Attachment 5.8

Appendix 8.12 Odour Impact Assessment

Appendix 8.12

Odour Impact Assessment

REPORT

Appendix 8.12 - Odour Impact Assessment

Indaver Ireland, Ringaskiddy, County Cork

CLIENT	DOCUMENT REFERENCE	DATE
Indaver Ireland	267501.0724AR02	28 August 2026

AWN Consulting Ltd, The Tecpro Building, IDA Business & Technology Park, Clonshaugh, Dublin 17, D17 XD90

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1. INTRODUCTION

The current modelling assessment has been undertaken to assess the odour impact from the facility which will involve the acceptance and treatment of primarily municipal waste. The air will be extracted directly from the waste storage area for use in the process and will pass through the furnace and flue gas cleaning equipment prior to release to atmosphere via the stack.

Air dispersion modelling was carried out using the United States Environmental Protection Agency's regulatory model AERMOD (Version 24142). The aim of the study was to assess the contribution of odour emissions from the proposed facility, located in Ringaskiddy, County Cork, to off-site levels of odour. The dispersion model study consisted of the following components:

- Review of emission data and other relevant information needed for the modelling study;
- Summary of background odour levels in the region;
- Dispersion modelling of odour under the maximum emission scenario;
- Presentation of predicted ground level concentrations of odour;
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient odour guidance levels.

The study has been carried out at maximum odour concentrations and volume flow rates for 24 hours per day 365 days per annum.

Information supporting the conclusions has been detailed in the following sections. The assessment methodology and study inputs are presented in Section 2. The dispersion modelling results and assessment summaries are presented in Section 3.

The control of potential fugitive odour emissions from the facility during normal operations and during planned shutdowns is outlined in the draft Odour Management Plan for the facility included in Attachment 1.

2. ASSESSMENT METHODOLOGY

Emissions from the proposed facility have been modelled using the AERMOD dispersion model (Version 24142) which has been developed by the U.S. Environmental Protection Agency (USEPA)[1] and following guidance issued by the EPA[2,3]. An overview of the AERMOD dispersion model is outlined in **Appendix 8.2** of **Chapter 8** of the EIS.

The air dispersion modelling input data consisted of information on the physical environment (terrain features), design details from all emission points on-site and five full years of appropriate meteorological data. Using this input data the model predicted ambient ground level concentrations beyond the site boundary for each hour of the modelled meteorological years. The model post-processed the data to identify the location and maximum of the worst-case ground level concentration. The worst-case ground level concentration was then compared with the relevant ambient air quality standard / odour guidance value to assess the significance of the releases from the site. Throughout this study a worst-case approach was taken. This will most likely lead to an over-estimation of the levels that will arise in practice.

2.1 Odour Guidance

Odours are sensations resulting from the reception of a stimulus by the olfactory sensory system, which consists of two separate subsystems: the olfactory epithelium and the trigeminal nerve. The olfactory epithelium, located in the nose, is capable of detecting and discriminating between many thousands of different odours and can detect some of them in concentrations lower than those detectable by currently available analytical instruments[4]. The function of the trigeminal nerve is to trigger a reflex action that produces a painful sensation. It can initiate protective reflexes such as sneezing to interrupt inhalation. The olfactory system is extremely complex and peoples' responses to odours can be variable. This variability is the result of differences in the ability to detect odour; subjective acceptance or rejection of an odour due to past experience; circumstances under which the odour is detected; and the age, health and attitudes of the human receptor.

2.1.1 Odour Intensity And Threshold

Odour intensity is a measure of the strength of the odour sensation and is related to the odour concentration. The odour threshold refers to the minimum concentration of an odorant that produces an olfactory response or sensation. This threshold is normally determined by an odour panel consisting of a specified number of people, and the numerical result is typically expressed as occurring when 50% of the panel correctly detect the odour. This odour threshold is given a value of one odour unit and is expressed as 1 OU_E/m^3. The odour threshold is not a precisely determined value but depends on the sensitivity of the odour panellists and the method of presenting the odour stimulus to the panellists. An odour detection threshold relates to the minimum odorant concentration required to perceive the existence of the stimulus, whereas an odour recognition threshold relates to the minimum odorant concentration required to recognise the character of the stimulus. Typically, the recognition threshold exceeds the detection threshold by a factor of 2 to 10[4].

2.1.2 Odour Character

The character of an odour distinguishes it from another odour of equal intensity. Odours are characterised on the basis of odour descriptor terms (e.g. putrid, fishy, fruity etc.). Odour character is evaluated by comparison with other odours, either directly or through the use of descriptor words.

2.1.3 Hedonic Tone

The hedonic tone of an odour relates to its pleasantness or unpleasantness. When an odour is evaluated in the laboratory for its hedonic tone in the neutral context of an olfactometric presentation, the panellist

is exposed to a stimulus of controlled intensity and duration. The degree of pleasantness or unpleasantness is determined by each panellist's experience and emotional associations. The responses among panellists may vary depending on odour character; an odour pleasant to many may be declared highly unpleasant by some.

2.1.4 Adaptation

Adaptation, or Olfactory Fatigue, is a phenomenon that occurs when people with a normal sense of smell experience a decrease in perceived intensity of an odour if the stimulus is received continually. Adaptation to a specific odorant typically does not interfere with the ability of a person to detect other odours. Another phenomenon known as habituation or occupational anosmia occurs when a worker in an industrial situation experiences a long-term exposure and develops a higher threshold tolerance to the odour.

