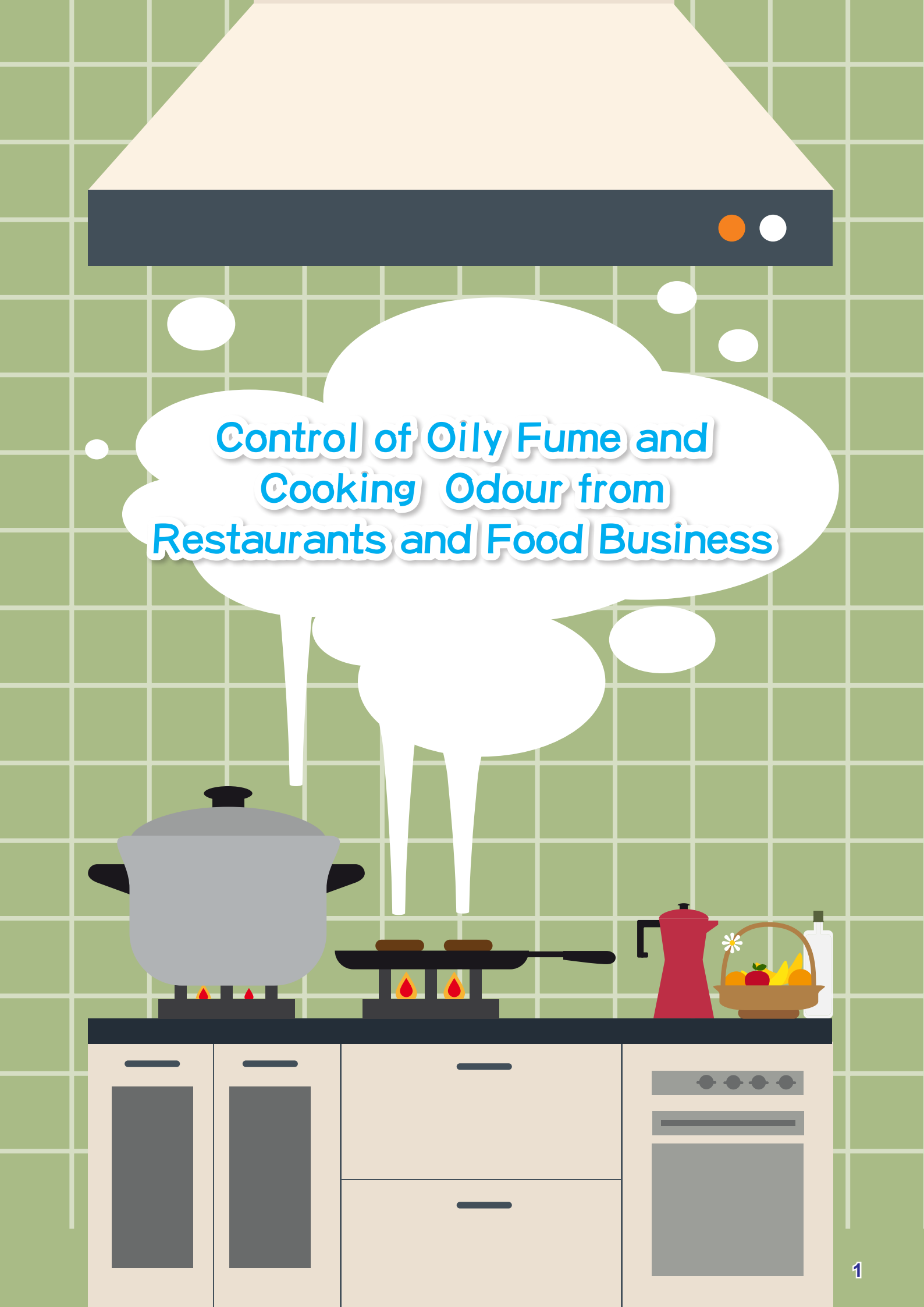

Control of Oily Fume and
Cooking Odour from
Restaurants and Food Business

Introduction

Oily fume and cooking odour emissions from cooking processes are under the control of the Air Pollution Control Ordinance (The "Ordinance"). It is necessary for owners and operators of restaurants and food business to take appropriate measures to ensure that no visible cooking fumes nor objectionable odour would be emitted causing air pollution nuisance. In this regard, appropriate air pollution control equipment have to be installed at the kitchen exhaust system of the food premises for treating cooking fume emissions before being discharged to the outdoor environment, lest to violate the requirements of the Ordinance.

