Sustainable Communities and Waste

National Environmental Science Program

Low-cost sensor networks and interventions to improve awareness, and reduce exposure to air pollution

(IP4.02.04)

1 Low-cost sensor (LCS) guidance

Rationale:

- Low-cost sensor (LCS) devices to measure air quality are undergoing rapid growth.
- They offer an opportunity to identify air pollution sources and raise awareness about air quality.

- But... choosing a monitor that's fit-for-purpose can be confusing and time-consuming.

LCS guidance: What we've done

LCS resource compilation

Scientific articles, grey literature, and online resources including product evaluations.

LCS product matrix

Survey of ~50 low-cost sensor devices; narrowed selection to ~30 sensors meeting ‘low-cost’ price criteria (<10K) and available to Australia.

Cross referenced each device with key user concerns, eg price, type of pollutants measured.

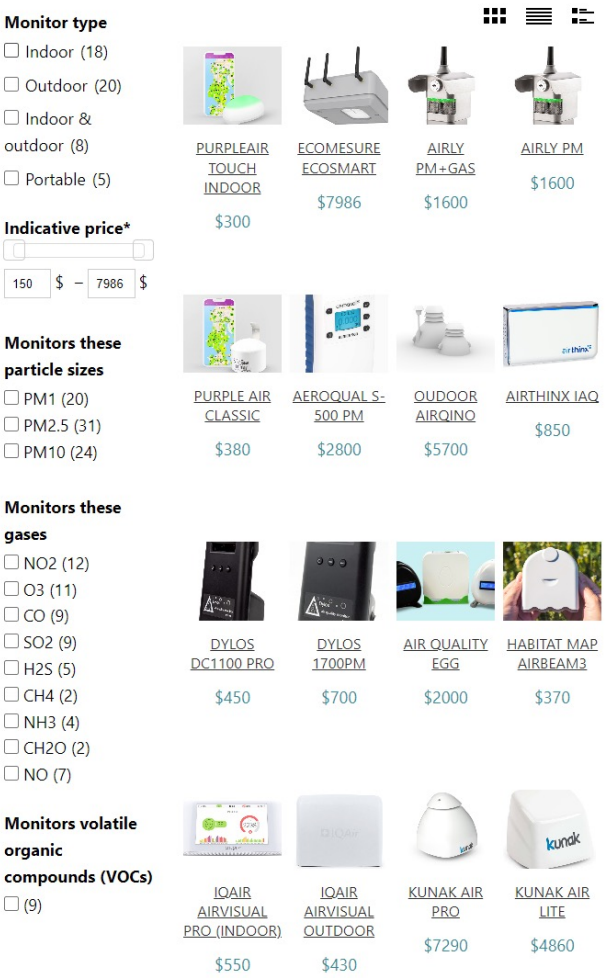
Online LCS decision tool

Used matrix to produce an online decision tool that helps non-expert users find low-cost sensors to suit their needs.

Info Sheets

Plain English guidance for key user groups on how to select LCS.

LCS guidance: Online decision tool

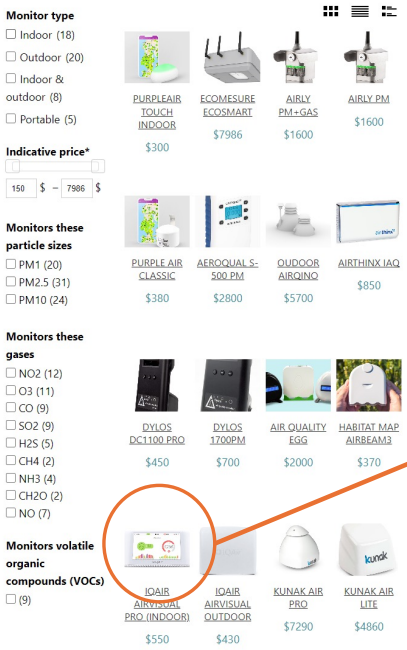


Simple, accessible tool helps users quickly refine their search for a low-cost sensor based on:

