Clean Air IN LONDON

Clean Air in Cities: ‘Out’ and ‘In’

National Clean Air Day 2017

By Simon Birkett
Founder and Director
Clean Air in London
Twitter: @CleanAirLondon

camfil

Lead sponsor since 2011

Clean Air in Cities – 'Out' and 'In'

1. Context
2. 'Out' – air pollution and greenhouse gases
3. 'In' – inside and outside sources
4. Include indoor air quality in new London Plan

Improving indoor air quality is the quickest and cheapest way to protect people

1. Context

- It's a great time to be an air pollution campaigner!
- Great Smog 1952 and Clean Air Act 1956
- 'Cohort studies' identified long-term effects of $PM_{2.5}$
- Myopic focus in UK since 1990 on CO_2 and fuel efficiency
- Many roads in Central London tend (today) to have the highest NO_2 concentrations in the world. Blame diesel
- Need to protect ourselves and reduce air pollution
- Back where we thought we were 60 years ago
- 61st anniversary of first Clean Air Act on 5 July 2017

2. ‘Out’ on 15 March 2012

2. ‘Out’ – Jargon

- Particles (PM_1, $PM_{2.5}$, PM_{10}) and gases (NO_2). Ozone (O_3)
- Short (e.g. PM_{10}) and long-term (e.g. $PM_{2.5}$) health effects. Mortality and morbidity. Overlapping effects
- Emissions and concentrations. Exposures, impacts and outcomes. Visible and invisible
- All affected. Up to 9,400 attributable deaths in London (3,500 $PM_{2.5}$ and 5,900 NO_2) versus 8,500 from smoking. Mainly cardiovascular. Biggest environmental risk
- Local (NO_2), regional ($PM_{2.5}$) and transboundary pollution e.g. tropospheric ozone (O_3)

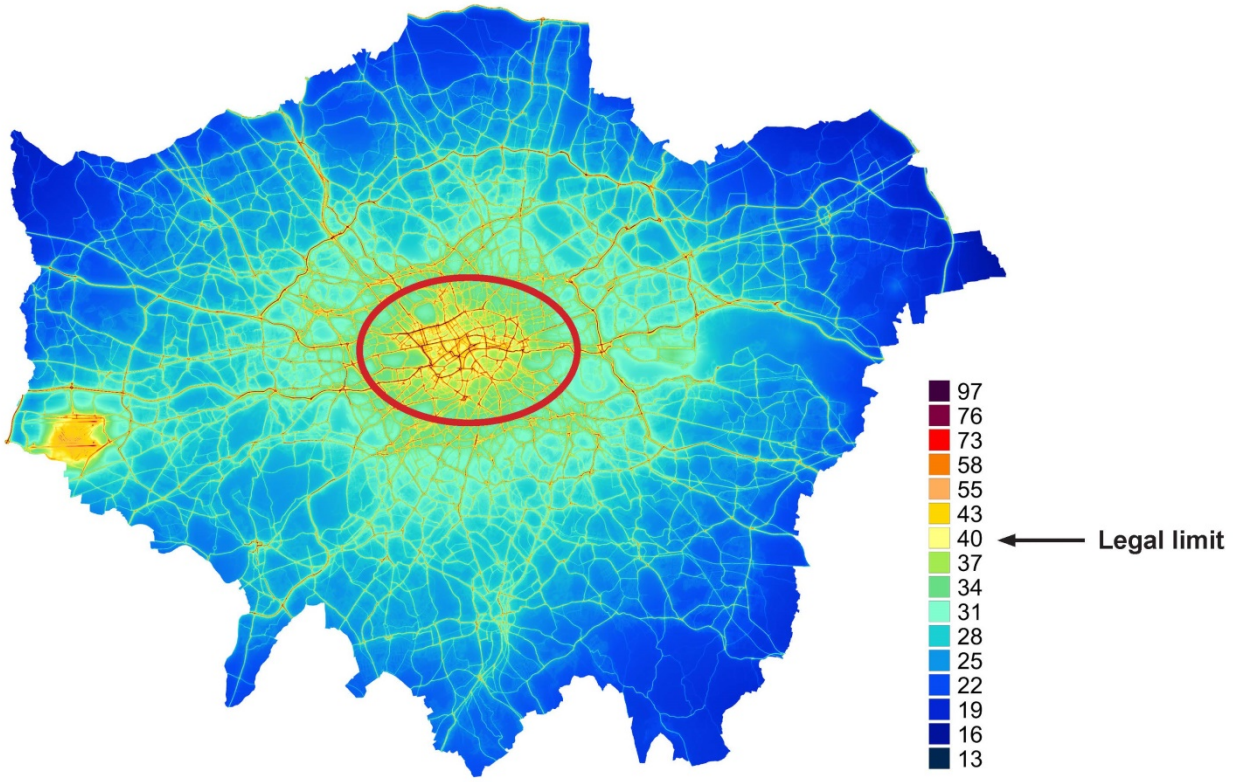
2. ‘Out’ – Huge changes in the last 5 years

- Scientific evidence is overwhelming
- Public understanding is rocketing. Over half of Londoners want a diesel ban in central London
- Ongoing media campaigns e.g. ES, Guardian, ST
- National political attention e.g. PMQs
- New legal cases. ClientEarth on NO_2. Ella Kissi-Debrah
- New Mayor – ‘Top 3’ issue in the election
- Interventions by UN (e.g. SDGs), WHA, WHO, UNEP

