Mr R Sasikaran

1282 Uxbridge Road, UB4 8JG

Odour Appraisal

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Consultants in air quality & odour assessment

Odour Appraisal

Contents

1 Introduction 1

2 Odour – Background and Guidance 2

2.1 Guidance 2

2.1.1 DEFRA Guidance 2

2.1.2 IAQM Guidance 6

2.2 Regulation 8

3 Appraisal 9

3.1 Site location and surroundings 9

3.2 Proposed Development 9

3.3 Odour Risk Assessment 10

3.3.1 DEFRA Odour Risk Assessment 10

3.3.2 IAQM SPR Assessment 11

3.4 Summary of Assessment Outcomes 12

4 Conclusions 13

Approved for Issue 

Michael Bull – Director, Michael Bull and Associates

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1 Introduction

Michael Bull and Associates Ltd (MBAL) has been commissioned by Mr R Sasikaran to undertake an odour appraisal in connection with the proposal for Change of use from cafe/restaurant (Use Class A3) to hot food takeaway (Use Class A5). The London Borough of Hillingdon (LBH) has placed a condition on the planning approval as follows:

"*Notwithstanding the submitted plans, no air extraction system shall be used on the premises until a scheme for its siting, and the control of noise and odour emanating from the site has been submitted to and approved in writing by the Local Planning Authority. Thereafter, the scheme shall be implemented and maintained in full compliance with the approved measures*".

This report provides information to satisfy the requirement relating to odours.

Operation of commercial kitchens can result in odorous emissions which, if not properly controlled, can result in a nuisance if sensitive properties (receptors) are frequently affected by high odour concentrations. An assessment is therefore required to determine the level of risk of problems from odours, to assess whether odour mitigation is required and if so, to determine an appropriate level of control to avoid nuisance.

This report provides background detail on odours, the approaches used for the assessment of odours from commercial kitchens and also provides the results of the odour appraisal for this proposed development using methods outlined in guidance from the Department of Environment, Food and Rural Affairs (DEFRA) and the Institute of Air Quality Management (IAQM).

The principal author of this report is Dr Michael Bull who was the chair of group that produced the Institute of Air Quality Management (IAQM) guidance on the assessment of odours for planning. He is an air quality and odour consultant with over 34 years of experience, has published and spoken widely on air quality and odour matters and was a contributing author to the book, Designing with Smells, published by Routledge in 2017.

2 Odour – Background and Guidance

2.1 Guidance

2.1.1 DEFRA Guidance

DEFRA produced guidance on the Control on Odour and Noise from Commercial Kitchen Exhaust Systems in January 2005[1] and Odour Guidance for Local Authorities in 2010[2]. These documents were withdrawn in September 2017 and there is no indication that they will be replaced or updated by Defra. However, most of the content of this guidance remains both relevant and useful in providing background information on odours and for providing a framework for the assessment methodology which is discussed below. One of the authors of the Commercial Kitchen guidance provided their own update in 2018[3] and this provides further relevant information and clarifies aspects of the original guidance.

The human nose is very sensitive to odour and can detect the presence of some chemicals at very low concentrations that would be difficult for instruments to measure. The environment is rarely "odour free" even in places that are perceived to be clean such as rural areas or by the sea. Our response to odours depends on four interlinked (sensory) characteristics:

- Hedonic tone: this is a judgement of the relative pleasantness or unpleasantness of an odour made by assessors in an odour panel;
- Quality/Characteristics: this is a qualitative attribute which is expressed in terms of "descriptors", e.g., "fruity", "almond", "fishy". This can be of use when establishing an odour source from complainants' descriptions;
- Concentration: the "amount" of odour present in a sample of air. It can be expressed in terms of parts per million, parts per billion or in mg/m^3 of air for a single odorous compound. More usually a mixture of compounds is present and the concentration of the mixture can be expressed in odour units per cubic metre (ou_E/m^3) (see definition below); and
- Intensity: is the magnitude (strength) of perception of an odour (from faint to strong). Intensity increases as concentration increases but the relationship is logarithmic. Increases or decreases in concentration of an odour do not always produce a corresponding proportional change in the odour strength as perceived by the human nose.