2.1.5 Odour Standards & Guidelines

The exposure of the population to a particular odour consists of two factors; the concentration and the length of time that the population may perceive the odour. By definition, 1 OU_E/m^3 is the detection threshold of 50% of a qualified panel of observers working in an odour-free laboratory using odour-free air as the zero reference (the selection criteria result in the qualified panel being more sensitive to a particular odorant than the general population). The recognition threshold is generally about five times this concentration (5 OU_E/m^3) and the concentration at which the odour may be considered a nuisance is between 5 and 10 OU_E/m^3 based on hydrogen sulphide (H_2S)[5]. Clarkson and Misslebrook[7] proposed that a "faint odour" was an acceptable threshold criteria for the assessment of odour as a nuisance. Historically, it has been generally accepted that odour concentrations of between 5 and 10 OU_E/m^3 would give rise to a faint odour only, and that only a distinct odour (concentration of >10 OU_E/m^3) could give rise to a nuisance[7]. However, this criteria has generally been based on waste water treatment plants where the source of the odour is generally hydrogen sulphide. In 1990, a survey of the populations surrounding 200 industrial odour sources in the Netherlands showed that there were no justifiable complaints when 98%ile compliance with an odour exposure standard of a "faint odour" (5 - 10 OU_E/m^3) was achieved[8].

The odour which will be generated within the proposed facility will primarily be that of raw municipal waste. However, as the material intake area and bunker (storage) area will be under negative pressure, untreated odours are unlikely to be significant.

Guidance from the UK[11], and adapted for Irish EPA use, recommends that odour standards should vary from 1.5 – 6.0 OU_E/m^3 as a 98th%ile of one hour averaging periods at the worst-case sensitive receptor based on the offensiveness of the odour and with adjustments for local factors such as population density. A summary of the indicative criterion is given below in Table 2-1 (taken from EPA Guidance document AG9[3]):

Table 2-1 - Indicative Odour Standards Based On Offensiveness Of Odour And Adapted for Irish EPA[3]

Industrial Sectors	Relative Offensiveness of Odour	Indicative Criterion Note 1
• Processes involving decaying animal or fish remains. • Processes involving septic effluent or sludge • Waste sites including landfills, waste transfer stations and non-green waste composting facilities.	Most Offensive	1.5 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor
• Intensive Livestock Rearing • Fat Frying / Meat Cooking (Food Processing) • Animal Feed • Sugar Beet Processing • Well aerated green waste composting Most odours from regulated processes fall into this category i.e. any industrial sector which does not obviously fall within the "most offensive" or "less offensive" categories.	Moderately Offensive	3.0 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor
• Brewery / Grain / Oats Production • Coffee Roasting • Bakery • Confectionery	Less Offensive	6.0 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor

Note 1 Professional judgement should be applied in the determination of where the worst-case sensitive receptor is located.

Based on the guidance above, a worst-case odour threshold of 1.5 OU_E/m^3 as a 98th%ile of hourly mean values has been selected for identifying the potential for odour nuisance for the facility. The selection of the "most offensive" category is conservative due to the fact that all waste material odours are extracted under negative pressure from the bunker and thus no untreated odours are emitted directly from the facility.

2.1.6 Sensitivity Of Odour Receptors

When assessing a range of sensitive receptors, of varying sensitivity, the appropriate odour criterium which reflects the sensitivity of the receptor should be selected. The Institute of Air Quality Management (IAQM) has published "*Guidance On The Assessment Of Odour For Planning V1.1*" (IAQM, 2018)[12]. Receptor sensitivity to odour is characterised into the following categories:

- High sensitivity receptor

- Users can expect a high level of amenity,
- People would be expected to be present for extended periods,
- Examples are residential dwellings, hospitals, schools, tourist areas.

- Medium sensitivity receptor
  - Users can expect a reasonable level of amenity,
  - People would not be expected to be present for extended periods,
  - Examples are workplace, commercial / retail, recreation areas.
- Low sensitivity receptor
  - The enjoyment of amenity would not reasonably be expected,
  - Transient exposure where people would only be expected to present for limited periods,
  - Examples are industrial use, hospitals, farms, footpaths and roads.

The guidance also outlines a general relationship between the level of odour exposure (impact) experienced by a receptor of a given sensitivity and the magnitude of adverse effect that is likely to result as shown in Table 2-2.

Table 2-2 - IAQM Suggested Descriptors For Magnitudes Of Odour Effects

		Receptor Sensitivity		
Odour Exposure (Impact)		**Low**	**Medium**	**High**
	Very Large	Moderate adverse	Substantial adverse	Substantial adverse
	Large	Slight adverse	Moderate adverse	Substantial adverse
	Medium	Negligible	Slight adverse	Moderate adverse
	Small	Negligible	Negligible	Slight adverse
	Negligible	Negligible	Negligible	Negligible

The guidance notes that where the overall effect is greater than "slight adverse" the effect is likely to be considered significant.

The IAQM recommends that an appropriate odour criterion could lie somewhere in the range of 1 to 10 OU_E/m^3 as a 98^{th}%ile of hourly mean odour concentrations. As shown in Table 2-3, the odour criterion has been broken down into the three receptor types (low, medium and high) which are described above.

Table 2-3 - IAQM Proposed Odour Effect Descriptors – Moderately Offensive Odours

Odour Exposure Level C_{98}, OU_E/m^3	Receptor Sensitivity		
	Low	Medium	High
>10	Moderate	Substantial	Substantial
5 – 10	Slight	Moderate	Moderate
3 – 5	Negligible	Slight	Moderate
1.5 – 3	Negligible	Negligible	Slight
0.5 – 1.5	Negligible	Negligible	Negligible
< 0.5	Negligible	Negligible	Negligible

2.2 Odour Emission Rates From WTE Facilities

Odour emission data is available from the Carranstown WTE. The monitoring results are outlined in Table 2-4. This odour emission rate has been used to estimate the odour emission rate from the Ringaskiddy WTE facility.

