

Odour Assessment
The Light Cinema, Huddersfield

Client: The Light Venues Ltd

Reference: 9017r1

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Report Issue

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Executive Summary

Redmore Environmental Ltd was commissioned by The Light Venues Ltd to undertake an Odour Assessment in support of a cinema and leisure complex at Unit 1 Kingsgate Shopping Centre, King Street, Huddersfield, HD1 2QB.

The proposals have the potential to cause odour impacts at sensitive locations in the vicinity of the site as a result of emissions associated with food preparation within the units. As such, an Odour Assessment was undertaken in order to assess potential effects as a result of the scheme and identify any necessary mitigation measures to prevent adverse impacts.

An assessment using the standard industry methodology was undertaken to identify the potential odour risk associated with the proposals.

The results of the assessment indicated the potential odour risk was classified as **high**. This prediction does not infer that the proposed development would result in significant odour impact or affect local amenity levels. However, it does suggest that appropriate mitigation is required to reduce potential effects to an acceptable level.

The recommended abatement options have been specified in line with the relevant guidance for kitchens with a **high** risk of impact. It therefore follows that with this mitigation in place, potential odour impacts at nearby sensitive receptors would be reduced to an acceptable level.

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2.0 INTRODUCTION

2.1 Background

2.1.1 Redmore Environmental Ltd was commissioned by The Light Venues Ltd to undertake an Odour Assessment in support of a cinema and leisure complex at Unit 1 Kingsgate Shopping Centre, King Street, Huddersfield, HD1 2QB.

2.1.2 The proposals have the potential to result in odour emissions and associated impacts at sensitive locations in the vicinity of the site. As such, an Odour Assessment was undertaken in order to evaluate potential effects as a result of the scheme and identify any necessary mitigation measures to prevent adverse impacts.

2.2 Site Location and Context

2.2.1 The proposed development is located at Unit 1 Kingsgate Shopping Centre, King Street, Huddersfield, HD1 2QB, at approximate National Grid Reference (NGR): 414745, 416550. Reference should be made to Figure 1 for a map of the site and surrounding area.

2.2.2 The development is located within a predominantly commercial area of Huddersfield. The site is bordered to the north by Kingsgate Shopping Centre, to the south by restaurants and bars, to the east by Southgate and retail units and to the west by Zetland Street. Within the immediate vicinity of the site are a number of restaurants and commercial kitchens. The closest residential receptors are located off of Queensgate to the south and Oldgate to the northeast.

2.2.3 A planning application (reference: 2019/70/92693/W) was submitted to Kirklees Council (KC) for the change of use of an existing retail unit in mixed Class A1/A2/ to form a mixed A1/A2/A3/A4/D2 retail and leisure development, with internal alterations and reconstruction of an upper level, extension, external slide and formation of roof terrace for use as sky bar. The application was subsequently approved, subject to a number of planning conditions, including the following in relation to odour:

" 7. Prior to the hereby approved A3/A4 use(s) being brought into use, a Cooking Odour Impact Assessment shall be submitted to, and approved in writing by, the

Local Planning Authority. The assessment shall include details of the proposed cooking activities at the development and the installation and/or erection of any extract ventilation system that will be provided for these cooking activities. It shall including details of the methods of treatments of emissions and filters to remove odours and the measures to control noise emissions. The works specified in the approved scheme shall be installed and be operational before the A3/A4 use(s) are brought into use. The approved extraction equipment shall be retained thereafter and operated at all times when the food cooking is being carried out and maintained in accordance with the manufacturer's instructions."

2.2.4 The proposed development will provide a restaurant and associated seating area within the leisure area of the wider development. The associated kitchen will utilise a number of cooking methods including convection ovens, fryers, grills, microwave ovens and pizza ovens, with the potential to produce odour emissions and impacts to local sensitive receptors.

2.2.5 Bridge Mechanical Services Ltd, the project Mechanical & Engineering Consultants, have designed a ventilation system and abatement strategy for the development. This is summarised as follows:

- Emissions from food preparation activities within the kitchen will be removed via dedicated extraction canopies located above the main cookline area and pizza oven area of the kitchen;
- Each canopy is fitted with a high efficiency grease separator to provide initial grease removal from the extract;
- Following the first stage of grease removal, an in-built Ultra-Violet (UV) system provides secondary grease destruction and odour removal; and,
- Treated air will be transferred via internal ducting and discharged vertically to atmosphere through a flue above roof level on the Zetland Street façade of the premises at first floor level.

2.2.6 Reference should be made to Figures 2 and 3 for the proposed canopy extraction designs and to Figure 4 for the ventilation design.

2.2.7 Emissions from the kitchen extraction system have the potential to result in impacts at sensitive locations in the vicinity of the site. An Odour Assessment has therefore been

undertaken in order to evaluate potential effects and identify the requirement for any additional mitigation to reduce impacts to an acceptable level. This is detailed within the following report.

3.0 ODOUR BACKGROUND

3.1 Odour Definition

3.1.1 The Institute of Air Quality Management (IAQM) guidance¹ defines odour as:

"[...] the human olfactory response (perception followed by psychological appraisal) to one, or more often a complex mixture of, chemical species in the air."

3.1.2 The stated definition is considered to be relevant in the context of this assessment.

3.2 Odour Impacts

3.2.1 The magnitude of odour impact depends on a number of factors and the potential for complaints varies due to the subjective nature of odour perception. The **FIDOL** acronym, is a useful reminder of the factors that will determine the degree of odour pollution. These are described by the IAQM² as follows:

- **F**requency - how often an individual is exposed to odour;
- **I**ntensity - the individual's perception of the strength of the odour;
- **D**uration - the overall duration that individuals are exposed to an odour over time;
- **O** odour unpleasantness - odour unpleasantness describes the character of an odour as it relates to the 'hedonic tone' (which may be pleasant, neutral or unpleasant) at a given odour concentration/ intensity. This can be measured in the laboratory as the hedonic tone, and when measured by the standard method and expressed on a standard nine-point scale it is termed the hedonic score; and,
- **L**ocation - the type of land use and nature of human activities in the vicinity of an odour source. Tolerance and expectation of the receptor. The 'Location' factor can be considered to encompass the receptor characteristics, receptor sensitivity, and socio-economic factors.

¹ Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.

² Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.

3.2.2 It is important to note that even infrequent emissions may cause loss of amenity if odours are perceived to be particularly intense or offensive.

3.2.3 The **FIDOL** factors can be further considered in relation to the following and the potential for an odour emission to cause a nuisance:

- The rate of emission of the compound(s);
- The duration and frequency of emissions;
- The time of the day that this emission occurs;
- The prevailing meteorology;
- The sensitivity of 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.

3.3 Legislative Control

3.3.1 The main requirement with respect to odour control from premises not controlled under the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments, such as commercial kitchens, is that provided in Section 79 of Part III of the Environmental Protection Act (1990). The Act defines nuisance as:

"Any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance."

