WRH Ltd

80 - 82 Southampton Row, WC1B 4AR

Odour Appraisal

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MICHAEL BULL & ASSOCIATES

Consultants in air quality & odour assessment

Odour Appraisal

Contents

Approved for Issue 

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1 Introduction

Michael Bull and Associates Ltd (MBAL) has been commissioned by WRH Ltd to undertake an odour appraisal of their site at 80 - 82 Southampton Row, WC1B 4AR. A planning application has been made for the premises for refurbishment of the basement and ground levels of the building to provide a new restaurant.

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).

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 These documents were withdrawn in September 2017 and there is no indication that it will be replaced or updated. Some of the content of this guidance remains 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, this is known as the Defra/EMAQ+ 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 trained panel. 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

[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

been diluted in an olfactometer by a factor of 10,000 to reach the detection threshold, then the concentration of the original sample is 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/EMAQ+ Kitchen Ventilation guidance provides three factors that influence the production of odour from a commercial kitchen:

- Size of the facility – This influences 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 a higher level of odour control measures will be required. Where this cannot be achieved, then odours need to be reduced by 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/EMAQ+ 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 or UV/Ozone treatment.

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 0.4-0.8 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 multitool approach (i.e., a combination of at least two techniques).

The Defra/EMAQ+ 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

When odour control equipment is required and installed, this would reduce the source odour potential to small and therefore the outcome of the assessment would always be a negligible to low risk.

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 site is at 80 - 82 Southampton Row, WC1B 4AR, the site location is shown in Figure 1. The site is in a mixed use area in Central London, many properties have retail use on the ground floor with a mix of commercial and residential uses on the upper floors. There are several other food establishments is the same area including KFC and Food Hub. Their ventilation arrangements were not clear except it was evident that Food Hub discharged at the rear of the building and a combined ESP/UV system was fitted.

The property is currently vacant but is proposed to be used for predominantly Thai soup style bowls and tea. The only cooking will be heating of soups and reheating of prepared dishes. There will be no frying or griddling of foods. The food preparation is therefore of a very low odour potential.

In terms of the Defra/EMAQ+ size categories, this proposal would fall into the “medium” class of 20-100 covers per day. The cooking fumes are extracted through canopies containing grease traps that have an efficiency of up to 65-80% and these will assist in reducing residual odour emissions.

The extract air will pass through an Ecolight unit (See Appendix A) that combines filtration, an electrostatic precipitator (ESP) and a carbon filter. This provides a High level of odour control as defined in the DEFRA/EMAQ+ guidance. This then discharges at the rear of the building at ground floor level. The properties at the rear have a mixture of commercial and retail uses

3.2 Odour Risk Assessment

3.2.1 DEFRA Odour Risk Assessment

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

Criteria	Score	Justification
Dispersion	20	Poor – discharge into courtyard
Proximity of receptors	10	Close - Closest sensitive receptors within 20m of kitchen discharge
Size of kitchen	3	Medium – 20 to 100 Covers
Cooking type	1	Low – only reheating of soup/noddle dishes.

Table 6 Defra/EMAQ+ Odour Risk Assessment Scores

The total score is therefore 34 which would be rated as a High risk. However, it is important to note that the style of cooking results in very low odour generation and the high score results principally from the location of the vent at low level. Furthermore, odour reduction is provided with the Ecolight unit to further reduce the odour level in the emissions using a combination of treatment methods that are in accordance with the DEFRA/EMAQ+ requirements. Where there is a very small odour source, then it is very unlikely to result in an odour risk wherever the vent is located and this can be assessed using the IAQM SPR approach.

3.2.2 IAQM SPR Assessment

There is one odour source – the kitchen exhaust, this has been included in an odour risk assessment following the SPR approach detailed in the IAQM Odour Guidance. The outcome of this assessment is shown in Table 8.

