CHARTERED INSTITUTE OF ENVIRONMENTAL HEALTH

HAMPSHIRE AND ISLE OF WIGHT BRANCH

ENVIRONMENTAL CONTROL ADVISORY COMMITTEE

CONSULTATIONS ON PLANNING APPLICATIONS FOR HOT FOOD PREMISES: GUIDELINES FOR ODOUR AND ENVIRONMENTAL CONTROL

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1. FOREWORD

In May 1995 the Environmental Control Advisory Committee resolved to consider the issue of varying standards in response to planning consultations for Hot Food Takeaways and Restaurants.

Following a sustained period of economic recession with many commercial and retail units remaining empty, it was noted that there was a growing trend to convert these vacant units to Hot Food Takeaways. This trend had led to a steady growth in consultations by planning departments on planning applications for change of use to Use Class A3 (Hot Food Businesses).

The Committee considered the issue of standardising responses to these consultations, as it was clear that no guidance was already available and there was a wide variation in requirements being imposed by way of planning conditions, etc both within and between local authorities in Hampshire and the Isle of Wight.

This document provides guidance on the various types of odour reduction systems available and their principles of operation. Guidance is also given on the choice of systems which are the most appropriate for the various types of hot food business and there are Appendices with useful contact names and addresses, references and suggested planning conditions.

2. PRELIMINARY NOTES

A ***TO BE USED AS GUIDELINES ONLY AND SHOULD BE ADAPTED TO MEET THE INDIVIDUAL CIRCUMSTANCES OF EACH LOCAL AUTHORITY AS APPROPRIATE. EACH APPLICATION SHOULD BE CONSIDERED ON ITS INDIVIDUAL MERITS***

B **With the increasing number of planning applications for change of use to Use Class A3, there is a need to produce guidance for local authority Environmental Health Staff and other officers in an endeavour to achieve a degree of uniformity in approach. This is the aim of this document.**

C **Environmental Health Staff should remember that one aim of the planning process is concerned with the concept of 'loss of amenity' and annoyance or disturbance. This is fundamentally different from nuisance procedures where a Best Practicable Means defence would apply.**

D **IT SHOULD BE APPRECIATED THAT THERE IS A WIDESPREAD MISCONCEPTION THAT IT IS MERELY NECESSARY TO SPECIFY THE APPROPRIATE TYPE OF EXTRACTION/FILTRATION SYSTEM TO ELIMINATE AN ODOUR PROBLEM. PROVIDED ENVIRONMENTAL HEALTH STAFF MAKE THE LIMITATIONS OF ARRESTMENT SYSTEMS CLEAR AND MAKE CONSISTENT RECOMMENDATIONS THEY CANNOT BE CRITICISED FOR FAILING TO SPELL OUT POTENTIAL PROBLEMS.**

IT IS ESSENTIAL WHEN COMMENTING ON PLANNING CONSULTATIONS THAT THIS MISCONCEPTION IS DISPELLED. IT CANNOT BE OVER STRESSED THAT ENVIRONMENTAL HEALTH STAFF AND PLANNING OFFICERS HAVE COMPLEMENTARY BUT DIFFERENT ROLES TO PLAY IN THE PLANNING PROCESS. PLANNING OFFICERS AND PLANNING COMMITTEES OF ELECTED MEMBERS HAVE THE JOB OF DETERMINING PLANNING APPLICATIONS IN LIGHT OF THE VARIOUS FACTORS FOR AND AGAINST EACH CASE.

E The guidelines relate to ventilation/extraction systems in all types of premises where hot food is prepared for immediate consumption other than reheating in microwave ovens.

F The guidelines are considered to set reasonable standards which, when sensibly and correctly applied, can be justified and defended.

G The guidelines are based on practical experience of Environmental Health staff working in this field.

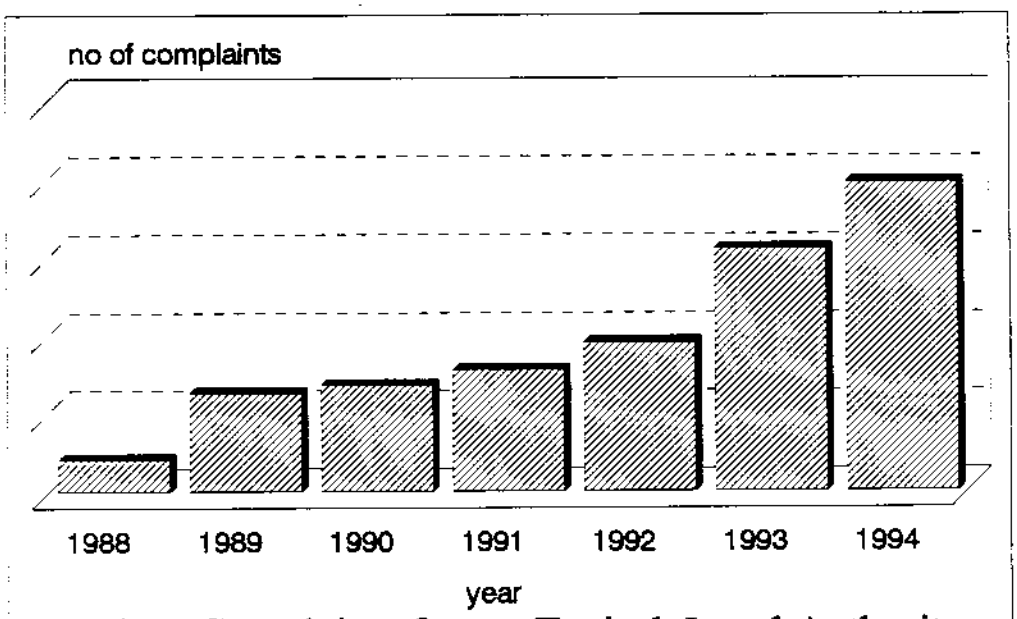
H It is anticipated that if these guidelines are widely applied throughout Hampshire and the Isle of Wight at planning application stage, the standard set for any particular type of hot food business will come to be regarded as the norm. In the event of a complaint about an existing business with an extraction system to a lower standard, it will be easier to argue that the best practicable means have not been taken to minimise the odour.

I Odour, unlike noise, is fundamentally different when consideration is made of annoyance and disturbance. With noise there is commonly a measure of background sound into which a new noise source can merge. With odour, and in the majority of cases, persons are not aware of any 'background' as such; a new smell is readily identifiable and will be often considered objectionable.

J It is apparent that for certain particularly pungent types of hot food businesses, particularly fish and chips and, to a lesser extent, Indian-style, no system of odour reduction will completely eliminate the characteristic smell in the vicinity. However it is recognised that it may be appropriate, in certain cases, to recommend to planning colleagues that they refuse an application, but add a caveat that if the Planning Authority, in view of wider planning considerations, is of a mind to grant consent, then the highest specification extraction equipment be required to mitigate the odour problem.

3. INTRODUCTION TO ODOUR

Odour complaints from industrial, commercial and agricultural premises represent a significant proportion of the total complaints received by any local authority; in 1992/93 the Institution of Environmental Health Officers reported more than 18,500 complaints to local authorities relating to odour.



