CAMBRIDGE RETROFIT HUB

Indoor Air Quality

paul kershaw | 11th Feb 2026

Name that tourist destination

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Name that tourist destination

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London, 1952, The Great Smog

Name that tourist destination

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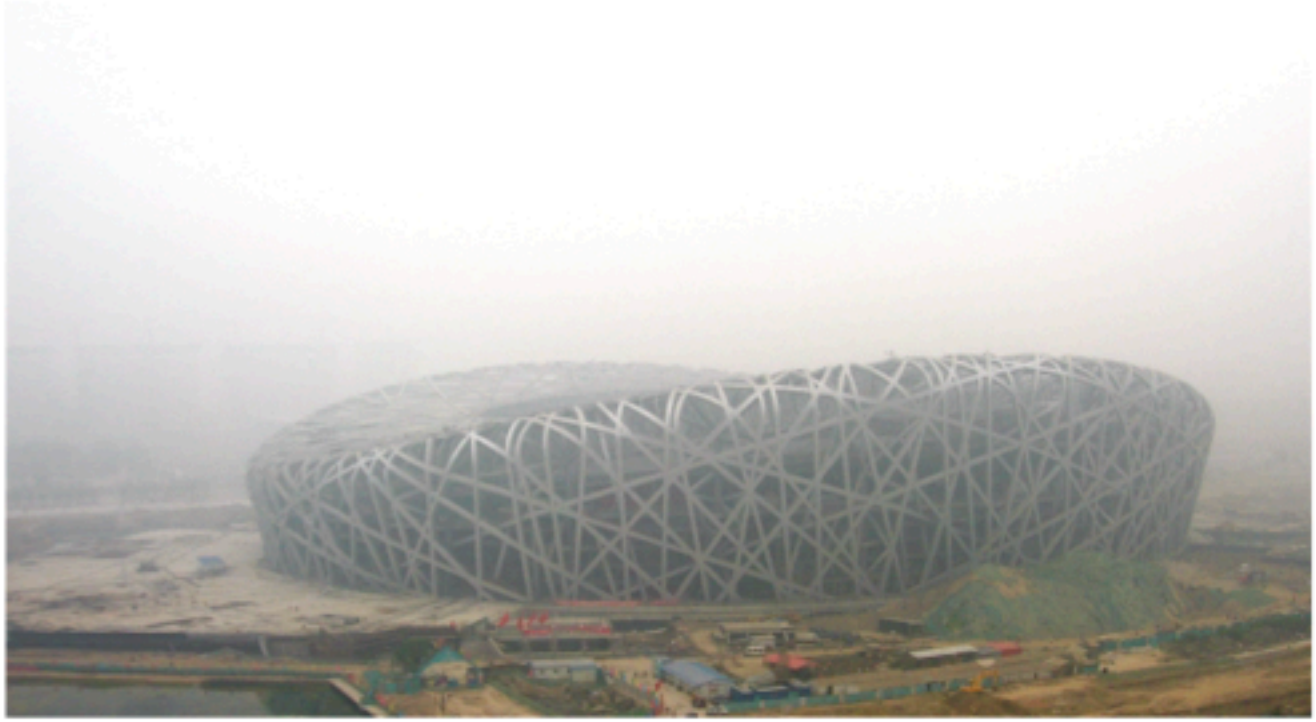

Name that tourist destination

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Beijing Birds Nest Stadium, 2008

Name that tourist destination

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Name that tourist destination

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New Delhi, India Gate before and during lockdown

IAQ | What do we measure?

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- Temperature

The World Health Organisation supports a minimum room temperature of 18°. WHO further states: "There is no demonstrable risk to human health of healthy sedentary people living in air temperature of between 18 and 24°C."

PECT
CREATING SUSTAINABLE PLACES

Fuel poverty and its impacts

High energy bills

Mental health challenges

Decreased immunity

Damp and mould

Temperature	Effect
18°C	Minimal risk to healthy person Vulnerable households may need higher temperatures
Under 18°C	May increase blood pressure & risk of cardiovascular disease
Under 16°C	May diminish resistance to respiratory diseases
4-8°C	Outdoor temperature threshold for risk of death
5°C	High risk of hypothermia

IAQ | What do we measure?