Table 7 Source Pathway Receptor Odour Assessment

Source	Source Odour Potential	Pathway Effectiveness	Receptor	Odour Risk and Justification
Vent above ridge height	Thai noodle soup style/Tea. Only reheating and boiling of food – no frying or griddling. Odour control equipment using an ESP and carbon filter is provided. Small Odour Source potential	Sensitive receptors are located less 20m from the source but at lower level. Discharge is at low level. Highly effective pathway.	Residential properties are considered to be highly sensitive.	The odour risk is considered to be Low. Discharge at high level above sensitive receptors and above roof ridge height.

As can be seen, the outcome of the odour risk assessment is that there is a low risk of adverse odour impacts from the current arrangements at the site.

3.3 Odour Management

The Ecolight system will be serviced in accordance with the manufacturer's recommendations with regular cleaning of the ESP and replacement of the carbon filters in accordance with the manufacturer's recommendations. The vent pipework will be inspected at regular intervals and will be cleaned when necessary. Where excessive soiling was noted then the appropriate sections of the vent would be cleaned by a specialist contractor. Records would be kept of the maintenance, filter replacement and cleaning.

Should a complaint be received regarding odours, then the operation of the kitchens would be reviewed to determine if there were any unusual circumstances that would have led to excessive odour emissions. The ventilation system would be checked to ensure that it was operating in accordance with the manufacturers recommendations and would be cleaned and filters replaced.

The restaurant manager would be the person responsible for odour management and would maintain the appropriate records.

4 Conclusions

An odour assessment has been carried out in accordance with the risk assessment methodology detailed in the Defra/EMAQ+ Kitchen Ventilation Guidance and using the SPR methodology suggested by the IAQM. This considers the location of the extract vent, the distance to the nearest sensitive receptor, the size of the restaurant and the type of food being prepared.

The proposal is for preparation of a style of food with very low odour potential. The ventilation air from the kitchens is treated by a combined filter/ESP and carbon filter system to further reduce the odours. The use of this type of system provides an appropriate level of control in accordance with DEFRA/EMAQ+ guidance given the very low initial odour potential of the cooking style.

This conclusion is supported by the IAQM SPR approach that concludes that the potential odour risk for this proposed development would be Low.

Taking the outcome of both assessment methods together, it is concluded that the odour impacts from the operation are not significant.