- Type of monitoring (indoor, outdoor, portable)
- Price (under 10K)
- Target pollutants (PM, gases, VOCs)

https://monitors.cleanairstars.com

LCS guidance: Online decision tool



IQAir AirVisual Pro (Indoor)

$550

Category: Indoor
Monitors these particle sizes: PM2.5
Data transmission: Wi-Fi
Data display: On-device display, app, web, API
Data storage: Local
Calibration: Factory calibrated
Size: 82 x 184 x 100mm
Power options: Plug-in, battery
Product page: https://www.iqair.com/au/air-quality-monitors
Sensor accuracy: PM2.5: 0.79 – 0.81

Detailed information on products, including power, and data transmission and handling; direct links to seller web pages.

LCS guidance: Plain English info sheets

Guidance on key concerns for selecting a low-cost sensor product.

This guidance was tailored for, and peer reviewed by, five key user groups:

1. Researchers
2. Local government
3. Schools
4. Community & environment groups
5. Households

https://monitors.cleanairstars.com

2. HEPA guidance: What we've done

Interventions paper

Addresses knowledge gaps regarding ventilation and HEPA filtration in school settings.

Stakeholder workshop

“How to Protect Schoolchildren from Air Pollution”

Healthy Classroom FAQs

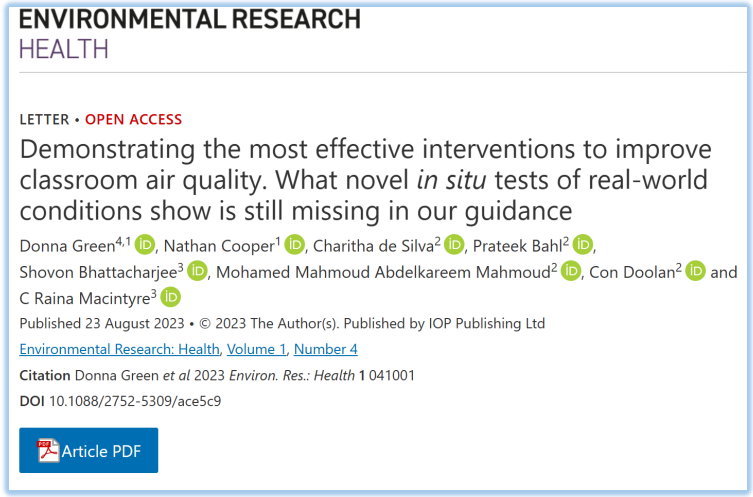
Answers to frequently-asked questions on indoor air quality.

HEPA guidance: interventions research paper

Rationale: to address the following dilemma, which many school decision-makers face:

Should you **open windows** to lower CO_2 levels, promote good air flow, and reduce indoor air pollution, or **close them** to prevent outdoor air pollution from entering?

HEPA guidance: Interventions research paper



ENVIRONMENTAL RESEARCH
HEALTH

LETTER • OPEN ACCESS

Demonstrating the most effective interventions to improve classroom air quality. What novel *in situ* tests of real-world conditions show is still missing in our guidance

Donna Green[4,1], Nathan Cooper[1], Charitha de Silva[2], Prateek Bahl[2], Shovon Bhattacharjee[3], Mohamed Mahmoud Abdelkareem Mahmoud[2], Con Doolan[2] and C Raina Macintyre[3]

Published 23 August 2023 • © 2023 The Author(s). Published by IOP Publishing Ltd

Environmental Research: Health, Volume 1, Number 4

Citation Donna Green *et al* 2023 *Environ. Res.: Health* **1** 041001

DOI 10.1088/2752-5309/ace5c9

Article PDF

- Compares effectiveness of HEPA filters vs. natural & mechanical ventilation
- Examines how natural ventilation affects classroom HEPA performance.