Examples of media coverage

ABC Al Jazeera Ars Technica BBC Bloomberg Boston Globe Business Green CBS Channel 4 China Central Television China Radio International CNN DW Eco dalle Citta El Pais ENDS Euronews Evening Standard Express Financial Times France 24 Gibraltar Chronicle Guardian The Hill Independent ITV LBC London Live Mail Metro Mirror New York Times Observer Oriental Morning Post Radio France International Reuters RT Saturday Paper Le Soir Sky Southern Weekly Sun Svenska Dagbladet Sydney Morning Herald Telegraph Time Time Out Times Vice Voice of Russia Yellow Advertiser ZDF

2. ‘Out’ – Pollution challenges

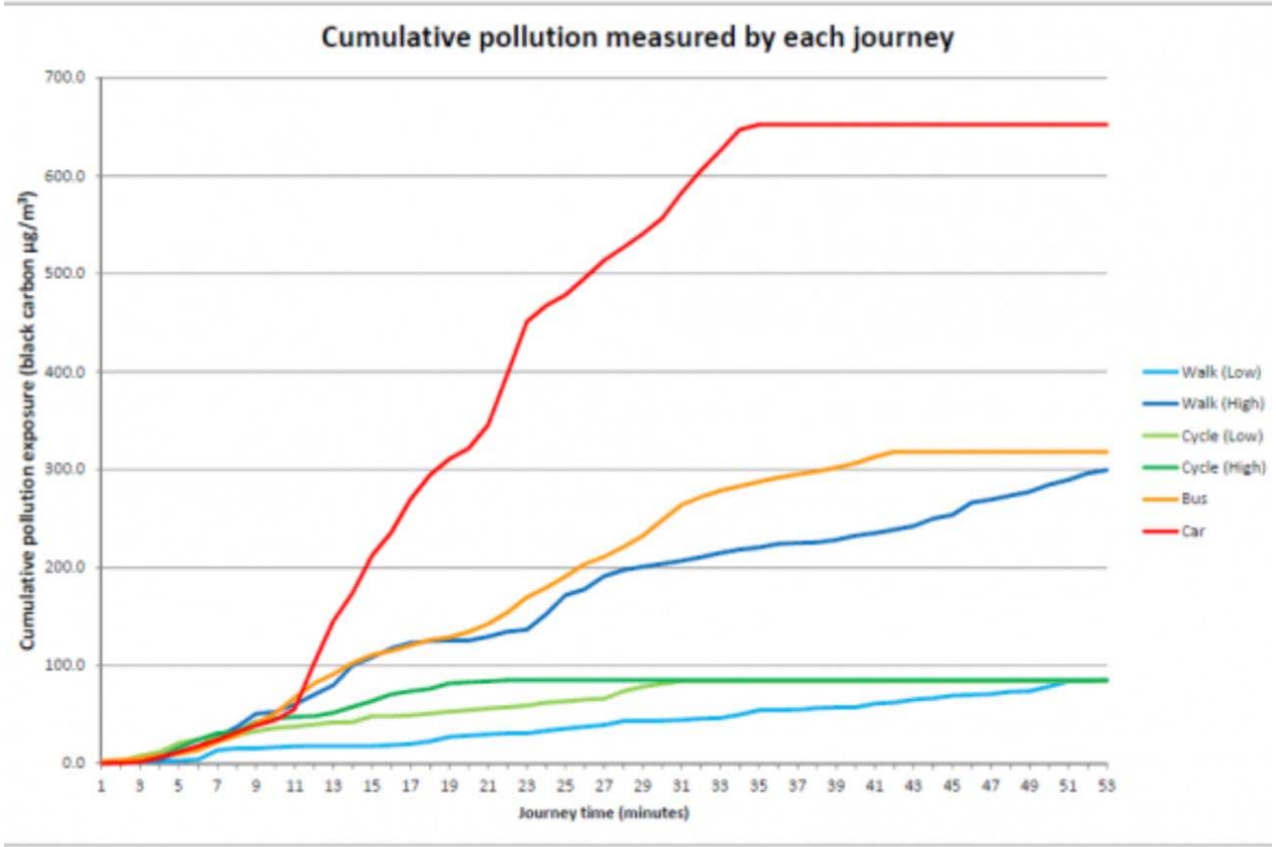


NO_2 annual mean concentrations in 2020 (µg/m^3)