Odour Complaints from a Typical Local Authority

Most complaints about odour are due to annoyance which is related to loss of the amenity of homes, gardens and working environs. It is now appreciated that annoyance is the combined result of the following odour properties:

- Odour intensity - this is the strength of the perceived odour. Whilst it is dependent upon the concentration of the odorous substances present, the way these substances can combine may be highly complex. Odour intensity can be measured by comparison with reference odours, but more usually it is measured by dilution to the odour threshold. Various studies of odour thresholds have employed panels from six to 35 people. In some cases they are trained specialists, while in most instances' panellists are selected at random. Gases to be tested are generally diluted many times to provide a wide range of samples and a statistical inhalation programme is used. Some tests are conducted in special odour-free test rooms, while others are conducted in ambient surroundings. Despite these variations, the resulting threshold levels are generally in agreement.

- Odour character is the property that enables one odour to be distinguished from another, and it is a general property that an odour with a distinct recognisable character tends to be more annoying.

- Hedonic tone is the term used to place an odour on a scale of pleasantness

and unpleasantness in a neutral context and differs from acceptability which is a judgement in a specific situation, eg a pleasant odour from a fragrance factory may be unacceptable if in a residential area. The hedonic tone of an odour, whether pleasant or unpleasant when first perceived by the public, can change. Thus, both unpleasant and pleasant odours may become objectionable.

- The frequency of the odour releases and the durations of each occurrence are also significant factors in determining annoyance and/or loss of amenity.

4. BACKGROUND TO ODOUR CONTROL AND PLANNING

Traditionally, the control of odour has been through the Public Health Act 1936 and now under the Environmental Protection Act 1990. Both Acts allow a defence of Best Practicable Means (BPM) in respect of an odour nuisance from industrial, trade or business premises. In addition, Part 1 of the Environmental Protection Act 1990 controls many of the main sources of odour complaint, eg animal treatment processes and maggot breeding establishments etc, through the issue of an authorisation by the Local Authority. However, odour is clearly established as material planning consideration and which if ignored, may be impossible to solve.

Hot food premises eg takeaways, restaurants, cafes, snack bars, wine bars and public houses, fall within Use Class A3 (Food and Drink) of the Town and Country Planning (Use Classes) Order 1987. If the use of the premises alters, then planning permission is required; changes of use within a class do not require planning permission. Planning permission is also not required if the use is "established" and no specific planning permission has ever been granted.

Circular 13/87 which accompanied the 1987 Order noted that service uses such as fast food premises contribute to the vitality of shopping centres and additionally help to create employment opportunities. This promotion of mixed use development and the retention of key town centre uses has been carried through into the Department of the Environment's more recent and specific Planning Policy Guidance Notes.

PPG6: Town Centres and Retail Development (draft) encourages the diversification of uses and mentions the use of vacant premises and rooms above shops for conversion to flats. Local Authorities are advised to take a flexible approach and to keep the Government's objectives on sustainable development in mind. Sustainable development in this context is about the need to reduce travel distances and maintain accessibility.

PPG13: Transport goes on to further define these objectives as:

- to reduce growth in the length and number of motorised journeys;
- to encourage alternative means of travel which have less environmental impact; and hence
- to reduce reliance on the private car

Clearly the above comments, by encouraging mixed land use in urban areas, have the potential to produce problems where certain activities coexist alongside residential areas. However, PPG23: Planning and Pollution reiterates the comments in the Government's White Paper, This Common Inheritance, by asserting that the Government will apply policies to:

- reduce pollution at source;
- encourage the most advanced technical solutions that can be cost-effectively applied

PPG23 also says that the planning system should complement the above control policies by regulating the location of operations in order to avoid or minimise adverse effects on the use of land and on the environment.

Finally, the guidance also recognises that planning and pollution control systems are separate, but complementary in that both are designed to protect the environment from the potential harm caused by development and operations. It is recognised that Environmental Health Staff and Planning Officers should work closely in the determination of the Planning Applications. The Planning Officers should take the lead in collating information and the Environmental Health Staff should provide the specialist knowledge on matters which fall within their remit. It should also be borne in mind that the Environmental Health Staff will be responsible for investigating the future problems which may result if complaints are later received.

5. GUIDELINES

It is apparent that for certain particularly pungent types of hot food businesses, particularly fish and chips and, to a lesser extent, Indian-style, no system of odour reduction will completely eliminate the characteristic smell in the vicinity. However it is recognised that it may be appropriate, in certain cases, to recommend to planning colleagues that they refuse an application, but add a caveat that if the Planning Authority, in view of wider planning considerations, is of a mind to grant consent, then the highest specification extraction equipment be required to mitigate the odour problem.

Where sites are located within **25 metres of residential accommodation** or other odour sensitive premises (such as wool and clothing shops, funeral directors etc), a **recommendation for refusal** should normally be made to any planning application for use within **food category 1,2,3 or 4** as defined by this document

Where sites are located within **100 metres of residential accommodation** or other odour sensitive premises (such as wool and clothing shops, funeral directors etc), a **recommendation for refusal** should normally be made to any planning application for use within **food category 2,3 or 4** as defined by this document.

Except in certain cases when there is **no likelihood of loss of amenity** due to odour, eg locations within industrial estates, applications for changes of use to Use Class A3 falling within **food categories, 3 and 4** as defined by this document, should be recommended for **refusal.**

Where an application is for premises at which the end user is unknown, the highest specification of odour control equipment will be required, ie Food Category 4 as defined by this document. However any future occupant will have to demonstrate that their use can be satisfactorily controlled in terms of odour, noise etc, prior to the occupation of the property.

The following table and legend divide various types and styles of food preparation into four categories; this was carried out by assessing the amount of odour and grease likely from each of the typical styles mentioned. It is appreciated that this list is not exhaustive, but should be adequate for most situations. Against these 'food categories' there have been tabulated the current odour control techniques and the recommendation as to whether the use of any particular odour control method is recommended, possible or not recommended.

It should be recognised that some of the techniques are complementary (for example, all systems will require grease filters) and some of the techniques will be used in isolation. In order to decide on the particular components of any system, it is recommended that,'Appendix I, Abatement Technology', is consulted. More information on each control method and its advantages and disadvantages is also given in Appendix I.

Guidelines for Odour Control

Food Category (see legend)

	Grease Filter	Pre-Filter (particulate filtration) (a)	Electrostatic Precipitator	Charcoal Filter	Odour Neutralisation	Wet Scrubber	High Dilution/High Vel
1	✓✓	✓✓	✓	✓	✓	✗	✓
2 (b)	✓✓	✗	✓✓	✓✓	✓	✗	✓✓
3	✓✓	✓✓	✓✓	✓✓	✓	✗	✗
4	✓✓	✓✓	✓✓	✓✓	✓	✓	✗

Legend:

Food Category	Styles of Cooking which contain
1	Low odour/low grease to moderate odour/moderate grease content *eg Tea Shops, Pizza Restaurants, Kebab Houses, Steakhouses, UK(not including Fish & Chips, French, Italian, Most Pubs (but see Category 4), etc*
2	Moderate odour/high grease content *eg Chinese, Japanese, Cantonese etc*
3	High odour/high grease content *eg Indian, Thai, Vietnamese etc*
4	Very high odour/very high grease content *eg Fried Chicken-type outlets, Pubs with a large turnover of deep-fried food, Fish and Chips, Large Fast Food & Burger Chains (c)etc*

✓✓ Recommended for Use
✓ Use Posssible
✗ Not Recommended for Use

(a) Depending on the application, electrostatic precipitation may be more appropriate
(b) The recommendation is either High Dilution/High Velocity or electrostatic precipitation and charcoal filter
(c) Most well known burger chains address the problem of odour by utilising a combination of electrostatic precipitation and charcoal filtration. This is adequate for most situations, when allied with other factors such as location, high flue outlet etc.