This note aims to provide guidance to the owners and operators of restaurants and food business in helping them understand and apply the best practicable control measures to minimize these emissions, thereby preventing air pollution problems.

A typical air pollution problem associated with cooking fumes emissions

Standards of Control

As a general guideline, all air emissions from a restaurant and food premises should not give rise to an air pollution problem, including odour nuisance, and should be free from visible fume.

For exhaust outlets in close proximity to the sensitive receptors, such as residential premises, schools, clinics, it is possible that the air pollution problem would still exist even after the application of advanced control technologies. To avoid air pollution nuisance likely caused to the air sensitive receivers, the owners and operators of the restaurants and food business should appropriately choose the locations for their business.

Positioning of Exhaust Outlets

Exhaust outlets should be set at appropriate locations to avoid causing air nuisance to the public. In deciding the location of the exhaust outlet, the following should be considered :

(a) the exhaust outlet should be located at such a place where the ventilation is good and the emissions can be effectively dispersed;

(b) the exhaust outlet should be kept at an appropriate separation distance from any air sensitive receivers; and

(c) the emissions should not be restricted by the use of boards, covers or other coverings.

For the use of diesel oil or solid fuel, the exhaust chimney should be directed vertically upwards and preferably extended at least 3 metres above the highest point of the building where the restaurant is located. If there are any adjacent or connected buildings within a twenty-metre radius that are taller than the building where the exhaust outlet is located, the exhaust height should be extended accordingly. If this is not practicable, advice from environmental professionals should be sought.

An example of good practice, extending kitchen exhausts to rooftop

Oily Fume and Cooking Odour Control

The complete exhaust system serving the cooking stoves or other cooking appliances, including the air pollution control equipment, should be designed, commissioned and maintained by competent professionals, and be operated by competent staff. The design of air pollution control equipment should be based on peak load conditions (i.e. the worst case scenario). For easy reference, a brief description of the available techniques for the control of emission of oily fumes and cooking odour is given in Annex A.

For those kitchen exhaust systems serving stoves for frying, charbroiling, roasting and similar operations that will give out excessive oily fume emissions, they should be equipped with high efficiency air pollution control equipment to remove oily fume from the waste gases before discharging into open atmosphere.

If the exhaust contains a strong odour or the exhaust outlet is in close proximity to any sensitive receptor in the vicinity, high efficiency odour control equipment should also be installed.

Oily fume treatment system on the roof

Operation and Maintenance of Control Equipment

It is important that the kitchen exhaust system, including the air pollution control equipment, is properly operated and maintained. The following practices should be fully adopted:

(a) Operation and servicing of the kitchen exhaust system and the air pollution control equipment should only be carried out by competent staff with sufficient training and relevant skills; and

(b) Maintenance and repair of the system should be carried out by competent professionals in accordance with the manufacturers' recommendations.