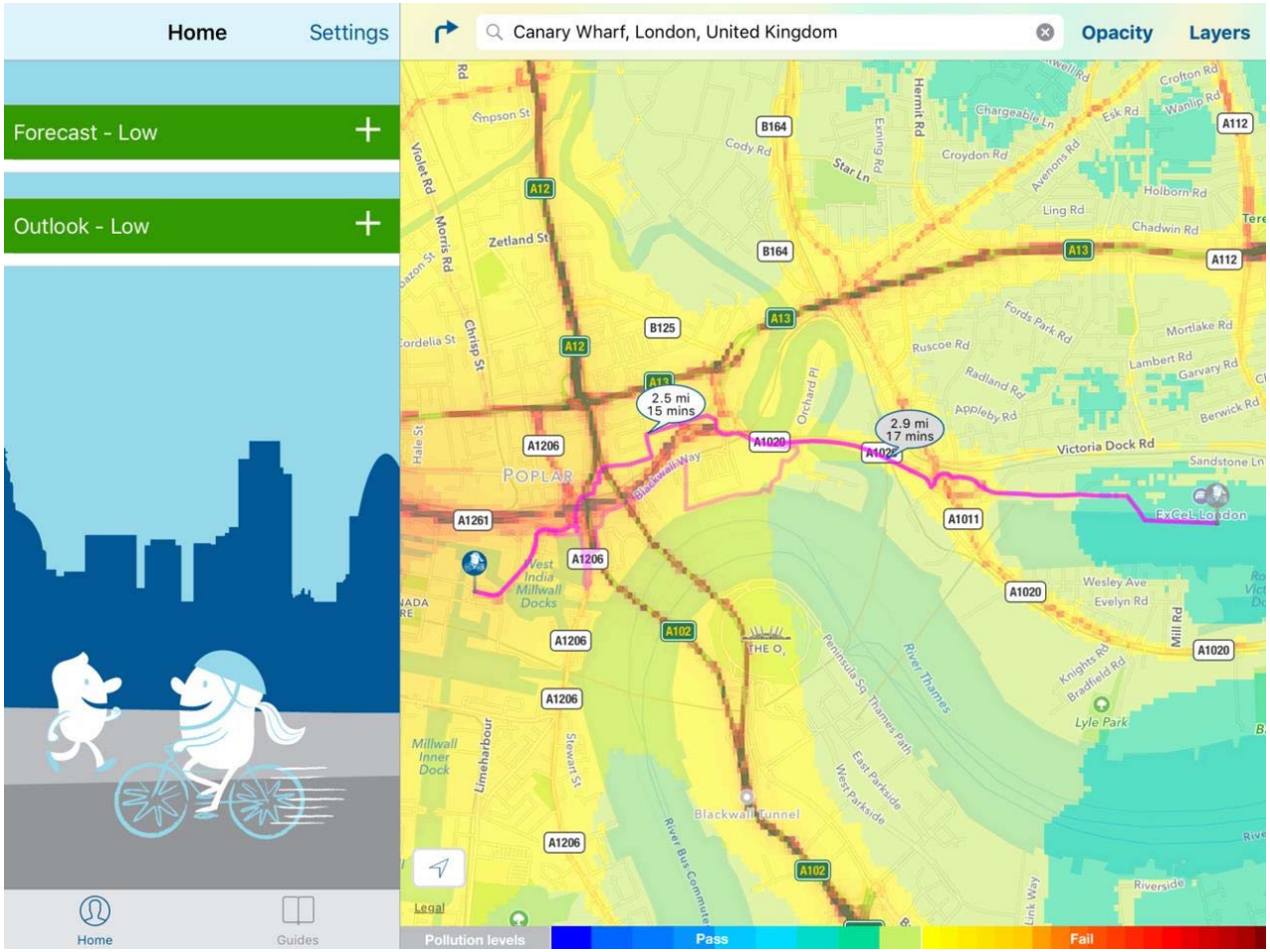
2. ‘Out’ – Protect yourself (26 March 2012)

2. ‘Out’ – Protect yourself

Graph by King’s College London



2. ‘Out’ – Protect yourself (City Air app)



2. ‘Out’ – Priorities

- ‘One Atmosphere’ – seek win-win for greenhouse gases and local air pollution
- Integrate policies e.g. air, energy and transport
- Mitigation – reduce emissions at source
- Adaptation – protect people e.g. route choice
- Diesel. Diesel. Diesel.
- Building emissions: efficiency, on-site energy; and renewables
- Achieve zero local and then zero total emissions
- Government strategy. Clean Air Act. Less bad – more good

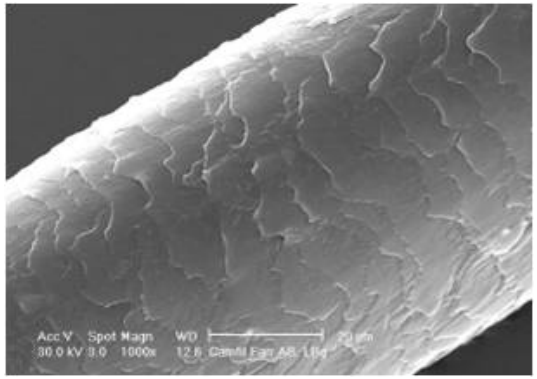
3. ‘In’ – Inside and out on 19 February 2013

