



A CityAir Toolkit

Improving Air Quality in the City of London

A practical guide for building engineers
and facilities managers

April 2018



In partnership with



www.cityoflondon.gov.uk/air

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AIR QUALITY IN CONTEXT

The City of London can experience high levels of air pollution. Air quality monitoring reveals that Nitrogen Dioxide (NO₂) can be over twice the recommended level at busy roadsides. Levels of Particulate Matter (PM) also exceed World Health Organisation guidelines. The latest City of London Air Quality Strategy¹ outlines action being taken to improve air quality in the Square Mile.

HEALTH IMPACT OVERVIEW

Poor Air Quality has an impact on health. The Mayor of London's Report² is the most authoritative summary for the whole of London.

SOURCE OF AIR POLLUTION

As with carbon, the major source of air pollution is from combustion, a direct result of some forms of transportation and heating.

Carbon reduction, energy efficiency and modifying transport policies should therefore go hand-in-hand with improving air quality.

With the help of City businesses, and the people that live and work in the Square Mile, we can make a difference to our health and the wellbeing of those around us.

THE FUTURE AND DOCUMENT GOALS

There are many measures in place to deal with emissions from new developments including the construction and development phase, but few measures are in place to address existing building stock and how activities associated with them can reduce emissions of air pollutants.

Although troubleshooting guides exist, there is very little available that either relates to the air quality impact of the built environment, or simple guidance outlining where the building engineer can have a direct impact on a day to day basis.

The information in this document provides a short and simple toolkit, to address air quality, behaviour change and engagement issues resulting from day to day building use. This document has been produced with the Chartered Institute of Building Service Engineers (CIBSE), the professional organisation for the building engineer.

www.cibse.org

1 – City of London Corporation – Air Quality Strategy – www.cityoflondon.gov.uk/air

2 – Mayor of London – Pollution and Air Quality – www.london.gov.uk

AIR QUALITY & THE CITY BUSINESS

BUILT ENVIRONMENT IMPACT SUMMARY

The City of London Corporation Air Quality Strategy has a clear focus on the importance of working with organisations across the City.

Through the CityAir business engagement programme, the City Corporation supports businesses to:

- take action to reduce emissions associated with business activities
- raise awareness of air quality and its potential impact on health

There are many plans and programmes to deal with emissions from vehicles, but few measures in place to deal with emissions from existing building stock. Facilities managers are therefore encouraged to consider what action they can take to reduce emissions and help to improve local air quality.

ONGOING ENGAGEMENT AND SUPPORT

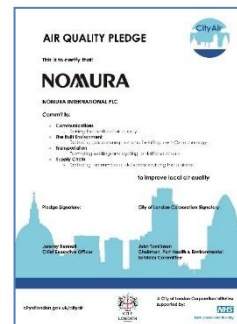
Through the CityAir program the City of London Corporation has been proactively briefing businesses on what they can do to improve the health and wellbeing of staff by reducing their air pollution impact.

Dozens of City businesses, from asset owners, facilities management companies and individual organisations have already signed up to be CityAir Champions to do their bit to reduce their impact – for more information visit the City of London website.

These actions normally dovetail with satisfying sustainability targets as poor air quality in the City of London is mostly the result of local combustion, namely from:

- Transport (cars, taxis and buses)
- Buildings (gas boilers and generators)
- Supply chain (LGV and rigid HGV)

So, to reduce your impact look at: how people move around the City; how you keep people warm; how deliveries are made.



Key issues:

- Communications – profile raising – if you don't know it's a problem you won't look for solutions to fix it
- The Built Environment – increasing building efficiency, reducing gas consumption and minimising the impact of generators
- Transportation – promoting walking and cycling over short taxi journeys
- Supply Chain – reducing the number of vehicles delivering to your premises and considering the emission profile of their fleet



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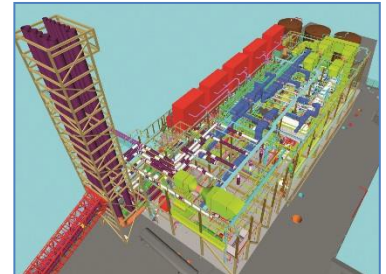
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OPERATIONAL BEST PRACTICE