The most commonly used attribute is the concentration of odours; this is measured in European odour units (ou_E/m^3) using a device known as an olfactometer which presents a sample of odour at different dilutions to a selected and trained panel of human "sniffers". The panel is asked whether they are able to detect odour at various concentrations. Once only 50% of the panel can detect the odour, it is considered to be at its "Detection Threshold". The odour concentration at the Detection Threshold is defined to be 1 ou_E/m^3. For instance, if an odour sample has been diluted in an olfactometer by a factor of 10,000 to

[1] DEFRA, Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems, January 2005 (withdrawn September 2017).
[2] DEFRA, Odour Guidance for Local Authorities, March 2010 (withdrawn September 2017).
[3] EMAQ+ Control of Odour and Noise from Commercial Kitchen Exhaust Systems, Update, Dr Nigel Gibson, 2018

reach the detection threshold, then the concentration of the original sample is by definition 10,000 ou_E/m^3.

DEFRA notes in their Local Authority guidance that 5 ou_E/m^3 would be considered to be a 'faint' odour whilst 10 ou_E/m^3 would be considered a 'distinct' odour. Generally, an average person would be able to recognise the source of an odour at about 3 ou_E/m^3, although this can depend on the relative offensiveness of the odour. Background odour levels can be some 5-60 ou_E/m^3 or more.

The Local Authority guidance notes that the main issue with odour is its ability to result in an effect that is "objectionable". The guidance notes that an offensive odour can occur at concentrations of compounds that are far below the level that would result in an effect on the physical health of humans.

The DEFRA Kitchen Ventilation guidance provides three factors that influence the production of odour from a commercial kitchen:

- Size of the facility – This influences the quantity of food cooked, the volume of ventilation air handled and the intensity of the odour;
- Type of food prepared – This affects the chemical constituents in the ventilation air; and
- Type of cooking appliances used – This dictates the level of fat, water and the temperature of the ventilation air.

In general, the amount of odour released depends on the amount of oil/grease in the vented air and the quantities of spices used in the cooking. Therefore, deep fat frying, open grills and the cooking of more highly spiced food result in the highest odour releases.

The guidance notes that existing premises should have systems designed to comply with the principles of Best Practical Means and these should be achieved with an adequate level of odour control and stack dispersion. It notes that the discharge stack should ideally be located at least 1m above the roof ridge of any building within 15m of the vent. Where this is achieved, further odour control may not be required depending on the level of risk.

If this requirement cannot be complied with, then the discharge should be 1m above the roof eaves or dormer window of the building housing the kitchen and some odour control measures will be required. Where this cannot be achieved, then odours need to be reduced by further control equipment and the guidance details how different levels of mitigation can be achieved to allow a low-level ventilation system to work successfully.

Annex C of the guidance provides a risk assessment framework for odour (see Table 1 below). This examines four factors - the location of the exhaust vent, the proximity of sensitive receptors, the size of the kitchen and the type of food cooked. An overall score is then calculated to give a risk rating, there are three possible risk levels: Low to Medium, High and Very High. The 2018 update to the guidance slightly amended the risk factors of cooking type and these are also detailed in Table 1.

Criteria	Score	Score	Details (DEFRA Guidance)	Details (Updated 2018 Guidance)
Dispersion	Very poor	20	Low level discharge, discharge into courtyard or restriction on stack	Low level discharge, discharge into courtyard or restriction on stack
	Poor	15	Not low level but below eaves, or discharge at below 10 m/s	Not low level but below eaves, or discharge at below 10 m/s
	Moderate	10	Discharging 1m above eaves at 10-15 m/s	Discharging 1m above eaves at 10-15 m/s
	Good	5	Discharging 1m above ridge at 15 m/s	Discharging 1m above ridge at 15 m/s
Proximity of receptors	Close	10	Closest sensitive receptor less than 20m from kitchen discharge	Closest sensitive receptor less than 20m from kitchen discharge
	Medium	5	Closest sensitive receptor between 20 and 100m from kitchen discharge	Closest sensitive receptor between 20 and 100m from kitchen discharge
	Far	1	Closest sensitive receptor more than 100m from kitchen discharge	Closest sensitive receptor more than 100m from kitchen discharge
Size of Kitchen	Large	5	More than 100 covers or large takeaway	More than 100 covers or large takeaway
	Medium	3	Between 30-100 covers or medium takeaway	Between 30-100 covers or medium takeaway
	Small	1	Less than 30 covers or small takeaway	Less than 30 covers or small takeaway
Cooking type (odour and grease loading)	Very high	10	Pub (high level of fried food), fried chicken, burgers or fish and chips	Pub (high level of fried food), fried chicken, burgers or fish and chips, Turkish, Middle Eastern or any premises cooking with solid fuel
	High	7	Kebab, Vietnamese, Thai or Indian	Vietnamese, Thai, Chinese, Steakhouse, Indian, Japanese