3.3.2 Enforcement of the Act, in regard to nuisance, is currently under the jurisdiction of the local Environmental Health Department, whose officers are deemed to provide an independent evaluation of nuisance. If the Local Authority is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an Abatement Notice under Part III of the Environmental Protection Act (1990). The only defence is to show that the process to which the nuisance has been attributed and its operation are being controlled according to best practicable means.

3.3.3 The legislative controls described above were considered as necessary throughout the undertaking of the assessment.

3.4 National Planning Policy

3.4.1 The revised National Planning Policy Framework³ (NPPF) was published in December 2024 and sets out the Government's planning policies for England and how these are expected to be applied.

3.4.2 The purpose of the planning system is to contribute to the achievement of sustainable development. In order to ensure this, the NPPF recognises three overarching objectives including the following of relevance to odour:

"c) an environmental objective - to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

3.4.3 Chapter 12 of the NPPF details objectives in relation to achieving well-designed place. It states that:

"Planning policies and decisions should ensure that developments:

f) create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users; and where crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesions and resilience."

3.4.4 The implications of the NPPF have been considered throughout this assessment.

³ NPPF, Ministry of Housing, Communities and Local Government, 2024.

3.5 Local Planning Policy

3.5.1 The Kirklees Local Plan⁴ was adopted by KC in February 2019. A review of the document was undertaken in order to identify any planning policies relevant to the assessment. This indicated the following:

"Policy LP52

Protection and improvement of environmental quality

Proposals which have the potential to increase pollution from noise, vibration, light, dust, odour, shadow flicker, chemicals and other forms of pollution or to increase pollution to soil or where environmentally sensitive development would be subject to significant levels of pollution, must be accompanied by evidence to show that the impacts have been evaluated and measures have been incorporated to prevent or reduce the pollution, so as to ensure it does not reduce the quality of life and well-being of people to an unacceptable level or have unacceptable impacts on the environment. Such developments which cannot incorporate suitable and sustainable mitigation measures which reduce pollution levels to an acceptable level to protect the quality of life and well-being of people or protect the environment will not be permitted. Where possible, all new development should improve the existing environment."

"Policy LP24

Design

[...]

Proposals should promote good design by ensuring:

[...]

⁴ Hambleton Local Plan, HDC, 2022.

b. They provide a high standard of amenity for future and neighbouring occupiers; including maintaining appropriate distances between buildings and the creation of development-free buffer zones between housing and employment uses incorporating means of screening where necessary; [...]"

3.5.2 The above policies were taken into consideration throughout the undertaking of the assessment.

4.0 **METHODOLOGY**

4.1 **Introduction**

4.1.1 The proposals have the potential to cause odour impacts as a result of emissions from cooking processes within the kitchen units. An assessment has therefore been undertaken in accordance with guidance document 'Control of Odour and Noise from Commercial Kitchen Exhaust Systems' prepared by EMAQ+ for the Department for Environmental, Food and Rural Affairs (DEFRA)⁵. This document provides an update to the 2005 guidance⁶ produced by DEFRA.

4.1.2 The relevant process is summarised in the following Sections.

4.2 **Assessment Methodology**

4.2.1 The EMAQ+ and DEFRA methodology provides an approach for identifying the risk of odour impact associated with food preparation premises and defining an appropriate level of mitigation to control potential effects to an acceptable level.

4.2.2 The first stage in the process is to score the proposed premises in accordance with the criteria outlined in Table 1.

Table 1 Risk Scoring Criteria

Criteria	Score	Score	Details
Dispersion	Very poor	20	Low level discharge, discharge into courtyard or restriction on stack
	Poor	15	Not low level but below eaves, or discharge at below 10m/s
	Moderate	10	Discharging 1m above eaves at 10 - 15m/s
	Good	5	Discharging 1m above ridge at 15m/s
Proximity of receptors	Close	10	Closest sensitive receptor less than 20m from kitchen discharge

⁵ Control of Odour and Noise from Commercial Kitchen Exhaust Systems, EMAQ+, 2022.

⁶ Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems, DEFRA, 2005.

Criteria	Score	Score	Details
	Medium	5	Closest sensitive receptor between 20 and 100m from kitchen discharge
	Far	1	Closest sensitive receptor more than 100m from kitchen discharge
Size of kitchen	Large	5	More than 100 covers or large sized takeaway
	Medium	3	Between 30 and 100 covers or medium sized takeaway
	Small	1	Less than 30 covers or small take away
Cooking type (odour and grease loading)	Very high	10	Pub (high level of fried food), fried chicken, burgers or fish & chips, Turkish, Middle Eastern or any premises cooking with solid fuel
	High	7	Vietnamese, Thai, Indian, Japanese, Chinese or steakhouse
	Medium	4	Cantonese, Italian, French, Pizza (gas fired)
	Low	1	Most pubs (no fried food, mainly reheating and sandwiches etc) or Tea rooms

4.2.3 The score obtained using the values shown in Table 1 is subsequently used to define the associated risk and odour control requirement. The relevant criteria are summarised in Table 2.

Table 2 Odour Control Requirement

Significance Score	Impact Risk	Odour Control Requirement
Less than 20	Low to Medium	Low level odour control
20 to 35	High	High level odour control
More than 35	Very high	Very high level odour control

4.2.4 A suitable odour control system can then be identified from the techniques summarised in the EMAQ+ and DEFRA guidance⁷.

⁷ Control of Odour and Noise from Commercial Kitchen Exhaust Systems, EMAQ+, 2022.

5.0 ASSESSMENT

5.1 Odour Risk

5.1.1 The odour risk associated with the proposals was rated in accordance with the EMAQ+ and DEFRA methodology⁸. The results are summarised in Table 3.

Table 3 Odour Risk

Criteria	Score	Score	Notes
Dispersion	Moderate	10	Extracted air from the kitchen will be pretreated before being released to the atmosphere above roof level. As such, a 'moderate' risk score prescribed for dispersion within the EMAQ+ and DEFRA guidance was applied
Proximity of receptors	Medium	5	The development is located within a predominantly commercial area. The closest sensitive residential properties are located approximately 60m south. As such, a score corresponding to 'medium' proximity was applied in accordance with the EMAQ+ and DEFRA guidance criteria
Size of kitchen	Large	5	It is anticipated the kitchen will generate more than 100 covers. As such, the size of the kitchen is considered to be 'large' in line with the EMAQ+ and DEFRA guidance
Cooking type (odour and grease loading)	Very High	10	The cooking methods will include a high level of fried foods. As such, a 'very high' score was applied to ensure a worst-case appraisal of potential odour and grease loading

5.1.2 As shown in Table 3, the odour risk was scored as 30. The risk was therefore classified as **high**, in accordance with the EMAQ+ and DEFRA criteria.

5.2 Odour Control

5.2.1 Based on the assessment results, the development requires mitigation suitable for a **high** level of odour risk. There are a number of options for abatement identified within the

⁸ Control of Odour and Noise from Commercial Kitchen Exhaust Systems, EMAQ+, 2022.