3. ‘In’ – Jargon

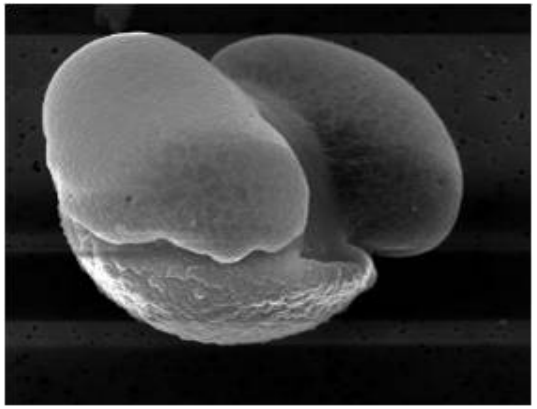
- European citizens spend on average over 90% of their time indoors
- 75% or more of the health impact of outdoor or ‘ambient’ air pollution can therefore occur indoors (Source: EnVIE 2010 p82)
- Indoor concentrations of some pollutants can be much higher than outdoor (e.g. 10 or 20 times higher in the case of formaldehyde)
- We can use air filters to protect ourselves from 90% of air pollutants for up to 90% of the time
- British and European standard BS EN 16798-3:2017 specifies the required filter performance for good indoor air quality in non-residential buildings taking into consideration outdoor air quality
- ISO 16890 ePM_1 and ISO 10121 address particles and gases
- Second hand smoke (ETS) is still an issue e.g. children in homes

Relative size of particles

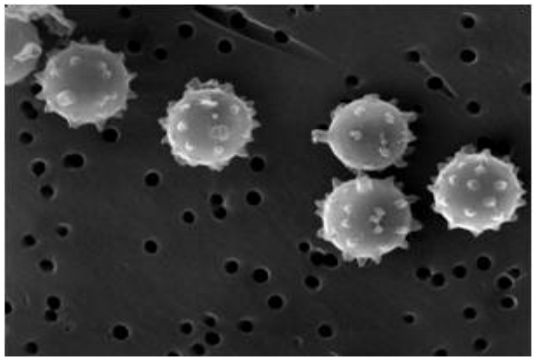
Human hair: 70 μm



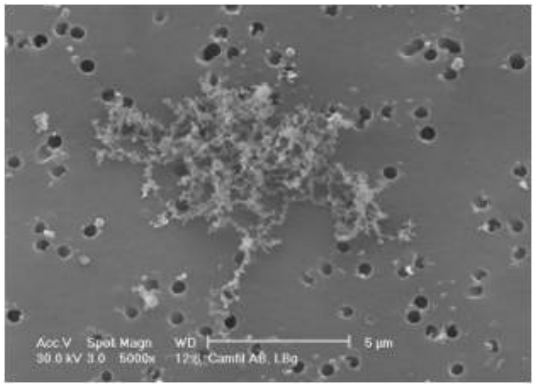
Pollen: 20-100 μm



Spores 3-50 μm



Airborne particles < 1 μm



3. ‘In’ – Huge changes in the last 5 years

- Scientific evidence is overwhelming e.g. WHO
- Clean Air in London’s investigations
  - local authorities don’t know if their schools use air filters
  - few hospitals comply with indoor air standards
- Environmental Audit Committee warned on schools
- Planning approvals in London are setting indoor standards – but still linked to WHO guidelines!
- New study links office performance to air pollution
- More focus on correlations between NO_2 and PM_1

3. ‘In’ – Pollution challenges

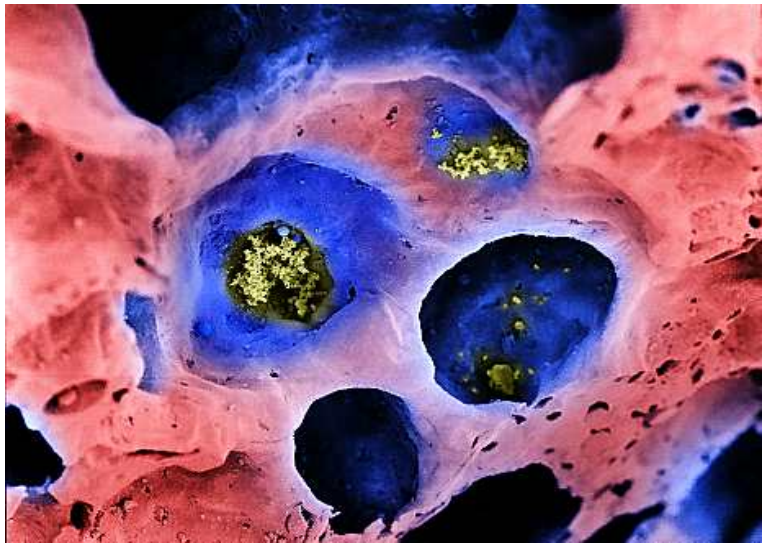
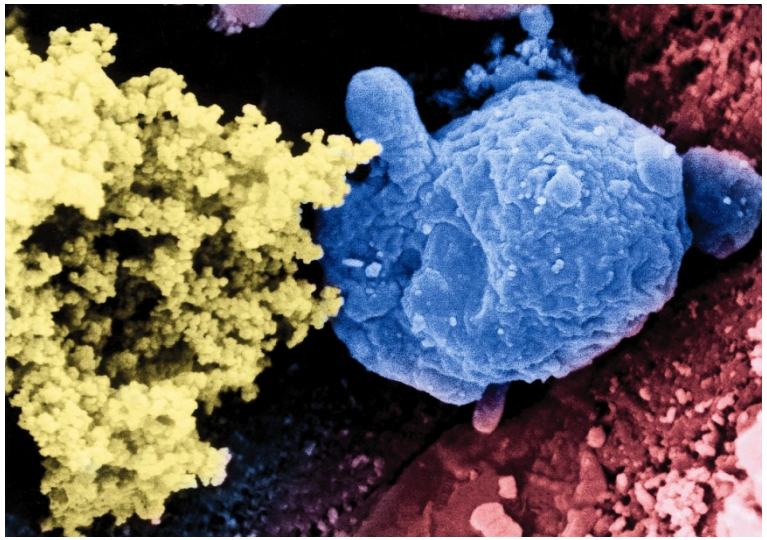