MANAGEMENT PROCESSES & CHECKLIST

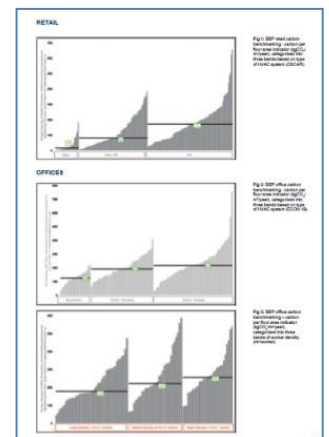
Initial Survey

- An initial baseline survey gives an assessment of the present condition of components or systems
- They provide information on both short term and long-term maintenance needs
- They are valuable in setting priority objectives and when planning short and long-term expenditure
- In the absence of any other detailed listing of the plant and equipment within the property, for example a building log book, they provide an opportunity for such information to be collected and assembled in a consistent format
- For more please see the CIBSE Knowledge Portal³



Performance Monitoring

- Understanding how a building is performing by comparing data against recognised indicators can be invaluable in assessing whether the building has a fundamental problem
- Considerable energy performance data is available for a range of building types, listing both 'good practice' and 'typical practice'
- Since all buildings are provided with regular invoices showing the energy used, based on meter readings, it is relatively straightforward to make comparisons with published information
- For more please see the CIBSE Knowledge Portal³



Building Log Book

- To undertake any form of performance monitoring, suitable records need to be kept
- Log books should improve the understanding, management and operation of buildings, resulting in more sustainable buildings with lower running costs:
 - to span the gap between design and operation
 - to improve the facilities manager's understanding of the design intent
 - to provide more concise and accessible information than in manuals provided
 - to provide a vehicle for recording building alterations and performance
- For more please see the CIBSE Knowledge Portal³

Function of building log book	Method of log book development		
	In-house	By contractor	By specialist author
<i>Understanding how a building is meant to work</i>	11	6	5
Above average	4	5	3
Below average			
<i>Maintaining building occupant comfort</i>	8	4	5
Above average	7	7	3
Below average			
<i>Assessing building information</i>	8	3	5
Above average	7	8	3
Below average			
<i>Monitoring building energy performance</i>	8	3	4
Above average	7	8	4
Below average			
<i>Educating staff and contractors about the building</i>	9	1	6
Above average	6	10	2
Below average			
<i>Managing health and safety risk</i>	8	4	5
Above average	7	7	3
Below average			
<i>Managing environmental risk</i>	6	3	5
Above average	9	8	3
Below average			
<i>Overall usefulness</i>	7	4	6
Above average	8	7	2
Below average			

Note: The total number of results equals 34 due to multiple methods of development for three log books

Checklist

- Alongside establishing a building log-book it is useful to keep a record of the changing requirements of individual tenants
- Maintain a checklist across all building operations to assist with energy management
- In terms of internal air quality please refer to CIBSE guide M – see the CIBSE Knowledge Portal³
- The template below has been developed to help the building engineer achieve this and is available free by contacting CityAir@cityoflondon.gov.uk