EMAQ+ and DEFRA guidance⁹ that provide this level of control. These include:

- Emission collection - Odour should be collected via extraction hoods situated above the hot food preparation area;
- Grease filtration system - Mesh type grease filters, such as baffle or cartridge filters, should be included for the purpose of grease filtration. Alternatively, Electrostatic Precipitators (ESPs) may be used;
- Gaseous phase - An activated carbon filter rated with a 0.2 - 0.4 second residence time should be included for odour removal. Alternatively, an oxidation system such as ultraviolet light or ozone may be used; and,
- Dispersion - Emissions should be discharged vertically through a stack, high enough to ensure adequate dilution.

5.3 Site-Specific Control Measures

5.3.1 Bridge Mechanical Services Ltd have designed a ventilation and abatement strategy for the development to incorporate sufficient odour control measures for cooking activities with a **high** risk of impact. This is summarised as follows:

- Emissions from food preparation activities within the kitchen will be removed via dedicated extraction canopies located above the main cookline area and pizza oven area of the kitchen;
- Each canopy is fitted with a high efficiency grease separator to provide initial grease removal from the extract;
- Following the first stage of grease removal, an in-built UV system provides secondary grease destruction and odour removal; and,
- Treated air will be transferred via internal ducting and discharged vertically to atmosphere through a flue above roof level on the Zetland Street façade of the premises at first floor level.

5.3.2 The canopies will be designed and supplied by Kitchen Vent Technical Ltd (KVT), commercial and institutional kitchen ventilation specialists. The KVT Spectrum UV Technology will be installed within each canopy to provide high efficiency reduction in

⁹ Control of Odour and Noise from Commercial Kitchen Exhaust Systems, EMAQ+, 2022.

grease and odour emissions at source. Reference should be made to Appendix 1 for the relevant technical datasheets for the described odour control techniques.

5.3.3 The following maintenance schedule has been identified for the proposed abatement systems:

- The extract system should be serviced at intervals between one and three months, dependent on usage;
- A visual inspection of the ventilation system should be carried out at least once per week to check for grease build up and surface damage;
- The canopy and grease filters should be cleaned on a daily basis;
- UV lamps should be wiped and cleaned on a daily basis; and,
- All fans should be maintained on a regular basis as recommended by the fan manufacturer;

5.3.4 The proposed odour control system and associated maintenance schedule have been specified in line with the EMAQ+ and DEFRA guidance¹⁰ for cooking activities with a **high** risk of impact. As such, they are considered suitable to reduce potential effects associated with the scheme to an acceptable level.

¹⁰ Control of Odour and Noise from Commercial Kitchen Exhaust Systems, EMAQ+, 2022.

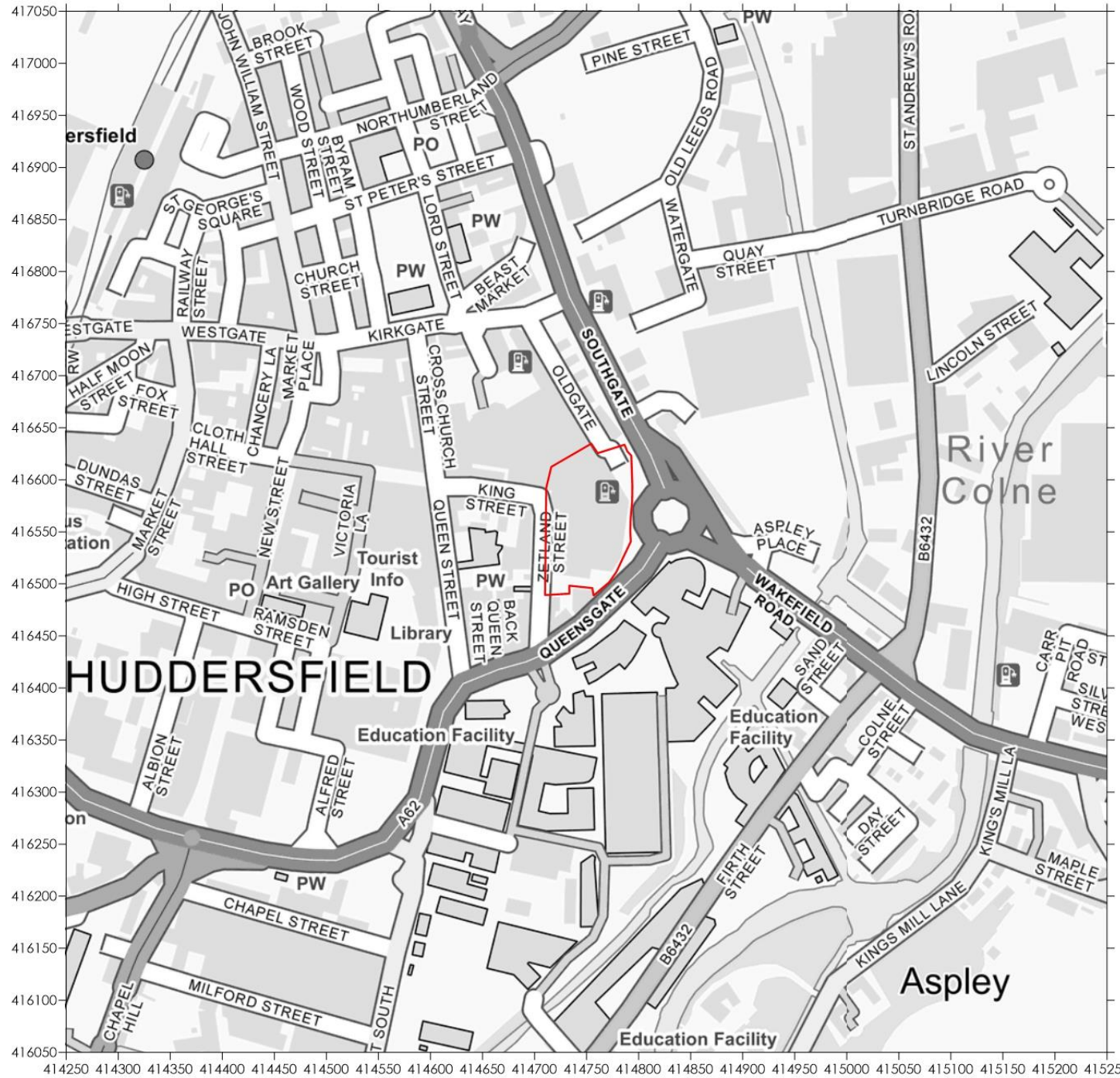
6.0 CONCLUSION

- 6.1.1 Redmore Environmental Ltd was commissioned by The Light Venues Ltd to undertake an Odour Assessment in support of a cinema and leisure complex at Unit 1 Kingsgate Shopping Centre, King Street, Huddersfield, HD1 2QB.
- 6.1.2 The proposals have the potential to result in odour emissions and associated impacts at sensitive locations in the vicinity of the site. As such, an Odour Assessment was undertaken in order to assess potential effects as a result of the scheme and identify any necessary mitigation measures to prevent adverse impacts.
- 6.1.3 The results of the assessment indicated the odour risk was classified as **high**. It should be noted that this prediction does not infer that the proposed development would result in significant odour impact or affect local amenity levels. However, it does suggest that appropriate mitigation options may be required to reduce potential effects to an acceptable level.
- 6.1.4 The recommended abatement options for the site have been specified in line with EMAQ+ and DEFRA guidance for kitchens with a **high** risk of impact. It therefore follows that with this mitigation in place, potential odour impacts at nearby sensitive receptors would be reduced to an acceptable level.
- 6.1.5 Based on the findings of the assessment, it is considered that odour should not be viewed as a constraint to planning consent for the development, subject to the installation of the specified mitigation.