Figures

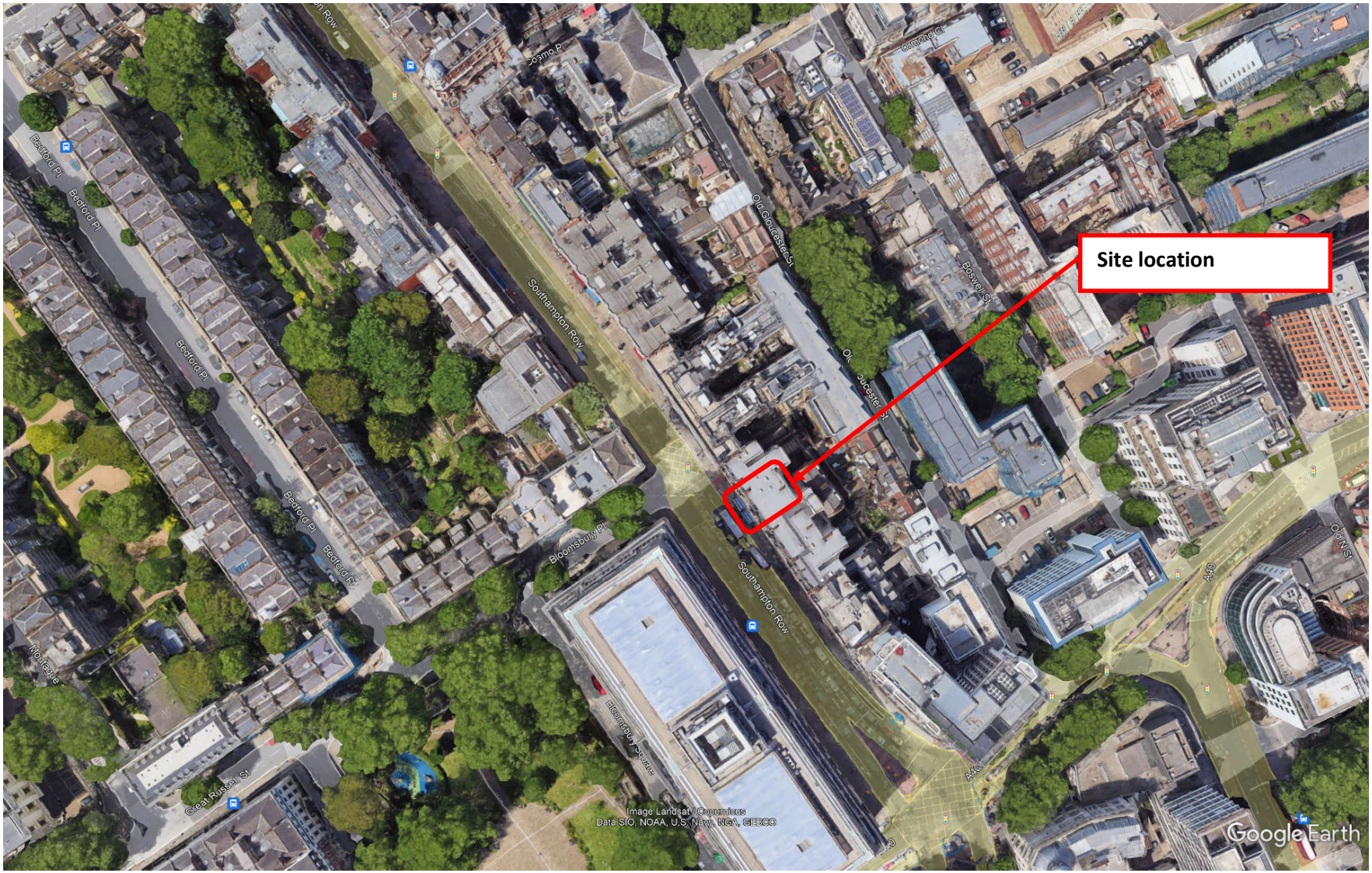


Figure 1 Site location

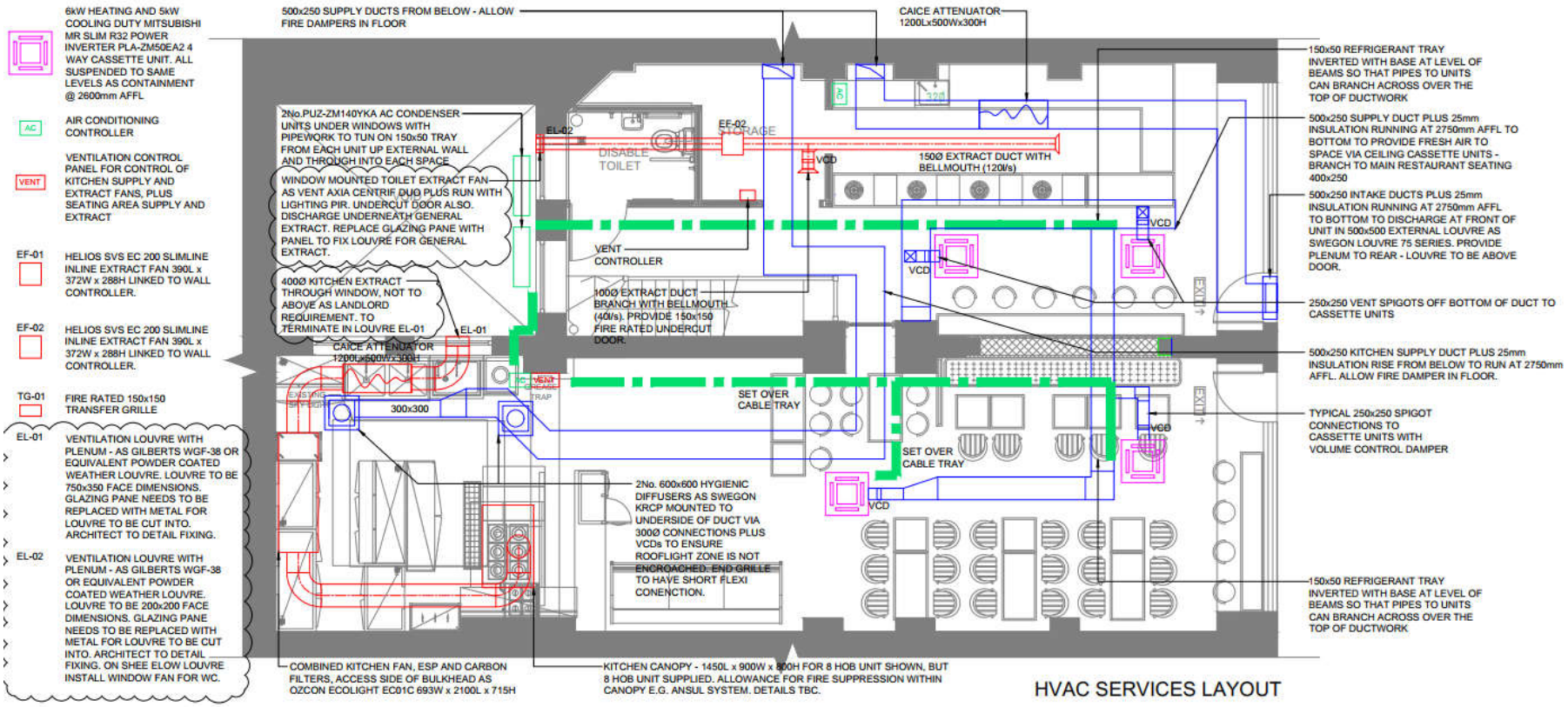


Figure 2 Schematic of ground floor ventilation proposals (not to scale)

Appendix A – Ecolight Specification Sheet

ECOLIGHT

OZCON
environmental solutions

HIGHLIGHTS

1. COMPACT SIZE
2. ELECTRONIC FILTER FEL SYSTEM STANDARD
3. ELECTRONIC ENGINE STANDARD
4. NEW PREFILTRATION WITH 3 WASHABLE STAGE
5. GRANULAR COCONUT/BAMBOO ACTIVATED CARBON
6. GUARANTEED HYGIENIC AND ANTIBACTERIAL EFFECT

Ozcon offers the new range of exhaust filtration units for kitchens with **compact size**, especially suitable for installation in small kitchens in historic centers: **ECOLIGHT.**

The **FEL System filter** installed as standard has been specifically designed for the removal of pollutants such as oil mist and vapors thanks to pointed collection blades that allow the capture and drop down high quantities of oily pollutant downwards.

Energy Saving is guaranteed as energy consumption is 3 times lower than that of a mechanical filter with equal filtration efficiency: this is mainly due to the **low pressure drops** almost constant over time, 62 Pa even when the filter is completely dirty.

The low energy consumption of the **ECOLIGHT** units is also guaranteed by the use of an **electronic motor** instead of a belt motor.

They are equipped with a new **3-stage prefiltration** completely removable and **washable.**

The possibility of installing before the activated carbon the combination of an **ionization cell FI** and an **ozonation cell FX** provides a hygienic and **antibacterial effect** and at the same time reduces odors.

Ozcon uses active labyrinth carbons with low pressure drops and high performance. It consists in **granular coconut/bamboo carbon.**

The **ECOLIGHT** can be supplied to be wired or **fully wired** ready for use, **including an electrical control panel.**

The structures are presented i**n self-supporting aluminum profiles,** with external 25 mm sandwich panels. Their body is made up of a **single block** that contains all the components inside it.

The **ECOLIGHT** units can be **installed on the wall**, on the **ceiling** or on the **floor** and are equipped with a folding, flag or removable door.

The installer will not have to provide any drainage system since the units are equipped with a **removable tray** designed tray to collect the oil captured by the electronic filter.