6. ADDITIONAL CONSIDERATIONS

A. HOURS OF OPENING

When planning applications for A3 uses are considered, it may be possible to mitigate the potentially disturbing effects by the imposition of appropriate planning conditions. The extent to which late night activity is already an established feature of the location will need to be considered. For example in the case of a proposed A3 use in a suburban shopping parade it would be appropriate to consider if any of the other commercial premises already open late. However, late night opening in such a situation may be a relatively recent phenomenon which has arisen since the relaxation and eventual repeal of the Shops Act 1950; late night opening and Sunday trading may already have caused loss of amenity to nearby properties which a change of use to Use Class A3 will aggravate.

It should also be appreciated that disturbance from late night shoppers is likely to be different in character from the late night opening of hot food premises, especially take-aways, where some of the customers may be the 'worse for wear' from the consumption of alcohol.

It may therefore be appropriate in many instances for Environmental Health Departments to make a recommendation for refusal to a planning application on the grounds of loss of amenity to nearby residential properties and point out the above factors. It would then be up to the Planning Department to make recommendations on whether or not planning consent should be granted or refused when all the other planning considerations are taken into account. Where a recommendation for refusal is raised in a planning consultation it would probably be appropriate to add a caveat that if the Planning Committee are of a mind to grant consent despite such objection, a condition should be applied to restrict opening hours to mitigate any disturbance.

It is not possible to suggest a universal condition which could be applied to every case, as each case must be judged on its own individual circumstances.

B NOISE

Noise from Ventilation Systems

Noise from ventilation systems serving hot food take-aways and restaurants can create noise disturbance and the issue must be carefully addressed at the planning consultation stage.

Noise from these systems will comprise of three basic components; noise from the fan itself, noise from the air movement along the ducting(ductborne) and noise from air leaving the top of the duct.

One of the main sources of noise within the ventilation system is the fan. Data should be available from the manufacturer as to the octave band sound power level for the desired

operating arrangement. By definition a ventilation fan is an air-moving device which continuously propels air by aerodynamic action of a rotating impeller. The mechanical energy from the driving motor is transmitted via a shaft to the impeller and emerges as energy in the form of air velocity and pressure, ie the fan duty.

Different system designs and applications require different types of fan. Not only the operating characteristics, but also the noise character will be dictated by the type of fan. Systems incorporating carbon filters will require a heavier duty fan which will have differing tonal qualities.

Sound generated by the fan will travel along the ductwork both upstream and downstream of the fan and will vary considerably depending on the shape of the ductwork, its material and its dimensions.

The sound passing through and out of the duct (breakout), may also cause problems.

Ventilation system noise can be effectively dealt with if the sound level is above 30dB, at which BS4142:1990 (Method for rating industrial noise affecting mixed residential and industrial areas) applies and the assessment of whether complaints are likely can be determined.

Vibration noise to the duct is harder to assess prior to completion as is the noise leaving the top of the ducting. The best method of preventive action is to request full noise details of proposed ventilation systems from the applicant.

Finally noise transmission through walls and floors to adjoining properties may give rise to noise problems. Appropriate sound insulation methods can be found in Building Research Establishment Digests, Nos 143, 252, 266, 293, 333, 334. These documents are available from BRE, Bucknalls Lane, Garston, Watford,WD2 7DR, Telephone 01923 894040/664444, Fax 01923 664010.

Noise from customers

In addition to actually using the hot food premises, customers will also generate noise as they enter and leave the premises, whether on foot or by car. This noise may be particularly disturbing to nearby residents, especially if the premises are open late into the night. To some extent this type of noise can be controlled by limiting the opening hours of the premises.

C FLUE DESIGN

Important Aspects

The main elements for consideration are those which have an impact on the height and velocity of discharge and ultimately on the dispersion and dilution of odours at concentrations likely to cause annoyance. It should be borne in mind that the presence of low level atmospheric temperature inversions and 'valley' type topography may, despite the essential elements of flues detailed below, result in odours remaining close to ground level.

Flue/Duct Height

Generally speaking, the greater the flue height, the better the dispersion and dilution of odours. The consensus of opinion on good practice amongst local authorities is that flues should not terminate less than **1 metre above the ridge height of the building to which it is attached.**

If there are buildings nearby which are likely to have an effect on the dispersion and dilution of odour, the flue height should be at least **1 metre above the ridge of that building**.

The rationale behind this standard is that unless a flue extends well above all nearby obstructions, downdraught of the odour plume can occur. Moreover, unless a flue terminates at sufficient height, the odour may be trapped in regions of stagnant air which are common between low level buildings, rather than being rapidly mixed and dispersed.