Table 2-4 – Carranstown WTE – Odour Emission Rate

RESULTS FROM ODOUR SAMPLES

	Concentration				Mass Emission			
Parameter	Units	Result*	LOWER CI	UPPER CI	Units	Result	LO CI	HI CI
Odour - A1-1 Main Incinerator Stack [2]	ouE/m³	3847	2435	6078	ouE/s	189321.5	119841	299128

Where CI stands for Confidence Interval (or Uncertainty associated with the result)

[2] Reference Conditions (REF) are: 293K, 101.3kPa, without correction for water vapour content

* The reported result is the geometric mean of the individual results.

2.3 Air Dispersion Modelling Methodology

The United States Environmental Protection Agency (USEPA) approved AERMOD dispersion model has been used to predict the ground level concentrations (GLC) of compounds emitted from the principal emission sources on-site.

The modelling incorporated the following features:

- A receptor grid was created at which concentrations would be modelled. Receptors were mapped with sufficient resolution to ensure all localised "hot-spots" were identified without adding unduly to processing time the model has a three tier grid of increasing density as it approaches the facility. In addition, nearby specific receptors are explicitly modelled in addition to boundary receptors spaced every 20 metres. In relation to the tiered grid, the outer grid is 20 km x 20 km spaced every 500m, the middle grid is 8 km x 8 km spaced every 100 m whilst the inner grid is 2.5 km x 2.5 km spaced every 50 m. Overall, for each run, there is 18,429 individual receptor points recording the ambient air quality concentration.

- Hourly-sequenced meteorological information has been used in the model. The worst-case years of meteorological data over a five-year period (Cork Airport, 2021 – 2025 and onsite data from 2007) were selected for use in the model.
- The source and emission data, including emission rates and release height have been incorporated into the model.
- Detailed terrain has been mapped into the model using SRTM data with 30m resolution. The site is located in complex terrain. All terrain features have been mapped in detail into the model using the terrain pre-processor AERMAP.

2.4 Meteorological Data

The selection of the appropriate meteorological data has followed the guidance issued by the USEPA[1]. A primary requirement is that the data used should have a data capture of greater than 90% for all parameters. Cork Airport meteorological station, which is located approximately 9km west of the site, collects data in the correct format and has a data collection of greater than 90%.

Long-term hourly observations at Cork Airport meteorological station provide an indication of the prevailing wind conditions for the region. Results indicate that the prevailing wind direction is from south to westerly in direction. The mean wind speed is approximately 4.6 m/s over the period 2021 - 2025.

2.5 Process Emissions

The information used in the dispersion model for the main emission point is shown in Table 2-5.

Table 2-5 – Stack Information

Stack Reference	Stack Temperature	Stack Height Above Ground Level (m)	Stack Diameter (m)
Stack	408.15	70	2.30

The odour emission rate used in the dispersion model was taken from information contained within peer reviewed literature as outlined in Section 2.2 of this report. Details of odour emission rates are given in Table 2-6.

Table 2-6 - Odour Emission Rate From Stack

Stack Reference	Odour Concentration (OU_E/m^3)	Volume Flow (m^3/hr)	Exit Velocity (m/s)	Odour Mass Emission (OU_E/s)
Main Stack	3847	211,000	19.94	225,477

3. RESULTS AND DISCUSSION

3.1 Odour Emission Process Contributions

Ambient Ground Level Odour Concentrations (GLCs) have been predicted with the proposed facility in operation below. The study has been carried out at maximum post-abatement odour concentrations and volume flows for 24 hours per day 365 days per annum.

The odour modelling results are detailed in Table 3-1 at the site boundary and in Table 3-2 at the nearest sensitive receptor. The results indicate that the ambient ground level concentrations are below the relevant odour guideline values. Emissions from the facility operating for a full year leads to an ambient odour concentration which is 18% of the maximum ambient 1-hour limit value (measured as a 98th%ile) at the worst-case sensitive receptor and no more than 29% of the maximum ambient 1-hour limit value (measured as a 98th%ile) at the site boundary.

Table 3-1 - Dispersion Model Results – Maximum 1-Hour Odour Concentration (as a 98th%ile) At The Site Boundary

Pollutant / Meteorological Year	Averaging Period	Predicted Ground Level Concentration (OU_E/m^3)	Standard (OU_E/m^3)[Note 1]
Odour / Year 2007 Onsite	Maximum 1-hr (as a 98th%ile)	0.42	1.5
Odour / Year 2021	Maximum 1-hr (as a 98th%ile)	0.37	
Odour / Year 2022	Maximum 1-hr (as a 98th%ile)	0.36	
Odour / Year 2023	Maximum 1-hr (as a 98th%ile)	0.39	
Odour / Year 2024	Maximum 1-hr (as a 98th%ile)	0.43	
Odour / Year 2025	Maximum 1-hr (as a 98th%ile)	0.40	

Note 1 Guidance Based On "Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)"(2)

Table 3-2 - Dispersion Model Results – Maximum 1-Hour Odour Concentration (as a 98th%ile) At The Nearest Sensitive Receptor

