RUNCORN ENERGY RECOVERY FACILITY

Environmental Permit Variation Application

Odour Impact Assessment

Prepared for: Viridor Energy Limited
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SLR

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1.0 INTRODUCTION

SLR Consulting Limited (SLR) has undertaken a detailed Odour Impact Assessment of the Runcorn Energy Recovery Facility (ERF) located at Weston Point, Runcorn ('the Site') operated by Viridor Energy Limited (Viridor Energy). The purpose of the assessment is to support an Environmental Permit variation application for the addition of Municipal Solid Waste (MSW) to the approved waste types which can be received at the Site.

1.1 Background

The Runcorn ERF operates under Environmental Permit reference: EPR/XP3005LB as issued by the Environment Agency (EA). The ERF is permitted for the receipt of up to 1,100,000 tonnes per annum (tpa) of a range of non-hazardous waste types including Refuse Derived Fuel (RDF), commercial and industrial (C&I) wastes and source segregated packaging for combustion to generate electricity (approximately $74MW_e$).

Viridor has submitted an Environmental Permit variation application seeking to add receipt of MSW. For the purposes of this assessment, the receipt of MSW has been assumed at a rate of 110,000 tpa. In practice, actual annual tonnages may be more or less than this depending on waste contracts procured by Viridor for the Site. The proposal would not result in an overall increase to the volume of waste received at the Site as the MSW received would be off-set by reductions in an equivalent volume of RDF (i.e. RDF intake decreased as MSW intake increases).

1.2 Scope

The Runcorn ERF is a source of potential odour due the nature of material received and processed, with the potential to impact upon the amenity of existing sensitive receptors in the surrounding area.

The objective of this study is to assess the effect of odour emissions from the ERF under the proposed operations (i.e. with receipt of MSW) on the surrounding area.

This report presents the approach, detailed methodology and findings of this Odour Impact Assessment.

1.3 Report Structure

The remainder of this report is structured as follows:

- Section 2 presents an overview of the relevant legislation and guidance;
- Section 3 details the assessment methodology;
- Section 4 details the site setting;
- Section 5 presents the dispersion model input parameters and the quantification of odour emissions;
- Section 6 presents the results of the odour impact assessment; and
- Section 7 concludes the study.

2.0 RELEVANT LEGISLATION AND GUIDANCE

2.1 Acceptability of Predicted Odour Impact

The potential for odorous compounds to cause nuisance is dependent upon a wide range of factors, including:

- The rate of emission of the compound(s);
- The duration and frequency of exposure;
- The time of the day that this emission occurs;
- The prevailing meteorology;
- The sensitivity of the 'receptors' to the emission, i.e. whether the odorous compound is more likely to cause nuisance, such as the sick or elderly, who may be more sensitive;
- The odour detection capacity of individuals to the various compound(s); and
- The individual perception of the odour, (i.e. whether the odour is regarded as unpleasant). This is greatly subjective and may vary significantly from individual to individual. For example, some individuals may consider some odours as pleasant, such as petrol, paint and creosote.

There are neither European nor United Kingdom (UK) specific regulatory standards for the assessment of the impact of odours. However, it may be reasonably argued that complaints are likely to occur when odours become detectable and recognisable. The longer the odour detection persists for an individual, the greater the level of complaints may be expected, particularly if the odours are unpleasant.

On this basis, odour impact criteria are typically based upon guideline documents (predominately based on research from outside of the UK), case law and research. These documents typically indicate a numerical concentration limit of between 1.5 and 6ou_E/m^3, (based on the 98th percentile of hourly averages), depending on the offensiveness of the odour and sensitivity of the location. The lower criterion are typically applied to odours categorised as highly offensive in more urban areas, and higher criterion to less offensive / more pleasant odours in rural or industrial areas where odours are more likely to be tolerated.

2.1.1 H4 Odour Management Guidance

The EA's H4 Guidance[1] ('H4 Odour Guidance') proposes installation-specific exposure criteria (benchmarks) on the basis that not all odours are equally offensive, and not all receptors are equally sensitive.

The H4 Guidance proposes the following benchmarks levels for the assessment and indication of unacceptable odour pollution:

- 1.5 ou_E/m^3 (as a 98th percentile of 1-hour average concentrations) for the 'most offensive' odours;
- 3.0 ou_E/m^3 (as a 98th percentile of 1-hour average concentrations) for 'moderately offensive' odours; and
- 6.0 ou_E/m^3 (as a 98th percentile of 1-hour average concentrations) for 'less offensive' odours.

The H4 Odour Guidance refers to the application of the 1.5ou_E/m^3 criterion against the most offensive odorous sources, such as those processes involving domestic waste.

2.1.2 IAQM – Odour Assessment for Planning Guidance

To a lesser extent, the odour guidance produced by the Institute of Air Quality Management (IAQM) '*Odour assessment for planning guidance*'[2] has been considered. The IAQM odour guidance summarises the typical

[1] H4: Odour Management – How to comply with your Environmental Permit, EA, 2014.
[2] IAQM Guidance on the assessment of odour for planning. IAQM 2014.

requirements and approaches for undertaking an odour assessment for planning applications to determine the potential amenity impacts. Whilst this guidance does not form Environmental Permitting guidance, it is considered that if odour exposure does not cause significant detriment to amenity, then it cannot be causing 'significant pollution'.

To facilitate the assessment of the significance of predicted odour exposure on amenity, the guidance defines receptor sensitivity and proposes 'odour effect descriptors' which combine the relative sensitivity of the receptors, the nature (or offensiveness) of the odour with quantitative predicted odour exposure levels.

The IAQM receptor sensitivity types are summarised in Table 2-1.

Table 2-1
IAQM Odour Receptor Sensitivity

Receptor Sensitivity	Example Land-uses
High sensitivity receptors	Surrounding land where: • Users can reasonably expect enjoyment of a high level of amenity; and • People would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium sensitivity receptors	Surrounding land where: • Users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or • People wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Low sensitivity receptors	Surrounding land where: • The enjoyment of amenity would not reasonably be expected; or • There is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial use, farms, footpaths and roads.

The IAQM then presents a matrix for 'most offensive' and 'moderately offensive' odour types. However, given the 'most offensive' type of odour associated with domestic waste specifically referenced by the EA's H4 Odour Management guidance, this assessment has only considered the matrix for 'most offensive' odour types and the associated IAQM effect descriptor as summarised in Table 2-2. It is noted that impacts descriptors apply equally to cases where there are increases and decreases in odour exposure as a result of a development. Therefore, the terms 'adverse' and 'beneficial' should be applied to the descriptors as appropriate.

Table 2-2
Odour Effect Descriptors – IAQM Guidance

Predicted Odour Exposure $C_{98,1\text{-hour}}$ ou_E/m^3	Receptor Sensitivity		
Most offensive	Low	Medium	High
≥10	Moderate	Substantial	Substantial
5 – <10	Moderate	Moderate	Substantial
3 – <5	Slight	Moderate	Moderate
1.5 – <3	Negligible	Slight	Moderate
0.5 – <1.5	Negligible	Negligible	Slight
<0.5	Negligible	Negligible	Negligible

As presented in

Table 2-2, in relation to the impacts of a 'high sensitivity' receptor to a 'most offensive' odour type; the IAQM matrix indicates that exposure greater than $C_{98\text{-}\%ile,\ 1\ hour}$ 1.5ou_E/m^3 would be classified as 'moderate adverse' effect. This would be considered to represent a 'significant adverse' effect, which correlates with the EA's H4 criterion for 'significant pollution'.

Conversely, exposures less than $C_{98\text{-}\%ile,\ 1\ hour}$ 1.5ou_E/m^3 would be classified as a maximum of a 'slight adverse' effect. This would be not considered to represent a 'significant adverse' effect, which correlates with the EA's H4 criterion for 'significant pollution' for the 'most offensive' odours.

3.0 ASSESSMENT METHODOLOGY

3.1 Process Description

The ERF operations are summarised below:

The Site is permitted to receive up to 1,100,000 tpa of RDF, commercial and industrial (C&I) wastes and source segregated packaging, which is received by road and by rail. On average, and under current operations, approximately 2,500 tonnes of waste is received at the site each weekday and approximately 1,100 tonnes each day over a weekend (reflecting approximately 930,000 tpa). The Site almost exclusively receives RDF (which is predominately derived from MSW). The proportions of RDF received by road and by rail are approximately equal at 480,000 tpa via road and 450,000 tpa via rail, on average.

Combustion operations are undertaken 24-hours per day. Waste is typically received at the facility by road between 6:30 am and 11:00 pm. Typically, two trains are received at the railyard each day; one at 12:30pm and another at 10:30pm.

RDF is received at the site via road in large trailers hauled by articulated trucks, entering the site via the access point off Picow Farm Road. Loads are checked-in and weighed at the weighbridge prior to joining the queue for access to the Tipping Hall to offload. After entering the Tipping Hall, the 'walking-floor' system within the trailers is utilised a to offload the RDF directly into the waste bunker.

Approximately 1,300 tonnes of RDF is received via road each weekday. On average, a much lower volume of RDF (approximately 110 tonnes each day) is received via road over the weekend.

RDF is received at the site via the rail network at the Railyard, located on the north-eastern side of the Site. RDF is transported to the site within individual 13-tonne capacity containers. Containers are offloaded from the trains via two overhanging loading cranes onto a number of loading trucks which shuttle the waste containers to the Tipping Hall to be deposited within the bunker. Empty containers are returned to the railyard to be loaded back onto the trains.

Approximately 1,200 tonnes of RDF is received via rail each weekday. On average, a lower volume of RDF (approximately 990 tonnes each day) is received via road over the weekend.

RDF within the waste bunker is utilised as feedstock for the combustion process within the four operational Lines. Air is drawn from within the Tipping Hall and Waste Bunker to fuel the combustion process. Combustion emissions from the four lines are released from the main stack (4 stacks contained within a single shroud).

Incineration Bottom Ash (IBA) and Air Pollution Control Residues (APCr) resulting from the combustion process are transported off-site for recycling.

Wastewater is discharged into the Runcorn & Weston Canal.

Viridor is seeking to receive MSW at the Site to afford greater flexibility in terms of accepted feedstocks. For the purposes of this assessment, the receipt of MSW has been assumed at a rate of 110,000 tpa. In practice, actual annual tonnages may be more or less than this depending on waste contracts procured by Viridor for the Site. It is understood that the proposed diversification in feedstock received at the Site would not result in an overall increase to the volume of waste received at the site (i.e. the MSW received at the site would displace the same volume of RDF).