7.0 **ABBREVIATIONS**

DEFRA	Department for Environment, Food and Rural Affairs
ESP	Electrostatic Precipitation
HEPA	High-Efficiency Particulate Arrestance
IAQM	Institute of Air Quality Management
KC	Kirklees Council
NGR	National Grid Reference
NPPF	National Planning Policy Framework
UV	Ultra-Violet

Figures



Legend



Site Boundary

Title

Figure 1 - Site Location

Project

Odour Assessment
The Light Cinema, Huddersfield

Project Reference

9017

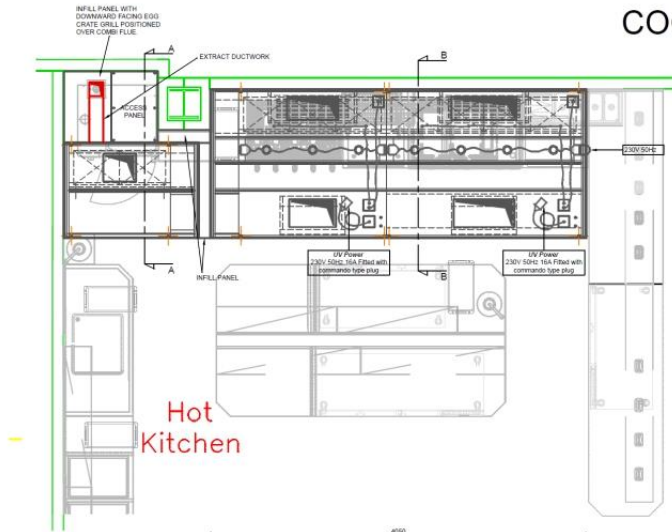
Client

The Light Venues Ltd

Contains Ordnance Survey Data
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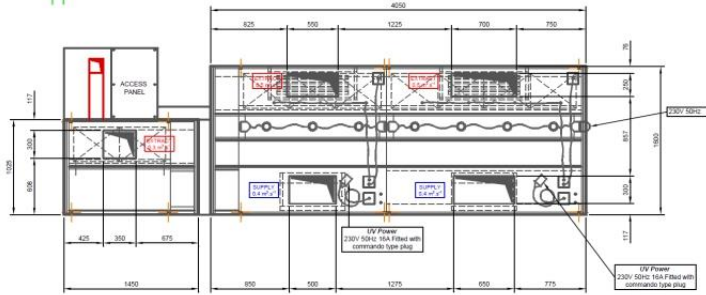


COOKLINE CANOPY:

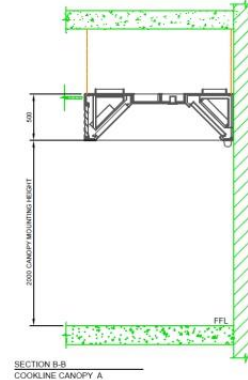
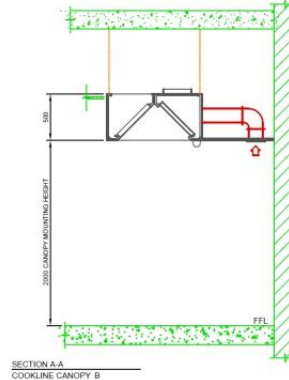
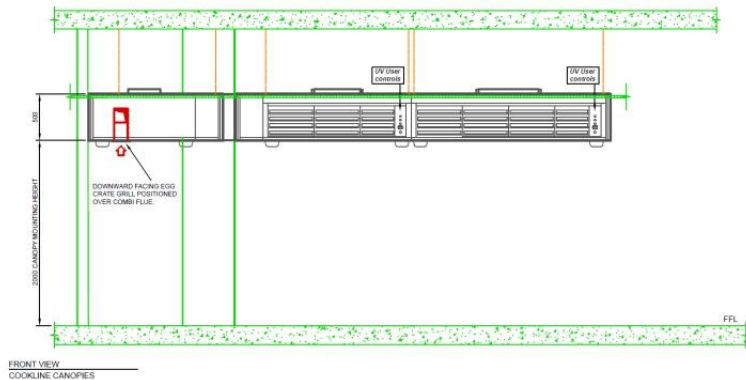


KEY TO COMPONENTS	
	OPEN ENDED SPIGOT SUITABLE FLANGE TO BE ATTACHED BY DUCTWORK CONTRACTOR
	REMOVABLE GREASE FILTER PANEL
	REMOVABLE BLANK PANEL
	REMOVABLE EGG CRATE EXTRACT GRILLE (DISH-WASH CANOPY)
	REMOVABLE SUPPLY AIR DIFFUSER
	UV USER CONTROL PANEL AND HOUR METER
	5W EACH LED LIGHT FITTING AND INTERCONNECTING WIRING COMPLETE WITH SOCKET FOR ONWARD WIRING BY OTHERS
	REMOVABLE GREASE COLLECTOR
	CANOPY HANGING POINT

- Important Notes Regarding Spectrum, UV Grease and Odour Control Systems - (May 2019)**
- Used in a very specific way. Ultra-violet light is a means of controlling the grease and odour content of air extracted from cooking installations. UV systems cannot remove smoke from extracted air. For a detailed description of the process, please refer to the 'UV Fact Sheet'.
 - The UV lamps generate traces of ozone that can be present in the final discharge. If the kitchen discharge is at high level, then natural breakdown and dispersion ensures ozone is not noticeable at ground level. Ozone rapidly breaks down naturally into oxygen and after three to four seconds most of the ozone will have dissipated although some individuals may still notice a fresh 'swimming pool' smell. For a detailed information, please refer to our 'Ozone Fact Sheet'.
 - If the kitchen discharge vent is to be positioned at low level, in a sensitive area, close to opening windows or near air intakes, then additional treatment may be required to destroy residual traces of ozone. This equipment requires installation in the duct or incorporated into an air-handling unit.
 - For highly sensitive installations, consideration should be given to inclusion of additional stages of filtration:
 - Electrostatic Precipitators for smoke removal
 - HEPA filters for fine particle and smoke removal
 - Final stage Activated Carbon filtration in the downstream ductwork or air-handling unit. Please note that carbon filtration used in this way is utilised differently from conventional carbon systems and does not require the same frequent replacement and maintenance.
 - The UV system will remove grease and odour from the contaminated cooking air such that there is no significant grease deposit in the ductwork and no significant cooking odour at the point of discharge. The other major benefit of grease destruction is the significantly reduced risk in having grease free ductwork downstream. All downstream components will be protected in this way, however, ductwork must still be inspected at regular intervals as required by legislation, landlord, local authority and insurers but the cleaning intervals will be significantly extended over those normally required for a conventional open UV system.
 - A properly controlled and planned maintenance schedule must be implemented immediately upon system installation in order that maximum efficiency is always achieved, so minimising the risk of system failure and therefore potential long-term damage to system components. You can utilise existing maintenance arrangements and additional training for those operatives can be provided by KVT. Alternatively, we can recommend approved independent maintenance contractors.
 - We strongly recommend that the end user should carry-out detailed in-house risk assessments for all aspects of operating and maintaining UV grease & odour control systems.
 - When carrying out any work or maintenance on the canopy or any of its components, the system must be switched off and isolated from its electrical power supplies.
 - On canopy only projects, we fit 10mm high open-ended spigots for connection to the ductwork system. Balanced connections to each canopy spigot to be provided by others.
 - The UV control panel requires a main, dedicated 230v single phase power supply directly from the clients distribution board terminating with a 230v, 16A, 2P+N, surface-mounted, angled (downward), IP67 rated appliance inlet socket to BS 4343 (all to be supplied and fitted by others), located within 500mm of the proposed panel location. The supply to the UV panel should be protected within the clients distribution board by a type 'C' circuit breaker.
 - The UV System can be linked into a remote stop/start SMS system or interlocked with kitchen gas supply if required.
 - The UV certification of the above or for further design assistance, please do not hesitate to contact any member of either our sales or technical teams.