Pollutant / Meteorological Year	Averaging Period	Predicted Ground Level Concentration (OU_E/m^3)	Standard (OU_E/m^3)[Note 1]
Odour / Year 2007 Onsite	Maximum 1-hr (as a 98th%ile)	0.15	1.5
Odour / Year 2021	Maximum 1-hr (as a 98th%ile)	0.24	
Odour / Year 2022	Maximum 1-hr (as a 98th%ile)	0.27	
Odour / Year 2023	Maximum 1-hr (as a 98th%ile)	0.23	
Odour / Year 2024	Maximum 1-hr (as a 98th%ile)	0.23	
Odour / Year 2025	Maximum 1-hr (as a 98th%ile)	0.17	

Note 1 Guidance Based On "Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)"[2]

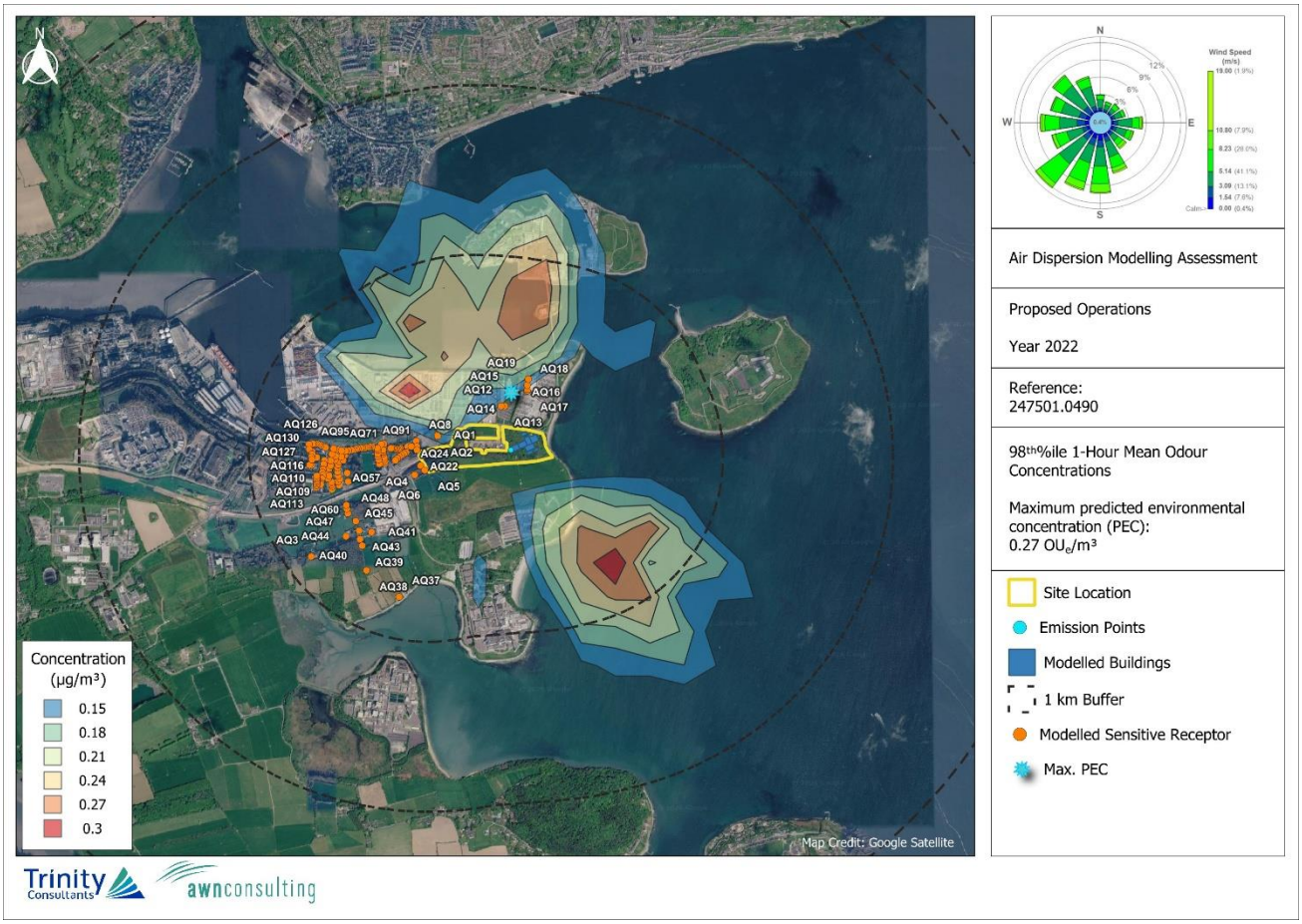
3.2 Concentration Contours

The geographical variation in ground level odour concentration (in units of OU_E/m^3) for the worst-case scenario is illustrated as concentration contours in Figure 3.1.

The concentrations listed in Figure 3.1 are for the maximum concentrations to be predicted at any location off-site. All other locations are below these values. The concentration contours show where the maximum concentrations are predicted to occur and the reduction in concentration with distance away from the maximum.

The maximum concentrations are observed at or near the boundary of the site. The contour plots show a significant fall in concentrations with distance from the site. The south-westerly prevailing winds tend to lead to higher long-term concentrations to the north-east of the site.

Figure 3.1 98th%ile of 1-Hour Odour Concentrations (OU_E/m^3) (Year 2022)



3.3 Assessment Summary

With regard to odour, the modelling assessment has found that ambient odour concentrations are in compliance with the relevant limit values, reaching at most 18% of the 1-hour limit value (measured as a 98th%ile) at the worst-case sensitive receptor.