SCHEDULE OF ENERGY MANAGEMENT HOUSEKEEPING MEASURES			Work with service partner:					
MAIN THEME	Method	SITE ADDRESS:	Building Manager	Tenant	Cleaning	Security	Maintenance	
HEATING & COMFORT	Control	Review with Staff that best setting for TRV's is between '3' & '4'						
	Control	Engage with tenants to remind that energy best practice room temperature is 21 deg. C						
	Control	Setting of local cooling plant temperatures - often fighting heating?						
	Control	Weekly management of local overtime/heating times						
	Control	Turn off ventilation/heating to occasional meeting rooms when not in use.						
	Control	Close doors and windows especially at end of day						
	Manage	Liaise with tenant manager to report any early finish of requested heating extensions						
	Manage	Manage adjustment of thermostats down GRADUALLY (1 degree/week) 1 degree C reduction on heating thermostat saves 10%						
	Manage	Obvious waste e.g. overheated corridors/stairwells/lobbies (produce 6 monthly temperature logs)						
	Review	Avoid using local electric heaters - investigate reason for need and resolve the cause - heating defects/filtration						
	Review	Check that grilles to ventilation systems are clean - dirt lowers efficiency						
	Review	Check that heat emitters are not blocked with office equipment- lowers efficiency						
	Review	Investigate all reports e.g. 'overheating' - Ask for heating to be turned down /don't open windows						
Review	Check room thermostat is in a position to represent the temperature of the occupied space							
Review	Reports draughty windows/doors/grilles - often reported as area is 'cold' causing thermostats to go up.							
	Control	Before starting local cooling make sure heat emitters are timed/switched off						
	Control	Check the setting of local cooling plant & temperatures/ fighting heating						
	Control	Computer Servers usually OK to 28 deg. C - set local 'Stat to 25 degrees C min.						
	Control	Cooled rooms- keep doors and windows closed - Don't try to cool the street						
	Control	Switch off PC monitors at vacant desks/out of hours - the monitor is 75% of total power use						
	Review	In summer close blinds to East windows over night - less heat gain for 9.00AM start						
	Review	Cooled areas-use blinds or curtains in summer to mitigate the effects of solar gain						
	Review	switch off unwanted office equipment -if left on takes a further 1/3 kW to remove by Cooling systems						
WATER ISSUES	Control	Reduce excessive hot tap temperatures waste energy - extra cold is used to cool it						
	Control	Report leaking taps and running overflows						
	Control	Where available, only use dishwashers on 'full loads' - 'part loads' = same use						
	Manage	Attend to exceptional use promptly - water leaks are expensive						
	Review	WC cisterns use approx. 7 litres/flush - save by using a 'half flush' on light loads						
	Review	Where spray taps are not fitted use the basin plug when washing your hands						
LIGHTING	Control	At end of day switch off the lights when areas are vacated						
	Control	Cooled rooms - lights left on waste energy twice - 1/3 kW is used in cooling power for every kW of light						
	Control	Resolve obvious waste e.g. external lights on in middle of day						
	Control	Resolve obvious waste e.g. lights on in corridors/stairwells/lobbies						
	Control	Arrange for canteen lights to be switched off after lunchtime						
	Control	Switch off kitchen & WC lights in good daylight and at end of working period						
	Manage	Consider a local energy mentor to switch lights off to stores etc						
	Manage	Consider green labels to switches so everyone knows what can be off when OK						
	Manage	Consider local task lighting instead of lighting whole zones (especially out of core hours)						
	Manage	Report dim/yellow lamps - lamps that need changing use the same power for less light						
	Review	Ask management about improved zoning of light switches/fittings						
	Review	Make best use of daylight - consider switching off lights by windows						
POWER	Review	Switching economy -10% saving on 90% is as good as 90% on 10%						
	Control	Check automatic plant - is it correctly set for British Summer/Winter time?						
	Control	Avoid local electric heaters and fans - cost up to 4 X main central heating system						
	Control	Heat & vent plant 'on' out of hours wastes fan/pump power as well as heat						
	Control	Kitchen/smoking room fans - switch off when you leave						
	Control	PC screens = 75% of PC computer load - switch off if away 1/2 hr or more						
	Control	Refrigerators - do not set stats to achieve lower than 5 degrees C = waste						
	Manage	Switch off sundry equipment at end of working day e.g. copiers and printers						
	Review	Only going down or up one floor- why not use the stairs?						
	Review	If practical turn the AC off 1 hour before the scheduled end of the working day						
	GENERAL ISSUES	Manage	Basic good Housekeeping can save up to 10%					
Manage		Be responsible for advising staff of need for control and care about power use						
Manage		If you do not manage the switch off the lights and air conditioning at the end of the day, who else will?						
Manage		Energy Awareness helps shortfalls in controls etc. to be rectified = more saved						
Manage		Energy Awareness reduces costs without affecting comfort or performance						
Manage		Extra savings are available for minimum of effort - providing it is sustained						
Manage	Induct new staff to the need to control Energy/waste							

