clean air for airports

Camfil Farr	Segment brochure
Airports	
Camfil Farr – clean air solutions	

airports and air travel

Demand for air travel is at an all time high and growing at an unprecedented rate. An industry forecast[1] indicates that if unconstrained, demand would grow approximately 4% per annum. This rate would nearly double passenger numbers at airports by 2020 (4.2 to 7. 4 billion). In reality, growth will be constrained by capacity-issues in air space and at airports. Two consequences of capacity restrictions will be more delayed flights and passengers having to spend more time at airports.

Airport buildings are ventilated to provide breathing air for human comfort and health. Large amounts of external air are drawn into airport buildings and this air will be heavily polluted.

Airports and air pollution

There is universal acceptance that increased levels of air pollution are present at airports. A study[2] of the impact of existing and projected aircraft emissions on local air quality at 10 American cities concluded that:

- **Commercial aircraft emissions have the potential to significantly contribute to air pollution in all 10 study cities.**
- **Projected ground level emissions from aircraft will have increased in all cities by 2010.**
- **The contribution to total ground level emissions from airplanes will have increased in all cities by 2010.**

Airplanes are not the only source of pollution at airports. The ground traffic needed to support air operations can not be ignored. Air quality is degraded by the operation of; push-back trucks, passenger buses, staff buses, baggage wagons, cleaning team vehicles, catering vehicles etc. In fact, because most of these vehicles are powered by diesel

engines and they operate in very close proximity to the gates, they are probably responsible for the greater proportion of pollution inside the terminals and other airport buildings. Camfil Farr have made a study at a major European airport and confirmed that a high proportion of the pollutants in the ventilation system fitted the profile of diesel emissions. Pollution levels at airports may also be impacted by related but off-site activities and local non-related activities. There are very high densities of road traffic at airports and these make a significant contribution to pollution, as they do in cities.

1 Airports Council International (ACI), Feb 2005, Vienna.

2 United States Environmental protection Agency, EPA420-R-99-013, 1999.

air pollutants

Air pollution can be categorised as being either particulate (solids) or molecular (gas). Particles are induced into the human respiratory system through breathing. Gaseous or molecular pollution also enters the body in breathing air, but it is able to penetrate beyond the lungs, into the bloodstream and around the entire body.

Particulate and molecular pollutants are both present at airports. The principal source is the combustion of fossil fuels. Jet and diesel engines both release fine particulates in their exhaust. For jet engines the particulates result from incomplete combustion of kerosene fuel. Combustion efficiency reduces at lower engine power levels which are used during landing, taxiing and idling. Diesel engines release high levels of particulates at all duties. The particulates result from the combustion of both fuel and engine oil. Diesel particulates fall into several categories:

- **Dry particles or soot**
- **Semi-volatile aerosols that have carbon nuclei with oily hydrocarbons condensed on the surface.**
- **Carbon particles with sulphur acid molecules condensed on the surface. The sulphur arises for impurities in the fuel.**

All diesel particulates are extremely small and virtually all are respirable. As such they readily enter the respiratory tract and lungs and can have a significant effect on human health.

Jet and diesel engines both liberate molecular pollutants. For jet engines, the emission profile depends on the power output of the engine. At low power (idling, taxiing, landing) the emissions are predominantly un-burnt kerosene fuel or products of partial combustion. Un-burnt fuel is a readily detected smell close to an airplane on stand at the gate. At higher power settings (take-off) there is an increased emission of nitrogen oxides. These are formed from oxygen and nitrogen under high temperature and pressure conditions in the engine.

Molecular pollutants emitted from diesel engines are characterised by hydrocarbons, aldehydes, oxides of nitrogen (NOX) and oxides of sulphur (SOX). Poly aromatic hydrocarbons (PAH) are also produced and these complex organic molecules have been widely associated with a carcinogenic risk to humans. Another harmful gas present at above normal ambient concentrations at airports is ozone. Although ozone is not emitted by either jet or diesel engines, it is formed through the presence of hydrocarbon precursors and the action of UV light.

In addition to the principal external sources, there are other activities that impact on human comfort and health. To address burgeoning passenger loads, airports undertake extensions, upgrades and refurbishments. In many cases this work appears to be continuous. These activities can add significantly to levels of both particulate and molecular pollutants. Other sources include food facilities, cigarette smoke and on-site generation of heat and power.