3.4 Mitigation Measures

A range of mitigation measures will be put in place to ensure that odour from the facility does not lead to a nuisance at the nearest sensitive receptor. These measures are outlined in the draft odour management plan for the facility included in Attachment 1. These measures will be underpinned by the following operating principles and objectives:

- Air from all solid waste input handling areas will be extracted from the bunker for use in the combustion process prior to discharge to atmosphere;
- The abatement system will be maintained to ensure optimum performance;
- All raw materials i.e. feedstock waste delivered to the facility will be in appropriately covered vehicles. Similarly, all potentially odorous materials being removed from the facility will be in covered vehicles;
- A detailed, site-specific odour management plan will be developed prior to the detailed design and construction of the facility. This plan will include management strategies for the prevention of emissions and a strict preventative maintenance and management program for ensuring that all odour mitigation techniques remain operational at optimal capacity throughout all operational scenarios e.g. when the plant is shut down for annual maintenance activities;
- Full implementation of these measures will ensure that odour nuisance at nearby sensitive receptors will not occur.

EPA publication "*AG9 – Odour Emissions Guidance Note*" (2019)[3] outlines a range of mitigation options which should be explored, on a case-by-case basis to ensure odour emissions are prevented, minimised and controlled. These include:

- Mitigation measures for the storage and handling of odorous materials located outdoors include constructing 3-sided enclosures and relocating activities indoors.
- Good housekeeping of all outdoor areas should be implemented particularly during periods of unfavourable meteorological conditions (for example, decomposition of organic material will accelerate during warmer periods).
- All spills, overflows and leaks should be cleaned up promptly with all operators aware and trained in the relevant SOP for this procedure.
- A local fume hood collection system with flexible hoses may be useful for capturing and extracting fugitive odours from sources with odour potential. Localised containment will reduce the volume of air to be extracted and, if necessary, treated.
- For the transfer or delivery of odorous liquids, vapour recovery or a closed-loop system should be used.
- Extraction of air through a negative pressure system to a point source will reduce fugitive emissions associated with passive sources such as general ventilation exhausts, louvers, windows or doors.
- A building integrity test is recommended for any building where odorous material is stored. Ideally, the building should have a negative pressure system installed with the extracted air ducted to a vertically pointed stack (and possibly with an abatement system prior to release where the need arises). Self-closing doors and trigger alarms on roller doors should also be installed.

- The facility should have a high level of cleanliness with outdoor surfaces washed down regularly with any remaining stagnant water removed. Cleaning of waste and storage bins, trucks carrying odorous materials and holding vessels should be undertaken regularly with an increased frequency in summer months.

- A closed-door policy should be strictly enforced where there is the potential for odorous releases through open doors.

- Keeping the temperature as low as possible will reduce evaporation and thus odorous material should be kept out of direct sunlight and refrigerated if possible.

- Increasing the humidity and reducing airflow over the surface of the odorous liquid will reduce the rate of evaporation (the rate of evaporation is directly proportional to the speed of air flow over the liquid surface).

- Reducing the exposed surface area of liquid storage tanks by using floating covers will reduce the rate of evaporation and subsequent release to atmosphere.

- Activities such as agitation, shredding and mixing (turbulence) in liquids and solids will increase the odour emission rate significantly. These activities should be undertaken with appropriate mitigation measures in place.

- Adjustment to pH can increase the solubility of certain odorous compounds in water. For example, acidic conditions will suppress the evaporation of ammonia and similar alkaline compounds. Likewise, increasing alkalinity will help suppress H_2S release to atmosphere.

- Stack design to ensure that extracted air is dispersed adequately is important. The exhausted air should have sufficient stack exit velocity and an appropriate stack diameter to avoid stack-tip downwash (typically greater than 10 - 15 m/s required). The stack height should be sufficient to avoid significant building downwash and be directed in a vertical direction without rain caps on top of the stacks.

- Fugitive emissions such as valves, pump seals, flanges and leaks should be investigated using appropriate methods (for example photoionisation detection (PID)) and followed up with a corrective action programme.

A draft Odour Management Plan is outlined in Attachment 1 which will form the basis of the Odour Management Plan for the facility.

4. REFERENCE

1. USEPA (2024) AERMOD Description of Model Formulation
2. EPA (2020) Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)
3. EPA (2019) Odour Emissions Guidance Note (AG9)
4. Water Environment Federation (1995) Odour Control in Wastewater Treatment Plants
5. AEA Technology (1994) Odour Measurement and Control – An Update, M. Woodfield and D. Hall (Eds)
6. Warren Spring Laboratory (1980) Odour Control – a concise guide, F.F.H. Valentine and A.A. North (Eds)
7. C.R. Clarkson and T.H. Misselbrook (1991) "Odour emissions from Broiler Chickens" in "Odour Emissions from Livestock Farming", Elsevier Applied Science Publishers London
8. J.E. McGovern & C.R. Clarkson (1994) in "The Development of Northumbrian Water Limited's Approach to Odour Abatement for Wastewater Facilities", Proceedings of Symposium on Odour Control and Prevention in the Water Industry
9. CH2M Beca Ltd (2000) Analysis of Options For Odour Evaluation For Industrial & Trade Processes - Prepared for Auckland Regional Council
10. EPA & OdourNet UK (2000) Odour Impacts and Odour Emission Control Measures for Intensive Agriculture
11. Environment Agency (2011) H4 Odour Management – How To Comply With Your Environmental Permit
12. Institute of Air Quality Management (IAQM) (2018) Guidance On The Assessment Of Odour For Planning V1.1

ATTACHMENT 1

Manual

[Draft Odour Management Plan

Approval Date:

Document Owner:

Approved by:

1. PURPOSE

To ensure that no odours associated with our activity result in the impairment or interference with any amenities or the environment beyond our facility boundary. This Odour Management Plan provides information on the potential odour impacts from the WtE facility and the mitigation measures that are implemented.