3.2 Identification of Odour Sources

The following potential sources of odour from the ERF have been identified on the basis of the site visit undertaken by SLR on 3rd June 2021 as well as a review of the Site's Operating Techniques:

- Receipt of RDF and MSW;

- Deposition of waste (within the Tipping Hall);
- Storage of waste (within the Tipping Hall);
- Waste combustion process; and
- Waste combustion by-products.

The receipt of RDF is the majority source of potential odour generation. RDF arriving at the Site by rail is transported in containers and arrives in the railyard prior to offloading. These containers provide some level of containment of waste odours. RDF arriving at the Site by road would be transported in open-top trailers, covered by sheeting. Waste arriving at the site by road would enter the site via Picow Farm Road prior to check-in at the weighbridge and subsequently queueing along the Tipping Hall ramp. The Environmental Permit variation application proposes that MSW would also be received at the Site via road. MSW would be received in the same fashion as the RDF which is currently received via road. Potential odour from waste arriving at the site by rail and road have been considered within this OIA.

The tipping of RDF and MSW into the waste bunker within the Tipping Hall represents a large source of potential odour generation from the Site. However, the Tipping Hall is maintained under negative pressure to achieve containment, with ambient air from within the Tipping Hall extracted for use in the combustion process. This minimises the potential for unabated and fugitive emission of odour from the Tipping Hall. Leakage testing was undertaken at the Site on 3rd June 2021 to assess the efficacy of containment / negative pressure. Reference should be made to Appendix C for details of the testing process and overall results. In summary, the results determined that the extraction system achieved a high level of containment of air from within the Tipping Hall, even during events where the doors are open to allow for vehicular access. It is considered that fugitive odours from the Tipping Hall are negligible and, therefore, fugitive odour from the Tipping Hall has not been considered further as a potential emission source in this assessment.

RDF within the waste bunker is utilised as feedstock for the combustion process, with combustion emissions subsequently discharged to air from the main stack (emission to air point A1, A2, A3 and A4 in the Site's Permit). Potential odour within the combustion flue gas from the main stack has been considered negligible, in consideration of the high temperatures associated and required with the combustion process. The high temperatures would result in total thermal destruction of odorous compounds prior to release to atmosphere. Therefore, potential odour emissions from the main stack points A1, A2, A3 and A4 have not been considered further in this assessment.

IBA & APCr produced by the combustion process are not considered to pose a significant source of odour emissions due to their negligible odour potential. It is also noted that APCr is classified as hazardous waste and therefore must be stored in sealed containers, further reducing the potential for odour emissions from this source. Therefore, potential odour emission from IBA & APCr have not been considered further in this assessment.

3.3 Derivation of Emissions

The odour emissions for the ERF have been determined based on an odour monitoring exercise conducted at the Runcorn ERF and another Viridor Site. The source term and corresponding emission rates for the reception of RDF and MSW were derived with consideration of the following data sources:

- odour monitoring of RDF at the Runcorn ERF on 3rd June 2021; and
- odour monitoring of MSW at another Viridor facility on 12th May 2021.

Odour monitoring was undertaken in accordance with British Standard BS EN 13725[3]. The results of the odour monitoring undertaken at the Runcorn ERF and the other Viridor facility to inform this assessment are summarised in Appendix B.

Further details on the derivation of emissions are presented in Section 5 and Appendix B.

3.4 Quantification of Odour Impact

The assessment of odour exposure (and therefore impact) may be undertaken with two differing approaches, by the use of indicator determinands, or total odour.

In the case where an emission is dominated by one particular odorous gas, the use of an indicator determinand allows simple validation of an assessment through monitoring at source and receptor.

However, more commonly (as with waste derived odours) an odour is the result of a complex mixture of chemicals. On this basis, a more appropriate approach in the case of this complex gas mixture is that of total odour. Odour assessments are undertaken using the concept of the European Odour Unit (ou_E), as defined in BS EN 13725[4]. This approach allows impact assessment of any odorous gas as it is independent of chemical constituents and centres instead on multiples of the detection threshold (i.e. the physiological response of a human) of the gas in question.

As the odour unit is a Standard Unit in the same way as gram or milligram, the notation used in odour assessment follows the conventions of any mass emission unit as follows:

- concentration: ou_E/m^3;
- emission: ou_E/s; and
- specific emission (emission per unit area): $ou_E/m^2/s$.

Like air quality standards for individual pollutants, exposure to odour is given in terms of a percentile of averages over the course of a year. The exposure criteria most accepted in the UK at present is given in terms of (concentration) European Odour Units as a 98th percentile (C_{98}) of hourly averages. This allows 2% of the year when the impact may be above the limit criterion (175 hours). The notation for impact is therefore: $C_{98,\ 1\ hour}$ X ou_E/m^3.

3.5 Detailed Dispersion Modelling

In order to predict potential odour impacts within the vicinity of the Runcorn ERF, a quantitative assessment using the AERMOD dispersion model[5] was undertaken. AERMOD is a regulatory model approved for the United States Environmental Protection Agency (US EPA) and is used extensively for odour impact assessment in the UK.

The detailed dispersion modelling has been used to predict the concentration of odour at a height of 1.5m AOD in accordance with the relevant EA guidance[6]. In accordance with the EA H4 odour guidance, 5 years of meteorological data have been investigated in the dispersion modelling to represent conditions for an “average year”.

[3] BS EN 13725:2003 Air quality. Determination of odour concentration by dynamic olfactometry.
[4] BS EN 13725:2003 *Air Quality – Determination of Odour Concentration by Dynamic Olfactometry.*
[5] Software used: Lakes AERMOD View, version 9.8. Aermod model executable 19191.
[6] Environment Agency – Air dispersion modelling report requirements (for detailed air dispersion modelling), Air Quality Modelling and Assessment Unit.

3.5.1 Criterion for use in Odour Impact Assessment

The objective of this assessment is to determine the potential extent to which unacceptable levels of odour impact could reasonably be expected to occur as a result of emissions from the Site.

In order to ensure that a cautious approach is adopted, it has been assumed that odours from the ERF would be 'most offensive' and that all sensitive receptors are of a 'high sensitivity' to odours. Therefore, in reference to the odour benchmark levels outlined within the EA's H4 Odour Guidance for a 'most offensive' odour (see Section 2.1.1) the $C_{98,\ 1\text{-hour}}$ 1.5ou_E/m^3 odour criterion has been applied within this assessment for all sensitive receptors to present the point at which the adverse effect of odours could be considered 'significant pollution'.

4.0 SITE SETTING AND BACKGROUND

4.1 Site Location

The Runcorn ERF site is located off Picow Farm Road in an industrial area at Weston Point, Runcorn at approximate National Grid Reference (NGR) x349860, y381680. The Site extends from south to north, in parallel with the A557.

There are a number of sensitive receptors in proximity to the Runcorn ERF, the closest of which are residential properties located to the southwest (Clarks Terrace, 25m), south (Sandy Lane, 45m) and east (Russell Road, 225m).

4.2 Potentially Sensitive Receptors

The identified sensitive receptors in proximity of the Site are presented in Table 4-1. Receptor sensitivity has been determined in reference to the IAQM Odour Guidance.

Table 4-1
Modelled Discrete Receptors

Receptor	Receptor Type	Receptor Sensitivity	Receptor Flagpole Height (m)	UK NGR (m)		Distance/Direction from Site
				X	Y	
DR_1	Residential	High	1.5	349725	381480	35m, SSW
DR_2	Residential	High	1.5	349658	381474	35m, SSW
DR_3	Residential	High	1.5	349702	381422	90m, SSW
DR_4	Residential	High	1.5	349694	381347	165m, SSW
DR_5	Residential	High	1.5	349769	381370	150m, S
DR_6	Residential	High	1.5	349860	381407	115m, S
DR_7	Residential	High	1.5	349928	381417	85m, SSE
DR_8	Residential	High	1.5	349974	381396	30m, SSE
DR_9	Residential	High	1.5	350054	381401	40m, SE
DR_10	Residential	High	1.5	350118	381406	100m, SE
DR_11	Residential	High	1.5	350170	381406	150m, SE
DR_12	Residential	High	1.5	350252	381447	225m,ESE
DR_13	Residential	High	1.5	350250	381578	250m, ESE
DR_14	Residential	High	1.5	350246	381682	255m, E
DR_15	Residential	High	1.5	350272	381727	280m, E
DR_16	Residential	High	1.5	350272	381804	300m, E
DR_17	Residential	High	1.5	350259	381873	290m, ENE

Receptor	Receptor Type	Receptor Sensitivity	Receptor Flagpole Height (m)	UK NGR (m)		Distance/Direction from Site
				X	Y	
DR_18	Residential	High	1.5	350173	381928	220m, ENE
DR_19	Residential	High	1.5	350136	381977	175m, NE
DR_20	Residential	High	1.5	350109	382054	150m, NE
DR_21	Residential	High	1.5	350132	382126	170m, NE
DR_22	Residential	High	1.5	350181	382184	205m, NE
DR_23	Recreational	High[(a)]	1.5	350129	381617	80m, N

Table note:

a) A recreational receptor could be considered of a ‘medium’ sensitivity to odours (in reference to the IAQM guidance), however in order to reflect a conservative assessment approach this receptor has been considered of a ‘high’ sensitivity to odours.

Reference should be made to Figure 4-1 for an illustration of the closest sensitive receptors identified, relative to the Site.