TYPICAL IMAGE OF UV CONTROLS - NTS
 Each canopy section is fitted with an independent UV system with individual controls - see above and section C-C for locations. If the UV controls are left in the 'ON' position, the UV lamps will operate whenever sufficient extract airflow is detected. The timing and operation of the extract and supply air system (by others) should be coordinated with cooking times to ensure efficient operation of the plant and UV systems whilst prolonging UV lamp life.



Legend

Title
Figure 2 - Main Cookline Canopy Design

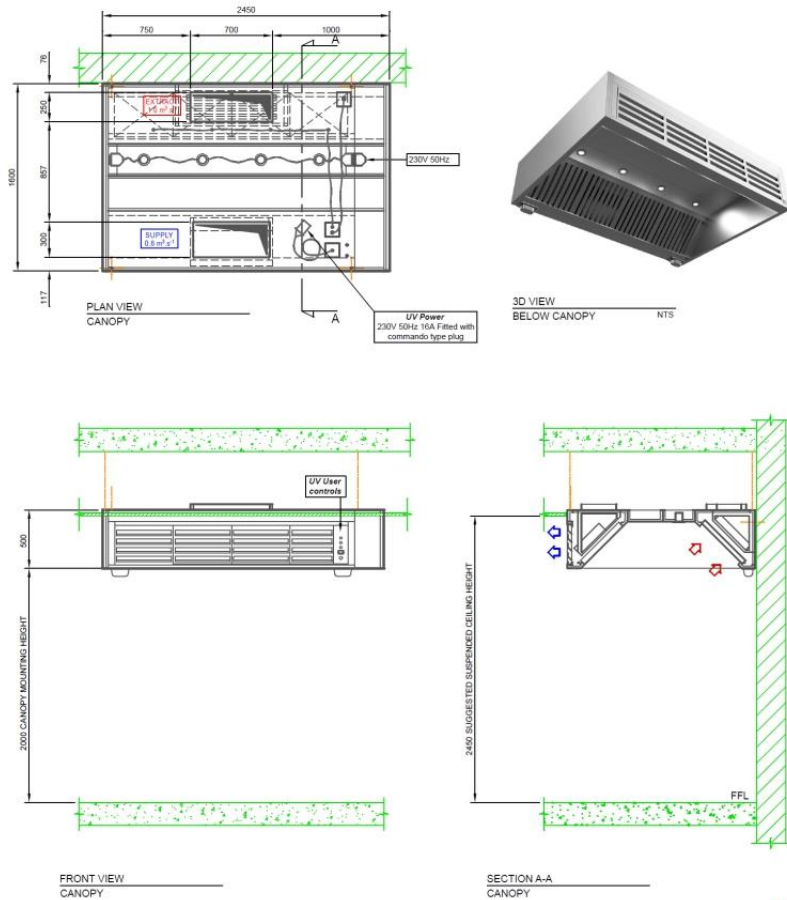
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Client
The Light Venues Ltd



PIZZA OVEN CANOPY:



KEY TO COMPONENTS	
	OPEN ENDED SPIGOT, SUITABLE FLANGE TO BE ATTACHED BY DUCTWORK CONTRACTOR
	REMOVABLE GREASE FILTER PANEL
	REMOVABLE BLANK PANEL
	REMOVABLE EGG CRATE EXTRACT GRILLE (DISH-WASH CANOPY)
	REMOVABLE SUPPLY AIR DIFFUSER
	UV USER CONTROL PANEL AND HOURS METER
	SW (EACH) LED LIGHT FITTING AND INTERCONNECTING WIRING COMPLETE WITH SOCKET FOR ONWARD WIRING BY OTHERS
	REMOVABLE GREASE COLLECTOR
	CANOPY HANGING POINT

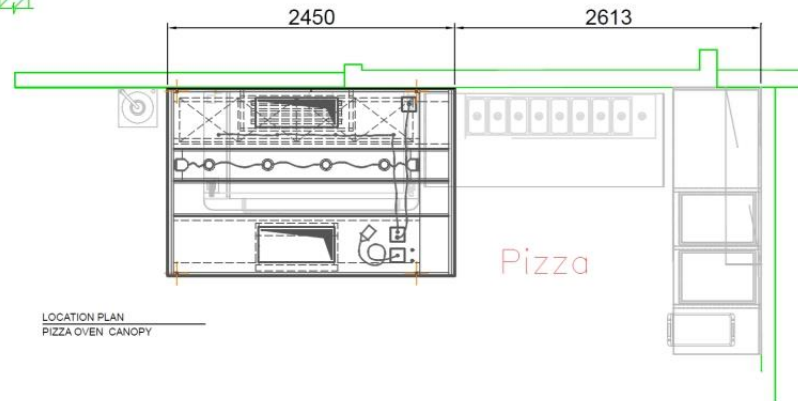
Important Notes Regarding Spectrum, UV Grease and Odour Control Systems - (May 2019)