The purpose of this document is to provide a formal roadmap detailing how the facility identifies, controls, monitors and minimises odorous emissions in-line with licence requirements and Indaver's QESH Policy.

2. SCOPE

This manual covers odour management at the proposed Ringaskiddy waste to energy facility and was drafted in accordance with the expected EPA IE Licence conditions that will be imposed.

3. SAFETY

N/A

4. ROLES AND RESPONSIBILITIES

It is the responsibility of all employees to carry out their work activities as per operational procedures and practices to ensure no odours arise.

It is the responsibility of all employees receiving an odour complaint from an external party to ensure it is reported as per the Environmental Complaints manual.

It is the responsibility of the Facility Manager, Production Manager, Process Engineer and the Environmental Team to work together to ensure odour emissions are minimised and where issues arise to put in place appropriate preventive and corrective actions.

It is the responsibility of the Environmental Team to maintain and implement the site's Odour Management Plan.

5. ABBREVIATIONS/DEFINITIONS

AER = Annual Environmental Report

Odour = The property of a substance that activates the human sense of smell.

WtE = Waste to Energy

OMP = Odour Management Plan

6. OPERATING/WORK INSTRUCTIONS

A. OPERATING INSTRUCTIONS

Odour Management

Risk of Odour Problems

The two main potential sources of odour will be from the tipping hall and bunker area and from incoming and outgoing waste trucks. There are many factors that are also important when considering odour being emitted from areas of the plant which are:

- Materials input (seasonal variation in weather may affect composition of waste input materials and its potential to generate odour);
- Process parameters (changes in temperature, etc.);
- Rate of throughput or increased hours of operation;
- Routine maintenance and inspection (e.g. annual planned shutdowns);
- Start-up and shut-down of key plant and equipment;
- Power failure (provision of backup facilities);
- External failure of other utilities, e.g. water supply etc;
- Mechanical breakdown of abatement equipment such as pumps, fans etc;
- Building damage which affects integrity, due to, for example storms;
- Failure in procedures to maintain containment (human error);
- Short term weather patterns which fall outside of the normal conditions for that area (i.e. highly unusual, not just the normal meteorological pattern - for example inversions and other conditions unfavourable to dispersion);
- Longer term weather patterns – prevailing wind direction, temperature, inversion conditions if these are normal variants of local weather.
- Site emission stack .

Identified Receptors

Land use in the surrounding area includes residential housing found to the east and south-east of the facility. As such, local residents may be affected, along with company employees.

Control and Mitigation Measures in Place

The odour management plan relies on a combination of minimisation, containment and treatment techniques and operational procedures in accordance with Odour Emissions Guidance Note (Air Guidance Note AG9), which includes:

- Negative pressure in the bunker prevents odour from escaping;
- Doors to tipping hall and exit points closed where possible;
- Spraying of odour-masking or neutralising chemicals at the tipping hall door and bunker level where appropriate;
- Good Housekeeping and Good Working Practice;

- Regular odour checks;
- Road sweeping and cleaning to ensure no lingering waste smells on roads, especially during periods of dry weather.

Additional Mitigation Measures During Planned Shutdowns

Additional measures are to be taken to manage the potential for fugitive emissions for planned shutdowns. These are as follows:

- Reduction in waste delivery volumes,
- Exclusion of deliveries of particularly odorous waste streams,
- Minimise opening of tipping hall doors to the limited times of waste deliveries,
- Minimisation of mixing of waste in the bunker to avoid additional odour creation by exposing older waste underneath and covering of older waste with the new waste deliveries,
- Use of odour-masking or neutralising chemicals in the bunker and tipping hall areas.

Monitoring in Place

Monitoring can be both proactive (i.e. routine monitoring of performance and improvement of environmental performance) and reactive (i.e. to qualify and quantify complaints). An odour check will be included on the infrastructure checks, which will be carried out by the Production Team for the facility. If an odour is detected that has the potential to cause offsite issues, it will be notified to the Environmental Team immediately to ensure the necessary corrective and preventative actions can be taken. Increased odour checks may also be implemented during annual planned shutdowns to ensure that measures taken during the shutdown are effective.

Internal audits of the facility will be conducted and odour will be included as an area to check on the audit schedule. If an odour issue is identified it will be raised through these audits and corrective and preventive actions put in place as required.

There will be a quarterly check carried out by the Environmental, Health & Safety Team or nominated deputy, using the Odour Investigation Field Record Sheet and the map of the site (Emissions and Monitoring Points Site Plan). The areas of observation of the odours are carried out in the sequence that is recommended in EPA Air Guidance Note 5 (AG5) Odour Impact Assessment and the main steps are detailed below:

Conducting an Odour Impact Assessment

Participants:

- One person can conduct the odour investigation however, periodically assessments should be done in groups of two or more.

- In groups of two or more, the investigators should make “side by side” assessments, with no discussion about the results until the assessment is complete.
- Alternatively, if there is a suspected odour, one person can go to the suspected source, while the other conducts the assessment where the complaint arose in the local area.
- Odour investigators must be in a fit condition and should adhere to the following rules:
    - Do not carry out the assessment if you have a cold, sore throat, sinus trouble etc.
    - Do not smoke or consume strongly flavoured food or drink, including coffee, for at least half an hour before the assessment
    - Avoid the consumption of confectionary or soft drinks immediately before or during the assessment
    - Avoid applying scented toiletries, including perfume/aftershave, immediately before or during the assessment
    - If using a vehicle during the assessment, it should not contain deodorisers or air fresheners
    - If using a vehicle, you must stop, get out and sniff
- Odour investigators should have regards to the recent complaint patterns, odour history of the site and current activities on-site.