Photo of soot particles in lung tissue

Photo: Lennart Nilsson

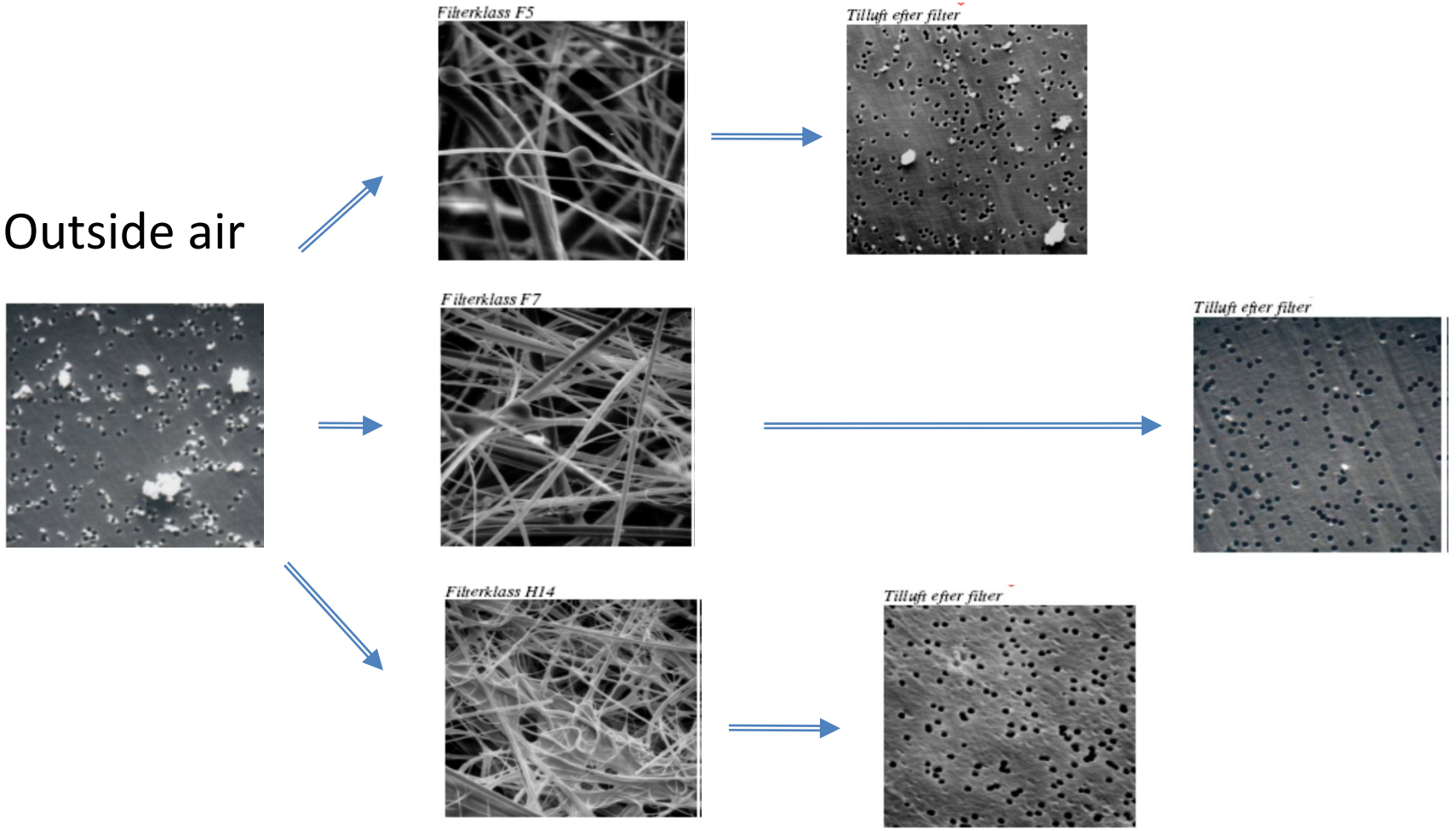


A white blood corpuscle from the body’s immune system (blue) tries to attack a soot particle and consume it

Photo: Lennart Nilsson

3. 'In' – Protect yourself

Particle filters with different efficiency

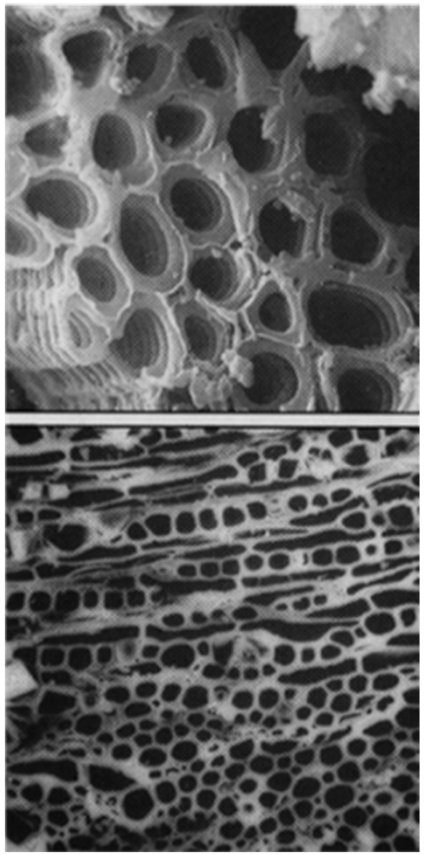


Source: Camfil

Gas filters – activated carbon/charcoal

Key issues include:

- **Charcoal's ability to retain gas molecules on their surface**
- **This capacity varies for different gases and charcoal quality**
- **Gas concentration**
- **Contact time**



Source: Camfil

Air filter groups and classes

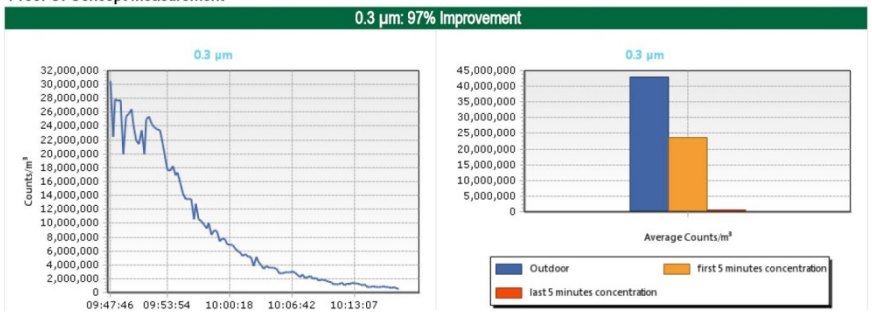
Group	Filter class (example of use)	Example of use	Average collection efficiency for the most penetrating particle size (MPPS)%	Average efficiency for 0.4 µm particles %	Average arrestance of dust %
Coarse	G4	Warehouses			Over 90
Medium	M5	Protection of ventilation systems		40-59	
	M6			60-79	
Fine	F7	Schools		80-89 (min 35)	
	F8	Laboratories		90-94 (min 55)	
	F9	Healthcare		95 and above (min 70)	
Efficiency particulate filters	E10	Precision tooling	85		
	E11		95		
	E12		99.5		
High efficiency particulate filters	H13 and H14	Operating theatres	Over 99.95		
Ultra low penetration air filters	U15, U16 and U17	Space craft	Over 99.9995		

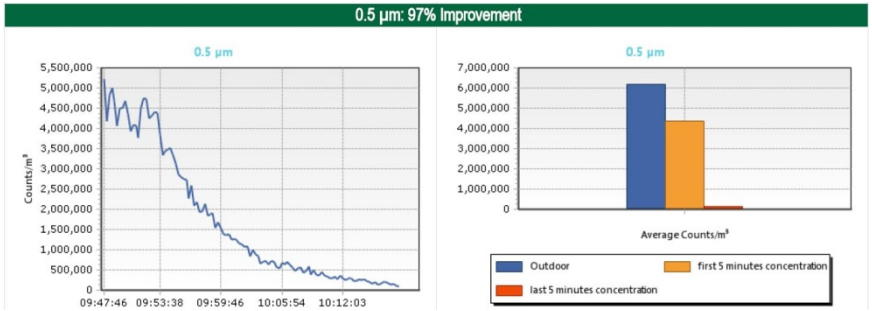
British and European standard BS EN 16798-3:2017
From July 2017 for non-residential buildings

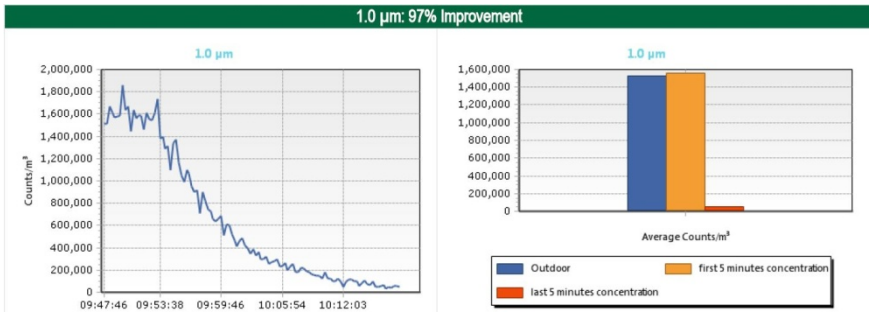
Outdoor Air Quality (ODA)		Indoor Air Quality (IDA) – Classification of Supply Air (SUP)*			
		SUP 1 (Very low concentration)	SUP 2 (Low concentration)	SUP 3 (Medium concentration)	SUP 4 (High concentration)
Increasing pollution ↓	ODA 1 e.g. countryside	M5 + F7 + GF?	F7	F7	F7
	ODA 2 e.g. smaller towns	F7 + F7 + GF	M5 + F7 + GF?	F7	F7
	ODA 3 e.g. city centres	F7 + F9 + GF	F7 + F7 + GF	M6 + F7 + GF?	F7