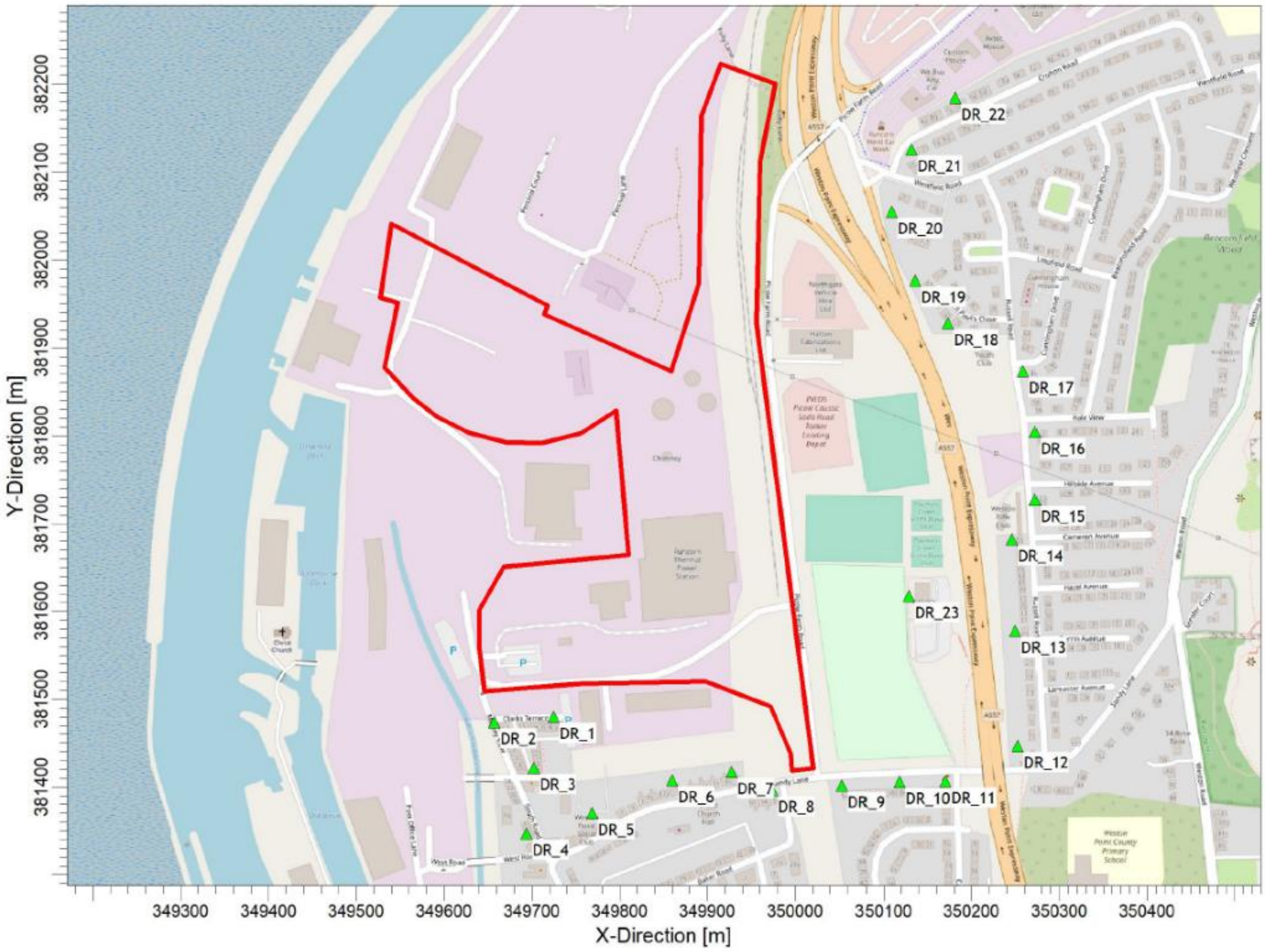

Figure 4-1
Runcorn ERF – Modelled Discrete Odour Receptors

The discrete receptors presented within Table 4-1 are not an exhaustive list; the closest sensitive receptors in each direction surrounding the Site have been identified. There may be more receptors at a greater distance, however when considering that odour concentration decreases with the distance from the source, it can reasonably be inferred that receptors at a greater distance would not be adversely effected if receptors in closer proximity are not predicted to experience an adverse effect.

The receptor sensitivity has been determined in reference to the IAQM guidance (as presented in Section 2.1.2), in which residential dwellings are determined to be of a 'high' sensitivity to odours.

A receptor grid has also been utilised (see Section 5.3).

4.3 Compliance Assessment Reports

The observations from the most recent Compliance Assessment Reports (CARs) provided by Viridor are summarised below.

CAR 0383109 - 18th January 2021

A remote inspection was hosted by the EA to investigate Viridor's follow up to complaints received in accordance with their complaint procedure.

A possible odour from the Site was noted from Viridor's investigation procedure as 'being possible' due to wind direction 'being corroborated' to the locations reported from the complainants and via the EA. Viridor had followed their established procedure for verifying odour and instructed a third-party contractor to carry out field-based odour monitoring on the 24th December 2020 and the 31st December 2020. No odour was detected during the odour monitoring by the third-party.

CAR 0386687 - 10th February 2021

A field-based odour (and noise) monitoring exercise was conducted by the EA. A train had recently arrived at the time of the assessment and waste containers were being unloaded from the train for transport to the Tipping Hall. Waste deliveries were also received by road during this time. A light SSW wind was observed.

At 8:21pm in the Railyard it was noted that *"No odours were detected despite being down-wind* (of the waste containers) *but it was noted it was exceptionally cold."*

At 8:50pm it was noted that *"Still no odours were detected near the site gates* (Picow Farm Road) *downwind* (of the waste containers and Tipping Hall) *and waste heavy goods vehicles continued to arrive at the site."*

CAR0386949 - 19th February 2021

A field-based odour (and noise) monitoring exercise was conducted by the EA. Waste deliveries were received to the Tipping Hall during the assessment period. A moderate SW wind was observed.

The following observations were made:

> *"Between 14:00 and 14:33 officers carried out observations along Sandy Lane to the Pavilion fields, during this time we noted a faint (1 on the intensity scale) sweet odour potentially compost, maybe MSW but it was very intermittent and barely detectable. The wind direction at that time would not have meant that odours from the reception hall would be blowing towards us. We were unable to determine the source of this faint odour, it may have been passing MSW trucks or another localised source not connected to Viridor."*
>
> *"Between 14:33 and 14:39 officers were stood at the Pavilion opposite the reception hall the reception hall doors were open. No waste odours were detected at this location."*
>
> *"Between 14:40 and 15:05 hrs EA officers walked along Russell Road, during this time both officers detected very slight (1 on the intensity scale) odour that were again of a compost/ sweet/ refuse nature. The incidences were only for a few seconds and it was not possible to determine the actual smell."*
>
> *"At 15:15 officers knocked on the door of a recent reporter and officers spent until and 16:05 in this reporter's garden. During this time EA officer were unable to pick up any odours that maybe refuse (MSW) even when vehicles carrying or had carried MSW could be seen using both sides of the slip road."*
>
> *"Between 16:00 and 16:16 hrs. EA officers visited another reporter on Westfield Road and again spoke to them, socially distanced at the front of their property. During this time no odours were detected of MSW or Compost /woodchip. This resident felt that some improvements had been noted since we first visited them."*
>
> *"The reception hall doors were open but no MSW type odours were detected at that location apart from brief occasions when vehicles entering or leaving the site with MSW drove past. Officers were outside the site from 16:23 until 16:51"*

4.4 Existing Odour Sources

From a review of aerial imagery, the current primary source of odours in the area is considered to be industrial in nature. A number of industrial facilities border the Site to the north and west. The majority of these facilities are not considered to be likely source of potential cumulative odours when considering the distance between these potential odour sources and the sensitive receptors identified. However the Veolia Runcorn Wood Recycling Facility could present a possible source of odours at the sensitive receptors.

It should be noted that the likely nature of odours from the Veolia Runcorn Wood Recycling Facility (earthy/musty odours) would be distinct from the Runcorn ERF (waste-type odours).

5.0 MODEL INPUT DATA

5.1 Modelling Scenarios

The operation of the ERF has the potential to generate odour during standard operation. The scenario considered within this assessment is detailed within Table 5-1.

Table 5-1
Odour Assessment – Modelling Scenario

Modelled Pollutant	Assessment Criteria	Modelling Criteria Applied
Odour	1-hour mean not to exceed more than 2% of the time (175 hours)	98th percentile of 1-hour means

The assessment considered odour emissions from all sources during normal operating conditions, as described below.

5.2 Model Assumptions

In producing the dispersion model, the following key assumptions were made:

- fugitive odours arising from the reception and storage of waste within the Tipping Hall are effectively contained by the extraction of air resulting in negative pressure containment within the building as well as the sound construction of the building (see Appendix C). Therefore, these have not been considered within the assessment;
- three trucks (two trailers of RDF and one trailer of MSW) are queuing continuously to enter the tipping hall during times at which waste is received on weekdays (6:00am to 11:00pm);
- one truck (one trailer of RDF) is queuing continuously to enter the tipping hall during times at which waste is received on weekends (6:00am to 11:00pm);
- on average 150 containers of RDF are received at the railyard each weekday. This has been averaged to 75 containers arriving at midday (1:00pm) and a further 75 containers in the evening (11:00pm). This has been represented in the modelling as 75 area sources within the railyard;
- on average 120 containers of RDF are received at the railyard each day of the weekend. This equates to 60 containers arriving at midday (1:00pm) and a further 60 containers in the evening (11:00pm);
- on average it takes two hours to offload each train received at the railyard;
- the train which arrives at 11:00pm remains in the railyard overnight and is subsequently unloaded from 08:00am the following day (i.e. unloaded by 10:00am);
- the odour emission rate for waste containers in the railyard has been reduced by 90% to reflect the high level of containment observed for the two containers tested (see Appendix C); and
- the sheeting covering the incoming trailers of waste is not considered to provide any meaningful containment of odours, reflecting a conservative assessment approach.

The above assumptions have been determined to form a representation of 'normal' Site operations. Unusual Site operations (such as plant breakdown, for example) have not been considered.

5.3 Assessment Area

The modelling has been undertaken using a radial receptor grid across the study area, as well as discrete receptors located at the sensitive receptors identified in proximity to the Site (see Table 4-1). Odour exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the predicted odour concentration to be calculated in the local area surrounding the Site.

The radial receptor grid was defined as follows:

- 36 radials of equal size (i.e. 10 degrees between radials);
- 16 rings at 25m increments up to 400m; and
- centred at NGR coordinates x349931, y381832.

5.4 Modelled Sources and Emission Rates

Emission parameters have been determined based on the monitoring results as presented in Appendix B and the assumptions outlined in Section 5.2 above.

Reference should be made to Figure 5-1 for an illustration of the modelled sources. Table 5-2 and Table 5-3 present the odour emission parameters defined for the modelling exercise.