Preparation:

Check the onsite weather station prior to conducting the odour investigation, record the information and it is seen as good practice to print the information and staple it to the completed field record.

Odour investigators should have regard to the weather forecast for the area, including:

- Wind strength and direction
- Barometric pressure
- Rainfall
- Temperature
- Humidity

Required documents for field work:

- The Assessment of Odour Impact Field Record Sheet
- This plan
- A scaled map of the area

Selection of Suitable Locations:

Selection of suitable odour assessment locations depends on whether the odour investigator is:

- Responding to a complaint

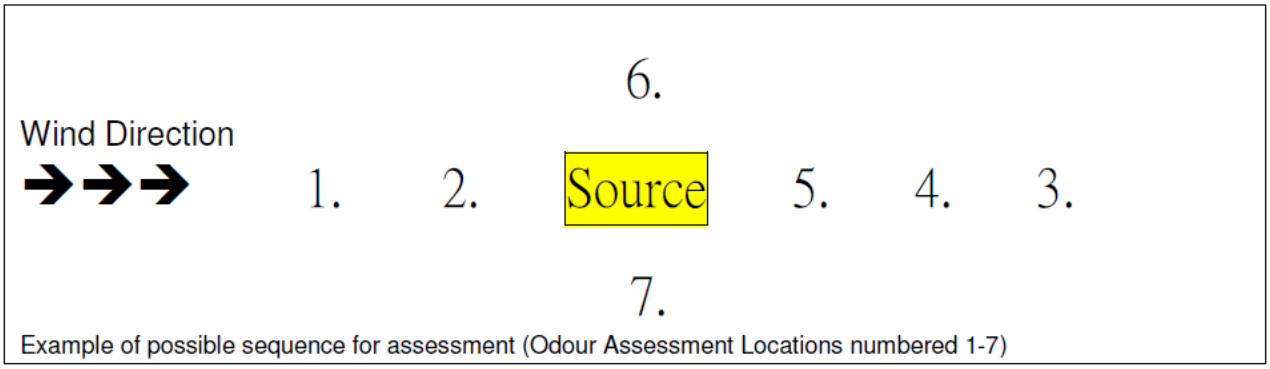
- Checking the state of compliance at sensitive receptors
- Attempting to establish the source of an odour

Wind direction will also affect suitable location selection.
Locations of each of the stations depends on factors such as:

- Proximity of sensitive receptors
- Local topography
- Availability of suitable access
- Source characteristics

Routine Assessment:

When the assessment is being carried out routinely (not a complaint investigation) the following sequence of sampling locations is recommended (diagram has been taken from *AG5 Odour Impact Assessment Guidance for EPA Licensed Sites*):



Example of possible sequence for assessment (Odour Assessment Locations numbered 1-7)

Selecting suitable assessment locations is more difficult when wind direction is not detectable. In these instances it is preferable to postpone an assessment. It is preferable to conduct the odour assessment in the morning, before the investigator(s) is/are exposed to onsite odours.

Determination of odour:

Odours are the result of several properties of an odour which are experienced by a human receptor. These properties can be summarised by the acronym “FIDOL”, which equates to Frequency, Intensity, Duration, Offensiveness and Location. This method can be used to quantify and evaluate the potential nuisance and social impact of an odour on a community and should be used as a reference guide to quantify the significance of an odour when completing an odour assessment.