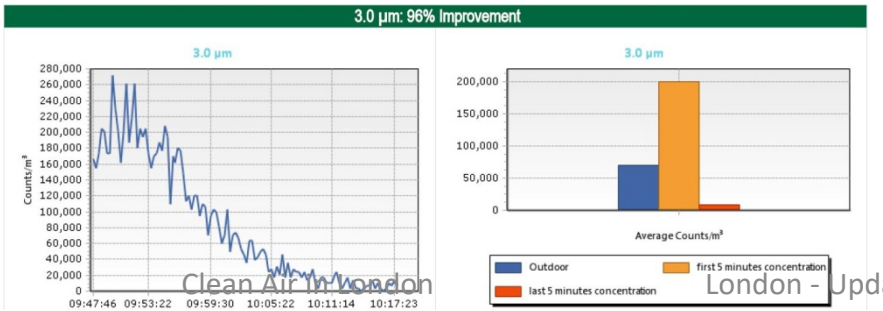
* Supply air with different concentrations of particulate matter and/or gases.
'GF' = Gas filtration (carbon filter) and/or chemical filter **required**. 'GF?' = Gas filtration **recommended**
Table B.2 "Recommended minimum filter classes" in BS EN 16798-3:2017 and
Table 18 "Required application of gas filter"

Proof Of Concept Measurement



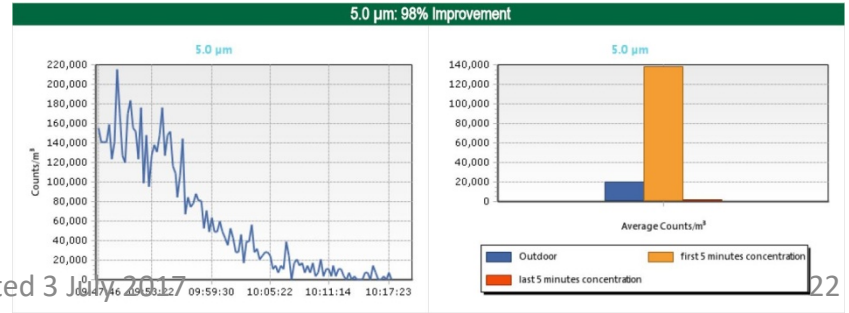






Home office test – City S unit
Over 25 minutes
Range 0.3 to 5 microns

97% - 98%
Particle number
reduction

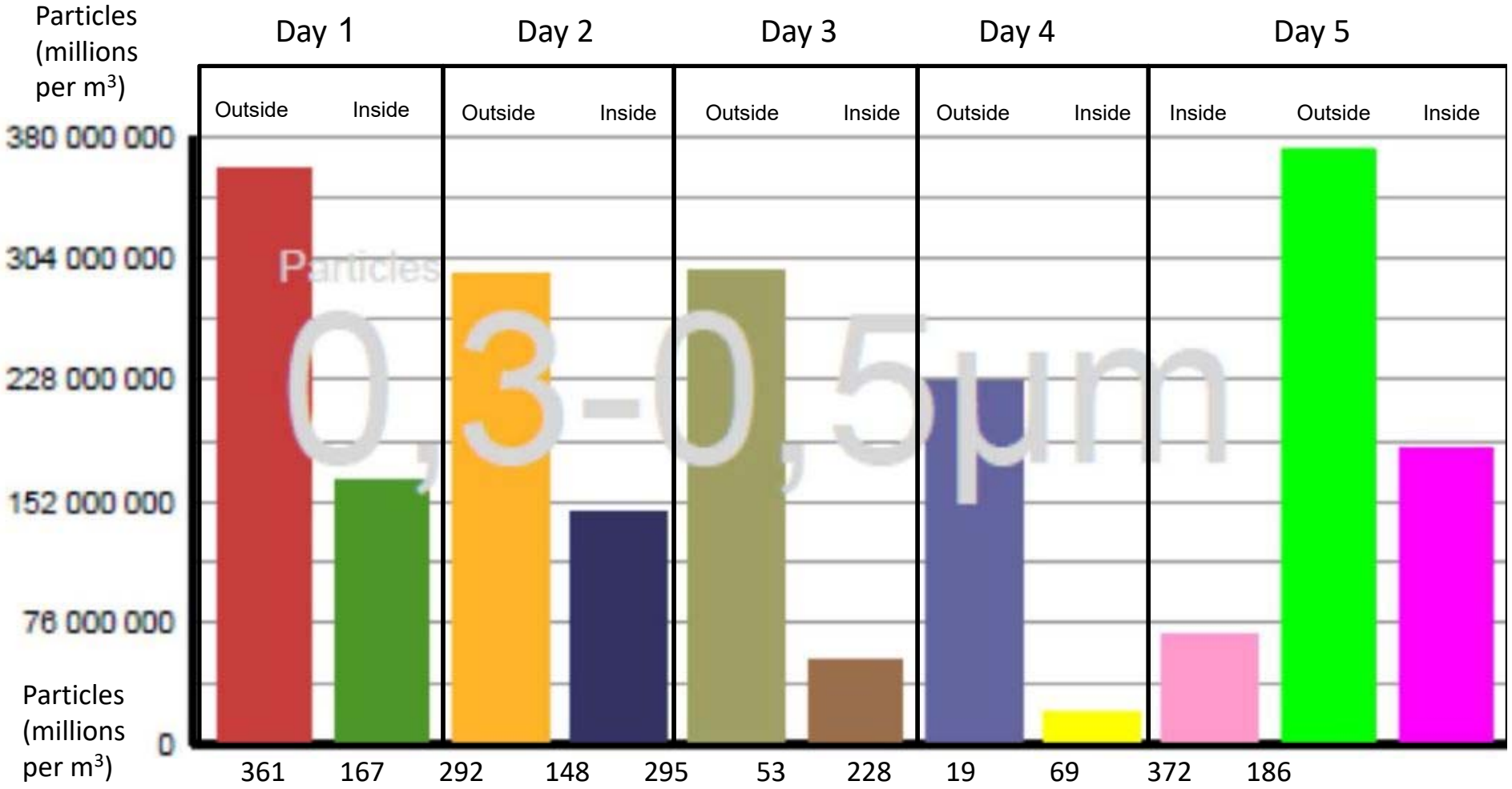


3. Current and prospective IAQ standards

Renewed focus on building regulations and 'duties'

- **Building Regulations (2010 and 2013) Part F** – NO_2
- **Air conditioning TM 44 inspections**
- **ISO 10121** – Molecular filtration performance
- **ISO 16890 ePM_1** rated combination air filters control particles and molecular contaminants for optimum indoor air quality. Better than: $ePM_{2.5}$, ePM_{10} or Coarse.
- **BS EN 16798-3:2017** 'Energy performance of buildings' replaces BS EN 13779 on 25 July 2017. It uses ISO 16890 (PM) and ISO 10121 (gases)
- Draft BB 101 for indoor air quality in schools?

Swedish Embassy – London Clean IAQ study Particle reduction by air filtration



Filter type	City-Flo F7	Hi-Flo F7	Hi-Flo F9	CityCarb F7	CityM	Opakfil F7
Particle reduction	54%	51%	82%	92%	81%	50%

Note: Readings were taken during a week of high air pollution in London March 2015. During these events HVAC filters were severely challenged and stretched to deliver clean indoor air. 10 million particles per m^3 and below is required for clean healthy air.
Nitrogen dioxide the other associated health damaging traffic air pollution gas was also correspondingly high during this period.

3. ‘In’ – Priorities