	Medium	4	Cantonese, Japanese or Chinese	Cantonese, Italian, French, Pizza (gas fired)
	Low	1	Most pubs, Italian, French, Pizza or Steakhouse	Most pubs (no fried food, mainly reheating and sandwiches etc), Tea rooms

Table 1 DEFRA Guidance Risk Assessment Framework Scoring

Each of the four factors is scored according to the criteria above and a total "significance score" is obtained. This score is used to assess the level of odour control required for the particular situation as shown in Table 2.

Impact Risk	**Odour Control Requirement**	**Significance Score**
Low to Medium	Low Level Odour Control	Less than 20
High	High Level Odour Control	20-35
Very High	Very High-Level Odour Control	More than 35

Table 2 Risk Assessment Framework Significance.

Where odour control is required, up to three stages of treatment can be used:

- Initial grease removal – usually by baffle filters or equivalent above the cooking area;
- Particulate removal – usually by filtration or electrostatic precipitator (ESP);
- Removal of gaseous odours – usually by carbon filtration, UV/Ozone treatment or odour neutraliser.

The guidance provides examples of equipment combinations that meet each level of odour control shown in Table 3.

Level of odour control	Equipment combination
Low to medium	1. Fine filtration or electrostatic precipitator (ESP) followed by carbon filtration (carbon filters rated with 0.1 second residence time)
	Fine filtration followed by counteractant/neutralising system to achieve the same level of control as 1
High	2. Fine filtration or ESP followed by carbon filtration (carbon filters rated with 0.2-0.4 second residence time)
	Fine filtration or ESP followed by UV ozone system to achieve the same level of control as 2
Very High	3. Fine filtration or ESP followed by carbon filtration (carbon filters rated with 0.2-0.4 second residence time)
	Fine filtration or ESP followed by UV ozone system to achieve the same level of control as 3
	Fine filtration or ESP followed by carbon filtration and by counteractant/neutralising system to achieve the same level of control as 3

Table 3 Examples of Odour Control Equipment and Level of Control

2.1.2 IAQM Guidance

The Institute of Air Quality Management (IAQM) produced guidance in 2014 and was updated in 2018[4] with the specific intention to provide advice for "assessing odour impacts for planning purposes". It provides details of various assessment techniques noting that each has its own strengths and weaknesses. Because of this, the guidance recommends using a multi-tool approach (i.e., a combination of at least two techniques).

The DEFRA Odour Risk Assessment method is one suitable tool and a second is the use of a Source, Pathway, Receptor (SPR) model. The SPR approach assesses the risk of an adverse odour impact by examining the source characteristics, how effectively the odours can travel from the source to a receptor (i.e., the Pathway) and examining the sensitivity of the receptor. For each of these factors, the guidance provides example risk factors to provide a consistent approach for the assessment. These risk factors are shown in Table 4.

[4] Bull M, IAQM, Guidance on the assessment of odour for planning, 2018 update

Source Odour Potential	Pathway Effectiveness	Receptor
Source odour potential is allocated to one of three levels: small, medium or large. Factors affecting the source odour potential are: • The magnitude of the odour release • How inherently odorous the compounds are • The unpleasantness of the odour	Pathway effectiveness is allocated to one of three levels: highly effective, moderately effective and ineffective, Factors affecting the odour flux to the receptor are: • Distance from source to receptor • The frequency of winds from source to receptor • The effectiveness of any mitigation in reducing flux to the receptor • The effectiveness of dispersion/dilution in reducing the odour flux to the receptor • Topography and terrain	Use professional judgement based on the expectation of the users at the receptor location. However, the assessment usually considered residential receptors that are considered to be highly sensitive.