Table 5-2
Odour Emission Sources - Weekdays

Emission Source	Number of sources	Total Surface Area (m^2) [a]	Waste Type	Odour Emission Rate ($ou_E/m^2/s$)	Odour Emission Rate (ou_E/s)	Applicable Times (weekdays)	Release Height (m)
Railyard waste containers (full train)	75	1,350	RDF (Fresh)	67.8 9 [b]	9,180 [d]	13:00 to 14:00 & 23:00 to 09:00	3.0
Railyard waste containers (half-full train during unloading operations)	38	684	RDF (Fresh)	67.8 [b]	4,590 [d]	14:00 to 15:00 & 09:00 to 10:00	3.0
Road trailer (RDF)	2	67.5	RDF (Fresh)	67.8 [b]	4,577	06:00 to 23:00	4.5
Road trailer (MSW)	1	33.8	MSW (Fresh)	10.1 [c]	341	06:00 to 23:00	4.5

Table note:

a) Total area calculated based on:
   - Railyard waste container dimensions: length 6m, width 3m.
   - Road Trailer dimensions: length 13.5m, width 2.5m.

b) Odour emission rate defined for ‘fresh’ RDF without agitation (see Appendix B).

c) Odour emission rate defined for ‘fresh’ MSW (see Appendix B).

d) Odour emission rate reduced by 90% to reflect the high level of containment provided by the waste containers (see Appendix C).

Table 5-3
Odour Emission Sources - Weekends

Emission Source	Number of sources	Total Surface Area (m^2) [(a)]	Waste Type	Odour Emission Rate ($ou_E/m^2/s$)	Odour Emission Rate (ou_E/s)	Applicable Times (weekdays)	Release Height (m)
Railyard waste containers (full train)	60	1,080	RDF (Fresh)	67.8 [(b)]	7,290 [(c)]	13:00 to 14:00 & 23:00 to 09:00	3.0
Railyard waste containers (half-full train during unloading operations)	30	540	RDF (Fresh)	67.8 [(b)]	3,645 [(c)]	14:00 to 15:00 & 09:00 to 10:00	3.0
Road trailer (RDF)	1	33.8	RDF (Fresh)	67.8 [(b)]	2,292	06:00 to 23:00	4.5
Road trailer (MSW)	0	-	MSW (Fresh)	-	-	-	-

Table note:

a) Total area calculated based on:
   - Railyard waste container dimensions: length 6m, width 3m.
   - Road Trailer dimensions: length 13.5m, width 2.5m.

b) Odour emission rate defined for 'fresh' RDF without agitation (see Appendix B).

c) Odour emission rate reduced by 90% to reflect the high level of containment provided by the waste containers (see Appendix C).

Figure 5-1 presents the modelled odour emission sources (green outlines) in relation to the site boundary (red outline). The coordinates, dimensions, elevation and release height of each odour source modelled are presented in Appendix D.

Figure 5-1
Runcorn ERF – Odour Emission Sources

5.5 Meteorological Data

The most important meteorological parameters governing the atmospheric dispersion of pollutants are as follows:

- wind direction: determines the broad transport of the emission and the sector of the compass into which the emission is released;
- wind speed: will affect ground level emissions by determining the initial dilution of pollutants emitted; and
- atmospheric stability: is a measure of the turbulence, particularly of vertical motions.

The nearest meteorological recording station to the Site is the Liverpool John Lennon Airport meteorological recording station, located approximately 6km west of the Site at an elevation of 22m. The next nearest meteorological station would be the Hawarden meteorological recording station, located at a distance of approximately 22km to the south-west of the Site at an elevation of 4m. When considering proximity, surrounding land use and elevation, the Liverpool John Lennon Airport meteorological recording station was determined to be the most representative of the Site locale and has been utilised in this study.

The meteorological data (5 years hourly sequential data for 2015-2019 inclusive) was obtained in .met format from the data supplier and converted to the required surface and profile formats for use in AERMOD, in accordance with the latest guidance[7], using AERMET View meteorological pre-processor, details specific to the recording site location were used to define surface roughness, albedo and bowen ratio in the conversion (see Table 5-4) using the AERSURFACE tool within AERMET.

Table 5-4
Meteorological Data Preparation – Applied Surface Characteristics

Zone (Start and End Sectors)	Albedo	Bowen	Surface Roughness
0 – 30°	0.16	0.32	0.070
30 – 60°	0.16	0.32	0.074
60 - 90°	0.16	0.32	0.075
90 - 120°	0.16	0.32	0.035
120 - 150°	0.16	0.32	0.035
150 - 180°	0.16	0.32	0.063
180 - 210°	0.16	0.32	0.074
210 - 240°	0.16	0.32	0.060
240 - 270°	0.16	0.32	0.055
270 - 300°	0.16	0.32	0.075
300 - 330°	0.16	0.32	0.075
330 - 0°	0.16	0.32	0.071

A composite windrose for the 5-year dataset is presented in Figure 5-2. Individual wind-roses for each year of meteorological data are presented in Appendix A. The wind-roses indicate that the prevailing wind directions are from the west and from the south.

Table 5-5 presents statistics on the meteorological dataset illustrating the number of hours of calms (i.e. no measurable wind-speed) predicted as well as any missing data within the 5-year period.

Table 5-5
Liverpool Airport Meteorological Data Statistics

Year	Calm Hours (%)	Missing Hours (%)
2015	0.7	0.4
2016	0.6	0.5
2017	0.6	0.6
2018	0.7	2.9
2019	<0.1	0.0

[7] AERMOD Implementation guide. AERMOD implementation workgroup, USEPA. Last revised April 2021.

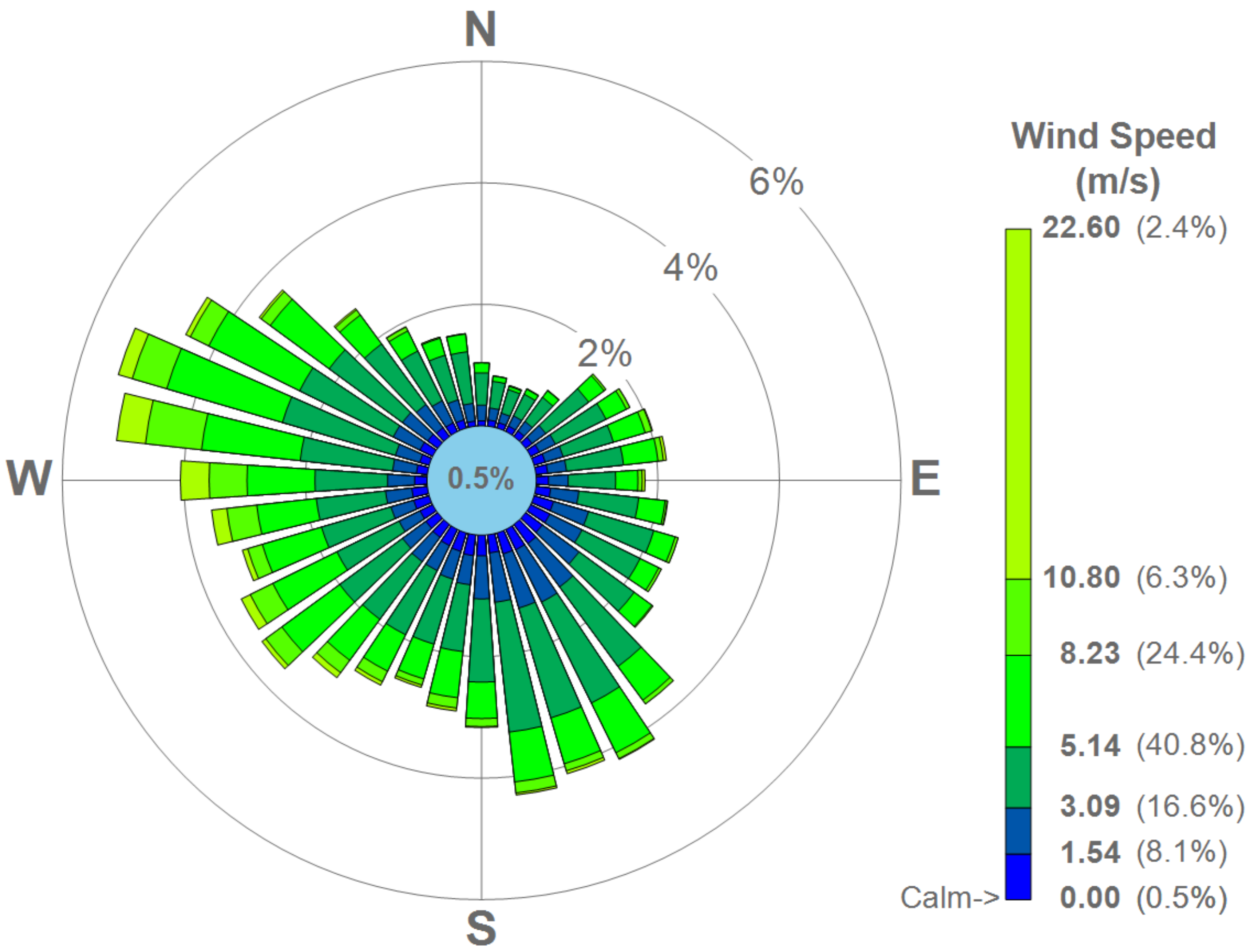

Figure 5-2
Liverpool Airport Meteorological Data Wind Rose 2015 - 2019

5.6 Terrain Data

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data. Data was processed by the AERMAP function within AERMOD to calculate terrain heights (see Figure 5-3).

The Site is situated on the east bank of the River Mersey at an elevation of approximately 20m AOD. The land rises to the east (Runcorn Hill) to a height of approximately 80m. As such, topography has been incorporated into the model.

Figure 5-3
Terrain Data

5.7 Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations.

Building downwash is only applicable to point source emissions when undertaking dispersion modelling in AERMOD. As there are no emissions modelled as point source emissions this has not been considered further in this assessment.

6.0 PREDICTION OF IMPACTS

This section provides a presentation of the predicted odour impact of the Site, as determined through the detailed dispersion modelling study.

The odour exposures predicted as a result of emissions from the ERF activities are presented in Figure 6-1, and Table 6-1 below.

