

9 Odour

9.1 Introduction

This chapter describes the likely significant effects of the proposed development on odour. Air quality and climate are addressed separately in **Chapter 8**.

9.2 Assessment Methodology

9.2.1 General

The generation and dispersion of odorous emissions have been assessed due to the nature and scale of the proposed development. This assessment considers the potential for likely significant odour effects during the operation of the proposed development. There will be no significant odour emission sources during construction and therefore no construction assessment or mitigation is considered necessary.

Air dispersion modelling of odorous emissions represents a widely accepted method of assessing potential risk of off-site impacts¹. In order to assess the likely significant effects of the proposed development on the ambient environment during operation, dispersion modelling of odorous emissions has been undertaken. The dispersion modelling methodology for the operational assessment is outlined in **Section 9.2.5.1**.

9.2.2 Limit Values

Currently, there is no general statutory odour standard in Ireland relating to industrial installations. Two reference documents have been cited herein and have been used to determine appropriate limit values. Table 9.1 outlines the odour limits used for this assessment based on the UK's Environment Agency Odour Management Guidance² and the Institute of Air Quality Management (IAQM) Guidance³.

These guidance documents recommend that odour standards should be between 1.5 and 6.0 OU/m³ as a 98th percentile of one-hour averaging periods at all receptors. This 98th percentile limit allows for exceedances for 176 1-hour values over a full year (8,760 hours).

¹ CIWEM (2016) *Policy Position Statement – Control of Odour*.

² Environment Agency (2011) *H4 Odour Management How to comply with your environmental permit*

³ Institute of Air Quality Management (IAQM) (2018) *Guidance on the assessment of odour for planning*

The guidance allows limits to be set based on the offensiveness of the odour and allows adjustments for local factors such as proximity to sensitive receptors and population density. A summary of the indicative limit criteria for various industrial sectors is given in Table 9.1.

Table 9.1: Indicative odour criteria for various industrial sectors

Industrial Sectors	Relative Offensiveness of Odour	Indicative Criterion
Processes involving decaying animal or fish remains Processes involving septic effluent or sludge Biological landfill odours	Most Offensive	1.5 OU/m ³ as a 98 th percentile of hourly averages at the worst-case sensitive receptor
Intensive livestock rearing Sugar beet processing Fat frying (food processing) Well aerated green waste composting	Moderately offensive	3.0 OU/m ³ as a 98 th percentile of hourly averages at the worst-case sensitive receptor
Brewery, Confectionery, Coffee roasting, Bakery	Less offensive	6.0 OU/m ³ as a 98 th percentile of hourly averages at the worst-case sensitive receptor

Considering the surrounding environment, proximity to sensitive receptors and the treatment of wastewater within the WwTP, an odour limit value of 3.0 OU/m³ of the 98th percentile of 1-hour value at both the site boundary and the nearest sensitive receptor is proposed. As such, the proposed development is considered to generate moderately offensive odours.

In order to carry out a reasonable worst-case scenario assessment, the limit value of 3.0 OU/m³ of the 98th percentile of 1-hour value has been applied herein.

9.2.3 Study Area

The proposed development is located in Arklow, County Wicklow and has been described in detail in **Chapter 4**. The WwTP site is located on the eastern periphery of Arklow Town, adjacent to the Irish Sea. The existing site area layout is illustrated in **Figure 1.1 in Volume 3**. The interceptor sewers will be located along the north and south quays.

The closest existing sensitive receptors to the proposed WwTP site are the residential complex known as the Marina Village located approximately 100m to the west of the site and 185m to the north-west of the site. On South Quay, the closest residential receptor to the WwTP is approximately 260m to the south of the site.

A number of sensitive receptors are also located within 15m of the interceptor sewers, at River Walk, South Quay and North Quay, as outlined in **Section 2.6.5.1 in Chapter 2**.

In addition, the lands adjacent to the WwTP are zoned for Waterfront (WZ), which includes for a mix of residential, commercial, employment, leisure and tourism uses. These lands have been included as future sensitive receptors for the operational assessment. The proposed WwTP site boundary is therefore considered the most suitable location to apply the operational odour limits.

The proposed development interacts with a number of different zoned areas, as outlined in the Arklow LAP⁴ and described in **Section 6.4.2**. Along North Quay, the proposed development crosses the Open Space (OS2) and Waterfront (WZ) zoned areas. The proposed development is also adjacent to Community & Education (CE) and Open Space (OSI) zoning objectives.

Along River Walk and South Quay, the proposed development crosses the Town Centre (TC), Open Space (OS1), Open Space (OS2) and Existing Residential (RE) zoning objectives. These have been considered in the assessment herein.