- Mitigation of pollution – reduce energy use
- Adaptation – protect occupants
- Improved liability management by building owners
- Ensure air filtration complies with the latest standards e.g. ISO 16890 ePM_1, ISO 10121 and BS EN 16798-3
- Demand better than just compliance with WHO guidelines for PM and NO_2 in planning permissions
- London Plan and Neighbourhood Plans must address indoor air e.g. CO_2, NO_2, PM_1, $PM_{2.5}$ and VOCs
- Respond positively to increasingly public concern

Benefits of air filters

Photo: Lennart Nilsson

We can protect ourselves from 90% of air pollutants for up to 90% of the time

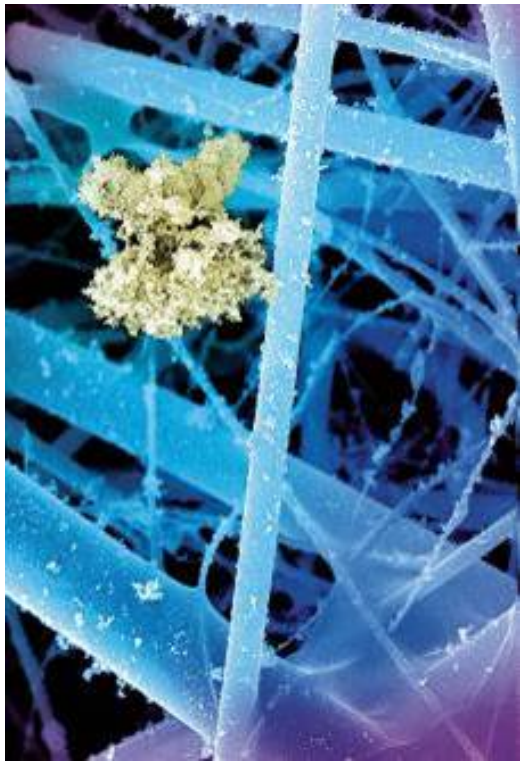


Photo of soot particles in air filter

Photo: Lennart Nilsson

If your office has a mechanical ventilation system or air conditioning (i.e. it is likely to contain the necessary ducting) please ask
your facilities manager:

"Does our ventilation system include regularly maintained air filters that comply fully with ISO 10121, ISO 16890 (ePM_1) and BS EN 16798-3:2017?"

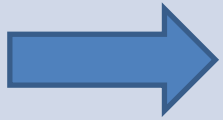
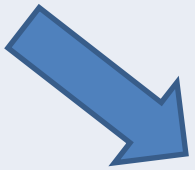
Ask Camfil for an 'Air Quality Test'
http://signup.air-cleaner.co.uk/5602156350

For anything else please visit www.camfil.com or call 01706 238 000

5. 61st anniversary of first Clean Air Act

- Build public understanding of air pollution
- Ban diesel, diesel, diesel as we banned coal in 1956
- Restrict polluting activities e.g. ultra low emission zones and/or Emissions Based Road Charging
- Promote positive measures e.g. active travel and car-free centres
- Re-engineer our cities to make us a world leader

The London Matrix – 'One Atmosphere'

	Air pollution	Climate change
London	**Success**	
Rest of world		

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