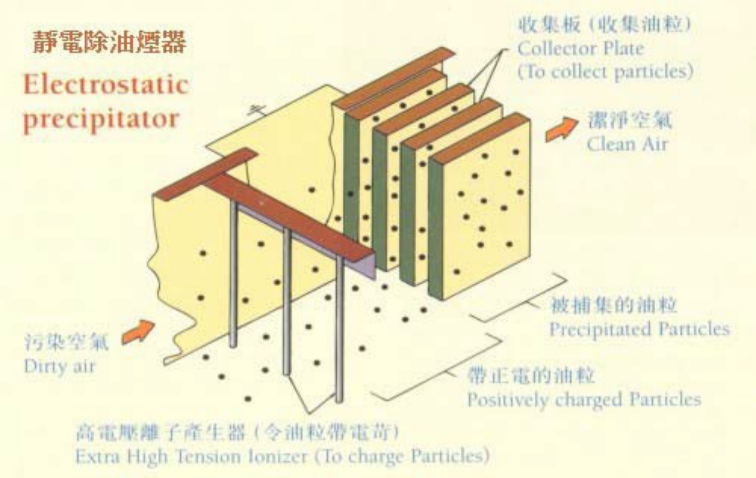
Consideration should be given in the design of the kitchen exhaust system to ensure adequate capacity of the air pollution control equipment to cater for the peak load. Safe access and sufficient space shall be provided for facilitating regular inspection, cleansing and maintenance of the air pollution control equipment. An inspection window in the form of a transparent panel shall be provided for equipment such as air washers, Venturi & packed water scrubbers and activated carbon filter units. A sufficient stock of such materials should be kept in the restaurant to facilitate immediate replacement. It is also recommended to interlock the air pollution control equipment with the associated kitchen exhaust system in such a manner that the kitchen exhaust system will stop operating when the control equipment is not functioning properly.

To ensure its proper performance, the air pollution control equipment should be scheduled for inspection, cleansing and maintenance regularly. Maintenance and repair log book should also be kept. The frequency for cleansing and servicing are recommended below:

(a) Electrostatic precipitators:

(i) The components of extra high tension ionizer and oily fume collector plate should be removed for cleansing by competent staff with sufficient training and relevant skill at regular intervals (for example every week to every month depending on the amount of cooking fume handled). While cleansing the oil droplets deposited on the collector plates, care must be given to detect if the detergents or chemical in use would cause damage to the collector plate components (such as strong alkaline would corrode and oxidize the aluminum components). Moreover, it is recommended to inspect emission at least twice a day. Whenever observing any signs of deterioration in performance, such as visible emission, is noted, they should be cleansed immediately. If a built-in washing system unit is installed, the unit should be activated once a day to help reduce the frequency of periodic cleansing of the components.

(ii) Sufficient maintenance space should be provided in the installation of electrostatic precipitator for safe removal of the components of extra high tension ionizer and oily fume collector plate for cleansing.



Collector plate is one of the essential component which must be cleaned regularly to ensure the performance of the Electrostatic Precipitators

Before and after conditions of the electrostatic precipitator collector plate. Oil droplets deposited on the collector plates will deteriorate the removal efficiency, regular cleansing have to be conducted to maintain operating performance.

(b) UV-C Lamp Exhaust Hood:

The UV-C lamps and the forefront grease pre-filters should be regularly cleaned (say every few days to every week depending on the amount of cooking fumes being handled). The cleaning procedures should be strictly adhered as recommended by the suppliers in order to ensure that the control equipment is in good operating conditions at all times.

Kitchen Exhaust Hood Equipped with Ultraviolet Bulb to Remove Grease and Odour

After removal of forefront grease pre-filters, UV bulb cassette is in sight installed behind them. The UV lamps and the pre-filters should be cleaned regularly.

(c) Hydrovents, air washers and scrubbers:

The hydrovents, air washers and scrubbers should be cleaned and serviced immediately as soon as there is any sign of deterioration in fume control and in any case, not less than once a month. Besides, the water and dosing pumps, filters, detergent dosage rate, pressure gauge, spraying (i.e. adequate atomizing) condition, etc, should be checked regularly to ensure the control equipment is in good operating conditions at all times.

(d) Duct works:

They should be cleaned and serviced at least once every 6 months.

Regular visual inspection on the exhaust outlets and scent for likely odour nuisance during peak hours should also be conducted to ensure an early discovery of any operational problem with the equipment. In general, a frequency of twice a day or more at busy hours is recommended.

Remedial measures should be taken immediately if objectionable odour or visible oily fume are noticed. This could be done by checking the operating conditions and performance of the air pollution control equipment and the condition of the kitchen exhaust system. Any defective parts, choked filters, saturated scrubbing liquid, etc. should be replaced as soon as possible. To facilitate immediate replacement, there should be sufficient stock of such materials kept in the restaurant.

It is also desirable for the restaurant owners and operators to keep a copy of the operation and maintenance manual and the maintenance and repair log book of the air pollution control equipment at the restaurant.