9.2.4 Categorisation of the Baseline Environment

A desk-based study has been undertaken in order to establish the baseline environment and inform this assessment. In addition, a site visit undertaken in April 2018 to ascertain if there are any prominent existing odour sources in the area. Baseline conditions are outlined in **Section 9.3**.

9.2.5 Impact Assessment Methodology

9.2.5.1 Air Dispersion Modelling

There is the potential for odour to be generated from the proposed development during operation due to discharge venting from the emission vent stacks along the interceptor sewers and from the vent stacks on the Inlet Works building and Process building. Detailed air dispersion modelling has been undertaken for the vent stacks using the industry standard Breeze AERMOD software package⁵. As outlined in **Section 9.2.1**, the air dispersion modelling has been undertaken in accordance with the EPA guidance⁶.

AERMOD models the ground level concentration level of odours that are emitted from specified sources. In order to undertake the modelling, the following information is inputted:

- The location, size and scale of any on-site buildings;
- The location of the boundary line for sensitive receptors;
- Meteorological conditions in the study area; and
- The number, type and location of emission sources.

⁴ <https://www.wicklow.ie/Living/Services/Planning/Development-Plans-Strategies/Local-Area-Town-Settlement-Plans/Arklow/Arklow-and-Environs-Local-Area-Plan-2018-2024>

⁵ Breeze AERMOD software package – version 1612r, released January 2017.

⁶ EPA (2010) *Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)*

The model was used to predict ground level odour concentrations over a 1-hour averaging period and relevant percentiles.

Meteorological Conditions

Meteorological data from Met Éireann's synoptic station at Dublin Airport was used for the years 2011 to 2015 inclusive. The meteorological data includes hourly values for wind speed, wind direction, atmospheric stability, ambient temperature and mixing height.

Location, Size and Scale of On-Site Buildings

The length, width and height of the Inlets Works Building and Process Building was included in modelling. AERMOD includes a software utility called Building Profile Input Program (BPIP) to calculate direction-specific building downwash factors using the relative positions and dimensions of sources and neighbouring buildings.

Location of Sensitive Receptors

Receptors are locations where AERMOD computes an odour concentration. As the distance from the subject site increases, the receptor grid density decreases. As such, three nested, Cartesian receptor grids were used for both modelling the Inlet Works Building and Process Building and the Interceptor Sewer Vents, centred on the emission source. The size of each grid is as follows;

- The largest grid has receptors covering a 10km by 10km area at 250m intervals;
- The medium sized grid has receptors covering a 1.5km by 1.5km area at 50m intervals; and
- The smallest grid has receptors covering a 2km by 2km area at 15m intervals.

For the Inlet Works Building and Process Building a dense receptor grid was placed around the development's site boundary to predict odour concentrations.

For the Interceptor Sewer Vents a dense receptor grid was placed around one of the vents, which is representative of the other vents, to predict odour concentrations.

By using this approach, a more dense receptor grid is placed closer to the source(s) where the highest concentrations are likely to be, and a less dense grid is used further from the source(s) to account for any high concentrations that may be located further away from the site.

Elevations were taken from Ordnance Survey mapping.

Emission Sources

As noted in **Chapter 4**, odour control measures have been incorporated as part of the design of the proposed development. The proposed development includes an odour treatment unit (OTU), as depicted in **Drawing No.247825-00-STE-001in Volume 3**.

Drawing No.'s 247825-00-MP-001 to 247825-00-MP-010 and Drawing No.'s 247825-00-C-IS-700 to 247825-00-C-IS-716 in Volume 3 show the locations of the vent stacks for the OTU Vent Stack, Process Building Vent Stack and the Interceptor Sewer Vents.

Table 9.2 outlines an indicative, reasonable worst case emission source data for the proposed OTU vent stack at the Inlet Works building, vent stack at the Process building and interceptor sewer vent stacks, as extracted from the design specification. It should be noted that during the detailed design stage, efficient design may result in further improvements in emissions at the Inlet Works Building and the Process Building. However, at a minimum, compliance with limit values outlined in **Section 9.2.2** will be achieved.

A centralised OTU has been designed for the WwTP, that would comprise biological and carbon filters and the treated air would discharge through a vent stack on the Inlet Works Building. The Process building will be sealed and mechanically ventilated and therefore odour treatment is not required. The Process building will be vented via a vent stack located on the building.