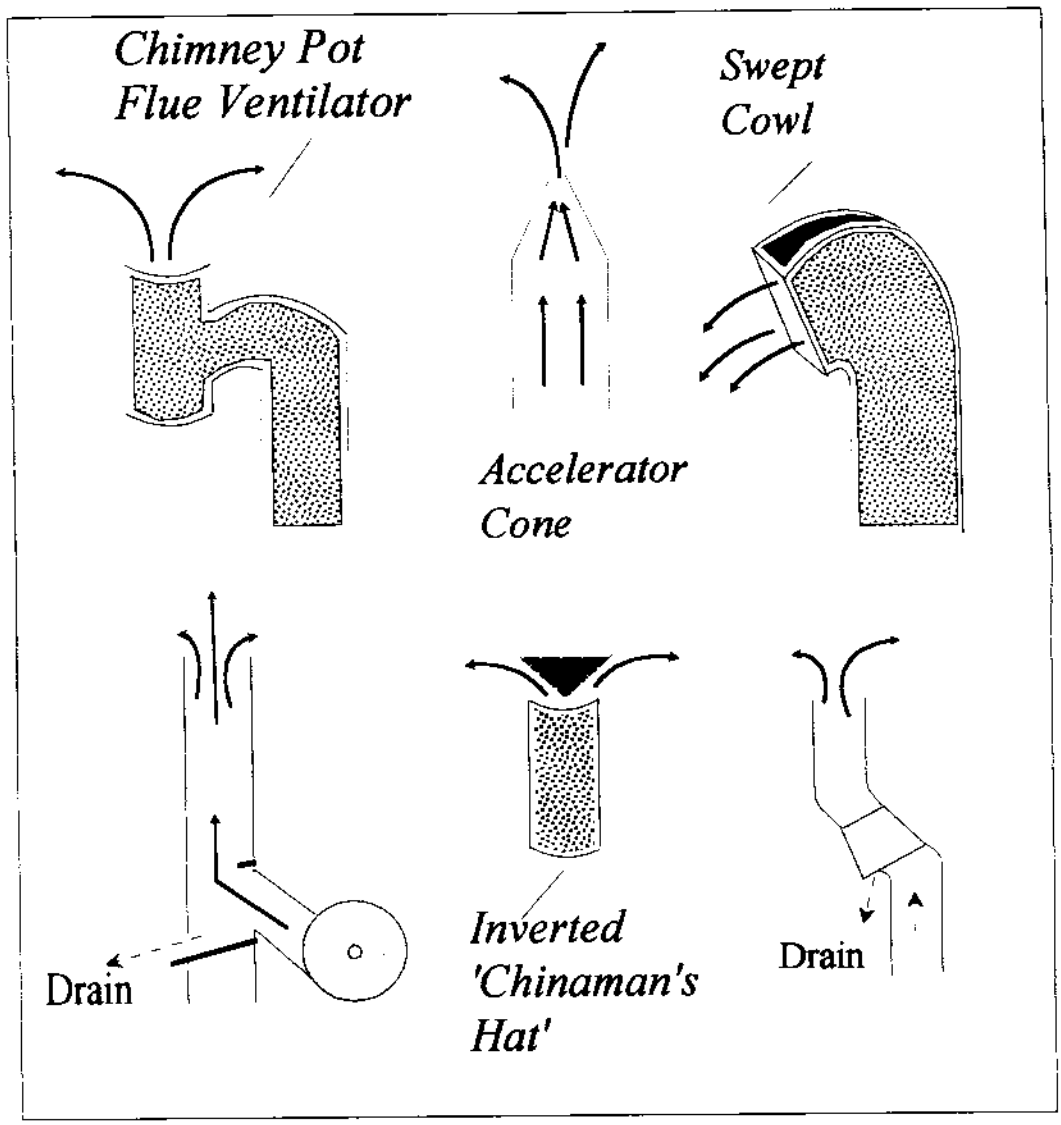
Efflux Velocity

Maximising the velocity with which odour-laden air is discharged from ducting increases the effective height of discharge and maximises the dilution of odours. Most local authorities and AEA Technology at Harwell agree that as a minimum, the efflux velocity should be **8ms^{-1}**

Principles of Good Duct Design

In addition to the above, the following measures should be employed to further encourage dispersion and dilution of odours:-

- final discharge should be vertically upwards;
- the discharge should be unimpeded by flue terminals - however some fixtures such as inverted Chinaman's Hats, Accelerator Cones, Swept Cowls and Chimney Pot Flue Ventilators may be acceptable (see the figure below);
- the number of bends in the ducting should be minimised;
- the ducting should have a smooth internal surface;
- circular duct cross-sections produce less drag and are preferred;
- where ducting utilises an existing internal flue, particularly where this is at a party wall, the flue should also have an impermeable liner to prevent odour migration to adjacent premises;
- the ducting should be well insulated to minimise heat loss and maximise thermal buoyancy of the discharge;
- flues should be sited to minimise effects of vibration transmission and noise to any adjacent facade. They may need to incorporate anti-vibration mounts, flexible couplings, silencers etc.



Examples of Flue Terminals etc

D LITTER

Litter discarded from food containers or packaging may be a problem outside certain hot food premises, particularly take-aways. Indeed, litter from take-aways may extend over a large area as the food is often consumed whilst people walk away from the point of purchase. It may therefore be necessary to condition the planning permission so that one or more litter bins are provided. It may not be possible to make customers use the litter bins!

Litter may also arise from inadequate storage of food waste and other rubbish, usually to the rear of the hot food premises. Prior to the premises being brought into use it will be necessary to obtain from the end-user, a scheme for the satisfactory storage of refuse to prevent problems associated with litterblow and vermin.

E CAR PARKING

Traffic and car parking are often cited as potential problems associated with hot food premises. In the case of traffic, it is generally recognised that hot food premises are not likely to generate any more traffic than any other type of retail development. In addition, such premises tend to attract the most traffic at times of the day when other shops are closed.

The parked vehicles of customers may however cause problems with congestion and obstruction. This issue should therefore be addressed and if necessary, a condition be applied to the planning permission to make sure that adequate off-street parking provision is made. This may be particularly relevant for premises that offer a delivery service as such vehicles will need to be parked when not in use.

APPENDIX I

ABATEMENT TECHNOLOGY

(a) GREASE FILTERS

The grease filter is one of the most visible parts of a mechanical extract ventilation system.

It is situated within the extraction canopy and its function is to remove the larger grease particles from the airstream. Primarily this is to prevent a build up of grease on the inside of the ductwork and fan, which may present a fire hazard.

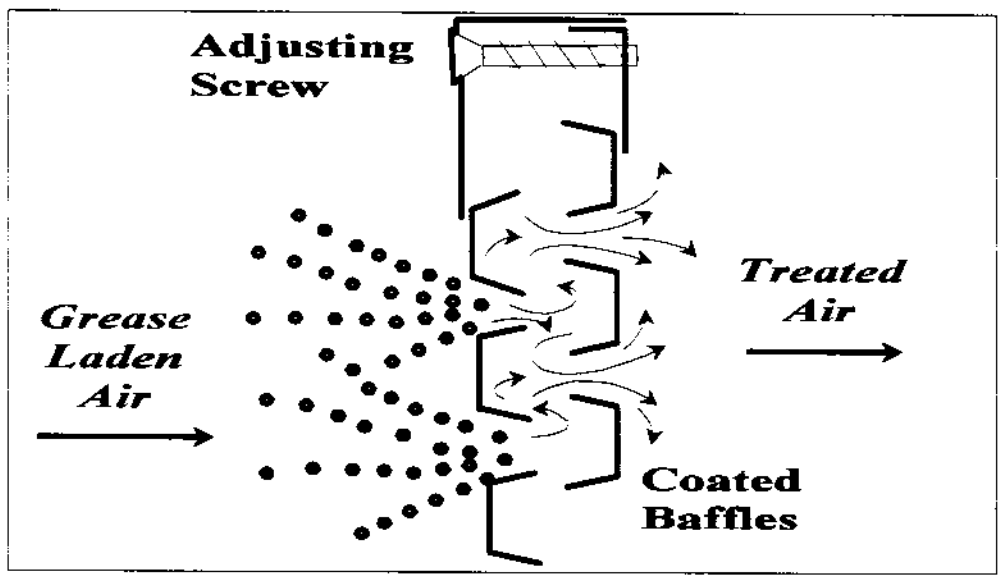
The grease filter does not fulfill an odour control role as such, but prevents grease damaging other elements of the extraction system.

There are two distinct types of grease filter:-

- Disposable
- Cleanable

The disposable grease filter consists of a fibrous material (often mineral fibre) within a metal frame. Once the material becomes heavily soiled, it is simply replaced with clean material. It is common for the maintenance of such filters to be carried out by contractors.

Grease Filters



The commonest form of metal or cleanable filters consists of a mass of "wire wool" within a metal frame. Such a filter needs to be cleaned on a regular basis. Otherwise, it will become clogged with grease.

Once any filter has become saturated with grease it can no longer perform efficiently.

It is recommended that two sets of grease filters are provided to enable a clean filter to be fitted when the contaminated filter is removed for cleaning. The periods of time between removal and cleaning will vary depending on the grease-loading. However it is recommended that there be **weekly replacement of grease filters** as part of the routine cleansing programme.

