Operational Waste Generated                        | All waste generated through the cremation process and general operating waste must be disposed of at a registered landfill site.                      | Managing Director | Monthly                                   |
| <b>Gas Installation</b><br>Installation and operating of fuel infrastructure. | All fuel infrastructure (powering the incinerator units) will be installed by a registered professional and certificates of installation be retained. | Managing Director | 1 Week prior to commissioning.            |
| <b>Safety Procedures</b><br>Training and ensuring safety of operators         | The DC shall implement a health and safety system that includes regular training and awareness.   | Managing Director | Monthly                                   |
|   | All employees will be issued with the required health and safety PPE for their respective roles.  | Managing Director | Monthly                                   |
| <b>Air Quality</b><br>Regular Inspection of units                             | DC will inspect the units monthly to ensure they are operating at the installation specifications.  | Managing Director | Monthly                                   |
| Visual observations of stack emissions  | The DC staff will conduct visual observation of the stack emissions regularly.  | Managing Director | Daily                                     |
|   | All retorts and equipment will be regularly serviced  | Managing Director | As determined by equipment specifications |
| <b>Monitoring of Emissions</b><br><b>Annual stack emissions monitoring</b>    | Annual monitoring of stack emissions to be reported to the authorities.   | Managing Director | Annually                                  |

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## 10. Conclusions and Recommendations

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The DC is performing a social service in the region by receiving human and animal remains and allowing closure to be obtained by grieving families. The cremation process also provides a positive impact in that the use of cemetery space is avoided and the cremation process is considered to be a better environmental option compared to burials in that soil and water contamination is avoided.

Inefficient operations however do result in nuisance air quality impacts that require continued maintenance and adherence to the operating procedures. The following recommendations are made:

- The DC should implement the EMP to enhance management efficiency.
- The DC should implement the recommendations of the air quality assessment.
- The DC should conduct annual audits and monitoring to determine the effectiveness of the operations in terms of the performance against the EMP.
- The DC should implement a complaint system to allow complaints to be handled and addressed timeously when neighbouring communities raise concerns.

## 11. References

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1. DEDEAT, 2021 – Directive in terms of section 30A of the National Environmental Management Act, 1998 (act 107 of 1998), “NEMA” in response to the request for the expansion of the existing Crematorium Authority East Cape Facilities (t/a Despatch Crematorium) in Nelson Mandela Bay Municipality, Despatch.
2. Stuart *et al.* (SRK Consulting) – 2014, Nelson Mandela Bay Municipality Bioregional Plan
3. Albertyn, C.H. – 2022, Air Quality Impact Assessment prepared for the Crematorium Authority Eastern Cape t/a Despatch Crematorium, Despatch.
4. SA Weather Service Data (obtained by direct purchase)