- Used in a very specific way, Ultra-violet light is a means of controlling the grease and odour content of air extracted from cooking installations. UV systems cannot remove smoke from extracted air. For a detailed description of the process, please refer to our 'UV Fact Sheet'.
- The UV lamps generate traces of ozone that can be present in the final discharge. If the kitchen discharge is at high level, then natural breakdown and dispersion ensures ozone is not noticeable at ground level. Ozone rapidly breaks down naturally into oxygen and after three to four seconds most of the ozone will have dissipated although some individuals may still notice a fresh 'swimming pool' smell. For a detailed information, please refer to our 'Ozone Fact Sheet'.
- If the kitchen discharge vent is to be positioned at low level, in a sensitive area, close to opening windows or near air vents, then additional treatment may be required to destroy residual traces of ozone. This equipment might be installed in the duct or incorporated into an air-handling unit.
- For highly sensitive installations, consideration should be given to inclusion of additional stages of filtration:
 - Electrostatic Precipitator for smoke removal
 - HEPA filters for fine particle and smoke removal
 - Final stage Activated Carbon filtration in the downstream ductwork or air-handling unit. Please note that carbon filtration used in this way is utilised differently from conventional carbon systems and does not require the same frequent replacement and maintenance.
- The UV system will remove grease and odour from the contaminated cooking air such that there is no significant grease deposit in the ductwork and no significant cooking odour at the point of discharge. The other major benefit of grease absorption is the significantly reduced fire risk in having grease free ductwork downstream. All downstream components will be protected in this way. However, ductwork must still be inspected at regular intervals as required by legislation, local authority and insurers but the cleaning intervals will be significantly extended over those normally required for a conventional non-UV system.
- A properly controlled and planned maintenance schedule must be implemented immediately upon system installation in order that maximum efficiency is always achieved; so, minimising the risk of system failure and therefore potential long-term damage to system components. You can utilise existing maintenance arrangements and additional training for those operators can be provided by KVT. Alternatively, we can recommend approved independent maintenance contractors.
- We strongly recommend that the end user should carry-out detailed in-house risk assessments for all aspects of operating and maintaining UV grease & odour control systems.
- When carrying out any work or maintenance on the canopy or any of its components, the system must be switched off and isolated from its electrical power supplies.
- On canopy-only projects, we fit 50mm high open-ended spigots for connection to the ductwork system. Balanced connectors to each canopy spigot to be provided by others.
- The UV control panel requires a clear, dedicated 230v single phase power supply directly from the clients distribution board terminating with a 230v, 16A, 3P+N, surface-mounted, angled downwards, IP67 rated appliance rated socket to BS 4343 (not to be supplied and fitted by others), located within 500mm of the proposed panel location. The supply to the UV panel should be protected within the clients distribution board by a type 'C' residual breaker.
- The UV System can be linked into a remote stop/start EMS system or interlocked with kitchen gas supply if required.
- For clarification of the above or for further design assistance, please do not hesitate to contact any member of either our sales or technical teams.



TYPICAL IMAGE OF UV CONTROLS - NTS

Each canopy section is fitted with an independent UV system with individual controls - see above and section C-C for locations. If the UV controls are left in the 'ON' position, the UV lamps will operate whenever sufficient extract airflow is detected. The timing and operation of the extract and supply air system (by others) should be coordinated with cooking times to ensure efficient operation of the plant and UV systems whilst prolonging UV lamp life.



Legend

Title
Figure 3 - Pizza Canopy Design

Project
Odour Assessment
The Light Cinema, Huddersfield

Project Reference
9017

Client
The Light Venues Ltd



Appendix 1 - Technical Specification

Spectrum UV – Information Sheet

1 INTRODUCTION

KVT offers an 'In-Canopy' Ultraviolet filtration system which is known as *Spectrum*.

The *Spectrum* UV filtration system provides secondary grease destruction and odour removal.

The *Spectrum* system incorporates high-efficiency, purpose-designed, primary filtration combined with carefully applied UVC 'light-in-airstream' technology to provide efficient protection against grease and odour for all downstream equipment and discharge. *Spectrum* incorporates several layers of safety mechanisms to prevent inadvertent exposure to UVC light or Ozone.

This document helps to address the requirement for grease and odour control in commercial catering applications.

2 BACKGROUND

Cooking operations in catering establishments are a major source of grease contamination and cooking odours. Grease is deposited in the kitchen extract ductwork and regular cleaning is required for hygiene and fire safety reasons, which can be a significant maintenance cost.

Ductwork cleaning requires the kitchen to be shut down and where long complex ductwork runs are involved; frequent access doors are required for access and inspection.

Kitchen ventilation, grease and odour controls are regulated under:

- The Food Safety (General Food Hygiene) Regulations 1995
- The Workplace (Health, Safety and Welfare) Regulation 1992

Detailed Recommendations and Standards for the design of kitchen ventilation systems and ductwork are contained in the Heating and Ventilation Contractors Association publications:

- DW/172 Specification for Kitchen Ventilation Systems
- DW/144 Specification for Sheet Metal Ductwork

3 GREASE CONTROL

Hot, humid, greasy air from cooking is collected by a canopy and passed through grease filters mounted in the face of the canopy where entrained droplets of grease and moisture are partially removed, thereby reducing the grease deposited in the downstream ductwork.

The only acceptable filtration systems fitted to kitchen canopies, in ascending order of grease removal efficiency are:

- Baffle-type grease filters
- Centrifugal grease separators
- Cold Water Mist Filters

Electrostatic precipitators are sometimes installed in the ductwork to capture entrained grease droplets.

Extract air leaving the grease filters / canopy passes through the extract ductwork and extract fan before discharge, generally at the top of the building.

Extract air-cools as it passes along the ductwork and on long duct runs, grease and moisture can condense in the duct. This can escape from ductwork joints and discharge vents and become entrained, causing staining of roofs, facades and even adjacent buildings.

4 TRADITIONAL ODOUR CONTROL METHODS

Notes on odour removal efficiency:

Unfortunately, there is no practical or reliable method of measuring odour or odour reduction. For this reason, it is entirely unreasonable for any equipment manufacturer or seller to quote a percentage efficiency at which their product will perform – it cannot be tested and therefore cannot be proven or disproven.

Odour detection is very personal and therefore, very subjective; what one person may consider a strong or unpleasant smell, another person may think is perfectly acceptable or even non-existent. However, we do know that certain means of filtration have an effect on odour be they physical or chemical. We also know that different types of filter influence different types of particulate & odour, and this means that to increase the effectiveness of a system's ability to remove odour, combining several types of filter will improve the process.

When it comes to specifying odour treatment, the following considerations must be addressed in order to apply the correct system:

- Type of odour to be treated
- Other contaminants such as grease, humidity and smoke which may affect the odour treatment process
- Transported air temperatures which may affect the filtration/reaction efficiency
- Capital budget
- Ongoing maintenance budget
- Through-life costs of the complete system
- Impact of odour filtration upon plant sizing (resistances etc...)
- Length of ductwork to atmosphere and in-duct air speed (dwell time for reaction)
- Point of discharge (is it high- level or low-level)
- Space available to house the filtration and plant
- What system running controls are utilised (Demand based, BMS etc.....)

For the best results, a combination of filtration methods is recommended such as UV with either Carbon & HEPA filtration or UV with Electrostatic Precipitation. It is then a case of balancing cost against the requirement for clean air discharge.

Kitchen extracts are a major source of odours and complaints in urban areas. Conventional odour abatement techniques include the following methods used alone or in combination:

- **HIGH LEVEL VENTS**

High-level vents use the principle of 'dilute and disperse'. Ductwork is extended to the top of the building to give a high discharge point. This has the advantage of simplicity, but odours are not destroyed, merely dispersed and diluted and can still cause offence to occupants in upper parts of buildings or downwind. High-level vents can be visually intrusive and may need to be clad. There can also be planning and listed building issues.