Advantages

Filters are easy to clean and maintain

Disadvantages

Performance rapidly declines if not regularly maintained and cleaned

(b) PRE-FILTERS(PARTICULATE FILTRATION)

These filters are used in conjunction with carbon filters as an alternative to electrostatic precipitation. Since carbon filters remove odours by adsorption, any build up of dirt or grease on the carbon face will result in the blanking or encapsulation of the open porous structure of the carbon and will inhibit or totally destroy the process. It is therefore essential that a suitable pre-filter is provided to protect the carbon filters and this should be of the highest grade economically viable.

The pre-filter would normally be a panel or bag system.

Just as pre-filters are essential to extend the working life of carbon filters, it is essential that grease filters are fitted before the pre-filter to prolong their lifespan. The need to regularly cleanse the grease filters cannot be overstated and they must always be fitted before using the extraction system.

All pre-filters should be checked regularly and replaced if necessary in accordance with the manufacturer's guidelines. The maximum life of the filter will vary with usage, but typically this will be **three months**.

Advantages

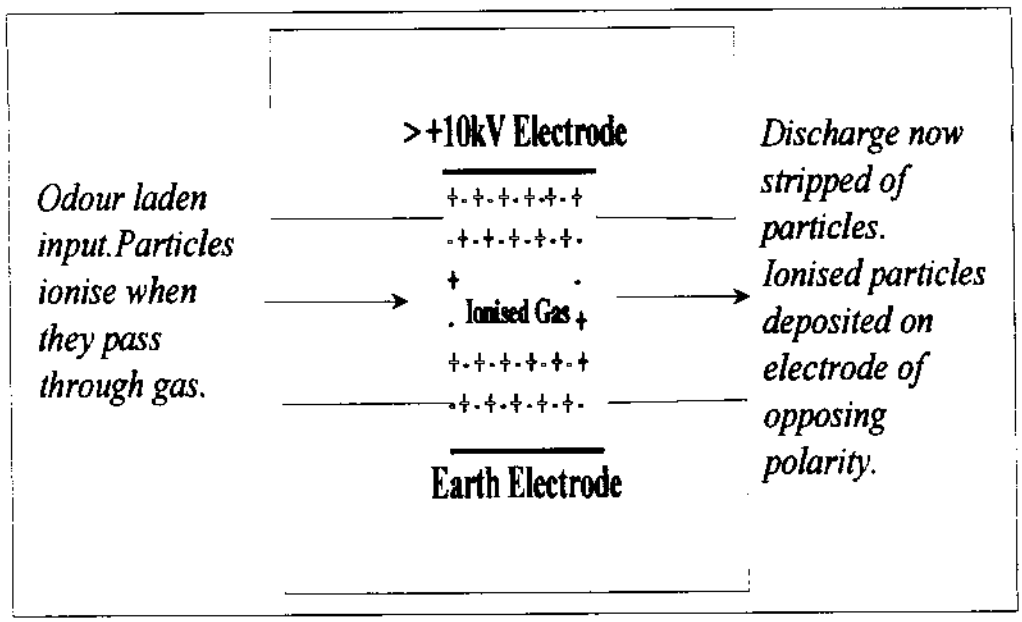
Low capital cost
Filter change easily carried out
Low-tech alternative without the safety hazards associated with high voltage electrostatic precipitation

Disadvantages

Require regular replacement
No gaseous odour removal

(c) ELECTROSTATIC PRECIPITATION OF PARTICULATE MATTER

In the context of odour from takeaways the principal application is for removal of small grease and smoke particles. Precipitators work by passing the discharge from the cooking extract system through the ionised region which exists in the electric field which is created between high voltage electrodes of opposing polarity. The ionised gas induces a charge in the particles present which are then attracted towards an electrode of the opposite polarity. Typically, particles are then removed from the electrodes by periodic washing. The precipitator will always be preceded by an initial series of coarse grease filters and succeeded by carbon adsorption or odour neutralisation (see figure).



Electrostatic Precipitator

Advantages

Low pressure drops
Effective down to very small particle sizes

Disadvantages

High capital cost
No gaseous odour removal
Potential fire risk
High Voltage safety hazards
High-tech equipment requiring specialist maintenance; failure requires cessation of use to prevent contamination of carbon filters with grease.

(d) CARBON ADSORPTION OF GASES

Within the extract discharge from takeaway establishments odour is carried, in part, as a range of gases. Those gaseous odours which are also volatile organic compounds (VOCs) can be adsorped by certain carbonised (partially burnt without excess oxygen) organic materials such as wood or coal. The filter is normally a 3 stage system contained within a single module. The adsorped compounds can be desorped using a hot gas, commonly superheated steam and the filter reused. In the context of cooking odours however, where it is undesirable to recover the adsorped gases, carbon filters are normally cheap enough to be disposed. Such devices should normally be preceded by coarse grease filters and a particulate filter such as electrostatic precipitation.

It is important to match the filter medium to the system requirements depending on the type of odour.

For the majority of filter beds, retention time is critical to achieve optimum adsorption and avoid breakthrough, therefore upgrading of the duty rating of the fan may lead to a reduction in filter performance.

It will be necessary to replace the carbon filters regularly depending on load and usage. However life spans greater than two years should be viewed with suspicion.

Advantages

High efficiency up to 95% under optimum conditions (see Disadvantages below)
Moderate operating costs

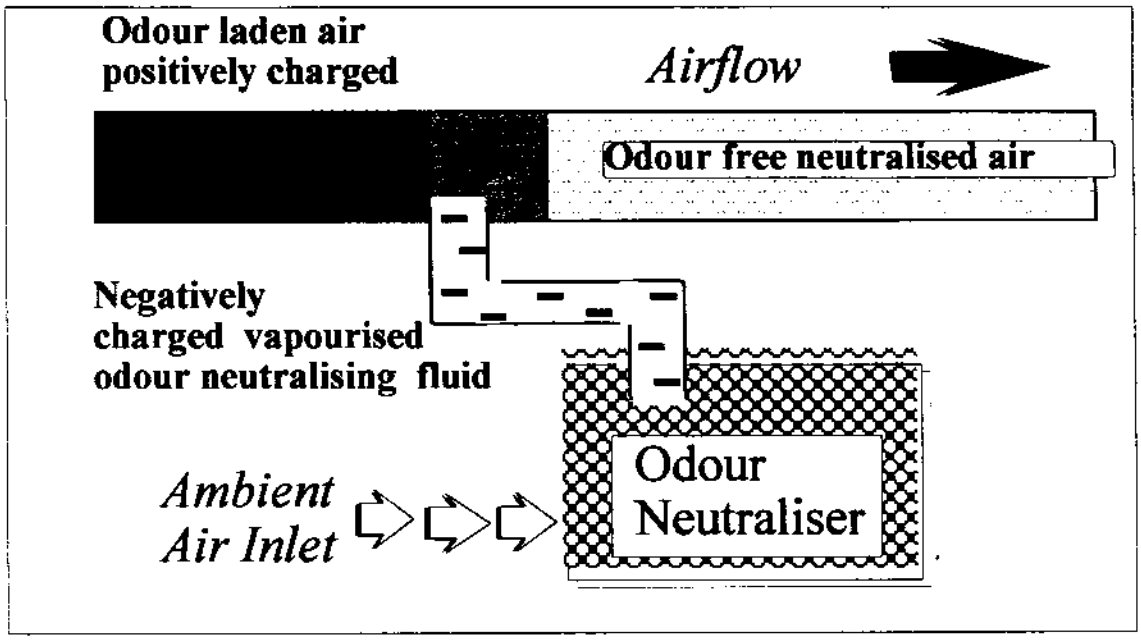
Disadvantages

Filter block requires regular replacement
Efficiency decreases with use
Not effective against particulate components
Temperature of input stream must be below 40°C
Must be preceded by grease and particulate filters
Sensitive to high humidity
Constant and detailed maintenance required
May still need dilution by increasing height of flue