6.1 Predicted Odour Concentrations at Sensitive Receptors

The predicted concentrations may be compared against the relevant benchmark criterion of 1.5ou_E/m^3 for 'most offensive' odours, reflecting a worst-case assessment approach.

The odour exposures predicted as a result of emissions from the ERF at the identified sensitive receptors are presented in Table 6-1 below.

Table 6-1
Predicted Odour Concentrations at Sensitive Receptors

Receptor	Receptor Sensitivity	Flagpole Receptor Height (m)	Predicted Odour Concentration ($C_{98,\ 1\text{-hour}}$ ou_E/m^3)
DR_1	High	1.5	0.6
DR_2	High	1.5	0.5
DR_3	High	1.5	0.4
DR_4	High	1.5	0.3
DR_5	High	1.5	0.3
DR_6	High	1.5	0.5
DR_7	High	1.5	0.8
DR_8	High	1.5	0.7
DR_9	High	1.5	0.6
DR_10	High	1.5	0.5
DR_11	High	1.5	0.4
DR_12	High	1.5	0.3
DR_13	High	1.5	0.4
DR_14	High	1.5	0.4
DR_15	High	1.5	0.4
DR_16	High	1.5	0.4
DR_17	High	1.5	0.4
DR_18	High	1.5	0.6

Receptor	Receptor Sensitivity	Flagpole Receptor Height (m)	Predicted Odour Concentration ($C_{98, 1\text{-hour}}$ ou_E/m^3)
DR_19	High	1.5	0.7
DR_20	High	1.5	0.8
DR_21	High	1.5	0.6
DR_22	High	1.5	0.5
DR_23	High	1.5	0.9

6.2 Isopleth Maps

The results of the dispersion modelling have been presented as isopleths of 98th percentile of 1-hour mean concentrations. The predicted concentrations may be compared against the relevant benchmark criterion of 1.5ou_E/m^3 for 'most offensive' odours.

Figure 6-1 presents the modelled dispersion of odours from the ERF when considering an 'average' of the 5-years of meteorological data investigated.

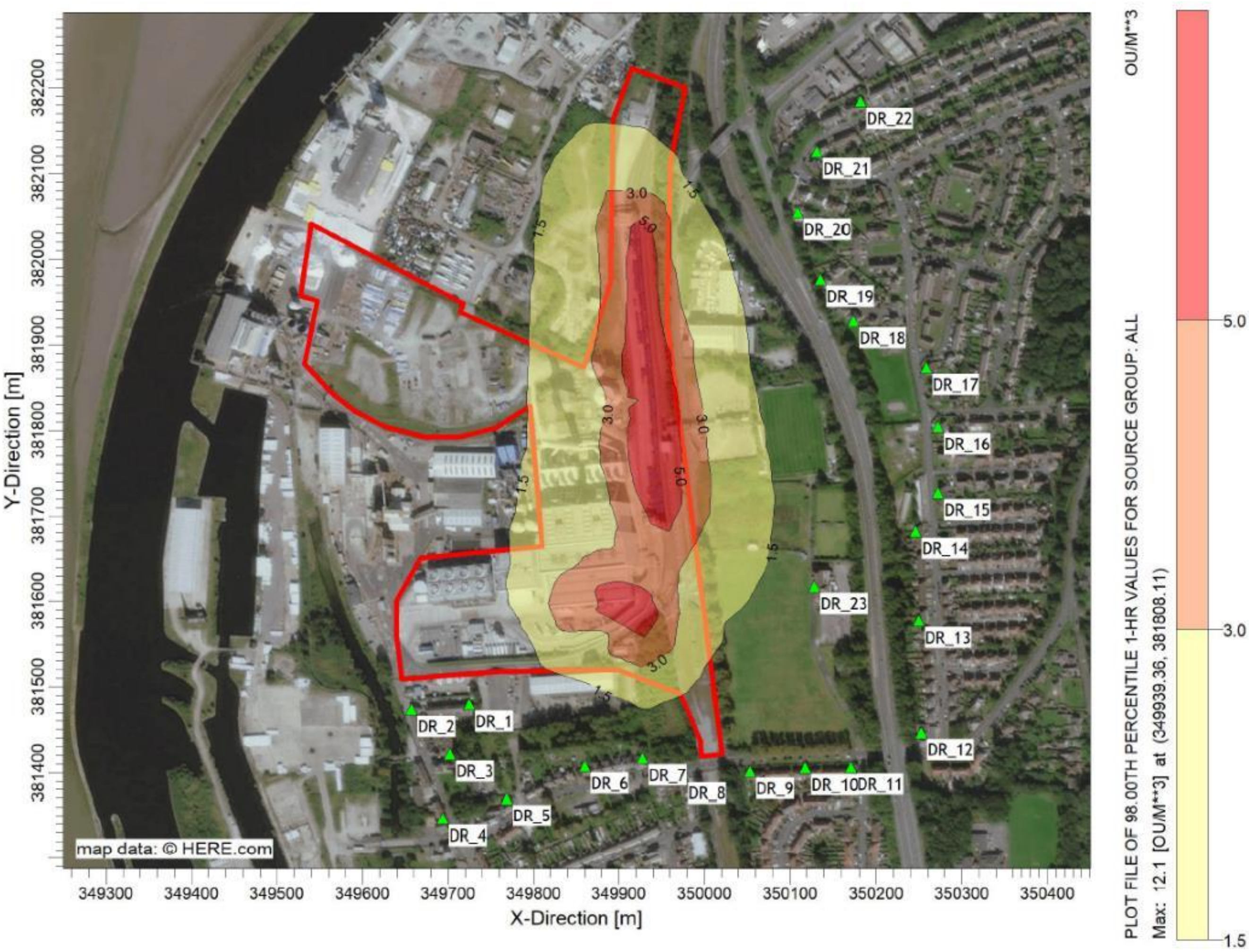

Figure 6-1
Modelled Odour Concentrations, Average of 2015-19 Meteorology

6.3 Interpretation of Results

The results of the assessment indicate that the predicted odour concentrations surrounding the Runcorn ERF, when considering the proposed amendments to Site operations as outlined in the permit variation, are below the benchmark criterion of $1.5ou_E/m^3$ as a 98^{th} percentile of 1-hour mean concentrations at all sensitive receptors.

The findings of the dispersion modelling are supported by the observations from the recent CAR reports (that waste odours, where detectable at sensitive receptors, do not constitute pollution), and the odour monitoring commissioned by Viridor by a third-party over the 2020 Christmas period (no detectable waste odours off-site). Whilst it is noted that these observations were undertaken whilst RDF (and no MSW) was received at the facility, the odour monitoring undertaken (as presented in Appendix B) found the MSW to be of a lower odour potential than the RDF currently received (i.e. a reduction in site odour emissions is predicted as a result of the proposed receipt of MSW).

Therefore, in accordance with the EA's H4 Odour Guidance this indicates that no sensitive receptors are subject to 'unacceptable odour pollution'.

7.0 SUMMARY AND CONCLUSION

SLR has undertaken an Odour Impact Assessment of identified sources of odour from the Runcorn ERF in Weston Point, Runcorn, to support an environmental permit variation application for the Site. The environmental permit variation seeks to diversify the feedstock received at the site through receipt of MSW. The proposal would not result in an overall increase to the volume of waste received at the site as the MSW received would replace an equivalent volume of RDF.

The potential odour impact from the Runcorn ERF has been quantified by dispersion modelling using Lakes AERMOD, applying a precautionary approach and model inputs, applied as part of a robust assessment. Odour emission rates for use in the dispersion modelling were determined in reference to an odour monitoring exercise at the Runcorn ERF Site as well as at another Viridor site (which processed waste representative of the MSW proposed to be received) as well as a containment testing undertaken at the Runcorn Site. The odour monitoring found the MSW to be of a lower odour potential than the RDF currently received, therefore the receipt of MSW represents an overall reduction in predicted site odour emissions.

Dispersion modelling of odours from operations at the Runcorn ERF 'has been compared against the $C_{98,1\text{-hour}}$ $1.5ou_E/m^3$ odour impact criterion (for 'most offensive' odours, in accordance with the H4 Odour Guidance) to reflect a worst-case assessment.

The results of the assessment indicate that the odour impact from the operation of the ERF is below the benchmark criterion of $1.5ou_E/m^3$ as a 98^{th} percentile of 1-hour mean concentrations for 'most offensive' odours at all sensitive receptors. Therefore, when considering the proposed amendments to site operations as outlined in the environmental permit variation (i.e. receipt of MSW waste) at the Runcorn ERF, no sensitive receptors are subject to 'unacceptable odour pollution' in accordance with the EA's H4 Odour Guidance.

