Controlling Emissions from Restaurant and Commercial Cooking Processes
Grease Smoke and Odour Control

3 Harben Parade, NW3 6JP

Interpretation of Requirements

Following conversations and a visit to study drawings for the proposed site, I have at your request put together a design for an odour control system for your proposed project.

As with any project we get involved in we always where possible recommend to our clients that they should closely follow the DEFRA guide for guidance on odour control equipment selection.

This ensures that what we propose will be in line with local authority's requirements and if the system is maintained correctly they will not exhaust nuisance smoke and odours leading to complaints from nearby residents

Taking into consideration the level of discharge, proximity of receptors, size of kitchen and cooking type your project requires a **very low level of odour control to comply.**

After our discussions, it was decided to recommend **a very high level** to please the client and to suggest the correct specification so as to be sure of not upsetting any receptors in the vicinity.

The System

The system specified has been designed on a maximum extract volume of 0.73m 3 /s

The first stage of control will be our Electrostatic Precipitator ESP3000 in a double pass configuration, (ESP followed by ESP) for total smoke removal. These units are the only ESP's on the market that are specifically designed for commercial kitchen application which is why we have built in sumps for oil and grease capture.

ESP's are also the most effective method for smoke removal. Our ESP works up to 98% efficiency through a single pass
Once Oil, Grease and Smoke have been removed the odorous air will mingle with our UV-O1000 Ozone system, which in total will achieve a minimum 0.4 second residence time.

If Char-Grilling, we would always recommend a double pass ESP

In conclusion you can see that the system I have designed is above what the DEFRA guide recommends, (double pass ESP's) and the end product of installing a system like this will be a result that should see a reduction of all kitchen extract smells, grease and smoke of up to 95%. A nuisance odour will not be factor at discharge.

How the Equipment Works

Electrostatic Precipitation and its use for the separation of sub-micron particles has been around since the late nineteenth century. The principle of operation is to impart a negative or positive electrical charge (Ionisation) to a particle. The particle is then passed between finely spaced parallel metal plates (average spacing 5-10mm) which are held at opposite electrical potentials. One plate will be charged to the same polarity as the ionised particle whilst the other will be earthed (opposite with respect to the positive/negative).

As the charged particle travels between the two metal plates it is forced away from the plate held at the identical polarity and drawn towards the earthed plate. During the path of travel the Parallel Effect takes place resulting in the charged particle becoming attached to the earthed plate due to the electrostatic difference, once attached the particle will either run off and be held in the sump or in the case of dry particulate remain suspended on the plate until cleaned off during maintenance.

The Electrostatic Precipitator is ideal for use in kitchen exhaust systems to separate the small grease and smoke particles that penetrate the main grease filters in the canopy.

Efficiency

The Electrostatic Precipitator is a very efficient means for separating the particulate phase; operating efficiency when clean can be as high as 98% at particle sizes down to 0.01 micron. However, as the plates and ioniser become laden with particles during the use the efficiency will reduce due to the insulating effect of the dirt.

Pressure Loss

The Electrostatic Precipitator does not present a high-pressure loss (10mm—15mm Water Gauge). This gives a specific advantage in that most standard Kitchen extractor fans will have the capability of overcoming this small differential.

This is particularly advantageous when it is considered that if the pressure loss were high larger noisier fans would probably be necessary resulting in potential noise pollution.

UV Technology (Gaseous Phase)

The system is based on the synergy that occurs when ozone and ultraviolet are combined. The system comprises a quantity of lamps a percentage of which are designed to produce UV light at 185nm, converting ozone from the oxygen present in the air. The remaining lamps combine to produce UV light at 254nm which destroys the ozone and any mercaptans remaining in the proximity of the lamps. A photo catalytic liner is used to enhance the production of hydroxyl radicals, which are both very shortlived and extremely oxidising. A UV system cannot destroy smoke or other particulate although it has some affect in altering the make-up of cooking grease to a better managed compound

How does Ultraviolet Work?

Strong sunlight permanently de-activates bacteria, spores, moulds and viruses. Over a century ago, scientists identified the part of the electromagnetic spectrum responsible for this well-known effect; wavelengths between 200nm and 300nmm, called UV-C. The mechanism of kill is well documented and unlike chemical disinfectants the organism is unable to develop any immune mechanisms. The mechanism of kill involves the absorption of photons of UV energy by the DNA, which fuses the DNA and prevents replication.

DNA (Deoxyribonucleic acid) consists of a linear chain of nitrogen bases known as purines (adenine and guanine) and pyrimidine's (thymine and cytosine). These components are linked along the chain by sugar-phosphate components. The DNA of most forms of life is double stranded and complementary; the adenine in one strand is always opposite thymine in the other, and linked by a hydrogen bond, and guanine is always paired with cytosine by a hydrogen bond. The purine and pyrimidine combinations are called base pairs.
When UV light of a germicidal wavelength is absorbed by the pyrimidine bases (usually thymine) the hydrogen bond is ruptured. The dimer that is formed links the two bases together, and this disruption in the DNA chain means that when the cell undergoes mitosis (cell division) the DNA is not able to replicate.

How is UV Light Generated?

Ultraviolet light is most typically generated from a low pressure lamp as described below; Low Pressure lamps are the most common lamp type and are the oldest source of ultraviolet light.. They consist of a quartz envelope that separates two tungsten filaments. The lamp is evacuated and a level of mercury is introduced into the quartz envelope. The spectral output of this lamp type is monochromatic, a single line output at 253.7nm or 185nm. A fluorescent lamp is a low-pressure lamp that has the inner surface of the lamp coated with phosphors to absorb all of the 253.7nm light an only emit the longer wave.

How the UV-O 1000 works

The Purified Air UV-O 1000 unit uses UV-C technology to produce ozone and hydroxyl free radicals to oxidize odours through a process of Ozonolysis. Unlike other UV-C systems, the UV-O 1000 is located outside the kitchen extract duct and connects via spigots and small diameter ducting. It is widely accepted that the best way to apply UVC is in the airstream itself. However, the lamps quickly become dirty and the effectiveness is greatly reduced. By applying the lamps outside of the airstream we are able to fully control the condition of the lamps which provides for a uniform output, the air entering the UV-O 1000 does not come via the extract and is filtered on entry, the system allows a uniform delivery of clean treated air to enter the extract system. A further advantage is that the pressure loss exhibited when the unit is installed is low and uniform.

Installation

Simple to install, with low maintenance and running costs, the system is designed to be located on a wall in the kitchen or plant room or can be fitted to the ducting itself. The fact that it is located external to the ducting makes the unit ideal for retrospective installations.

Technical & Safety Considerations

The unit must always be installed on the negative side of the fan and the system should be switched via an interlock both connected to the fan and an airflow switch connected to the unit itself which will ensure that in the event the unit is disconnected from the duct or if the extract system is switched off the system will be isolated. The unit can only discharge into duct which is going to atmosphere the unit must not discharge into an enclosed space. The unit comes as standard with ten lamps UV-C technology cannot remove smoke or other particulate, for instance where there is a lot of smoke produced due to the cooking style, for example char-grilling. Then Purified Air recommends that the UV-C system be used in conjunction with a filtration system such as their Electrostatic Precipitator (ESP)