HIGHLIGHTS

1. DIMENSIONI COMPATTE
2. FILTRO ELETTRONICO FEL SYSTEM DI SERIE
3. MOTORE ELETTRONICO DI SERIE
4. NUOVA PREFILTRAZIONE A 3 STADI LAVABILE
5. CARBONE ATTIVO DI COCCO/BAMBU' GRANULARE
6. EFFETTO IGIENICO ED ANTIBATTERICO GARANTITO

Ozcon presenta sul mercato la nuova gamma di unità filtranti per cucine con dimensioni compatte, adatta soprattutto all'installazione nelle piccole cucine dei centri storici: **ECOLIGHT.**

Il **filtro FEL System** installato di serie è stato progettato appositamente per l'abbattimento di inquinanti quali nebbie e vapori oleosi grazie a lame di captazione appuntite nella parte inferiore che permettono la cattura e lo scorrimento di elevate quantità di inquinante oleoso verso il basso.

L'**Energy Saving** è garantito in quanto i consumi energetici risultano essere 3 volte inferiori rispetto a quelli di un filtro meccanico con pari efficienza di filtrazione: questo soprattutto grazie alle **basse perdite di carico** pressoché costanti nel tempo, 62 Pa anche a filtro saturo.

Il basso consumo energetico delle unità **ECOLIGHT** è garantito anche dall'utilizzo di un **motore elettronico** anziché a trasmissione.

Sono dotate di nuova **prefiltrazione a 3 stadi** completamente smontabile e **lavabile.**

La possibilità di installare prima dei carboni attivi la combinazione di **cella ionizzante FI** e **cella ozonizzante FX** garantisce **effetto igienico ed antibatterico** e riduce allo stesso tempo gli odori.

Ozcon utilizza carboni attivi a labirinto con basse perdite di carico ed alte performance. Si tratta di **carbone di cocco/bambù granulare.**

Le **ECOLIGHT** possono essere fornite da cablare o **totalmente cablate** pronte per l'uso, **comprensive di quadro elettrico di gestione**.

Le strutture si presentano in **profilati d'alluminio autoportanti,** con pannellature esterne a sandwich da 25 mm. Il corpo delle **ECOLIGHT** è costituito da un **blocco unico** che contiene tutti i componenti al suo interno.

Le unità **ECOLIGHT** possono essere **installate a muro,** a **soffitto** o a **pavimento** e sono dotate di porta apribile a ribalta, a bandiera o removibile.

L'installatore non dovrà prevedere alcun sistema di drenaggio dal momento che le unità sono provviste di una **vaschetta estraibile** predisposta per raccogliere l'olio catturato dal filtro elettronico.

TECHNICAL FEATURES

As you can see from the table below, Ozcon provides different models based on:

- Airflow required
- Overall dimensions
- Components installed inside according to customer needs.

MODEL MODELLO	**DIMENSIONS (MM)** DIMENSIONI (MM)	**AIRFLOW (m^3/h)** PORTATA D'ARIA (m^3/h)	**EXTERNAL STATIC PRESSURE (Pa)** PRESSIONE STATICA (Pa)
ECO 0,5 A	458 x 1350 x 715	1500	400
ECO 0,5 B	458 x 1700 x 715	1500	400
ECO 0,5 C	458 x 2100 x 715	1500	400
ECO 0,5 D	458 x 2100 x 715	1500	400
ECO 0,5 E	458 x 1850 x 715	1500	400
ECO 0,5 F	458 x 1500 x 715	1500	400
ECO 1 A	693 x 1350 x 715	2500	500
ECO 1 B	693 x 1700 x 715	2500	500
ECO 1 C	693 x 2100 x 715	2500	500
ECO 1 D	693 x 2100 x 715	2500	500
ECO 1 E	693 x 1850 x 715	2500	500
ECO 1 F	693 x 1500 x 715	2500	500
ECO 2 A	1285 x 1350 x 715	5000	700
ECO 2 B	1285 x 1700 x 715	5000	700
ECO 2 C	1285 x 2100 x 715	5000	700
ECO 2 D	1285 x 2100 x 715	5000	700
ECO 2 E	1285 x 1850 x 715	5000	700
ECO 2 F	1285 x 1500 x 715	5000	700
ECO 3 A	1877 x 1500 x 715	7650	500
ECO 3 B	1877 x 1850 x 715	7650	500
ECO 3 C	1877 x 2100 x 715	7650	500
ECO 3 D	1877 x 2100 x 715	7650	500
ECO 3 E	1877 x 1850 x 715	7650	500
ECO 3 F	1877 x 1500 x 715	7650	500