APPENDIX A

Meteorological Data Wind Roses

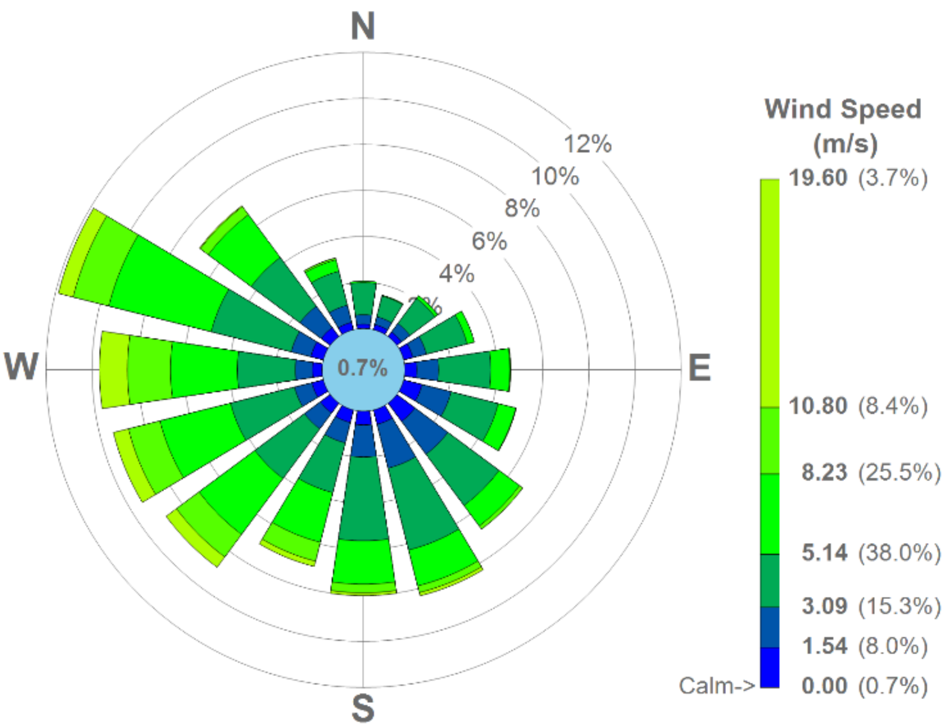

Figure A-1
Liverpool John Lennon Airport Meteorological Data Wind Rose 2015

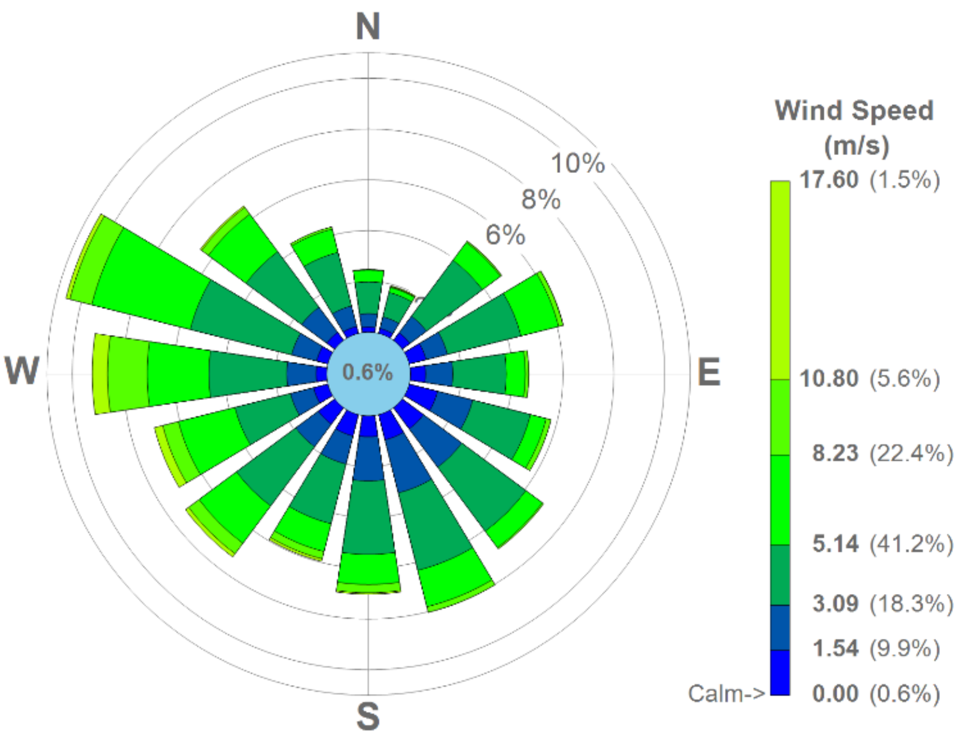

Figure A-2
Liverpool John Lennon Airport Meteorological Data Wind Rose 2016

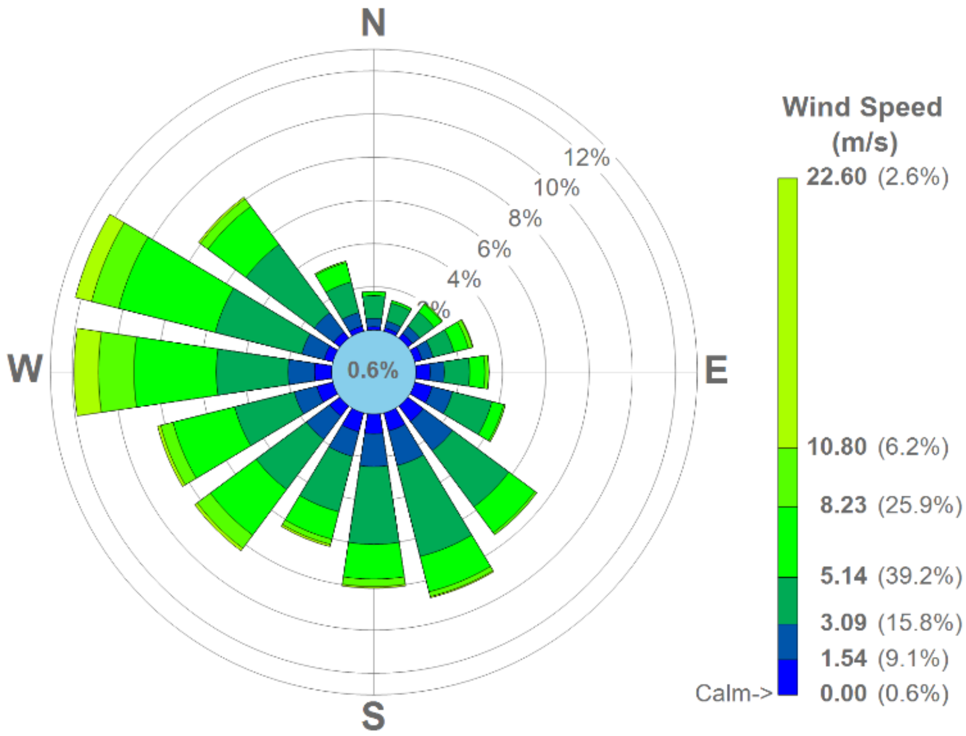

Figure A-3
Liverpool John Lennon Airport Meteorological Data Wind Rose 2017

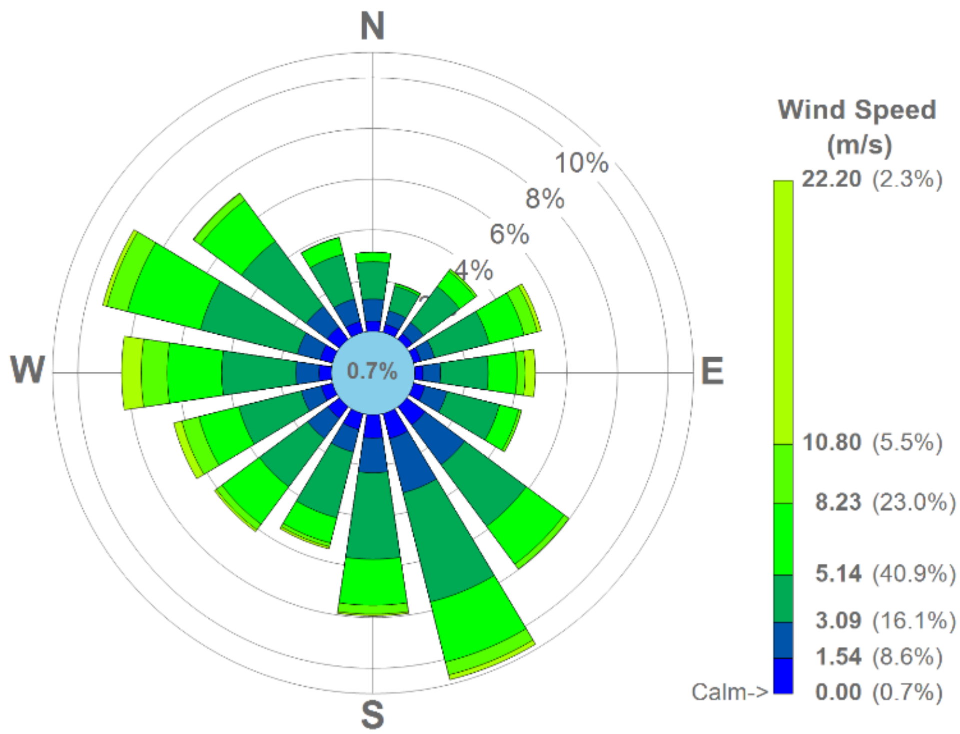

Figure A-4
Liverpool John Lennon Airport Meteorological Data Wind Rose 2018

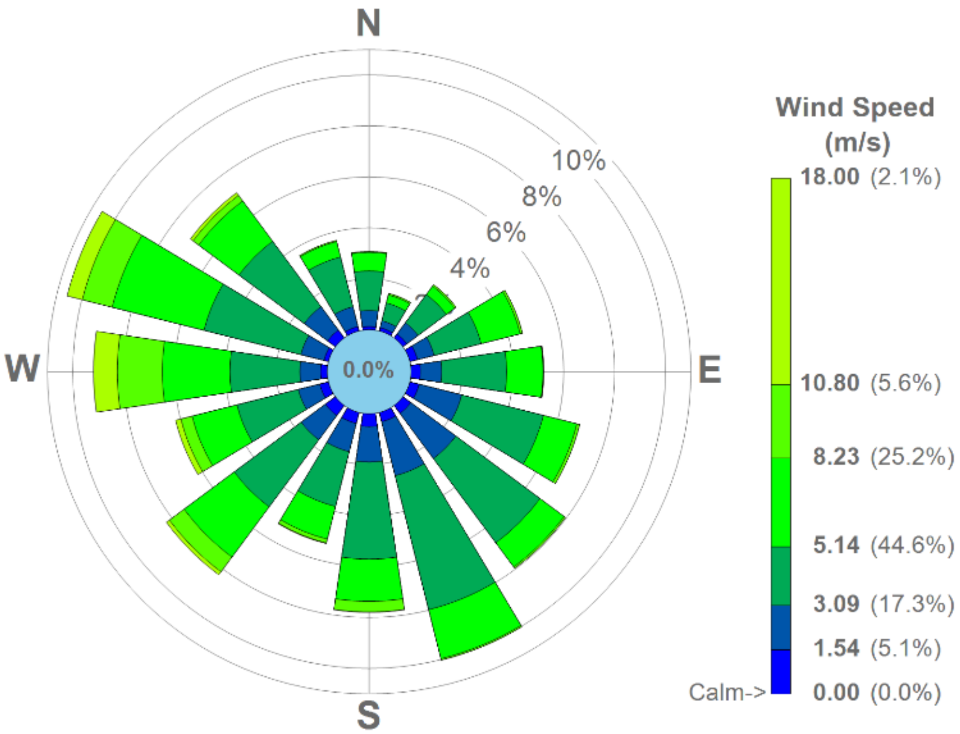

Figure A-5
Liverpool John Lennon Airport Meteorological Data Wind Rose 2019

APPENDIX B

Odour Monitoring Results

Odour sampling was undertaken to understand the odour potential of RDF received at the Runcorn ERF as well as the MSW proposed to be received as part of the environmental permit variation. As MSW is not currently received at the Runcorn ERF, monitoring was undertaken on MSW at another of Viridor's facilities (referred to as the 'Surrogate Site'). The MSW at the Surrogate Site was considered representative of that which would be received at the Runcorn ERF, as it was from the same catchment area and included co-mingled food waste.