- **CARBON FILTERS**

Kitchen extract air is treated in pre-filters (including electrostatic precipitators) followed by activated carbon filters to absorb odours. In theory,

Spectrum UV – Information Sheet

carbon filters should be effective provided adverse conditions, including entrained grease, particulates and high humidity, are avoided. To ensure effective odour control, the pre-filters and carbon filters need to be checked and replaced on a regular basis. This can be a significant cost and in practice, is often neglected, leading to the carbon filters becoming clogged, reduced airflow and no odour abatement.

Some local authorities are now unwilling to accept carbon filters for kitchen odour control because they are ineffective unless properly maintained.

- **MASKING OILS**

Masking oil spray is injected into the kitchen extract discharge vent. Due to the high cost of the masking oils, the operation is often intermittent. The original odours are not destroyed, and the masking agent odour can be intrusive.

- **LOW LEVEL DISCHARGES**

Low-level vents may be preferred to avoid running ductwork to the top of the building due to planning or ownership constraints. Odours at low level may not be acceptable and this can force the operator to install an odour control system.

5 KVT - GREASE AND ODOUR DESTRUCTION TECHNOLOGY

5.1 INTRODUCTION

KVT offers a range of integrated process technology for the destruction of grease and odour for the commercial catering industry. Special UV lamps are used to breakdown the organic material (i.e. grease and odour compounds) in the extract air by the mechanism of *Photolysis* and *Ozonolysis*. The end products of the destruction of the organic material, effectively mineralisation by cold combustion, are carbon dioxide and water vapour.

The *Spectrum* UV system automatically and continuously destroys organic material in the air stream and keeps the kitchen extract ductwork virtually grease free, significantly extending the period between duct cleaning and reducing fire risk.

The system also destroys cooking odours and eliminates the requirement and cost of replacing pre-filters and activated carbon. The cost savings resulting from elimination of duct cleaning, odour masking chemicals and replacement carbon filters can usually justify the investment in a *Spectrum* system.

Special systems are available so kitchen extract vents can be discharged at low level, and for treating heavily contaminated air from heavy duty cooking establishments such as fast food outlets.

The advantages of the *Spectrum* system are:

- Keeps extract ductwork grease free
- Destroys cooking odours
- Works automatically without manual intervention
- Significantly increases regular ductwork cleaning maintenance intervals
- Avoids activated carbon and associated replacement costs
- Reduces fire risk
- Simple and infrequent maintenance, lamps cleaned, say, every two months

- Protects all downstream equipment such as additional filtration and fans thus extending the useful life of each
- Heat recovery is more viable because the air has minimal grease content

5.2 INSTALLATION

The *Spectrum* grease and odour control system can be installed within a purpose-built kitchen canopy.

Existing or new fire protection systems (e.g. Ansul) can be easily integrated with *Spectrum* UV systems.

5.3 OPERATION

Operation of the *Spectrum* UV system is automatic, with the UV lamps turning on when the extract fan is started.

Safety interlocks prevent the UV lamps running without airflow through the canopy or during unauthorised opening of the lamp housing.

5.4 OPERATING AND MAINTENANCE COSTS

Grease filters in the canopies require regular cleaning following normal good hygiene practice. Typically, the grease filters are washed in a commercial washing machine once a week.

A fine layer of ash is gradually deposited on the special UV lamps. The exact rate of build-up depends on the cooking load. The lamps need occasional cleaning, say every 2 months, by wiping with a wet cloth soaked in washing-up detergent.

The only additional operating cost is electric power to the UV lamps. UV lamps need replacing after approx. 12,000 to 14,000 hours of operation. Maintenance and lamp replacement can be carried out under a maintenance contract. As the ductwork can be grease free, the cost of regular duct cleaning is significantly reduced.

5.5 SAFETY

The UV lamps operate in the UV-C band and direct exposure can be damaging to the eye and skin. The lamps are contained within the kitchen canopy or reactor and are not visible to the kitchen staff. Safety interlocks turn off the lamps and specially shrouding is fitted to prevent direct exposure.

Traces of ozone are generated around the UV lamps, but ozone is not discharged into the working area as the canopies run under negative pressure. Safety interlocks prevent the lamps operating without negative pressure in the extract system & also if a grease filter is inadvertently removed before the system is deactivated.

High-level vents contain traces of ozone, but this is not a hazard and ozone is quickly destroyed naturally in the atmosphere. In the case of low-level discharges into occupied areas where people may breathe the air, a catalyst unit is fitted to destroy remaining traces of ozone.

5.6 RESIDUAL GREASE LEVELS

Landlords, railway and airport operators are increasingly imposing their safety requirements in leases and franchise agreements. Some recommend the use of UV and ozone as a grease and odour control system.

Typically, after 100 days continuous operation duct walls and mastic jointing that is clean and free of grease. A heavily used but carefully maintained UV system can mean a site will be in operation for over two years without duct cleaning. On some sites the ductwork has developed a glazed shiny appearance but no coating that can be easily scraped off or measured.

Spectrum UV – Information Sheet



Clean downstream ductwork requires that good quality, high efficiency, baffle-type grease filters (specifically designed for use with 'in-canopy' UV systems) are installed upstream of the UV system. They must be properly effective for the cooking duty, properly installed and maintained. This will ensure that the UV system will work at its optimum performance, for the longest achievable period.

6. SPECIAL HEAVY-DUTY APPLICATIONS

6.1 INTRODUCTION

Busy fast food and burger outlets in built-up areas present special problems due to the heavy cooking duty. The fryers, flame grills and broilers produce a heavy grease load requiring frequent cleaning of the ductwork and the smoke and odours can cause a nuisance to neighbours.

6.2 TRADITIONAL PRACTICE

Traditional practice is to collect the air in dedicated canopies with grease filters, duct to a common fan and discharge from a short vent.

The flame grill or broiler is generally enclosed within a dedicated canopy as cooking burgers releases grease that flares up and burns with a smoky flame inside the broiler. At some locations a catalytic combustion unit, is placed immediately above the broiler / flame grill to partially burn out entrained fat and smoke. The air finally discharged is frequently smoky and odorous and carries entrained grease that can cause a nuisance to neighbours.

The cleaning regime involves daily cleaning of grease filters and regular cleaning of the ductwork by external contractors. Ductwork cleaning is expensive and often difficult with old installations. There is a fire risk if cleaning is not properly carried out.

6.3 NEW HEAVY-DUTY SOLUTIONS FOR GREASE AND ODOUR

HVAC can offer a range of process treatments to solve heavy-duty grease, odour and smoke problems. The treatment steps selected depend on the cooking duty, discharge point and the sensitivity of the site.

6.4 SENSITIVE SITES

On sensitive sites, where the air is to be discharged at a low level or close to other occupied parts of a building, smoke and ozone reduction is required.

Secondary filtration systems (including varying combinations of particulate, HEPA, Carbon and Electrostatic) can be incorporated, working in tandem with the 'In-Canopy' UV system to produce the best possible solution for clean exhaust air. See Section 7 – Low Level Discharges.

