

MAYOR OF LONDON

Air Pollution at Schools and Nurseries “The effectiveness of Air Filtration Systems in a real-world Nursery Environment”



Improving air quality is a priority for the Mayor of London given its significant health impacts, especially on the young and vulnerable.

This summary presents the findings of a 6-month Air Filtration Systems (AFS) trial in six nursery schools, as part of a wider programme of nursery air quality audits, to enable nurseries to make an informed choice about whether to install AFS.

The trial tested the effectiveness of AFS at reducing indoor air pollution in a “real world” nursery environment. It focussed on reducing key air pollutants, Nitrogen Dioxide (NO₂), and particulate matter (PM₁₀ and PM_{2.5}), as these pollutants are more likely to harm young children by causing lung problems and breathing difficulties.

What is an Air Filtration System?

An Air Filtration System is a device that removes or reduces the amount of particles and pollutants within an environment. It operates with the air that passes through it in one or multiple stages. An AFS can simply be a filter, for instance fitted to an air handling unit, or a stand-alone unit which helps reduce particulate matter, oxides of nitrogen and other atmospheric pollutants within a confined area. In either case, the filter traps and

filters out airborne particles before the air is released into the room. They operate using a range of different technologies, and a shortlist of six AFS were selected for the trial that had a range of different air filtration technologies:

Summary of AFS (in terms of suppliers) and technologies		AFS					
		CAMFIL	IQAIR	BLUEAIR	RADIC8	AIRLABS	FELLOVES
Technology Type	PM Filter	•	•	•	•	•	•
	Carbon Filter	•	•	•	•	•	•
	UV				•		
	Titanium Dioxide Activated				•		
	Electrostatic / Ionisation			•		•	•

Whilst they are established technologies, this trial was seeking to test their suitability in dynamic “real world” nursery environments, where windows and doors are open and children free-flow between classrooms and playgrounds throughout the day.

The intention has been to determine the general effectiveness of the AFS technologies in these unique settings, rather than directly compare the performance of the selected AFS units with one another, as it was recognised each was operating in particular conditions.

AFS Trial Results

The trial established that the AFS can be effective at reducing PM_{2.5}, and to a lesser extent NO₂, in a real-world nursery environment. The classrooms that served as the testing ground for the trial exemplify dynamic and unsealed environments, with opened doors and windows, constantly varying occupancy and pupil movements, which has previously led many to express doubts about the ability of an AFS to operate effectively in such a setting. So, for all of the AFS to be able to demonstrate a positive impact upon the nursery indoor air quality, reducing PM_{2.5} and in some cases NO₂, is an encouraging outcome of this trial.

Suitability for nursery environments

The trial also found that the AFS units were suitable for installation and operation in a nursery environment, with the experience of the nurseries found to be largely positive, with most remarking that the units were unobtrusive in terms of their presence in the classrooms, with low levels of noise and minimal requirements for space meaning they quickly faded into the background. In general, the wall-mounted units were felt to be better suited to a nursery environment.

Quick to install and immediate results

A benefit of AFS over some alternative measures is that they can typically be deployed very quickly, and should have an effect within hours, though it is always preferable to remove emissions at source where possible.

Consider operating costs

It will be important for nurseries to consider not only the upfront costs of the AFS units, but also the ongoing operating and maintenance costs. The annual maintenance costs and energy consumption must be factored into any investment decisions.

Understand the existing indoor air quality before investing

This trial noted that the six nurseries where the trial took place were within ambient air quality limit values, despite the nurseries being in amongst the most polluted areas of London, with their windows and doors open regularly, which serves to underline the importance of establishing the baseline indoor air quality conditions to inform the requirements for an AFS. Though it is important to note that other studies have found indoor air pollutants such as PM_{2.5} were often significantly

higher inside classrooms than outdoors, and that there are no entirely 'safe' levels of exposure to harmful pollutants, and children would still benefit from further reductions.

Recommendations

Ultimately, whether a nursery should invest in an AFS is a very much an individual decision for each nursery and its staff. They have a role to play, targeting particular classrooms or high-use areas where indoor air quality is poor, where the need is pressing, and where there are few alternatives to stop the pollution at source. We would not advocate a blanket roll-out of AFS, mindful of the associated financial and environmental costs, and would encourage an evidence-based approach, to ensure AFS are deployed effectively. As such, an appropriately specified AFS could be considered amongst the range of measures for addressing poor air quality.

Establishing common performance standards

It is important to recognise that there were limitations to this trial, and to fully quantify the impacts of AFS upon indoor air quality, a series of controlled and more intensive tests are required. Additionally, to allow people to make more informed decisions, a common set of performance standards should be introduced, as well as the development of AFS design standards, certified under common testing criteria by the Government or appropriate regulatory agencies.

Summary of AFS costs and performance

Features	Low	High	Average
Supply price	£750	£1,500	£1,000-1,200
Annual maintenance	£150	£400	£250-300
Annual energy consumption	£80	£185	£105
Noise level (dbA)	25	68	41
PM filter life span (hours)	2,000	8,760	4,000-4,500
Carbon activated filter life span (hours)	4,380	8,760	5,000-5,500

Features	Observations
Fan Setting	Each AFS was set up to run at a rate agreeable with the nursery, balancing the removal rate of polluted air against the noise of the unit. In addition, AFS treatment rates and airflow speeds were varied across operating hours. Typically, the AFS have at least three speed settings. Based on the information gathered the AFS typically run on a manual speed mode, unless additional remote controls are implemented.
Noise Levels	In terms of noise level, the units are no louder than a typical air conditioning unit (< 68 dBA). The noise levels are dependent on the fan speed of the AFS. The fan speed essentially determines how much ambient air is processed per hour. The higher the speed, the greater the noise levels.
Remote and automatic controls	Remote and automatic controls are typically available for each AFS unit (though sometimes at extra cost) and can be used for setting the fan speed of the AFS and are particularly helpful for the wall-mounted units which can otherwise be hard to reach.
AFS Positioning	In some cases, the AFS units were positioned more centrally within rooms to improve air flow to the unit and aide performance, whilst in other cases the AFS had to be positioned in more compromised positions to avoid them obstructing classrooms, or to be out of reach of the children. Wall mounted units were generally felt to be more appropriate for nursery environments than floor mounted / standing units.

Purchasing Arrangements	<p>The supply price can be affected by factors such as:</p> <ul style="list-style-type: none"> ■ Long term agreements on replacement filters (which can result in lower initial prices as an annual / monthly fee is charged for maintenance components) ■ Number of units purchased ■ Additional filters fitted to the AFS increase the price as they deliver an increased removal capacity (for instance, some units can run either in PM removal only or combining PM removal and NO_x). <p>The supply price is also effected by purchasing directly from suppliers or via distributors; usually purchasing directly (where available) can reduce supply prices.</p>
Ordering and Installation	<p>The average lead in time for placing an order for the AFS and the scheduled installation date was typically around 4 weeks.</p> <p>The installation of the units typically required no more than one hour. The AFS typically take the form of standalone floor-standing or wall-mounted units, though a number of units also required ducting to be installed.</p>
Maintenance plans	<p>Maintenance plans for the units are provided by the suppliers, although it is beneficial for a member of the nursery staff to also be familiar with the units and able to perform basic maintenance.</p> <p>Regular visual inspections of the AFS are advisable to identify any power supply problems and filter change notifications.</p>

Participating AFS Suppliers

Camfil wall mounted Air Cleaner CC



Blueair "Classic 605"



IQair CleanZone SL



AeraMax Professional (Fellowes Brands)



Radic8 VK Blue



Airlabs "Airbubbl"