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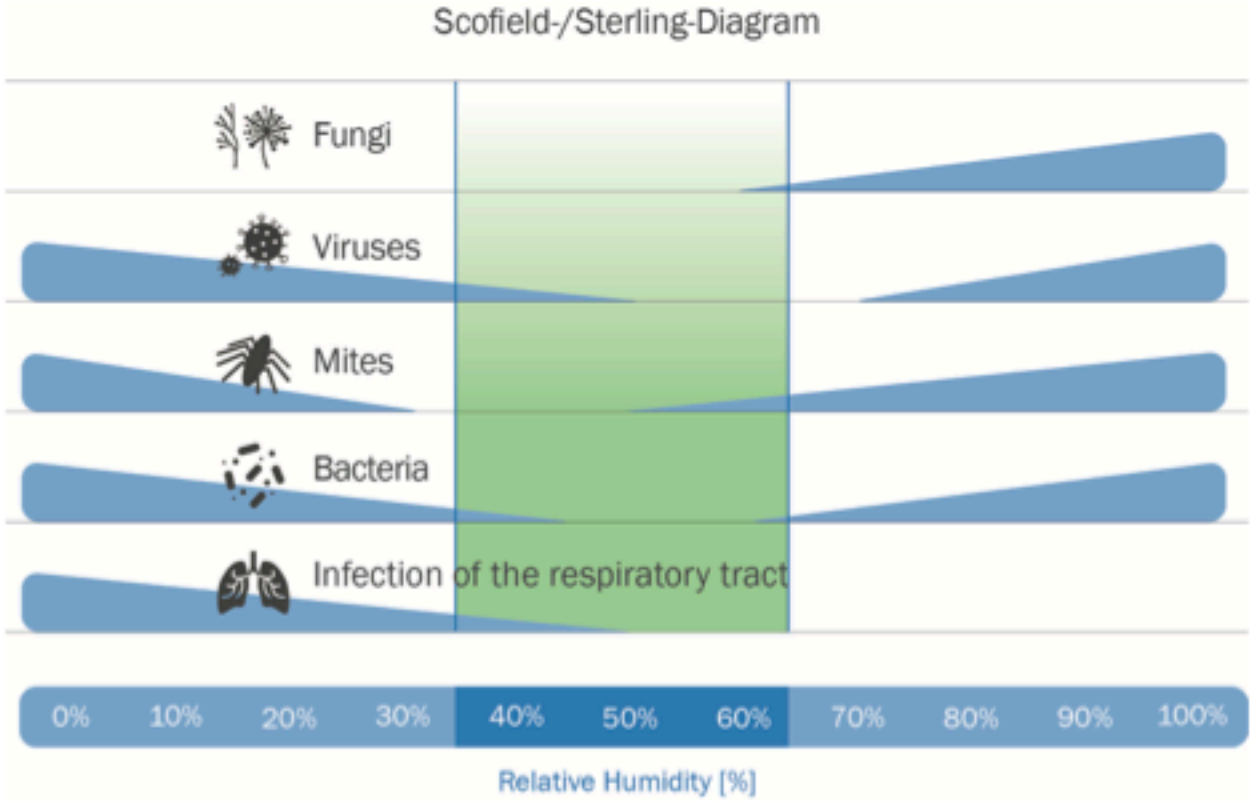
- Temperature
- Humidity
  - An effective measure of ventilation



IAQ | What do we measure?

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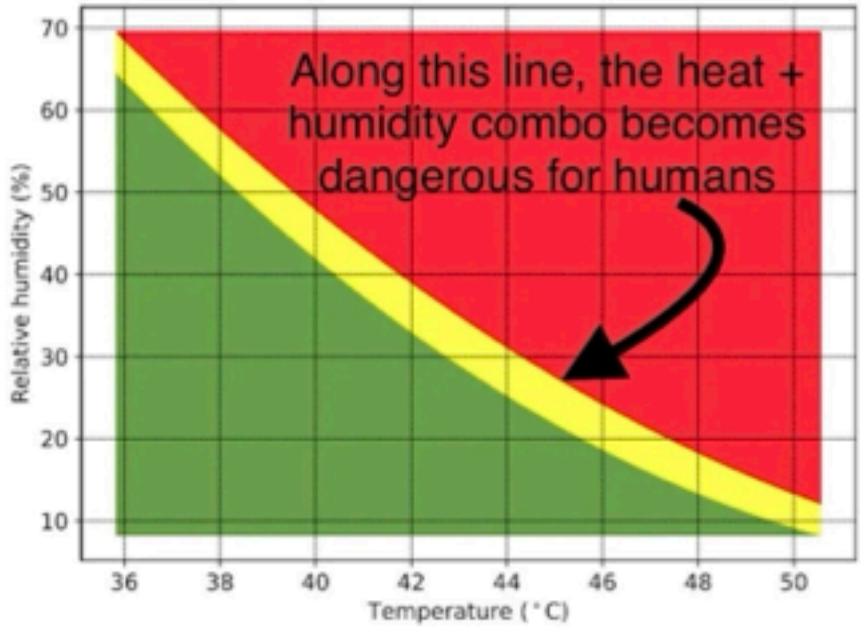
- Temperature + Humidity
  Wet Bulb Temperature



IAQ | What do we measure?