Table 9.2: Emission source input data

Parameter	Unit	OTU Vent Stack	PB Vent Stack	Interceptor Sewer Vent(s)
Stack Height	m	17.5	15.5	7.6
Stack Diameter	m	0.6	0.6	0.33
Flow Rate	m ³ /s	8.7	1.43	1.28
Velocity	m/s	30.79	5.06	15.0
Temperature	°C	15	15	15
Odour Concentration	OU/m ³	183	1,323	1,323
Odour Emission Rate	OU/s	1,592	1,890	1,696.5

9.3 Baseline Conditions

As outlined in **Section 9.2**, the proposed development is located in Arklow town. The proposed WwTP is located on the eastern periphery of Arklow town, approximately 20m from the coastline with the proposed interceptor sewers located primarily along the Avoca River at River Walk, North Quay and South Quay.

As outlined in **Section 2.3 of Chapter 2**, the existing wastewater network in Arklow town discharges untreated wastewater from homes and business to the Avoca River. It has been reported that this existing practise gives rise to a negative odour emanating from the Avoca River^{7,8}. The sailing, rowing clubs and the marina have each reported odour problems along the Avoca River.

⁷<http://wiclownews.net/2017/05/not-all-sunshine-in-arklow/>

⁸<https://www.independent.ie/regionals/wicklowpeople/news/residents-fume-at-stinking-river-30470608.html>

No other known existing odour sources were present in the area during a site visit on 12 April 2018.

9.4 Description of the Proposed Development

Chapter 4 provides a full description of the proposed development. The following aspects are particularly relevant to the odour assessment.

The main sources of odour at a WwTP are generally associated with either sludge or septic wastewater and hence, the priority for odour treatment is the inlet works, sumps and sludge tanks. The Process Building tanks, which form the secondary treatment, will not have the same potential sources of odour and therefore mechanical ventilation is considered appropriate for the Process building.

A centralised OTU has been designed for the WwTP, with an odour concentration of 183 odour units (OU)/m³ and an emission rate of approximately 1,592 OU/sec. The OTU would comprise biological and carbon filters and the treated air would discharge through a 600mm diameter, 17.5 m high vent stack, in the Inlet Works Building (i.e. terminating 1m above the roof).

Air from the following areas would be treated in the OTU:

- Inlet pump sump;
- Stormwater holding tanks;
- Inlet works – screenings and grit disposal skips;
- Sludge holding tanks;
- Sludge thickeners;
- Sludge dewatering;
- Dewatered sludge skips; and
- Supernatant sump.

As the Process building will be sealed and mechanically ventilated, odour treatment is not required. The design odour concentration for the Process building is 1,323 OU/m³ with an emission rate of 1,890 OU/sec. The Process building will be vented via a 600mm diameter vent stack at 15.5m height (i.e. terminating 1m above the roof).

12 vent stacks will be located along the interceptor sewer at each of the tunnel shafts. A reasonable worst-case odour concentration of 1,323 OU/m³ has been assumed with an emission rate of 1,697 OU/sec. The vent stacks along the interceptor sewer network will be vented via a 330mm diameter vent stack at 7.6m height.

The odour control system for the WwTP has been designed to comply with an odour limit offsite of 3.0 OU/m³.

9.5 Likely Significant Effects

9.5.1 Do-Nothing Scenario

In the scenario where the proposed development does not proceed as planned, none of the likely significant effects during operation, as set out in this chapter, would occur.

However, the current odours that are experienced across Arklow town, would continue, as described in **Section 9.3**.

9.5.2 Assessment of Effects during Construction

The proposed development will require excavation of soils and subsoils, to accommodate pipelines and structures, however, no significant negative effects on odour are predicted during construction of the proposed development. Furthermore, no significant effects are predicted during the excavation of any contaminated soil encountered during construction of the WwTP at the Old Wallboard site at Ferrybank.

9.5.3 Assessment of Effects during Operation

An odour modelling assessment has been undertaken in accordance with the methodology outlined in **Section 9.2**, and using emission data provided by the design team (Refer to Table 9.2). Predicted concentrations are compared to the limit value outlined in **Section 9.2.2**.

9.5.3.1 Inlet Works and Process Building

The highest predicted ground level concentrations of odour are presented in **Table 9.3** for the worst-case modelled results. **Figure 9.1 in Volume 3** shows an isopleth for the 98th percentile of 1-hour values for odour units.

Table 9.3: Modelling results for Inlet Works and Process Building Vents

Limit Value 98 th percentile of 1-hour value (OU/m ³)	Highest Predicted Ground Level Concentration (g/m ³)	Distance from source to predicted highest ground concentration level (m)	Grid Reference (ITM)	
			Easting	Northing
3	0.48	98m	725339	673134

The result for the highest 98th percentile 1-hour values is predicted to be 0.51 OU/m³ which is 16% of the limit value of 3.0 OU/m³ and occurs at the site boundary of the proposed development. This is in good compliance with the limit value.