Molecular pollutants at airports constitute both an odour nuisance and a threat to human health. The principal gases, their sources and effects are summarised in the table below. The threat of pollutants is not limited to passenger terminals. Exactly the same conditions can be found in other airport buildings and buildings in close proximity. Examples include administration buildings, hotels, emergency services facilities and offices buildings.

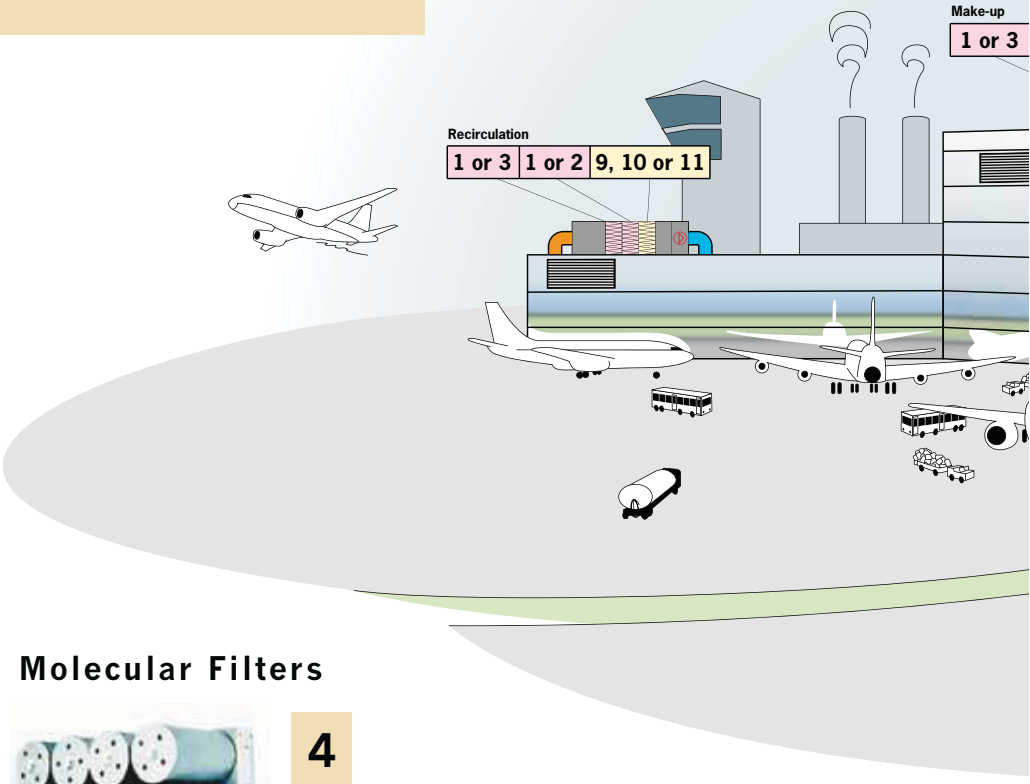
Note: Pollutions levels inside airport buildings are dependent upon air and ground traffic levels together with the direction of the prevailing wind.

Sources – Internal and external

EXTERNAL		
CONTAMINANT	SOURCE	EFFECT
Oxides of sulphur	Sulphur impurities in fuel, jet and diesel engines, power generation.	Odour, irritant, acidic behaviour, damage to respiratory tract
Oxides of nitrogen	Jet and diesel engines, power generation.	Smog/ haze formation, acidic behaviour, lung irritation
Hydrocarbons	Fuel	Odour, smog, eye irritation, respiratory tract issues, headaches, dizziness
Aldehydes	Diesel fuel	Odour, eye irritation, respiratory issues
Ozone	Not directly emitted, but formed from other precursors	Impairment of lung function,
Carbon monoxide	Jet and diesel engines	Headache, dizziness
INTERNAL		
Hydrocarbons	Painting, cleaning agents, floor covering, floor polish	
Formaldehyde	Carpets, wooden floors and furniture	
Odours	Humans, food facilities, cigarette smoke	

The solution to pollutants

Camfil Farr offer products that satisfy all the demands at airports to control particulate and molecular pollutants. These products also satisfy the recommendations of EN13779. Various solutions are available depending on the extent of the problem. Molecular filtration may be applied in either the fresh air make-up or recirculation air systems. Solutions for make-up air are preferred since the principal sources of pollutant are external. These tend to be more heavy duty and reflect the high pollutant concentrations and one-pass operation. Solutions for recirculation applications reflect lower ambient concentrations and multi-pass operation.