- See: Donna Green et al 2023 Environ. Res.: Health 1 041001

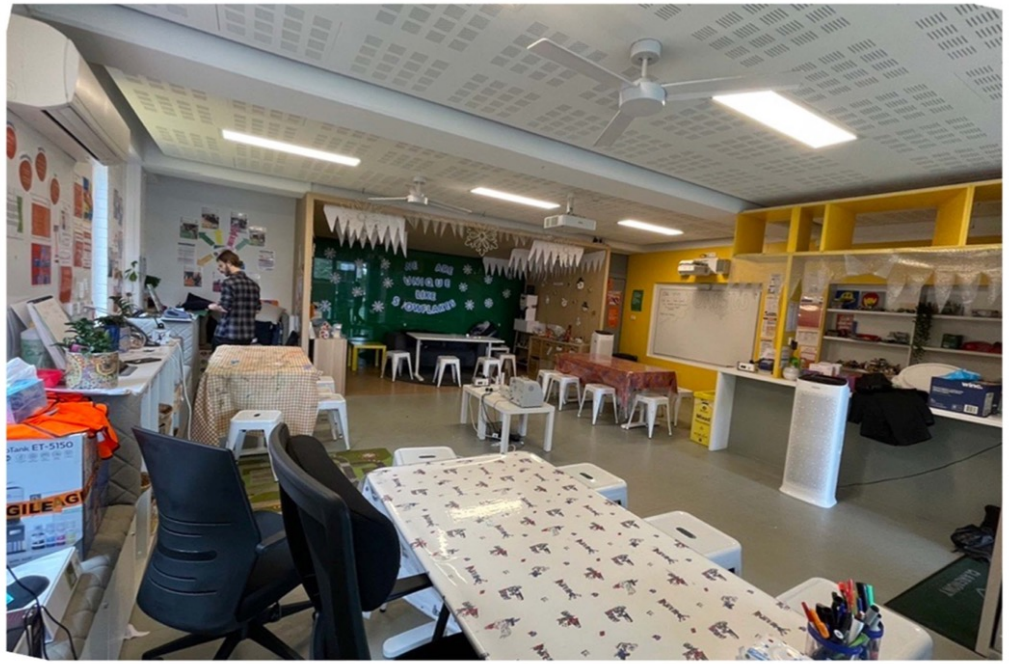


Figure 4. Set up of classroom with tables set up for volunteers (looking away from windows).

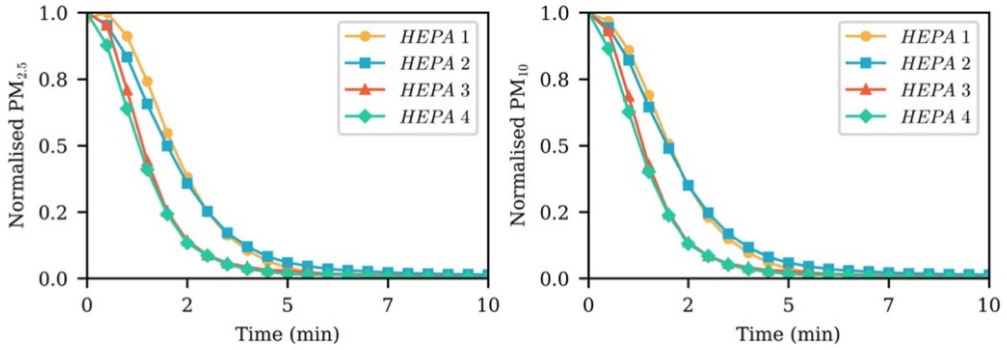


Figure 5. (a), (b) Comparison of $PM_{2.5}$ and PM_{10} removal by four different HEPA filters in a chamber.