3 – CIBSE – Knowledge Portal – www.cibse.org/Knowledge

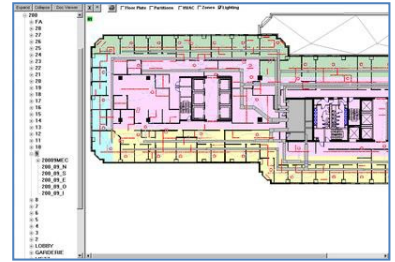
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BUILDING MANAGEMENT SYSTEMS

- By reviewing the surveys and log books described above - at this point establish better:
 - Temperature set points for each room/floor
 - Time setting for occupancy usage
 - Anomaly detection with action settings
 - Logging of requests to change settings and reverting when the situation changes back



BOILERS (NOx RATINGS AND BURNER RETROFIT)

- To ensure boilers operate at maximum efficiency and produce minimum airborne contaminants, it is essential to have regular combustion efficiency tests and routine maintenance procedures in place
 - Annual for gas and six monthly for oil
- **Inspection and maintenance - ensure:**
 - Planned preventive maintenance regime
 - Engineers have appropriate training and familiarity with the installed systems
 - Engineers have access to manufacturers guidelines and diagnostic equipment
- **Routine checks of the plant room**
 - Identify signs of damage/breakage/leaks
 - Is it uncomfortably hot or are there any dry pungent smells?
 - Establish a weekly report on flue gas temperatures and a full combustion analysis
- **Boiler replacement**
 - If replacing boiler plant make sure you specify the lowest NOx rating possible
 - The option is not usually significantly more expensive and will be a more efficient system during the life of the asset
 - **For more please see the guides B & M through the CIBSE Knowledge Portal³**
 - **When a boiler or other plant is years away from a planned upgrade or to do so is cost-prohibitive consider a retrofit:**
 - If a boiler upgrade is not feasible but running costs are continuing to grow a burner upgrade could be a cost-effective option
 - A number of companies provide retrofit lean burners and other adaptive technologies to improve the burn efficiency of mid-life boiler products that you might have at site
 - The City of London cannot recommend individual suppliers but guidance is available by contacting CityAir@cityoflondon.gov.uk



COMBINED HEAT AND POWER (CHP)

- **The City of London Corporation discourages the use of biomass and biofuels as a form of energy generation in all new developments – in addition:**
 - City's position on CHP's according to the Air Quality Strategy (found in policy 6):
 - All gas boilers in commercial developments are required to have a NO_x rating of <40mgNO_x/kWh
 - NO_x emissions from combined heat and power (CHP) plant will be required to meet the emission limits in the GLA document 'Biomass and CHP emission standards' March 2013
 - The City Corporation will ensure that all boilers, generators and CHP plant are installed to ensure minimal impact on local air quality
 - Although the main source of pollution in the City is currently road traffic, combustion plant such as combined heat and power and generators can also have a significant impact locally
 - The amount of pollution produced by combined heat and power plant varies with the type of technology
 - If you are considering installing CHP plant please contact cityair@cityoflondon.gov.uk for advice on the best type to install
 - In addition, plant over a certain size will require a chimney height approval from the City Corporation
 - Most commercial buildings have an emergency generator designed for dealing with interrupted power supplies
 - They tend to be fuelled by diesel and as a result can be highly polluting
 - **If you are considering running the generators for anything other than testing or in the event of a power outage, please contact cityair@cityoflondon.gov.uk for advice**
 - CIBSE also have a useful datasheet on options for reducing NO_x from CHP, both new and existing plant: CHP NO_x Datasheet 54, May 2017



4 – CIBSE – CHP NO_x Datasheet – www.cibse.org/CHP

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GENERATORS

- **Medium-sized Combustion Plant (MCPs) and generators are a largely unregulated, significant source of emissions of air pollutants**
- **General Guidance:**
- Talk to your supplier regarding bench-tested emissions before ordering and ask City of London for guidance on optimal abatement technologies
- Ensure that a regular inspection and testing regime is in place
- The inspection should result in the production of a report detailing the emissions during testing
- Does the exhaust cause environmental nuisance for particle discharge or noise?
- Lengthen the time between testing as long as it does not invalidate the manufacturer's warranty