(e) ODOUR COUNTERACTION AND MASKING

These are not true abatement techniques since removal of the odorous component does not usually occur. The technique is used principally for odours contained within the gaseous phase. It involves the addition of chemicals which modify human response to the odour because of changes in the perceived odour intensity (counteraction) or the perceived odour quality (masking). The odour modifier must be capable of withstanding variations in odour type and concentration and therefore the selection of odour modifier and dispensing rate are critical. In some systems the effectiveness of odour counteraction may be enhanced by ionising the effluent flow from the extract system in the same way as in an electrostatic precipitator(see figure below).

The neutralising chemical is then ionised to an opposing potential which encourages the physical combination of odour and counteractant chemicals which may then also undergo some chemical reaction. This type of system will normally be preceded by coarse grease filters and particulate removal.



Odour counteraction and electrostatic precipitation

Advantages

Minimal system pressure drop
Minimal maintenance

Disadvantages

Gives limited particulate filtration and therefore needs front end particulate control
Serious doubts over effectiveness for aromatic cooking sources
High capital cost
Further dilution almost certain to be needed

(f) WET SCRUBBERS

General Principles

The term scrubbing is applied to the process of removing particles (liquid or solid) from a gas stream in contact with a liquid. The transfer of malodorous compounds from the air stream to a liquid phase is often the best method for treating large air flows. Water is the usual

liquid, but commonly a chemical reagent is added to increase the transfer efficiency.

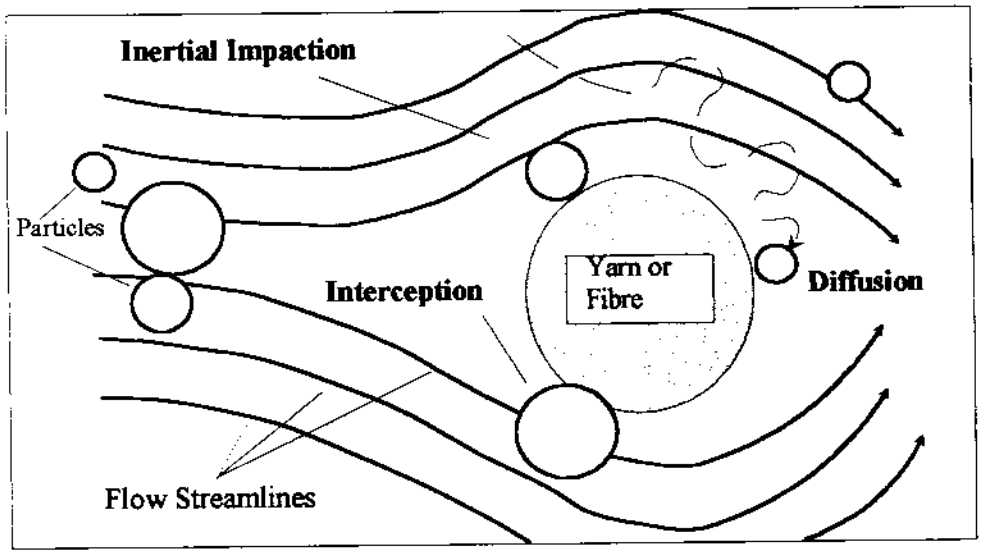
The complexity of many odours arising from the heat treatment of animal or vegetable matter means that in practice, a number of separate absorbtion stages with different reagents may be required.

In general the use of wet scrubbers in the control of food-based odours is confined to the factory food-processing situation, eg spices processing, cereal processing, animal feed mills etc. However, they do appear to have a proven record on the control of grease, cooking and spicy odours in such situations. Their use in hot food premises remains to be realised, but they may have a place in situations where other control methods are inadequate.

Particle Abatement Scrubbers

Particle collection by liquid scrubbing occurs by three main mechanisms:-

Inertial impaction, interception and diffusion (see figure).



Particle Capture Mechanisms - Interception, Inertial Impaction & Diffusion

a) Inertial impaction
A particulate laden gas stream will flow around an object, but particles with high inertia (momentum) will collide with and adhere to, the object.

b) Interception
Particle collection by interception occurs when larger particles in a particulate laden gas stream, flowing around an object, touch and adhere to the object.

c) Diffusion

Small particles move randomly through the gas stream, buffeted by larger molecules. On striking an object particles adhere to it and this is known as a diffusional collection mechanism.

Inertial impaction dominates the particles greater than about 0.3 microns in diameter, and diffusional collection is important for particles below this size. Collection efficiency increases as particle size increases for inertial impaction, and increases as particle size decreases for diffusional collection. Consequently the variation of the collection efficiency with particle size, passes through a minimum at about 0.3 microns. Particle scrubbers (wet dedusters) operate principally by inertial collection and use the liquid collection process. There are two types of collection process:-

- Wetted Surface Dedusters
- Distributed Liquid Dedusters

In the wetted surface deduster particles are collected on a solid surface (plate, sphere, fibre etc.) which is then irrigated with the scrubbing liquid. In a distributed liquid deduster, the scrubbing liquid itself forms the collection surface, usually in the form of droplets. Particles are retained by the droplets, which are then subsequently separated from the gas stream.

The collecting droplets can be generated by using the velocity of the gas stream to break up the liquid. Alternatively, the spray nozzles can be used for droplet formation. Final separation of dust laden drops from the gas stream can be achieved using either gravitational forces, inertial forces, impaction/interception or diffusion.

There are six principal particulate scrubbers generally in use:

- fibrous packing scrubbers
- impingement and entrainment scrubbers
- moving bed scrubbers
- plate scrubbers
- spray towers
- venturi scrubbers

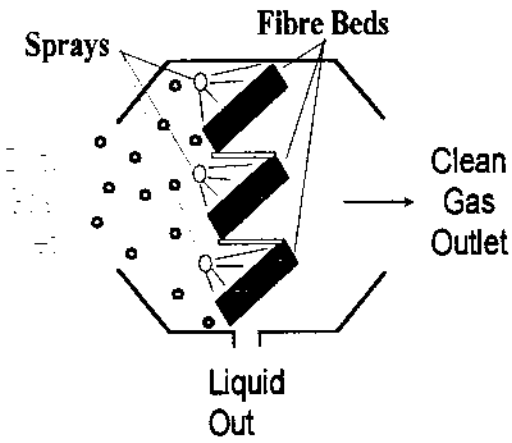
Diagrams of each are shown on the following page. The first five types of scrubbers are also for trace gas removal. The choice of which particulate scrubber to use will depend upon:

- abatement efficiency required
- energy requirements
- properties of the gas stream and particles to be collected.