Particle Filters

1

Hi-Flo

A high efficiency bag filter in filter classes from F5 to F9. With an optimised filter design and the use of superior material it is the ideal choice for very high levels of indoor air quality (IAQ). The Hi-Flo filter is the ideal first stage particle filter for an optimised low pressure drop and protection of second step filters.

2

Opakfil Green

A high efficiency compact filter in filter classes F6 to H11. Opakfil Green provides the highest level of particle removal in a compact format. The ideal second stage filter, to control fine particles.

3

Ecopleat Green

This new generation of fine compact filters is the ideal filtration solution for applications with restricted space Available in fully incinerable versions.

Molecular Filters

4

Camcarb Metal

A robust solution that can be filled with many adsorbents. The product provides long contact times, long life and extremely high efficiency. The stainless steel cylindrical cartridges may be refurbished by refilling with new media. Camcarb is particularly suited to make-up air applications.

5

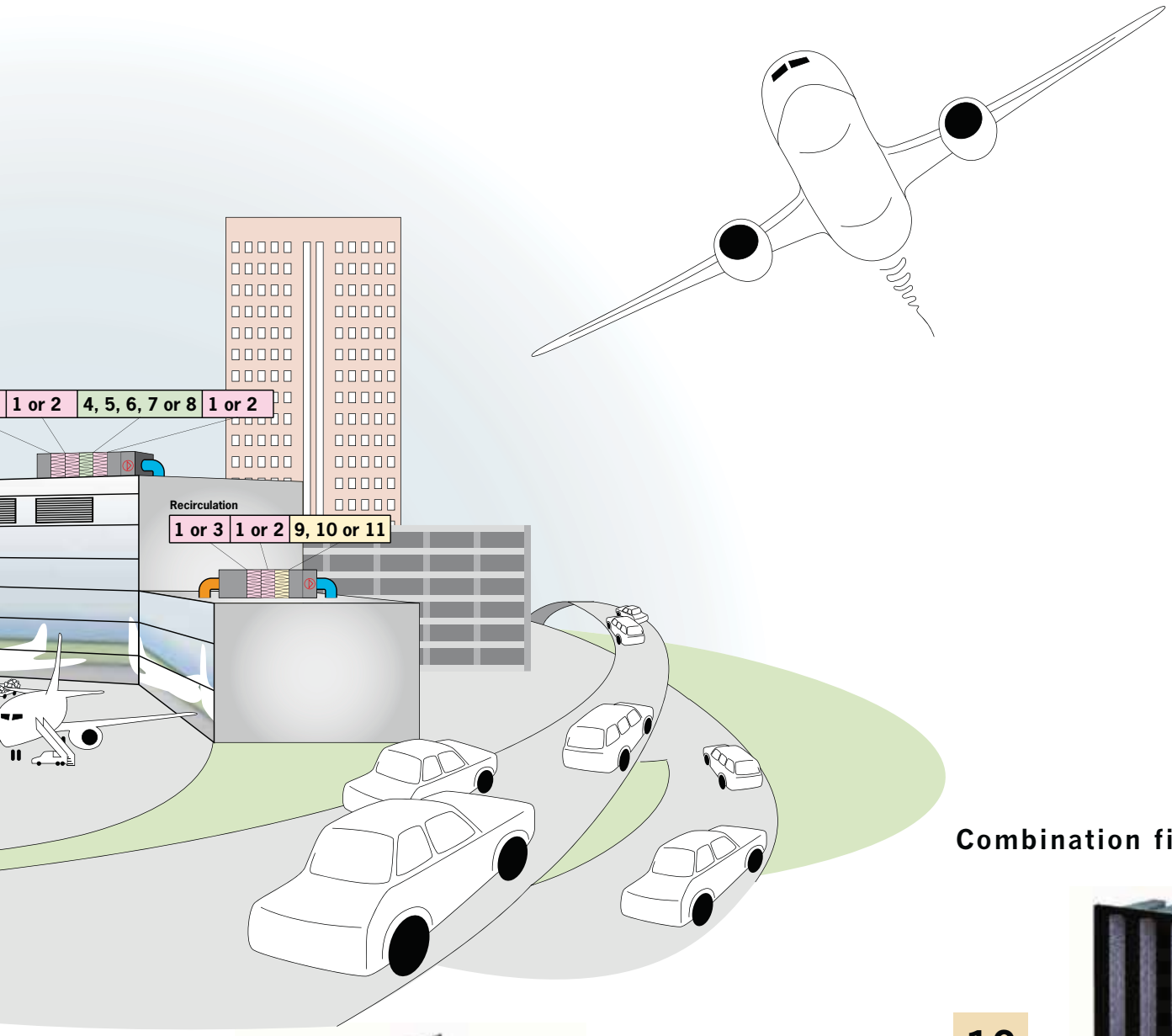
Camcarb Green

A robust solution that can be used with many adsorbents. The product provides long contact times, long life and extremely high efficiency.The Green version is a one-use product suitable for disposable by incineration. Camcarb is particularly suited to make-up air applications

6

GDM 300

A robust solution used with Campure medias.



Combination filters

7

GDM 440

A robust, low pressure loss solution used with Campure medias.

8

Camsure

A robust solution in flat panel/tray form that can be used with many adsorbents. The product provides long contact times, long life and very high efficiency.

9

Citysorb

A very compact and practical solution aimed at low concentration (predominantly recirculation air applications). Citysorb uses a very finely divided adsorbent and provides Rapid Adsorption Dynamics (RAD).

Two versions are available, one with very high quality Broad Spectrum adsorbent and one with impregnated activated carbon to target acidic gases.

10

Citycarb

Similar product to Citysorb, with the addition of an integral F7 particle filter layer.

Two versions are available, one with very high quality Broad Spectrum adsorbent and one with impregnated activated carbon to target acidic gases.

11

Cityflo

A member of the Hi-Flo bag filter family that includes a layer of very high performance Broad Spectrum activated carbon.

provision of clean air

Camfil Farr products satisfy all demands from airports to eliminate the nuisance of external pollutants and provide clean air that is comfortable and healthy for the travelling public and their staff. They are also fully compliant with the recommendations of the latest European Standard for Indoor Air Quality (IAQ): EN13779:2007