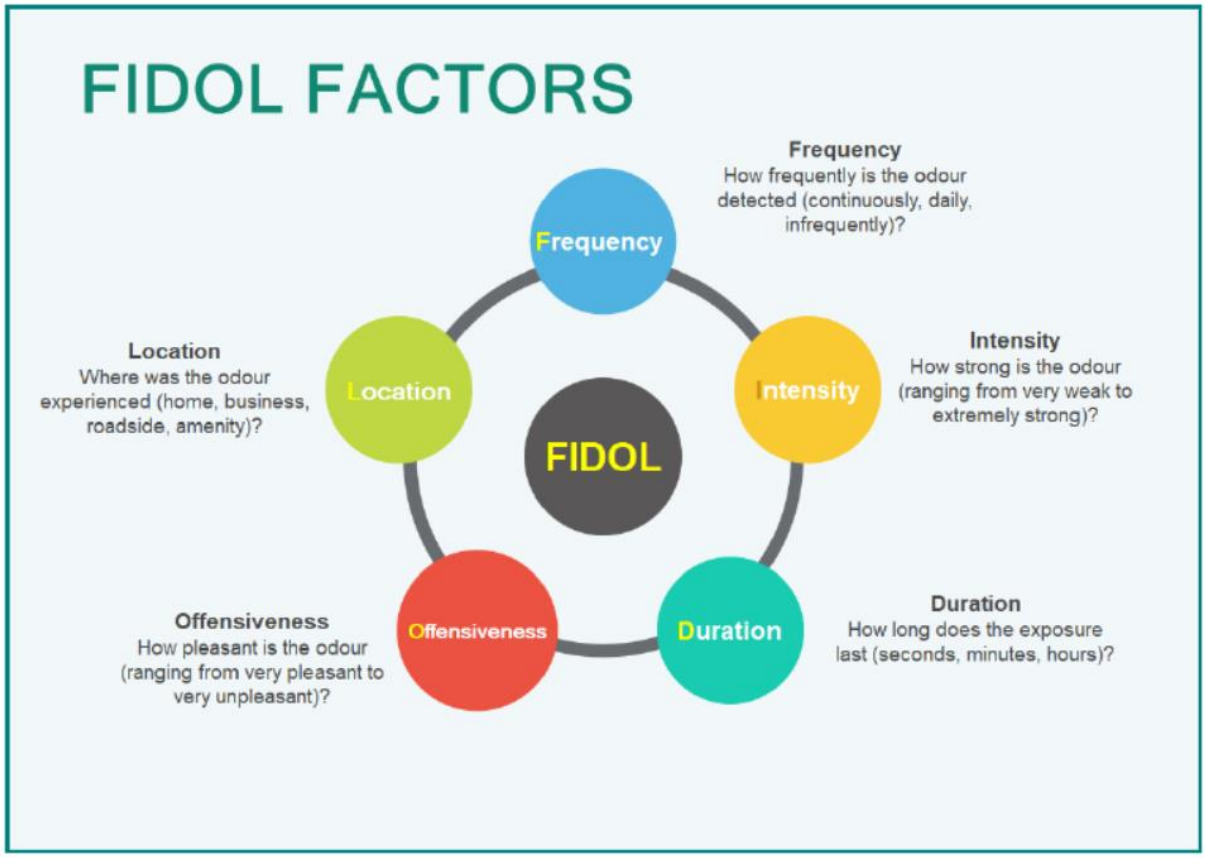


Figure 2. FIDOL factors used to determine odour.

Post Odour Assessment Site Investigation:

If a potential nuisance or interfering odour is detected during an assessment, the follow-up on-site assessment will include some or all of the following activities as appropriate:

1. A walk of the downwind site boundary to verify if odours can be detected;
2. An assessment of particular areas or activities on site to verify if odours can be detected, such an assessment shall cover all possible odour sources on the site;
3. An examination of site operations to:
   - Identify practices that might give rise to odours,
   - Assess the effectiveness of any abatement equipment used at the site (bypassing abatement equipment for the purposes of sniff testing as an abatement efficiency test is not permitted).

Following this inspection it may be necessary to visit other local potential sources of odour to eliminate them as sources of the observed odour. Plant management will be informed immediately of any significant findings.

Any of the above options may be used to provide information on odour levels and their sources, where the purpose of the monitoring is to:

- Demonstrate if actions taken to reduce odours have been effective;

- Demonstrate compliance with licence conditions; and
- Carry out continuous checks on the effectiveness of the control measures in place.

All odour complaints received will be recorded and followed up through the Environmental Complaints manual.

Follow Up of Odour Complaints

All complaints will be recorded, investigated and followed up through the Environmental Complaints procedure. Internal audits of the facility will be conducted and odour will be included as an area to check on the audit schedule. If an odour issue is identified it will be raised through these audits and corrective and preventive actions put in place.

Also odour complaints that are received at the facility will be followed up by completing an odour assessment of the affected area using the steps listed above. If the nature of the odour can be linked to the facility, a site audit should be undertaken to identify the source of the odour.

Once identified, the odour source should be investigated to determine whether there has been an operational failure or a failure of abatement systems with steps implemented to rectify the problem. Where no odour is detected by the individual carrying out the assessment at the location of the complainant, the complaint should not be dismissed out of hand. Odour detection can be transitory whilst the person conducting the assessment may have a higher odour threshold compared to the complainant.

The individual responsible for carrying out the assessment should ensure to follow up with the complainant, both prior to undertaking an assessment to ascertain all relevant details of the complaint and after the assessment once conclusions have been drawn. This should be focussed on informing the complainant of corrective/preventative actions taken to address the issue, should it be arising the site. This can be done via phone call, email or meeting the complainant in person, depending on how the complaint was made and if they have left contact information. This ensures building a positive relationship with the neighbouring community through transparency. A log of all communications should be kept as part of the OMP file.

Specific steps to follow when Investigating an Odour Complaint:

- When the assessment is being carried out in response to a specific complaint, if time permits the starting point should be upwind of the suspected source prior to visiting the complainant.
- If an assessment is needed in order to investigate a recent complaint and wind direction is not detectable and postponement is not an option, the odour investigator should start at the location of the complaint.
- Do not visit the source until all ambient observations have been completed.
- Note potential external activities that could be the source of the odour, contribute to the odour or be a confounding factor.

- When an odour is detected a determination of the extent of the odour plume may be carried out at points perpendicular to the plume axis and equidistant from the source (i.e. locations 6 and 7 on the above diagram), and this should be done before visiting the source.

Record Keeping

Records will be maintained for all checks, internal audits, environmental complaints and all preventive and corrective actions as per the procedure for Management of Records.

Environmental complaints are reviewed on an annual basis at the Management Review and at relevant meetings when they arise.

Communication

A summary of all odour complaints will be reported to the agency as part of the AER as per the Industrial Emissions licence.

Odour Management Cycle

Figure 3. Adoption & implementation of an Odour management Plan.

This Odour Management Plan will form part of the sites wider environmental management system and supports the principles of ISO 14001. Odour is a significant environmental aspect, and the controls, monitoring and review process set out in this plan contribute directly to our commitment to continuous improvement. By routinely evaluating odour performance, responding to complaints, learning from incidents and updating operational

control measures, Indaver ensures that odour management remains effectvie, proactive and aligned with Indaver's ongoing environmental objectives.