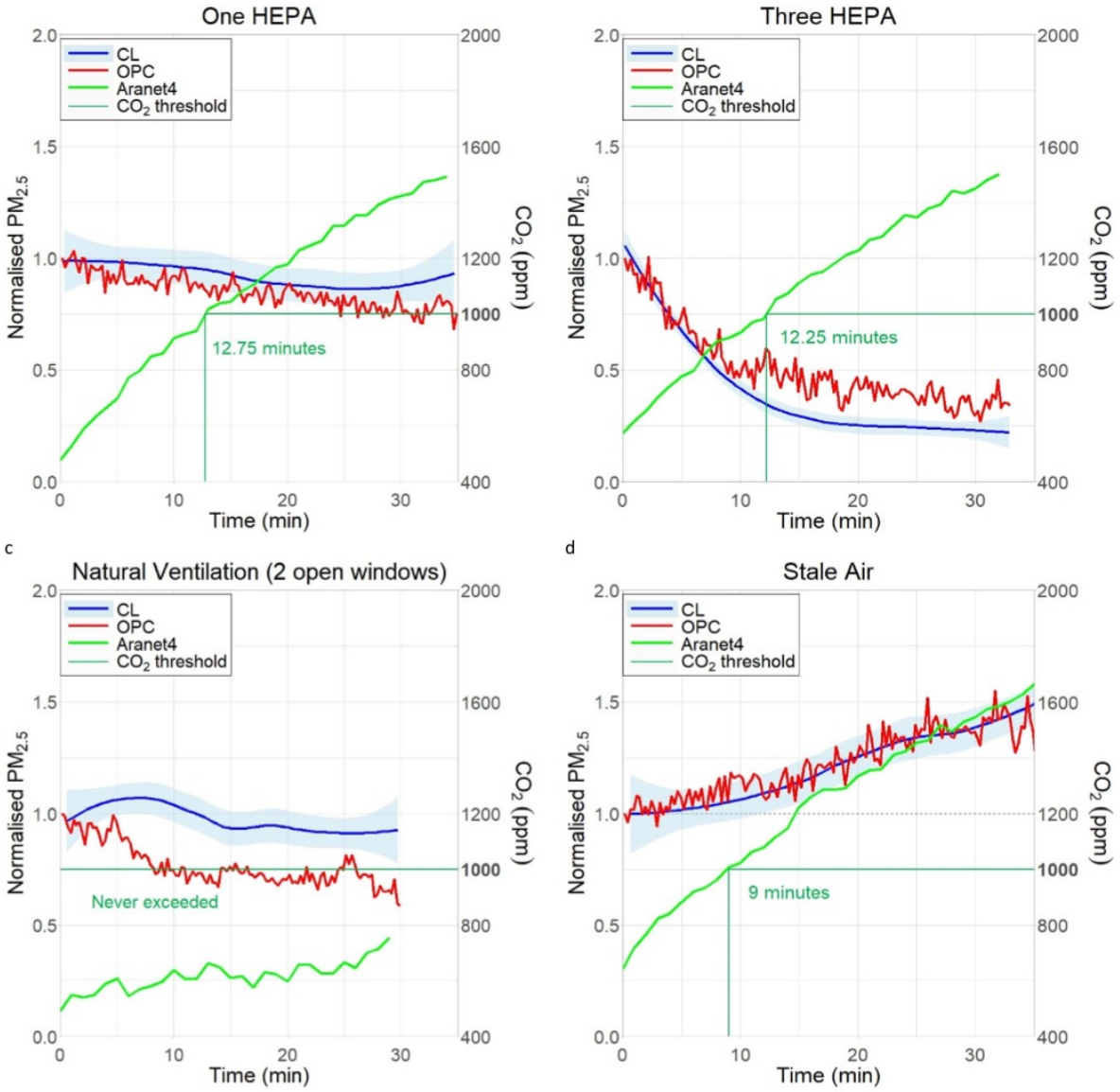


Figure 8. (a)–(d) Comparison of $PM_{2.5}$ number concentration levels during the unmasked people tests normalised to the initial value.

HEPA guidance: Stakeholder workshop

Theme: How to Protect Schoolchildren from Air Pollution

- **Who:** 23 representatives from education, government, research and non-profit sectors.
- **Key outcome:** Participants called for HEPA-specific guidance for schools reflecting new knowledge and advice on use, placement and maintenance.