Applicable standards and recommendations

There is a growing focus on the health impacts of pollution. The CAFÉ (Clean Air for Europe) group acting within the European Commission have already concluded that for both coarse and fine particles (PM10, PM 2.5) a safe concentration (no effect or threshold) is unlikely to exist[3].
The regulating authorities and policy makers such as the European Commission act to protect us from harm using the most practical methodologies. An example is the new European Standard for the ventilation of Non-Residential Buildings EN 13779. This standard sets out various categories of outdoor air quality, several categories of desi rable indoor air quality and the air filtration steps that should be applied to transform from one category to another.

Support services

Camfil Farr provide a comprehensive range of support services to ensure that users achieve the maximum benefit from their filter installations. In particular, it is essential to have confidence in the air quality within the enclosed space and to be able to predict the end of the useful service life.

The Gigacheck range of passive air samples are very well suited to determining concentrations of specific gases in ventilation systems and enclosed spaces. The "Airport" Gigacheck sampler is available to determine concentrations of; oxides of nitrogen, sulphur dioxide, ozone and mixed VOCs .

The Gigamonitor techniques are used to analyse samples of used molecular filtration media to determine the amount of adsorbed contamination. A series of analyses at appropriate periods allows the residual life to be monitored and replacements planned in advance of a failure. This is a sensible and economic procedure to ensure that building occupants are continuously provided with good air quality.

Camfil Farr operate a unique molecular filtration test facility in which full size products can be tested at a wide range of temperatures and relative humidity values to reproduce actual application conditions. The test filter can be challenged with a wide variety of gases and vapours. Sophisticated detection equipment upstream and downstream of the filters allows realistic initial efficiency and efficiency / lifetime curves to be produced. This facility is available to customers to evaluate the performance of new and (partially) used filters from Camfil Farr and other providers.

ISA Check

Gigacheck

[3] T. Sandstrom, D. Nowak and L. Van Bree. Health effects of coarse particles in ambient air: messages for research and decision-making. Eur Respir J 2005;26:187-188

External air quality at airports falls into "highly polluted" category (ODA class 3, EN13779:2007).