Table 4 IAQM Source Pathway Receptor Approach

An example matrix for assessing the outcome is also provided in the guidance and shown in Table 5 below.

		Source Odour Potential		
		Small	Medium	Large
Pathway effectiveness	Highly effective	Low risk	Medium risk	High risk
	Moderately effective	Negligible risk	Low risk	Medium risk
	Ineffective	Negligible risk	Negligible risk	Low risk

Table 5 Risk assessment framework at a specific receptor

2.2 Regulation

Generally, kitchen vents are not regulated under environmental legislation. At the planning stage, the arrangements for ventilation will be examined to ensure compliance with building regulations. In addition, at planning, it is likely that the local Environmental Health Officer (EHO) would wish to be satisfied that a new vent would not give rise to a statutory nuisance under the Environmental Protection Act.

Kitchen ventilation systems are regulated under Health and Safety and Food Hygiene legislation and generally require that kitchens are provided with sufficient air to maintain a safe working environment, particularly where gas cooking (or other burning fuel) is used. As a result, many kitchens have automatic systems that shut down the cooking appliances if the ventilation system fails.

3 Appraisal

3.1 Site location and surroundings

The application site is at 1282 Uxbridge Road, UB4 8JG (See Figure 1) and is a two storey building with a loft extension with retail use on the ground floor which will be used for the proposed takeaway. The proposed development is in a row of shops with a mix of uses including some retailing and some existing food uses. There appears to be residential use in some of the upper floors of the buildings. Therefore a few sensitive properties are within 20m of the proposal although most residential properties in the area are further from the proposal.

The frequency of the wind direction is an important consideration in an odour appraisal. To impact on a location, the wind direction must be from the source to a receptor. The frequency of wind directions at a location can be visualised by analysing data and preparing a wind rose. Wind data has been collected[5] from the Heathrow site for the years 2016-2020 and a wind rose prepared (shown in Figure 2). The most frequent winds are from the south and south west.

3.2 Proposed Development

Plans have been provided to MBAL for the extract vent which show this discharging at high level above ridge height, however, the plans show the discharge to be horizontal. Following advice from MBAL, the proposal is now to install a vertically directed exhaust discharging 1m above roof height at 15 m/s. in the same location but without the horizontal end point. This therefore meets the requirements in the Defra guidance with respect to the recommended stack height. Having met this requirement, some installations do not require any further odour control. It is proposed that the menu will include chicken, chips and pizza with an expectation of the number of covers being between 30 to 100.

[5] Data collected using the open source Openair and Worldmet software accessing the NOAA database.

3.3 Odour Risk Assessment

3.3.1 DEFRA Odour Risk Assessment

Table 6 provides the scoring following the DEFRA odour risk assessment framework.

Criteria	Score	Justification
Dispersion	5	Good – discharging at high level at 15 m/s
Proximity of receptors	10	Close – sensitive receptors within 20m
Size of kitchen	3	Medium – 30-100 covers
Cooking type	4 - 10	Medium to Very high

Table 6 DEFRA Odour Risk Assessment Scores

The total score is therefore 22-28 which would be rated as High Risk.

However, it is proposed that the kitchen extract is discharged 1m above the roof height at a speed of 15 m/s. This will increase the effective discharge height as the exhaust gases will rise owing to momentum.

The Defra guidance gives some guidance on the effective stack height achieved by vertical discharge providing the following formula:

$$\Delta H = 3W.d/U$$

Where

ΔH = additional height owing to plume rise (m)

W = efflux speed at discharge (m/s)

d = internal diameter of stack (m)

U = wind speed (m/s)

The calculated additional stack hight is shown in Table 7.