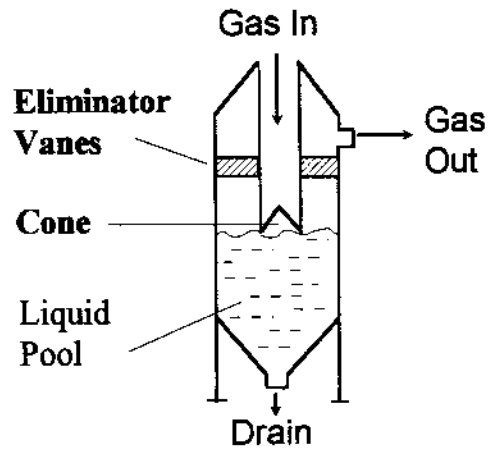
Scrubbers for Trace Gas Removal

Absorbtion is a term applied to the process which involves mass transfer between a soluble gas and a solvent (liquid) at a gas liquid interface. The absorbtion process can be with or without chemical reaction and with or without recirculation of the liquid. The term wet scrubber is often applied to gas absorbers as well as particle scrubbers. Wet scrubbers are used for particulate abatement (see earlier) and gas absorbers for trace gas removal. Whilst

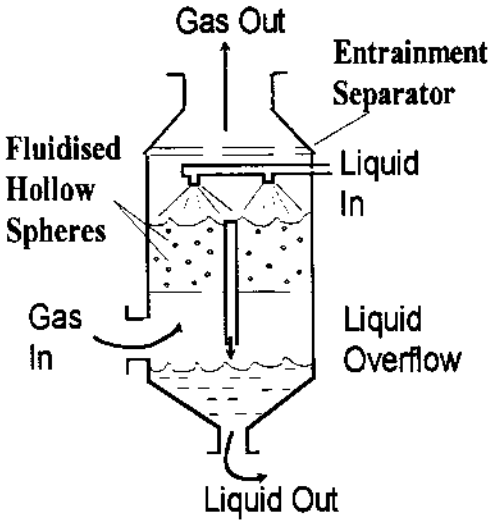
Types of Wet Scrubber



Fibrous Packing Scrubber



Impingement/Entrainment Scrubber



Moving Bed Scrubber

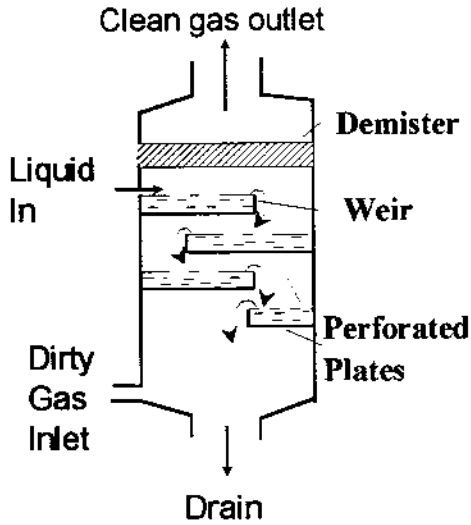
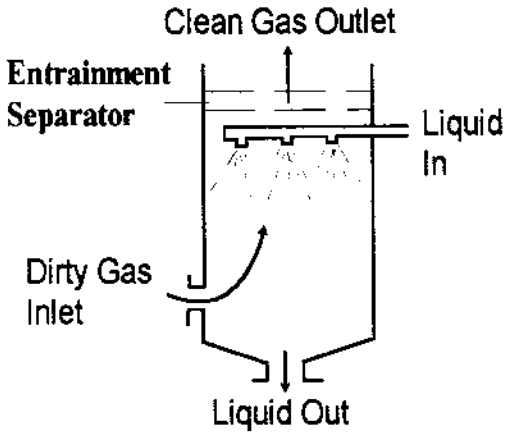
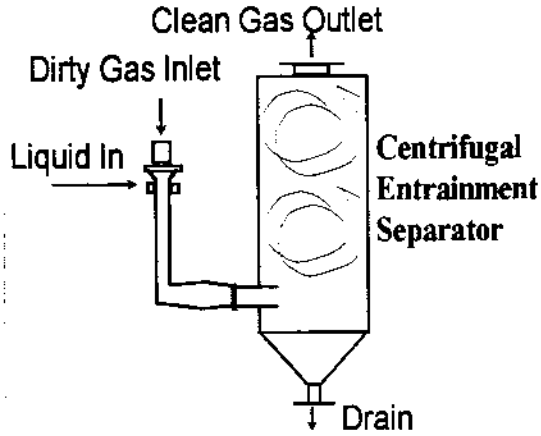


Plate Scrubber



Spray Tower



Venturi Scrubber

the basic technology for both these are similar, the design criteria for particulate or trace gas removal are very different. Simultaneous particle collection and trace gas removal may occur, however, in the wet scrubber.

The design of gas absorbers involves consideration of the chemistry of the system (solubilities of chemical reactions etc.) and physical structure of the absorber.

The absorbtion system can have either aqueous or non-aqueous liquid phases. The selection of the appropriate reagent depends on the properties of the pollutant to be removed from the gas stream.

- Water is suitable for absorbing soluble acidic gases.
- Alkaline solutions are suitable for absorbing less soluble acidic gases.
- Acidic solutions may be needed for the absorbtion of amines.
- Oxidizing solutions can be useful for the control of organic odours.

Organic solvents can be used for absorbing organic species, but this can generate additional problems (such as sludge formation or the separation of the solute from the solvent) which can be avoided by selecting a different abatement technology such as adsorption or incineration.

The driving force for trace gas removal by absorbtion, is the difference between the partial pressure of the soluble gas and the gas mixture, and the vapour pressure of the solute gas and the liquid film in contact with the gas. Mass transfer occurs by molecular diffusion across the gas liquid interface.

The rate determining step can be in the liquid or the gas phase. If the gas is very soluble, or is related chemically with a reagent in a liquid phase, then the absorbtion process is gas phase controlled. If the gas is only slightly soluble or the liquid almost saturated with gas, then the absorbtion process is liquid phase controlled.

The gas absorbing into the liquid gas interface applies to a high surface area across which mass transfer can occur. This is usually achieved using packing materials which are coated with liquid or by droplet/bubble formation. The absorber design also has to provide a means for renewing the liquid absorbents so that a high driving force and mass transfer is maintained.

Gas absorbers which attain gas liquid contact by bubbling dirty gas through a liquid are suitable for absorbtion processes which are liquid phase controlled. Gas absorbers which attain gas liquid contact by spraying liquid through the gas stream are suitable for absorbtion processes which are gas phase controlled.

Advantages

Very effective at controlling specific odours

Disadvantages

Very High Capital Cost
For complex mixtures of odours more than one scrubber may be required
Only really suitable where large volumes of odour-laden air require cleaning

(g) HIGH DILUTION HIGH VELOCITY EXTRACTION SYSTEM (HDHV)

The principle of high dilution to control odour is very simple; it involves the practice of mixing large amounts of fresh air with any odours being produced from cooking, in order to reduce their concentration in the atmosphere.