PF METAL: Metal mesh prefilter
FEL: Electrostatic filter FEL system
FAN: Fan
LAB: Labyrinth filter
FI: Ionization cell
FX: Ozonation cell
CARBOPACK: 2,5/5kg Active carbon filter
CARBOX: Box with active carbon filters 26/52 kg

CARATTERISTICHE TECNICHE

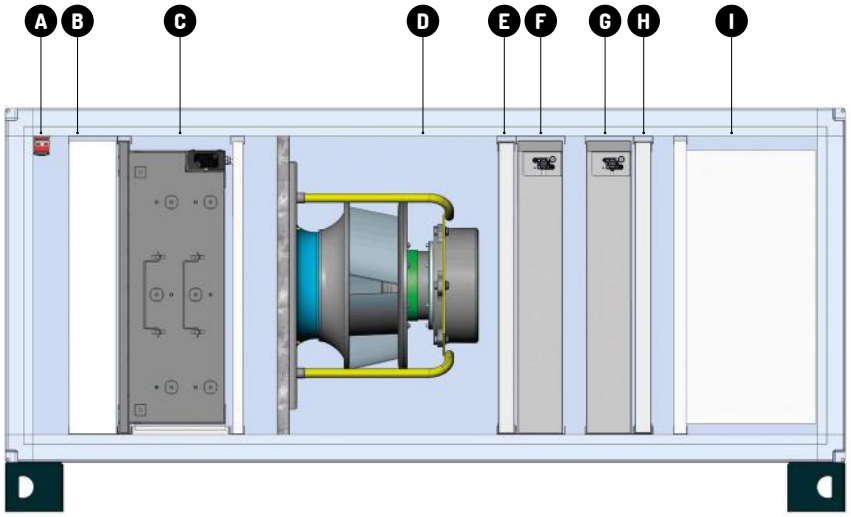
Come potete vedere dalla tabella sottostante, Ozcon fornisce diversi modelli in base a:

- Portata d'aria richiesta
- Dimensioni d'ingombro
- Componenti installati all'interno in base alle necessità del cliente.