Wind speed (m/s)	Additional Discharge Height (m)
1	22.5
2	11.3
3	7.5
4	5.6
5	4.5

Table 7 Additional Stack Height from Discharge Momentum

Vertical discharges are designed to operate at an air speed of 15 m/s, and the vent diameters for this size of restaurant would typically be 0.5m. In low wind speed conditions where odour risks are highest (i.e. 1-2m/s) the additional plume height gained by the vertical discharge would be approximately 11-21m removing the effective pathway to sensitive receptors. In particular, this will be above the height of the highest receptors in the flats to the south of the proposed development.

3.3.2 IAQM SPR Assessment

There is one odour source, the extract from the kitchen at low level. This have been included in an odour risk assessment following the SPR approach detailed in the IAQM Odour Guidance. The assessment of each of the three factors and the resulting risk (with justification) is provided in Table 8. Note that the assessment assumes that no odour control equipment is fitted.

Source	Source Odour Potential	Pathway Effectiveness	Receptor	Odour Risk and Justification
Kitchen extract at high level	Source located at high level, approximately 1m above roof height. Vertical discharge increases effective discharge height. Medium sized kitchen. Medium - Large source potential	The proposed development is located a close distance from sensitive receptors Discharge at high level above height of nearest receptors and several metres above the windows on the properties considered to be “close” to the discharge. Prevailing winds take odours away from nearest sensitive receptors. Ineffective pathway to nearest receptors.	Residential properties are considered to be High sensitivity.	The odour risk is considered to be Negligible- Low. Discharge is at high level. Effective discharge height above nearest properties.

Table 8 Source, Pathway, Receptor Assessment

3.4 Summary of Assessment Outcomes

The discharge location meets the recommendations of the Defra guidance discharging vertically above roof height. When this requirement is met, in many cases no further odour mitigation is required.