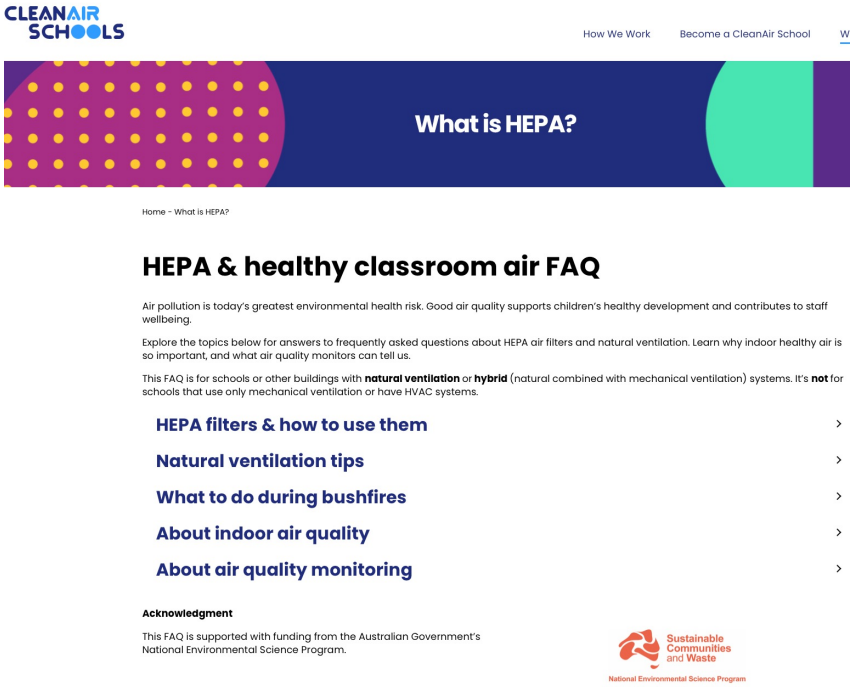
HEPA guidance: Healthy Classroom FAQs

Clean, healthy air in classrooms is crucial for optimal learning and teaching.

Based on stakeholder, research, and extensive literature review, we produced plain English guidance to answer ~30 frequently asked questions on:

- HEPA use
- natural ventilation
- what to do when bushfire smoke affects local air quality
- air quality & carbon dioxide monitoring.

Audience: school users, but broadly applicable to members of the general public seeking to use HEPAs.



https://www.cleanairschools.com.au/what-is-hepa/

HEPA & healthy classroom air FAQ

Air pollution is today's greatest environmental health risk. Good air quality supports children's healthy development and contributes to staff wellbeing.

Explore the topics below for answers to frequently asked questions about HEPA air filters and natural ventilation. Learn why indoor healthy air is so important, and what air quality monitors can tell us.

This FAQ is for schools or other buildings with **natural ventilation** or **hybrid** (natural combined with mechanical ventilation) systems. It's **not** for schools that use only mechanical ventilation or have HVAC systems.

HEPA filters & how to use them

Find practical information on how how to buy, use and maintain HEPA filters to clean indoor air.

What are HEPA units?

The air filtering appliances commonly called HEPA (High Efficiency Particulate Air) filters or HEPA units look like large rounded or square boxes with lots of small holes on their sides. Inside a typical unit you'll find a motor and a fan that draws air through a pre-filter, and behind that, the HEPA filter itself.

Each HEPA filter consists of a mat of dense fibres, arranged in pleats to increase its surface area. Air and any pollutants it contains is drawn through the filter, which traps pollution particles across a wide range of sizes. The unit vents clean air back into the room and the pollutants stay trapped inside the filter.

HEPA filters need to be replaced when they fill with dirt and dust.

How do HEPA filters work?