The monitoring was undertaken on 12th May 2021 at the Surrogate Site and 3rd June 2021 at the Runcorn ERF.

The 'aged' waste piles had been set aside two days prior to sampling.

The sampling was undertaken using the methodology outlined in BS EN 13725: 2003[8]. Collection of odour samples was undertaken using a Lindvall sampling hood to facilitate measurement of an area odour emission rate. The extract air was collected into 40-litre Nalophan sampling bags for transport. The samples were then analysed by an external UKAS accredited laboratory as specified in BS EN 13725: 2003.

A number of samples were collected from the 'fresh' waste immediately after the waste was tipped from the trailers to understand the variation in odour generation from 'fresh' waste after agitation (i.e. tipping into the bunker).

The results of the monitoring exercises are presented in Table B-1 and Table B-2 below:

Table B-1
Odour Monitoring Data - Odour Concentrations

Date	Waste Sampled	Notes	Time	Replicate Odour Concentration (ou_Em^3)	Geomean Odour Concentration (ou_Em^3)
13/05/21	'Fresh' MSW (Surrogate Site)	'Fresh' MSW - First hour after agitation (tipping)	12:31	1,459	1,900
			12:41	1,878	
			12:51	2,502	
			13:05	1,296	938
			13:17	1,025	
			13:29	621	
		'Fresh' MSW without agitation	13:43	413	435
			13:54	446	
			14:05	446	
	'Aged' MSW (Surrogate Site)	MSW stored at site, approx. two days old	10:57	1,078	687
			11:10	378	
			11:35	797	
03/06/21			10:55	54,302	46,143

[8] BS EN 13725: 2003 - Air quality. Determination of odour concentration by dynamic olfactometry.

Date	Waste Sampled	Notes	Time	Replicate Odour Concentration (ou_Em^3)	Geomean Odour Concentration (ou_Em^3)
	'Fresh' RDF (Runcorn ERF)	'Fresh' RDF - First hour after agitation (tipping)	11:06	47,823	
			11:19	37,832	
		'Fresh' RDF without agitation	11:53	8,558	8,585
			12:04	8,140	
			12:15	9,082	
	'Aged' RDF (Runcorn ERF)	RDF stored at site, approx. two days old	10:00	858	542
			10:13	572	
			10:22	324	

Table B-2
Odour Monitoring Data - Area Odour Emission Rates

Date	Waste Sampled	Notes	Time	Geomean Area Odour Rate ($ou_E/m^2/s$)
13/05/21	'Fresh' MSW (Surrogate Site)	MSW immediately after agitation (tipping)	12:31 - 13:29	10.1
		'Fresh' MSW without agitation	13:43 - 14:05	3.2
	'Aged' MSW (Surrogate Site)	MSW stored at site, approx. two days old	10:57 - 11:35	5.1
03/06/21	'Fresh' RDF (Runcorn ERF)	RDF immediately after agitation (tipping)	10:55 - 11:19	401.0
		'Fresh' RDF without agitation	11:53 - 12:15	67.8
	'Aged' RDF (Runcorn ERF)	RDF stored at site, approx. two days old	10:00 - 10:22	4.7

The odour monitoring results presented in Table B-1 and Table B-2 highlight the variability in odour load of each waste type under different conditions. The most notable feature of the results is the elevated odour emission rate observed for recently agitated waste monitored on 3rd June 2021 (first hour after tipping), with a monitored geomean odour concentration of 46,143ou_E/m^3. The odour concentration measured from recently agitated waste (i.e. first hour) was observed between 4 times and 7 times higher than the subsequent hour (geomean of 8,585ou_E/m^3 vs. geomean of 46,143ou_E/m^3).

The fresh RDF pile which monitoring was undertaken from was noted to comprise of highly odorous waste such as domestic food waste, domestic cleaning products and soiled clothing (see Figure B-1 below). RDF is generally considered to be of a low odour potential (due primarily to the biological pre-treatment of the waste) which does not correlate with the odour monitoring data from the fresh RDF. It is considered that the waste monitored represents a 'worst-case' for the quality of RDF received at the Site. Therefore, in order to present a conservative assessment approach, the measured odour emission rate for fresh RDF without agitation (67.8 $ou_E/m^2/s$) has been applied for all RDF waste odour sources modelled. It is noted that there are no RDF waste sources which are agitated outside of the Tipping Hall. Waste containers are lowered by a crane onto waiting trucks, and trailers of RDF may pass over speed bumps on the approach to the site, but this represents very minimal agitation of the waste.

The fresh MSW pile which monitoring was undertaken from was observed to comprise of typical domestic waste with food waste co-mingled (see Figure B-2 below). The fresh MSW waste received at the Surrogate Site was considered representative of the MSW which would be received at the Runcorn ERF under the permit variation (i.e. domestic black-bag waste with food waste co-mingled). It is noted that the measured area odour emission rate from the MSW was much lower than that measured from RDF. Therefore, in order to present a conservative assessment approach, the measured odour emission rate for fresh MSW during agitation (10.1 $ou_E/m^2/s$) has been applied for all MSW waste odour sources modelled.

The aged waste samples were present at the respective sites for approximately two days prior to the monitoring. 'Aged' RDF (4.7 $ou_E/m^2/s$) was observed to have a much lower area odour emission rate compared to the 'fresh' RDF monitored (67.8 $ou_E/m^2/s$ without agitation). 'Aged' MSW (5.1 $ou_E/m^2/s$) was observed to have a similar odour emission rate compared to the 'fresh' RDF monitored (3.2 $ou_E/m^2/s$ without agitation). However as aged waste is only present within the Tipping Hall (from which fugitive emissions are considered negligible, based upon the containment testing presented in Appendix C), this monitoring data has not been applied in the modelling assessment.

Figure B-1
Fresh RDF - Monitored Waste Pile

Figure B-2
Fresh MSW - Monitored Waste Pile

APPENDIX C

Containment Testing Results

An assessment was undertaken at the Runcorn ERF to determine the level of containment afforded by a number of key potential odour sources identified at the Site. This included consideration of fugitive odour emissions from the Tipping Hall and the waste containers at the railyard. This assessment has been utilised to establish the level of containment of each of the considered sources and, therefore, whether each of these represent a potential to generate fugitive odour.

Description of Approach

The containment testing was undertaken on 6th June 2021. The weather was partially cloudy with occasional sunshine. The temperature was between 17 and 19°C with a 4 km/h NNW wind.

Prior to undertaking the testing, the structures were inspected to identify any potential routes of air exchange with the external atmosphere. An industrial smoke machine (ViCount 5000) was used to fill the target areas with oil-based smoke, with testing undertaken in one area at a time. The structures were visually inspected from the outside throughout the smoke testing period to identify any areas of visible smoke (indicating leakage). Observations were documented through video recording.

At the time of testing, the main vehicular access door to the Tipping Hall was damaged and stuck in an open position[9]. Therefore, to simulate the door being in a closed position a large polythene sheet was stretched across the open area (i.e. the area ordinarily sealed by the door) and sealed at the edges for the period of the assessment . There were no other unusual activities taking place at the site during the testing. Incoming waste deliveries were held whilst the containment assessment was undertaken at the Waste Reception Hall (as the door was blocked by the sheeting). The processing of waste and associated activities remained ongoing during the assessment, therefore, the Tipping Hall was under negative pressure as a result of the air extracted to the combustion process.

Two empty railyard waste containers were assessed (ID numbers #5934 and #5947); selected based on their visible condition. The containers selected had perished or damaged seals around the doors, reflecting a worst-case assessment. This was confirmed by an inspection of the waste containers in use (i.e. the waste containers on the train were in a better general condition than those assessed).

Results

The results of the containment testing conducted at the Runcorn ERF site are summarised in Table C-1 and discussed in further detail below.

Table C-1
Containment Testing Summary

Unit Tested	Leakage Point	Magnitude of Leakage
Waste Reception Hall	General structure (external walls and louvres)	Negligible
	External pedestrian fire door	Negligible
	Vehicular Access Door (covered by sheeting / ‘closed’)	Negligible
	Vehicular Access Door (open)	Very Minor
	External louvres	Negligible
	Two ventilation holes at rear of the container (each of less than 10cm in diameter)	Minor/Moderate

[9] The damage was caused by a strike with a passing vehicle. A contractor has been booked to make repairs in the coming weeks.

Unit Tested	Leakage Point	Magnitude of Leakage
Railyard Waste Containers #5934 and #5947	Access doors at front of containers	Minor/Moderate
	General structure	Negligible

Table note:

a) The magnitude of leakage has been determined based upon SLR's site observations during the assessment undertaken on 3rd June 2021.

Tipping Hall

The overall level of containment afforded by the Tipping Hall was noted to be very good; largely due to the effectiveness of the air extracted from above the bunkers to the combustion process. The extraction of air within the building creates an area of negative pressure, drawing ambient air into the building and greatly reducing the potential for fugitive odour from the Tipping Hall. This was clearly evidenced at all locations tested within the building by the movement of oil-based smoke towards the bunkers.

The level of containment afforded by the structure of the Tipping Hall was very good. The walls were inspected for any cracks or gaps through which smoke might escape, however none could be identified. The only potential release points identified were by design; the louvres and access points. When smoke built up behind the louvres, no smoke was visible outside of the building for the period of the assessment (see Figure C-1), indicating what is considered to be a 'negligible' level of leakage from this source.

The pedestrian access (and fire) doors were assessed to determine the level of containment afforded whilst closed and also during use (i.e. pedestrians entering or exiting the building). All external pedestrian doors were observed to be fitting with self-closing mechanisms. When closed, all of the pedestrian doors were observed to achieve a very high level of containment (i.e. what is considered to be a 'negligible' level of leakage. When the external pedestrian door was opened (Figure C-2), only a small escape of smoke from within the building was observed (not a large visible plume) and the majority of the smoke was drawn back into the building by the ventilation system.