Enquiries

Enquiries can be addressed to the Regional Offices of the Environmental Protection Department. They will be glad to answer any enquiries concerning the control of oily fume and cooking odour from restaurants and food business.

ANNEX A

Available Techniques for the Control of Oily Fume and Odour Emissions

Grease Filters

Metallic grease filters, which are commonly found in the market, can screen out large oily droplets by way of simply physical collision and / or changing the direction of flow at high speed onto the filter surface, thus suitable for preliminary treatment of oily fumes.

Typical metallic grease filters {Mesh filter (left) and baffle filter (right)}

UV-C Lamp Exhaust Hood

Ultraviolet-C light emitted by the UV lamp can break down the chemical structure of oil molecules so as to achieve the removal of fumes and odour. A built-in UV lamp exhaust hood is generally equipped with several UV lamps depending on the handling capacity of fumes and the size of the hood. The lamps are mounted on cassette panel and installed behind the grease filters (usually 2 layers of forefront grease pre-filters). The forefront grease pre-filters serve as barrier impeding large oil droplets directly onto the UV lamps, and meanwhile screening off the harmful effect of UV-C light to human. Built-in UV lamp exhaust hood is another method with an added advantage to treat greasy fumes and odours.

Cassette panel mounted with UV-C lamps

Water Spray Hoods (Hydrovents) and Air Washers

In the design of a hydrovent and air washer system, due considerations should be given to the following:

(a) avoidance of channelling;

(b) sufficient residence time;

(c) adequate air-to-water-ratio;

(d) choices of scrubbing liquid; and

(e) easy maintenance and cleaning.

Air washers should be filled with specially designed baffles to enhance their performance.

Given the average removal performance of water spray hoods (hydrovents) and air washers for greasy droplets in the exhaust stream, they can only be used for preliminary treatment while satisfactory fume removal would result with the combined use of high performance air pollution control equipment, say, electrostatic precipitators.

Electrostatic Precipitators (ESPs)

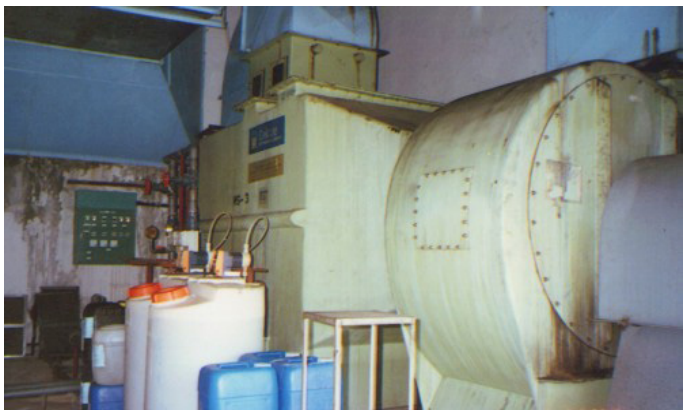
If properly designed and maintained, ESPs can achieve a high collection efficiency for oily fume. Since oily fume is sticky and easily coated on the collector plates and render the equipment inoperative, ESPs should be cleaned/ serviced regularly and properly. Whenever observing any sign of deteriorating performance for control of oily fume, it is required to cleanse the collector plates immediately.

Venturi and Packed Tower Scrubbers

Venturi scrubbers are sometimes employed to control oily fume. Exhaust gas stream is forced through the venturi throat where they are intercepted by an atomized scrubbing liquid stream. Removal efficiency depends on the pressure drop across the venturi throat and particle size. Noise may be a problem since air velocity at the throat is high.

Packed tower scrubbers remove oily fume by absorption as stream of scrubbing liquid is sprayed on the oily fume laden gas stream. The scrubber is filled with specially designed packing materials to increase the contact surface area between the scrubbing liquid and the waste gas stream to enhance the absorption efficiency. Packed tower scrubbers generally occupy more space for installation.