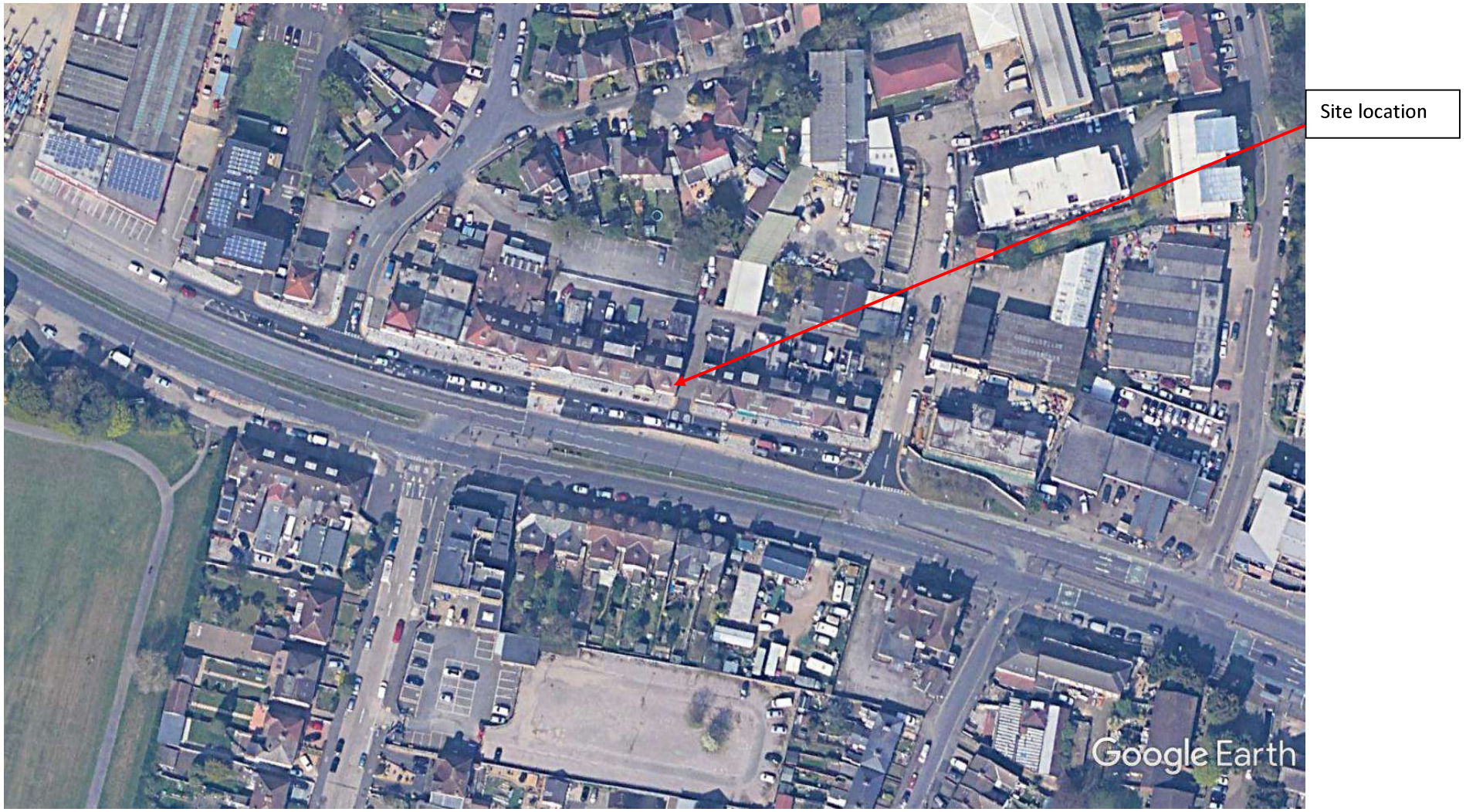
4 Conclusions

An appraisal has been carried out to assess the risk of adverse odours from a proposed development at 1282 Uxbridge Road, UB4 8JG. The proposal is for a change of use to takeaway chicken and pizza restaurant. Following a review by MBAL it is proposed to provide a high level exhaust (1m above roof height) discharging at 15m/s. This meets the requirements of the Defra guidance and further odour control would only be required if there was considered to be a high risk of odour impacts.

An assessment of the risks from odours has been made using the method details in the DEFRA guidance[1] and the SPR method provided in the IAQM guidance[4]. The discharge at high level together with the additional increase in effective discharge height owing to momentum results in an ineffective path to the nearest sensitive receptors. The outcome of these assessments therefore suggests that there is a low risk of adverse odours from the proposal and no further odour control equipment is required.

Figures

Figure 1 Site Location (Source – Google Earth)



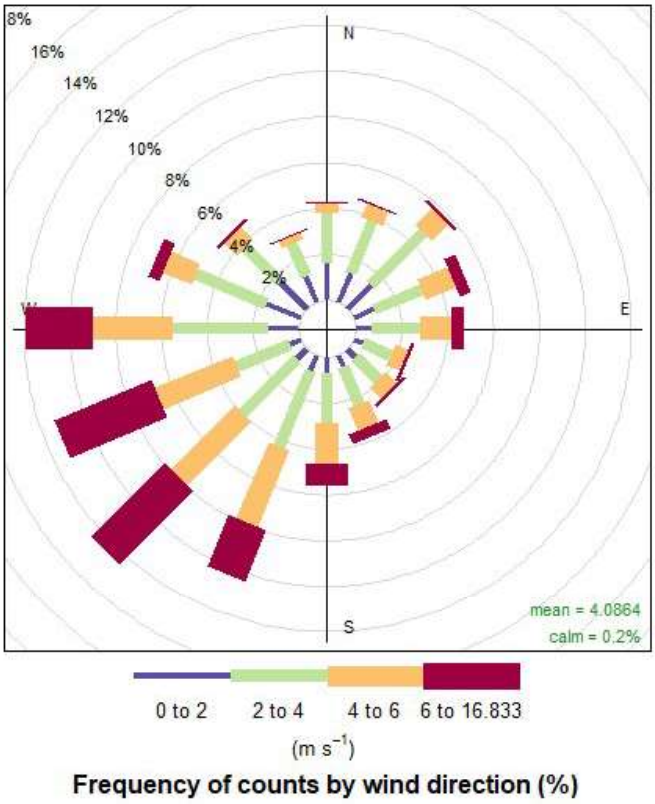


Figure 2 Windrose for Heathrow 2016-2020

Figure 3 Proposed Floor Plans and Elevations (source – AVIM Consultancy) – Discharge to be amended to be vertically directed