As air flows through a HEPA filter, most airborne particles collide or get stuck to the filter's fibres. Technically speaking, HEPA filters work through a combination of interception (trapping by fibres), impaction (colliding with fibres) and diffusion (erratically colliding with gas molecules before colliding with fibres).

What do HEPA filter ratings mean?

If a product's marketing material says HEPA, can I assume it really is?

What can HEPA filters do?

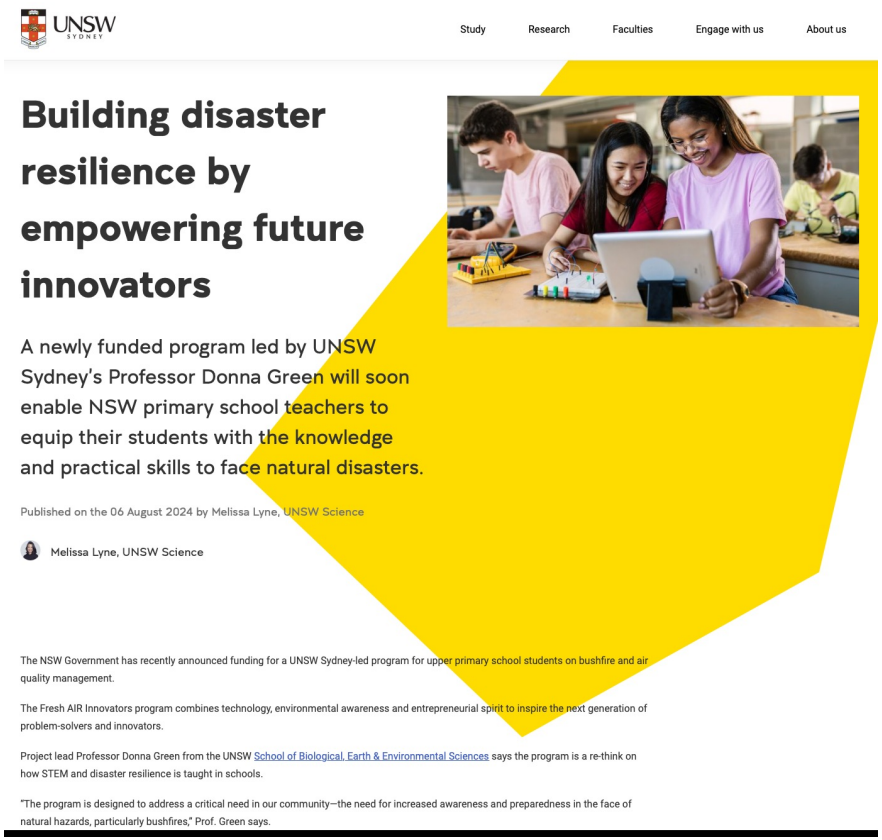
What are things HEPA filters can't do?

If virus particles are small enough to pass through HEPA filters, how can HEPAs capture them?

How do I choose the right HEPA unit?

How do I know how many HEPAs I need for a room?

Is it better to have one larger HEPA unit or two or more smaller HEPA units in a room?



UNSW SYDNEY

Study Research Faculties Engage with us About us

Building disaster resilience by empowering future innovators

A newly funded program led by UNSW Sydney's Professor Donna Green will soon enable NSW primary school teachers to equip their students with the knowledge and practical skills to face natural disasters.

Published on the 06 August 2024 by Melissa Lyne, UNSW Science

Melissa Lyne, UNSW Science

The NSW Government has recently announced funding for a UNSW Sydney-led program for upper primary school students on bushfire and air quality management.

The Fresh AIR Innovators program combines technology, environmental awareness and entrepreneurial spirit to inspire the next generation of problem-solvers and innovators.

Project lead Professor Donna Green from the UNSW School of Biological, Earth & Environmental Sciences says the program is a re-think on how STEM and disaster resilience is taught in schools.

"The program is designed to address a critical need in our community—the need for increased awareness and preparedness in the face of natural hazards, particularly bushfires," Prof. Green says.

Thank you for listening, any questions?