For both venturi scrubbers and packed tower scrubbers, water is the common scrubbing liquid. These kinds of scrubbers can be effective for odour control too if a suitable scrubbing liquid is used. The venturi scrubber, however, are notorious emitters of high-frequency noise and special consideration should be taken to avoid causing noise pollution problem if this equipment is selected. Further, given the larger volume of scrubbers occupying bigger space, they would merely suitable for food premises and workshops with sufficient spatial environment.



Example of venturi scrubber with odour control

Activated Carbon Filter

Activated carbon particles, which are highly porous and have very large surface to volume ratios, remove odour by adsorption in which the odorous compounds, when penetrate into the pores, are retained on the inner-surfaces of the granular solid.

Although activated carbon filters are effective in odour removal, their performance could be adversely affected under the following conditions:

(a) High moisture content will flood the adsorption sites, thereby reducing performance and media life.

(b) High temperature will increase the gas movement and therefore, reduce the adsorption capability.

(c) Any oily particles present in the exhaust gas stream will plug the adsorption sites, thereby reducing performance and media life and increasing services costs.

It should therefore be noted that the sole use of activated carbon is not suitable for controlling odour emission from cooking processes because of the nature of the emission.

Common factors which should be considered in the design of activated carbon filter system or other adsorption equipment include:

(a) Contact time between adsorbent and adsorbate;

(b) Total adsorptive capacity of the adsorbent;

(c) Uniform distribution of airflow over the surface of the adsorbent;

(d) Resistance to airflow;

(e) Quantity of exhaust gas handled per unit time; and

(f) Amount of oily particles to be adsorbed.

Adsorbers are mostly of a stationary packed bed arrangement. They are usually packed with appropriate depth adsorbent and installed in units of two or more modules in parallel to permit continuous operation. Preliminary treatment facility should be installed before activated carbon filters to remove oily fume and water from the exhaust gases, and, if necessary, to lower the exhaust gas temperature to the operational range. Particular attention should also be paid to the requirement of regular replenishment and to prevent carbon dust from blowing out.

Control of offensive odours

For cooking fumes with offensive smell, it is necessary to install high performance odour removal equipment in addition to high performance fume control equipment, such as activated carbon filter or UV-C / ozone de-odourizing equipment.

The odour control equipment should be installed at the rear portion of the ventilation ducting system immediately prior to exhaust outlet, such that the exhaust cooking fumes could be preliminarily treated for removal of oily droplets and moisture before allowing to pass through the odour removal equipment. The exhaust cooking fumes should preferably be cooled appropriately down where necessary, lest to causing detrimental effect to the control equipment.

Remarks: While for installing air pollution control equipment, such as electrostatic precipitator and activated carbon filter which form part of the kitchen exhaust system, the owners and operators of the restaurants and food business may need prior approval from relevant government departments and are advised to consult the Food and Environmental Hygiene Department, Fire Services Department and Buildings Department where appropriate.

ANNEX B

Regional Offices	
Districts / Address	Telephone No. / Fascimile No.
EPD Territorial Control Office 28/F Southorn Centre, 130 Hennessy Centre, Wanchai, Hong Kong.	Tel. 2835 1018 Fax. 2838 2155
Regional Office (East) (Kwun Tong, Wong Tai Sin, Sai Kung, Yau Tsim Mong & Kowloon City) 5/F Nan Fung Commercial Centre, 19 Lam Lok Street, Kowloon Bay, Kowloon.	Tel. 2755 5518 Fax. 2756 8588
Regional Office (South) (Hong Kong Island & Islands) 2/F Chinachem Exchange Square, 1 Hoi Wan Street, Quarry Bay, Hong Kong.	Tel. 2516 1718 Fax. 2960 1760
Regional Office (West) (Tuen Mun, Tsuen Wan, Kwai Tsing & Sham Shui Po) 8/F Tsuen Wan Government Offices, 38 Sai Lau Kok Road, Tsuen Wan, N.T..	Tel. 2417 6116 Fax. 2411 3073
Regional Office (North) (Yuen Long, Shatin, Tai Po & North) 10/F, Shatin Government offices, No. 1 Sheung Wo Che Road, Shatin, N.T..	Tel. 2158 5757 Fax. 2685 1133

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