The vehicular access door was assessed to determine the level of containment afforded whilst closed. When closed (simulated by covering of the open area by sheeting), the vehicular access door was observed to achieve a very high level of containment (i.e. what is considered to be a negligible level of leakage). The sheeting was observed to be drawn strongly inwards (see Figure C-3) as a result of the air extraction. This indicates that when the doors are opened, the negative pressure generated by the extraction system would be sufficient to effectively contain fugitive odours (as observed for the external pedestrian doors). This is supported by the observations of the EA from the recent CAR (0386949), where it was stated: *"Between 14:33 and 14:39 officers were stood at the Pavilion opposite the reception hall the reception hall doors were open. No waste odours were detected at this location."* and *"[…]* and *"The reception hall doors were open but no MSW* [sic] *type odours were detected at that location apart from brief occasions when vehicles entering or leaving the site with MSW* [sic] *drove past. Officers were outside the site from 16:23 until 16:51".* It should be noted that it was not possible to undertake leakage testing of the vehicular access door during use (i.e. vehicles entering or exiting the building) as the smoke would have obscured the view of drivers and posed a substantial hazard.

Therefore fugitive odour emissions from the Tipping Hall are considered 'negligible', including when the vehicular access doors are opened (in consideration of the intermittent mature of this operation).

Railyard Waste Containers

The level of containment afforded by the general structure of the Railyard Waste Containers was noted to be very good. All sides of both containers were inspected for any cracks or gaps through which smoke could escape, however none could be identified. Two potential release points were identified; the two ventilation holes (each less than 10cm in diameter) at the rear of the container, and the seals around the doors.

When smoke was built up within the container, a slow trickle of smoke was visible escaping the container from the ventilation holes at the end of the container (see Figure C-4). However it should be noted that the ventilation holes were small and represented only a small combined area of leakage, mitigating the severity of this leakage point.

When smoke was built up within the container, a slow trickle of smoke was visible escaping around the doors (on the opposite end of the container from the ventilation holes), due to perished seals or small dents or bends in the doors from use (see Figure C-5 and Figure C-6). However it should be noted that these gaps represented a small combined area of leakage, mitigating the severity of this leakage point.

Therefore, overall the level of leakage from the Railyard Waste Containers was assessed to be either 'very minor' (ventilation holes and around the doors) or 'negligible' (the general structure of the containers). On balance, the level of leakage is considered 'minor'.

It should also be considered that the leakage points identified are at either end of the containers. The containers are tightly packed together, sheltering the ends of the containers from winds which might blow through, further improving the level of containment afforded. In consideration of the above, it is considered that the Railyard Waste Containers would provide a high level of containment of fugitive odour emissions from the RDF contained within (when loaded). Therefore, a reduction factor of 90% has been applied in this assessment to represent the high level of containment observed (see Table 5-2).

Figure C-1
Containment Testing - Tipping Hall Louvres

Figure C-2
Containment Testing - Tipping Hall Pedestrian Door

Figure C-3
Containment Testing - Tipping Hall Vehicular Doors

Figure C-4
Containment Testing - Waste Container

Figure C-5
Containment Testing - Waste Container

Figure C-6
Containment Testing - Waste Container

APPENDIX D

Modelled Odour Emission Sources

The coordinates, dimensions, elevation and release height of each odour source modelled are presented in Table D-1 below.

Table D-1
Odour Emission Sources - Further Parameters

Emission Source	Location (NGR) (m)		Source Dimensions (m)		Base Elevation (m)	Release Height (m)
	X	Y	Length	Width		
Road Trailer 01 (RDF)	349917	381594	13.5	2.5	17.9	4.5
Road Trailer 02 (RDF)	349906	381584	13.5	2.5	17.5	4.5
Road Trailer 03 (MSW)	349892	381575	13.5	2.5	17.1	4.5
Railyard Waste Container 01	349950	381698	3.0	6.0	17.5	3.0
Railyard Waste Container 02	349949	381704	3.0	6.0	17.3	3.0
Railyard Waste Container 03	349949	381710	3.0	6.0	17.1	3.0
Railyard Waste Container 04	349948	381718	3.0	6.0	17.0	3.0
Railyard Waste Container 05	349947	381724	3.0	6.0	17.1	3.0
Railyard Waste Container 06	349947	381730	3.0	6.0	17.3	3.0
Railyard Waste Container 07	349945	381739	3.0	6.0	17.4	3.0
Railyard Waste Container 08	349945	381745	3.0	6.0	17.5	3.0
Railyard Waste Container 09	349945	381751	3.0	6.0	17.3	3.0
Railyard Waste Container 10	349944	381760	3.0	6.0	17.0	3.0
Railyard Waste Container 11	349943	381766	3.0	6.0	16.7	3.0
Railyard Waste Container 12	349943	381772	3.0	6.0	16.5	3.0
Railyard Waste Container 13	349942	381780	3.0	6.0	16.7	3.0
Railyard Waste Container 14	349942	381786	3.0	6.0	17.1	3.0
Railyard Waste Container 15	349941	381792	3.0	6.0	17.5	3.0
Railyard Waste Container 16	349941	381800	3.0	6.0	18.0	3.0
Railyard Waste Container 17	349940	381806	3.0	6.0	18.4	3.0
Railyard Waste Container 18	349940	381812	3.0	6.0	18.6	3.0
Railyard Waste Container 19	349940	381821	3.0	6.0	19.0	3.0
Railyard Waste Container 20	349940	381827	3.0	6.0	19.2	3.0
Railyard Waste Container 21	349939	381833	3.0	6.0	19.4	3.0
Railyard Waste Container 22	349938	381841	3.0	6.0	19.6	3.0
Railyard Waste Container 23	349937	381847	3.0	6.0	19.7	3.0

Emission Source	Location (NGR) (m)		Source Dimensions (m)		Base Elevation (m)	Release Height (m)
	X	Y	Length	Width		
Railyard Waste Container 24	349937	381853	3.0	6.0	19.8	3.0
Railyard Waste Container 25	349936	381861	3.0	6.0	19.9	3.0
Railyard Waste Container 26	349936	381867	3.0	6.0	19.9	3.0
Railyard Waste Container 27	349935	381873	3.0	6.0	19.7	3.0
Railyard Waste Container 28	349934	381881	3.0	6.0	19.5	3.0
Railyard Waste Container 29	349934	381887	3.0	6.0	19.3	3.0
Railyard Waste Container 30	349933	381893	3.0	6.0	19.1	3.0
Railyard Waste Container 31	349932	381901	3.0	6.0	18.8	3.0
Railyard Waste Container 32	349932	381907	3.0	6.0	18.6	3.0
Railyard Waste Container 33	349931	381913	3.0	6.0	18.4	3.0
Railyard Waste Container 34	349930	381921	3.0	6.0	18.1	3.0
Railyard Waste Container 35	349930	381927	3.0	6.0	18.0	3.0
Railyard Waste Container 36	349929	381933	3.0	6.0	18.0	3.0
Railyard Waste Container 37	349928	381942	3.0	6.0	18.0	3.0
Railyard Waste Container 38	349928	381948	3.0	6.0	18.0	3.0
Railyard Waste Container 39	349927	381954	3.0	6.0	18.0	3.0
Railyard Waste Container 40	349926	381963	3.0	6.0	17.7	3.0
Railyard Waste Container 41	349925	381969	3.0	6.0	17.5	3.0
Railyard Waste Container 42	349925	381975	3.0	6.0	17.3	3.0
Railyard Waste Container 43	349925	381983	3.0	6.0	17.1	3.0
Railyard Waste Container 44	349924	381989	3.0	6.0	17.0	3.0
Railyard Waste Container 45	349924	381995	3.0	6.0	17.0	3.0
Railyard Waste Container 46	349923	382004	3.0	6.0	17.0	3.0
Railyard Waste Container 47	349923	382010	3.0	6.0	17.0	3.0
Railyard Waste Container 48	349922	382016	3.0	6.0	17.1	3.0
Railyard Waste Container 49	349922	382024	3.0	6.0	17.5	3.0
Railyard Waste Container 50	349921	382030	3.0	6.0	17.8	3.0
Railyard Waste Container 51	349921	382036	3.0	6.0	18.2	3.0
Railyard Waste Container 52	349945	381707	3.0	6.0	18.2	3.0

Emission Source	Location (NGR) (m)		Source Dimensions (m)		Base Elevation (m)	Release Height (m)
	X	Y	Length	Width		
Railyard Waste Container 53	349946	381695	3.0	6.0	17.5	3.0
Railyard Waste Container 54	349946	381701	3.0	6.0	17.8	3.0
Railyard Waste Container 55	349944	381727	3.0	6.0	18.2	3.0
Railyard Waste Container 56	349944	381715	3.0	6.0	17.5	3.0
Railyard Waste Container 57	349944	381721	3.0	6.0	17.8	3.0
Railyard Waste Container 58	349941	381748	3.0	6.0	18.2	3.0
Railyard Waste Container 59	349942	381736	3.0	6.0	17.5	3.0
Railyard Waste Container 60	349942	381742	3.0	6.0	17.8	3.0
Railyard Waste Container 61	349940	381768	3.0	6.0	18.2	3.0
Railyard Waste Container 62	349941	381756	3.0	6.0	17.5	3.0
Railyard Waste Container 63	349940	381762	3.0	6.0	17.8	3.0
Railyard Waste Container 64	349938	381796	3.0	6.0	18.2	3.0
Railyard Waste Container 65	349938	381784	3.0	6.0	17.5	3.0
Railyard Waste Container 66	349938	381790	3.0	6.0	17.8	3.0
Railyard Waste Container 67	349936	381828	3.0	6.0	18.2	3.0
Railyard Waste Container 68	349936	381816	3.0	6.0	17.5	3.0
Railyard Waste Container 69	349936	381822	3.0	6.0	17.8	3.0
Railyard Waste Container 70	349934	381848	3.0	6.0	18.2	3.0
Railyard Waste Container 71	349934	381836	3.0	6.0	17.5	3.0
Railyard Waste Container 72	349934	381842	3.0	6.0	17.8	3.0
Railyard Waste Container 73	349932	381869	3.0	6.0	18.2	3.0
Railyard Waste Container 74	349933	381857	3.0	6.0	17.5	3.0
Railyard Waste Container 75	349933	381863	3.0	6.0	17.8	3.0

APPENDIX E

Modelled Input Files

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