The HDHV system is designed specifically for the Chinese food industry to deal with the high levels of cooking oil vapour in the extracted air. Because of the high oil content of vapours extracted from over the cooking range, only certain types of grease filter are suitable. The filters used in this type of application must meet certain criteria; they must:

- be efficient and not clog during use
- work at a constant velocity
- not be noisy in use
- not burn in the event of a fire
- be adjustable in order to control performance
- be easy to clean

An example of a filter which meets these criteria is one called "Flame Guard" (manufactured by Far East Industries). At optimum efficiency, up to 75% of airborne grease can be removed and the filter can perform at this level without regular cleaning; as the oil is filtered out of the air stream, it drains away to "catch pans" whilst still hot and liquid.

The air stream with its residual grease content is then expelled from the end of the duct at high velocity, in excess of $10ms^{-1}$(in still air conditions, the gas/air stream would reach at least 13m from the end of the ducting, ensuring good dilution and dispersion).

Unfortunately, this system cannot be used with carbon filters because they require low velocity airflow to ensure a reasonable performance.

The manufacturers of the HDHV system acknowledge that the way to deal with pollution is not to dilute it; their argument is that there will always be some residual odours and that the most practical way to deal with them is dilution.

Advantages

Proven record with odours from Chinese cooking
Filter does not require regular cleaning

Disadvantages

Use is not recommended with odours from anything other than Chinese cooking
A heavier duty fan is required; an odour problem may be solved at the expense of creating a noise problem

APPENDIX II

SUGGESTED PLANNING CONDITIONS

A FUME EXTRACTION

Condition 1 The use hereby permitted shall not be commenced until the equipment detailed in [letter/submission/etc dated.....] to discharge odours and fumes from the cooking process shall have been installed and be in full working order to the satisfaction of the Local Planning Authority.

Reason: To ensure that unsatisfactory cooking odours outside the premises are minimized in the interests of the amenity of occupiers of nearby properties.

Condition 2 Equipment shall be installed to suppress and disperse fumes and/or smell produced by cooking and food preparation, and the equipment shall be effectively operated for so long as the use continues. Details of the equipment shall be submitted to, and approved by, the Local Planning Authority and the equipment shall be installed and be in full working order to the satisfaction of the Local Planning Authority prior to the commencement of use.

Reason: To ensure that unsatisfactory cooking odours outside the premises are minimized in the interests of the amenity of occupiers of nearby properties.

Condition 3 The extraction equipment installed in pursuance to Condition [No...] above shall be regularly maintained to ensure its continued satisfactory operation and the cooking process shall cease to operate if at any time the extraction equipment ceases to function to the satisfaction of the Local Planning Authority.

Note: It is suggested that documentary evidence including receipts, invoices and copies of any service contracts in connection with the maintenance of the extraction equipment, is kept, preferably at the premises and is available for inspection by officers of the Local Planning Authority, to facilitate monitoring of compliance with this condition.

Reason: To ensure that the use does not result in excessive cooking odours outside the premises and that the amenity of occupiers of nearby properties is protected.

B RESTRICTION ON STYLE OF BUSINESS/LIMITATION OF USE

Condition 4 Not withstanding the provisions of any Town and Country Planning General Development Order or Use Classes Order, the use hereby permitted shall be restricted to.....[hot food takeaway/restaurant etc.....].

Reason: To enable the Local Planning Authority to consider the acceptability of alternative use.

Condition 5 The range of food sold at the premises shall be in accordance with the written details received on [date] and there shall be no change in the range of food sold unless appropriate measures are undertaken and agreed in writing by the Local Planning Authority to the extraction system approved under Condition 1 of this consent.

Reason: To protect the amenities of occupiers of adjoining properties.

Condition 6 The range of food sold at the premises shall be limited such that any frying of food shall be restricted to shallow frying only and at no time whatsoever shall a deep fat fryer be installed or utilised for the preparation of food at these premises without the prior written approval of the Local Planning Authority.

Reason: In the interests of the amenities of residents of nearby properties.

Condition 7 The range of food sold at the premises shall be limited such that any frying of food shall be restricted to shallow frying or deep fat frying in a fryer with a maximum capacity of 15 litres and at no time whatsoever shall a deep fat fryer with a capacity of greater than 15 litres be installed or utilised for the preparation of food at these premises without the prior written approval of the Local Planning Authority.

Reason: In the interests of the amenities of residents of nearby properties.

Condition 8 The range of food sold at the premises shall be restricted to .....[foods listed eg shallow fried chips,burgers,pizzas etc] only and there shall be no change in the range of food sold unless appropriate measures be undertaken and agreed in writing by the Local Planning Authority to the extraction system approved under Condition 1 of this consent.

Reason: In the interests of the amenities of residents of nearby properties.

Condition 9 If at any time a cooking process other than the preparation of hot beverages or the heating of food in a microwave oven is undertaken on the premises, an adequate extraction/ventilation system shall be installed, including suitable and sufficient grease filters and odour neutralising plant, to be approved in writing by the Local Planning Authority.

Reason: To protect the amenities of nearby residents.

C STORAGE OF WASTE

Condition 10 Prior to the premises being brought into use for the purpose hereby permitted, a scheme providing for the adequate storage of refuse from this use shall be submitted to and approved by the Local Planning Authority. The scheme shall be carried out and thereafter retained at all times.

Reason: In the interests of the amenity of occupiers of adjoining properties.

D LITTER

Condition 11 The use hereby permitted shall not commence until provision has been made within and in the vicinity of the site for the disposal of litter resulting from the use, and such provision shall be in accordance with details agreed in writing with the Local Planning Authority.

Reason: In the interests of the amenity of occupiers of nearby properties.

E OPENING HOURS

Condition 12 The .....[hot food takeaway/restaurant etc.....]use hereby permitted shall only be open between the hours of .....hours and .....hours.

Reason: To protect the amenities of occupiers of adjoining properties.

Condition 13 The premises shall not be open for business between the hours of ..... hours and ..... hours daily.

Reason: To protect the amenities of occupiers at adjoining properties.

NB: It may be appropriate to impose restrictions applying to Sundays and recognised Public Holidays.

F SOUND INSULATION

Condition 14 The change of use hereby permitted shall not begin until full details of a scheme for sound insulation has been submitted to and approved by the Local Planning Authority. The insulation shall be installed before the premises are first brought into use and shall be maintained in an effective manner thereafter.

Reason: To protect the amenities of occupiers of adjoining properties.

G CAR PARKING

Condition 15 .....[Insert No] off-street car parking place(s) shall be provided for the parking the delivery vehicle(s). The parking place(s) shall be used at all times when the vehicle(s) is(are) not in use.

Reason: In the interests of highway safety.

APPENDIX III

BIBLIOGRAPHY

Air Pollution Control	Colt International Ltd Air Pollution Division
Technical Guidance Note (Abatement) A3	HMIP
Odour Measurement and Control - An update	Netcen
PPG6:Town Centres and Retail Development(Draft)	Dept of the Environment
PPG13: Transport	Dept of the Environment
PPG23: Planning & Pollution	Dept of the Environment

BS4142:1990 A Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

APPENDIX IV

NAMES AND ADDRESSES

Odour Control Systems Ltd
33A Castle Close
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Netcen
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Tel 01235 463195

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