As stated in **Section 9.2.5.1**, during the detailed design stage, efficient design may result in further improvements in odorous emissions at the Inlet Works Building and the Process Building. This assessment shows that compliance with the limit value is capable of being achieved on the basis of the specimen design.

9.5.3.2 Interceptor Sewer Vents

The results for the highest predicted concentration of odour in proximity to an interceptor sewer vent are presented in **Table 9.4** for the worst-case modelled results. Meteorological data from 2011 was found to give rise to the highest predicted ground level concentration of odour.

Table 9.4: Modelling results for Interceptor Sewer Vents

Limit Value 98 th percentile of 1-hour value (OU/m ³)	Highest Predicted Ground Level Concentration (g/m ³)	Distance from source to predicted highest ground concentration level (m)
3	0.34	33

The result for the highest 98th percentile 1-hour values was predicted to be 0.34 OU/m³ which is 11% of the limit value of 3.0 OU/m³. This shows good compliance with the limit value.

As the results in Table 9.4 show, the highest predicted concentration of odour occurs at a distance of 33m from an interceptor sewer vent.

The 12 vent stacks will each be located at the tunnel shafts. The two closest shafts are TSS2A and TSS3, approximately 25m apart. In the unlikely worst-case scenario of the highest predicted ground level concentration values from both vents occurring at the same location, a cumulative value of 0.68g/m³ is estimated. This value is 22% of the limit value and shows good compliance with the limit value.

Given the low predicted ground level concentration from each vent, as well as the distance between vents, any cumulative effects are not predicted to be significant and will still be well below the limit value of 3OU/m³.

9.5.4 Cumulative

This section considers the potential for cumulative effects arising from the proposed development in association with other developments as described in **Section 2.6 in Chapter 2**.

The proposed development is not considered to give rise to significant odour effects during the construction phase, therefore cumulative odour effects will not occur during construction of the proposed development.

Gas Networks Ireland (GNI) have planning permission granted for a 3m high 'lamp post' style relief vent stack servicing the existing above ground district regulating installation located on North Quay adjacent to the planning boundary. This development, in combination with the proposed development will not give rise to any significant cumulative odour effects.

9.6 Mitigation Measures and Monitoring

9.6.1 Mitigation

9.6.1.1 Mitigation during Construction

No mitigation measures are considered necessary during the construction of the proposed development with regard to odour.

9.6.1.2 Mitigation during Operation

No mitigation measures other than those inherent design measures described in **Chapter 4** are required during the operation of the proposed development with regard to odour.

9.6.2 Monitoring

9.6.2.1 Monitoring during Construction

No monitoring measures are required during the construction of the proposed development with regard to odour.

9.6.2.2 Monitoring during Operation

The proposed development will be required to apply for a WWDA to the EPA prior to operation as outlined in **Section 4.5 of Chapter 4**. This licence will only apply to the wastewater discharged from the WwTP. All other environmental emissions, including odour, will be regulated by Wicklow County Council. Although the WwTP will not be formally regulated by the EPA, Irish Water will be operating the plant in accordance with EPA licensing standards. Monitoring of the OTU will be undertaken during commissioning and at predetermined frequencies over the life time of the proposed development.

Emissions from the WwTP and interceptor sewer vent stacks will be measured with continuous monitors to indicate the performance levels of the abatement measures. Furthermore, independent performance checks will be carried out by an ISO17025 accredited testing laboratory at quarterly intervals during the first two years of operation to verify the effectiveness of control measures and ongoing compliance with the odour limits.

9.7 Residual Effects

9.7.1 Residual Effects during Construction

No significant residual effects are anticipated during the construction of the proposed development with regard to odour.

9.7.2 Residual Effects during Operation

As outlined in **Section 9.5.3**, the odour levels are predicted to be in compliance with the limits presented in **Section 9.2.2**. No significant residual effects are therefore expected to occur at any of the receptor locations during the operation of the proposed development.

9.8 References

Chartered Institute of Water and Environmental Management (CIWEM), 2016. *Policy Position Statement – Control of Odour*.

Environmental Protection Agency (EPA), 2010. *Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)*. Co. Wexford, Ireland

Independent News, 2014.

<https://www.independent.ie/regionals/wicklowpeople/news/residents-fume-at-stinking-river-30470608.html>

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Wicklow News, 2017. <http://wicklownews.net/2017/05/not-all-sunshine-in-arklow/>

Wicklow County Council, 2018. *Local Area Plan 2018 - 2024*.