FAN VENTILATORE	**CHARACTERISTICS** CARATTERISTICHE	**MODEL** MODELLO
7/7 TIG	PF METAL + 1FEL300 + FAN + CARBOPACK 2,5 KG	ECO 0,5 A
7/7 TIG	PF METAL + 1FEL300 + FAN + LAB + FI + FX + CARBOPACK 2,5 KG	ECO 0,5 B
7/7 TIG	PF METAL + 1FEL300 + FAN + LAB + FI + FX + CARBOX 26 KG	ECO 0,5 C
7/7 TIG	PF METAL + 1FEL300 + FAN + LAB + FI + CARBOX 26 KG	ECO 0,5 D
7/7 TIG	PF METAL + 1FEL300 + FAN + LAB + CARBOX 26 KG	ECO 0,5 E
7/7 TIG	PF METAL + 1FEL300 + LAB + FI + FX + CARBOX 26 KG	ECO 0,5 F
RAD 310	PF METAL + 1FEL600 + FAN + CARBOPACK 5 KG	ECO 1 A
RAD 310	PF METAL + 1FEL600 + FAN + LAB + FI + FX + CARBOPACK 5 KG	ECO 1 B
RAD 310	PF METAL + 1FEL600 + FAN + LAB + FI + FX + CARBOX 52 KG	ECO 1 C
RAD 310	PF METAL + 1FEL600 + FAN + LAB + FI + CARBOX 52 KG	ECO 1 D
RAD 310	PF METAL + 1FEL600 + FAN + LAB + CARBOX 52 KG	ECO 1 E
RAD 310	PF METAL + 1FEL600 + LAB + FI + FX + CARBOX 52KG	ECO 1 F
RAD310	2PF METAL + 2FEL600 + FAN + 2CARBOPACK 5 KG	ECO 2 A
RAD310	2PF METAL + 2FEL600 + FAN + 2LAB + 2FI + 2FX + 2CARBOPACK 5 KG	ECO 2 B
RAD310	2PF METAL + 2FEL600 + FAN + 2LAB + 2FI + 2FX + 2CARBOX 52 KG	ECO 2 C
RAD310	2PF METAL + 2FEL600 + FAN + LAB + 2FI + 2CARBOX 52 KG	ECO 2 D
RAD310	2PF METAL + 2FEL600 + FAN + 2LAB + 2CARBOX 52 KG	ECO 2 E
RAD310	2PF METAL + 2FEL600 + 2LAB + 2FI + 2FX + 2CARBOX 52KG	ECO 2 F
RAD400	3PF METAL + 3FEL600 + FAN + 3CARBOPACK 5 KG	ECO 3 A
RAD400	3PF METAL + 3FEL600 + FAN + 3LAB + 3FI + 3FX + 3CARBOPACK 5 KG	ECO 3 B
RAD400	3PF METAL + 3FEL600 + FAN + 3LAB + 3FI + 3FX + 3CARBOX 52 KG	ECO 3 C
RAD400	3PF METAL + 3FEL600 + FAN + 3LAB + 3FI + 3CARBOX 52 KG	ECO 3 D
RAD400	3PF METAL + 3FEL600 + FAN + 3LAB + 3CARBOX 52 KG	ECO 3 E
RAD400	3PF METAL + 3FEL600 + 3LAB + 3FI + 3FX + 3CARBOX 52KG	ECO 3 F

PF METAL: Prefiltro in maglia metallica
FEL: Filtro elettrostatico FEL system
FAN: Ventilatore
LAB: Filtro a labirinto
FI: Cella ionizzante
FX: Cella ozonizzante
CARBOPACK: Filtro a carbone attivo da 2,5/5kg
CARBOX: Box con filtri a carbone attivo 26/52 kg

FILTRATION SECTIONS - SEZIONI FILTRANTI



A

Safety microswitch
with separate actuator.

Microinterruttore di sicurezza
con attuatore separato.

B

Metal filter made with galvanized wire mesh and galvanized frame, filter class EN 779 G2

Filtro in maglia metallica composto da rete metallica zincata e telaio zincato, classe filtro EN 779 G2

C

Electrostatic precipitator for oil and fat. FEL SYSTEM model, high efficiency performance with 230V electrical supply.

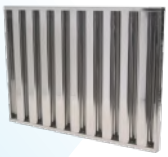
Filtro elettrostatico per oli modello FEL SYSTEM ad alta efficienza. 230V.

D

Electric **fan** with power control.

Ventilatore elettronico con controllo elettronico della potenza.

E



Labyrinth filter that guarantees the blockage of further possible drops of oil. It is placed before and after the ionization filter FI.

Filtro a labirinto che garantisce il blocco di ulteriori possibili gocce d'olio. Viene posto prima e dopo la cella ionizzante FI.

F

Ionization cell FI ensures better sterilization and reduction of odours.

La **cella ionizzante FI** garantisce una maggiore sterilizzazione e riduzione degli odori.

G

Ozonation cell FX, with plates that eliminates viruses and bacteria.

Cella ozonizzante FX, a piastre che è in grado di eliminare virus e batteri.

H

Inox Steel **Turbulator** to increase air, ions and ozone combination.

Turbolatore in acciaio inox per aumentare la miscelazione aria, ioni e ozono.

I

Carbox: Granular **activated carbon filters** with galvanized metal frame sheet. Labyrinth disposition. 26/52 kg.

Carbox: Filtri a carboni attivi granulari con telaio in lamiera zincata, disposti a labirinto. 26/52 kg.

Carbopack: plated active carbon mechanical filter. 2,5 / 5 kg.

Carbopack: filtro meccanico plisettato a carbone attivo. 2,5 / 5 kg.