- In an airport environment, it is recommended to use a molecular filter (gas filter). It is also a good solution in an area of category ODA 3. The gas filter should be combined with a downstream F8 or F9 particulate filter.
- For good hygienic reasons, it is recommended to use two-stage particle filtration:

– *Minimum F5, but preferably F7 in the first step.*
– *Minimum F7, but preferably F9 in the second step.*
– *If there is only one filtration step the minimum requirement is F7.*

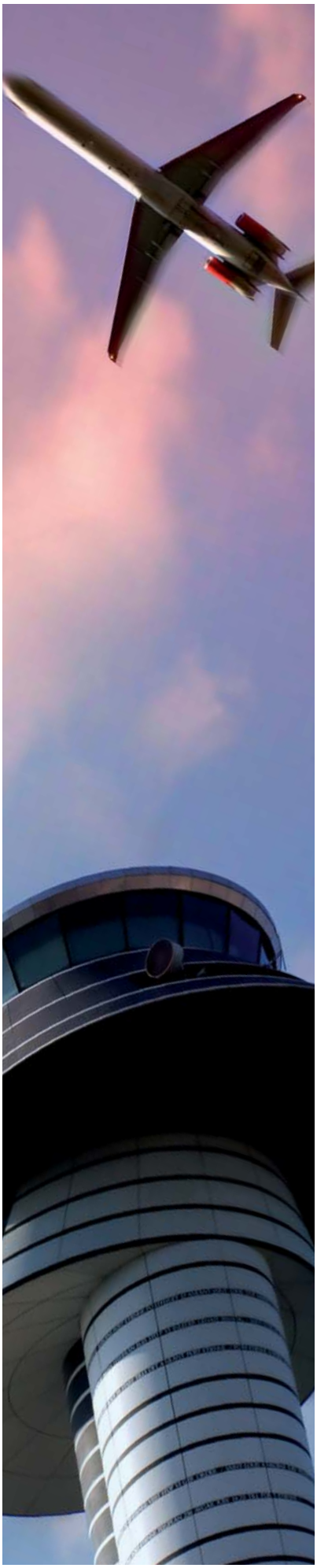
- For recirculation air, at least F5 quality must be used in order to protect the ventialtion system. Prefe rably the same filter class, as the main external air stream should be used.
- For protecting the extract and exhaust systems, use at least class F5.
- Regardless of filter class used, the efficiency must not deteriorate below defined values. Always look for the untreated (discharged) efficiency. The untreated (discharged) efficiency is reported when a filter is tested according to current valid European standard EN779:2002 which replaced the former EN779.
- The interval of filter replacement must not be selected only on the basis of economical optimisation. Hygiene issues must also be taken into account. Three limits must be considered, and the one that is reached first will determine the time for replacement: final pressure drop, time installed and time in operation.

– *For first step filters: 2000 hours operation or maximum 1 year installed or when the final pressure drop is reached.*
– *For second or third step filters: 4000 hours operation or maximum 2 years installed or when the final pressure drop is reached.*
– *For exhaust- and recirculation air filters: 4000 hours operation or maximum 2 years installed or when the final pressure drop is reached.*

- To avoid microbial growth, the plant should be designed so that the relative humidity (R.H.) always stays below 90% and so that the average R.H. for three days is less than 80% in all parts of the system, including the filters.
- Gas filters do not change pressure loss during normal operation. In the absence of a definitive statement within EN13779, Camfil Farr recommends to change IAQ gas (molecular) filters after 1 year installed or 5000 hours operation.

		IAQ			
OUTDOOR AIR QUALITY		**INDOOR AIR QUALITY**			
		IDA 1 (High)	IDA 2 (Medium)	IDA 3 (Moderate)	IDA 4 (Low)
Pollution Level ↓	ODA 1	**F9**	**F8**	**F7**	**F5**
	ODA 2	**F7 + F9**	**F6 + F8**	**F5 + F7**	**F5 + F6**
	ODA 3	**F7 + GF + F9**	**F7 + GF + F9**	**F5 + F7**	**F5 + F6**

Table refering to appendix "A3. Use of Air Filters" in the European Standard EN 13779:2007.



camfil FARR

On world standards...

...Camfil Farr is the leader in clean air technology and air filter production. Camfil Farr has its own product development, R&D and world wide local representation.

Our overall quality goal is to develop, produce and market products and services of such a quality that we aim to exceed our customers expectations. We see our activities and products as an expression of our quality.

To reach a level of total quality it is necessary to establish an internal work environment where all Camfil Farr employees can succeed together. This means an environment characterised by openness, confidence and good business understanding.

www.camfilfarr.com

FOR FURTHER INFORMATION PLEASE CONTACT YOUR NEAREST CAMFIL FARR OFFICE.
YOU WILL FIND THEM ON OUR WEBSITE.

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