7. LOW-LEVEL DISCHARGES

7.1 INTRODUCTION

Low-level discharges need to be free of grease and odour, and in some sensitive locations, may also need to be smoke free and cool. The standard *Spectrum* UV system destroys grease and odours to give an air-stream suitable for discharge at high level. To discharge at low-level into occupied areas, traces of ozone need to be removed using a catalyst system.

Grease filters, water-wash or UV systems do not remove smoke produced in cooking and a HEPA (High Efficiency Particle Arrestors) filter or electrostatic precipitator (ESP) must be installed where smoke removal is required.

KVT design & manufacture suitable secondary, filtration systems to compliment the *Spectrum* 'in-canopy' UV system.

8. PIZZA OVENS AND WOOD BURNING STOVES

Pizza ovens and wood burning stoves produce tars, smoke and ash as well as cooking odours. There are several alternative systems to treat the extract air depending on the stove and site requirements.

9. APPROVALS

The UV systems supplied by HVAC meet all UK and European requirements and carry the EC mark. Additional information to support specific planning applications, is available from HVAC.

How does UV Work? – An explanation of the technology

ULTRAVIOLET (UV)

We are all familiar with the coloured bands of light that are visible to the human eye when light from the sun pass through raindrops to create a rainbow. This visible portion of the spectrum varies from red, through orange, yellow, green, blue & indigo to violet. Beyond the red are longer wavelengths referred to as infrared and beyond the violet are shorter wavelengths called ultraviolet, both of which are invisible to the human eye.

Ultraviolet wavelengths are split into three bands A, B and C, for convenience. In the same way that fluorescent tubes can be made to emit white light, special lamps can be made that emit ultraviolet light. By carefully controlling the quality of the manufacturing process lamps can be made that emit ultraviolet predominately from one band. Ultraviolet light lamps have been used for many years. Typically lamps that emit 'A' band ultraviolet are used for sun lamps. Lamps that emit 'B' band ultraviolet are used in the water industry where the energy emitted has the ability to break down and destroy bacteria. 'C' band ultraviolet lamps are now available, and these have the energy levels to break down grease and odour.

OZONE

Ozone is a form of oxygen containing three atoms in the molecule against two atoms in the molecule of normal oxygen. The gas has a peculiar odour somewhat resembling dilute chlorine and can be noticed in sea breezes.

The gas readily changes into ordinary oxygen but has some distinct properties. Ozone is a powerful oxidising agent and it has been used for many years for odour control and the sterilisation of air and water. It has been used in industrial applications including the bleaching of fabrics and fatty materials, the oxidation of oils to thicken them and to sweeten foul smelling beer casks.

Specially designed & manufactured UV-C band lamps produce ozone when the oxygen in the air passes over them.

COLD COMBUSTION

Air extracted by the canopies from the cooking area will be contaminated with grease and cooking odours. Without treatment grease will deposit on the inside of the ductwork and odours will be discharged to atmosphere. As well as being a fire hazard in the kitchen, the odours from ventilation systems can be a significant source of nuisance.

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The use of UV and Ozone in combination breaks up and oxidises the grease and odours in kitchen extract systems to produce small traces of carbon dioxide and water that are discharged to atmosphere. This process can be referred to as cold combustion.

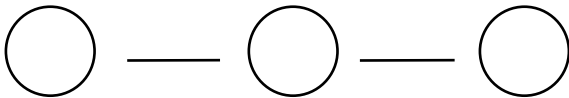
A Simple Explanation of the Chemistry

ATOMS, MOLECULES AND CHEMICAL BONDS

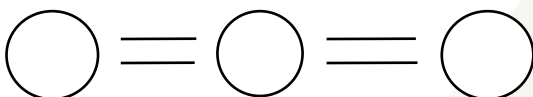
The grease and odours produced by the various cooking processes that are deposited on the inside of ductwork and discharged from kitchen ventilation systems are a mixture of complex molecules. The main constituents of these molecules are atoms of carbon, hydrogen and oxygen.

The atoms in a molecule are joined by bonds. For example, a water molecule is made up of two atoms of hydrogen, each having one bond, and one atom of oxygen that has two bonds.

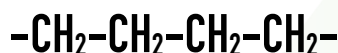
The chemical formula for water is; H₂O and the bonds in the water molecule can be drawn as follows;



Two bonds join the atoms in some molecules. For example, the chemical formula for carbon dioxide is; CO₂ and the bonds in the carbon dioxide molecule can be drawn as follows;

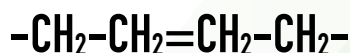


The fats, grease and odours that make up the deposits in ductwork and are discharged from kitchen ventilation systems are made up from long chains of carbon atoms that have combined with hydrogen, oxygen and other chemicals and can be depicted in the following ways: -



(with single bonds)

or



(with single and a double bond)

PHOTOLYSIS AND OZONOLYSIS

The ultraviolet light produced by the UV-C band lamps has sufficient energy to break the bonds in the long chain grease and odour molecules into smaller parts. This can

only happen where the lamps are positioned directly in the contaminated air-flow such as with 'in-canopy UV systems. The ozone produced by the lamps is a strong oxidising agent. The processes are referred to as photolysis and Ozonolysis. By using the effects of both the UV light and ozone it is possible to break down and oxidise the grease and odours.

The by-products are generally water and carbon dioxide. However, some inert minerals are also released from the process as fine dust that sticks to the lamps or as particulate discharged through the ductwork.

Frequently Asked Questions and Answers

1 WHAT IS THE POWER CONSUMPTION AND WHAT POWER SUPPLY DO I NEED?

The power consumption of a typical kitchen ventilation UV and ozone system will depend on the duty but will normally be in the order of 500 to 750 Watts per cubic metre of airflow. Most UV systems will therefore be supplied for connection to a single-phase 230 Volt 50 Hz supply.

2 WHAT IS INVOLVED IN OPERATION?

The UV system operates automatically and is normally left switched on. However, it should be interlocked with the main kitchen ventilation fan so that it will only operate when the kitchen ventilation fan is running and there is an adequate airflow. If the ventilation fan is used to ventilate the kitchen when there is no likelihood of cooking, then a 24-hour 7-day timer can be used to override the operation of the UV system. This will help to conserve UV lamp life.

As with any electrical equipment there are several safety issues that need to be considered. Full details are set out in the "Operating and Maintenance Manual" a copy of which can be obtained from HVAC on request.

3 WHAT IS INVOLVED IN MAINTENANCE?

A schedule of Routine Maintenance and Safety Checks is available from HVAC.

Normal maintenance involves the routine cleaning of the lamps, checking of system safety interlocks and relay settings and the replacement of UV lamps at the end of their useful life. (12,000 to 14,000 hrs).

4 UV LAMP TUBE CLEANING

Wipe the tubes with a cloth moistened with water with washing up liquid.

After cleaning, wipe the tubes with a clean damp cloth to remove the detergent. Finally, wipe the tubes with a cloth moistened with isopropyl alcohol (flammable). If the deposit on the tube proves to be difficult to remove a commercial heavy-duty detergent should be sprayed on to the lamp and left to soak for 10 minutes and then rinsed off. Follow this with the normal cleaning operation as described above.