- **Medium Combustion Plant Directive (MCPD)**
- Medium combustion plants are used for a wide variety of applications (electricity generation, domestic/residential heating and cooling, providing heat/steam, as well as for industrial processes, and are an important source of emissions of pollutants
- The Directive requires all plant (1-50MWth) to be registered or permitted and sets limits on the levels of pollutants emitted by the end of 2018
- The MCPD also requires operators to test emissions from plant to demonstrate compliance with emission limits
- The MCPD does not ameliorate the recent growth of (mainly diesel) generators which emit high levels of NO_x relative to other MCPs and are not subject to emission controls



AIR CONDITIONING & FILTRATION

- Improving indoor air quality is also an important consideration in increasing employee wellbeing:
 - Ensure that your air filters are regularly maintained and comply with EN 13779*
 - Install low energy two stage particle and gas filters for maximum effect and cost savings
 - The latest standard for particulate filters is ISO 16890; filter classes should be selected in consideration of outdoor air quality, with a view to meet desired indoor air quality levels (e.g. recommended WHO guidelines);
 - if NO_x filters are installed, their efficiency can be tested against ISO 10121-2:2013



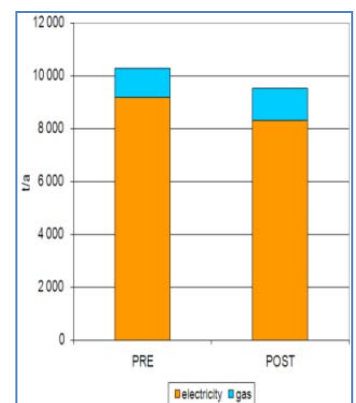
Particles caught by air filter
Photo: Lennart Nilsson

* It is a legal requirement to inspect all air conditioning systems with a rated output over 12kW at intervals not greater than 5 years

TENANT ENGAGEMENT

Profile Raising

- The City of London is happy to provide support with a range of campaigns and initiatives - please contact CityAir@cityoflondon.gov.uk
- Engage with tenants and encourage a free-flowing discussion on both energy usage and the importance of improving air quality
- Run awareness raising campaigns such as:
 - Walking (rather than a journey by taxi)
 - Reducing personal deliveries
- Start an open and honest dialogue to establish:
 - Impact of energy usage decisions
 - Real user requirements
 - Supply chain consolidation
 - Waste rationalisation
 - Employee transportation policy
- Practical Engagement:
 - Explain why rooms are the way they are...
 - Define comfort and defend your decisions
- If conducting an energy review don't just settle for pure energy efficiency - look at low NOx boilers and reducing gas consumption
- Identify floor-by-floor usage and bill monthly accordingly, rewarding occupiers through billing reductions
- Ensure that the filters in air handling units are suitable for the levels of NOx and PM in London and that they are changed regularly
- Show how important it is to reduce what the building emits alongside why there is a need to filter what is coming in!



The Bigger Picture

- Think air quality!
- Sign up to the CityAir app
 - Launch an awareness raising campaign
 - Share your knowledge and ideas
 - Follow us on Twitter @_CityAir



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SUPPORTING INFORMATION

CHECKLIST

Management Processes

Situation Survey	<input type="checkbox"/>
Performance Monitoring	<input type="checkbox"/>
Building Log Book	<input type="checkbox"/>
Checklist	<input type="checkbox"/>

Operational Best Practice

Building Management System	<input type="checkbox"/>
Boilers	<input type="checkbox"/>
Generators	<input type="checkbox"/>
Air Conditioning & Filtration	<input type="checkbox"/>

Engagement

Profile Raising	<input type="checkbox"/>
The Bigger Picture	<input type="checkbox"/>
Sign up to CityAir	<input type="checkbox"/>

CONTACTS:

City of London

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