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PM2.5 (Particulate Matter 2.5) refers to fine particles with diameter of 2.5 micrometers or less. Due to its tiny size, PM2.5 can be absorbed into bloodstream and the lungs, so that long-term exposure to high concentration of PM2.5 environment may cause eye and nose irritation, cough, asthma, emphysema, lung disease, heart attacks, cancer and etc.

Status	Reference NAAQS(2012)	Reference NAAQS(2024)
Poor	55.5~999.9	55.5~999.9
Fair	12.1~55.4	9.1~55.4
Good	0~12	0~9

IAQ | What do we measure?

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- Combustion - cooking, heating (esp. log burners & fires), candles
- Cleaning products - inc air fresheners
- Biological - pets, mould, dust mites
- Outdoor Pollution

Status	Reference NAAQS(2012)	Reference NAAQS(2024)
Poor	55.5~999.9	55.5~999.9
Fair	12.1~55.4	9.1~55.4
Good	0~12	0~9

IAQ | What do we measure?

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PM10 (Particulate Matter 10) refers to particulates with a diameter of 10 micrometers or less. Due to the larger size, it's inhalable but penetrates no further than bronchi as larger particles can be filtered out by cilia and mucus of nose and throat. It normally considered as less harmful to health than PM2.5.

Status / Pollutant	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy	Hazardous
PM2.5 ($\mu g/m^3$)	≤12	12.1~35.4	35.5~55.4	55.5~150.4	150.5~250.4	≥250.5
PM10 ($\mu g/m^3$)	≤54	54.1~154	154.1~255	255.1~354	354.1~424	≥425
CO_2 (ppm)	≤700	701~1000	1001~1500	1501~2500	2501~5000	≥5001

IAQ | What do we measure?

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- Combustion - inc smoking
- Activities - cleaning, vacuuming, crafts/DIY, 3D printing, printing, cleaning products
- Outdoor Pollution

Status / Pollutant	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy	Hazardous
PM2.5 (μg/m³)	≤12	12.1~35.4	35.5~55.4	55.5~150.4	150.5~250.4	≥250.5
PM10 (μg/m³)	≤54	54.1~154	154.1~255	255.1~354	354.1~424	≥425
CO_2 (ppm)	≤700	701~1000	1001~1500	1501~2500	2501~5000	≥5001

IAQ | What do we measure?

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Formaldehyde (HCHO) is a colorless and strong-smelling gas with formula CH_2O, which has been classified by IARC as Group 1 carcinogen. Long-term exposure to just low doses could cause chronic respiratory diseases, nasopharyngeal carcinoma, colon cancer, brain tumors, nuclear gene mutation and etc.

Pollutant \ Status	Healthy	UnHealthy
HCHO (mg/m^3)	≤0.1	>0.1

IAQ | What do we measure?

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- Pressed wood products - plywood, MDF
- Adhesives, paints
- Insulation (synthetic)
- Textiles
- Combustion
- Household/personal care products

Pollutant \ Status	Healthy	UnHealthy
HCHO (mg/m^3)	≤0.1	>0.1

IAQ | What do we measure?

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TVOC (Total Volatile Organic Compounds) refers to various common VOCs including benzene, toluene, styrene, formaldehyde and etc. Due to their volatility as well as toxicity, irritability and carcinogenicity, long-term exposure to TVOCs can cause damage to the skin, liver, kidneys, central nervous system and etc.

Status	Reference
Poor	351~500
Fair	101~350
Good	1~100

IAQ | What do we measure?

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TVOC (Total Volatile Organic Compounds) refers to various common VOCs including benzene, toluene, styrene, formaldehyde and etc. Due to their volatility as well as toxicity, irritability and carcinogenicity, long-term exposure to TVOCs can cause damage to the skin, liver, kidneys, central nervous system and etc.

- Aerosol Propellant
- Plastics
- Paints, adhesives
- Cleaning supplies
- Air Fresheners
- Furniture & carpets
- Building materials
- Office equipment
- Dry Cleaned Clothes
- Pesticides

Status	Reference
Poor	351~500
Fair	101~350
Good	1~100

IAQ | What do we measure?

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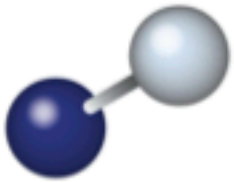

CO

Carbon Monoxide

CO is emitted as a product of the incomplete combustion of carbon-based fuels from cooking and heating appliances, especially gas boilers that are not correctly installed, maintained or ventilated, as well as tobacco smoking.

Exposure to CO causes cognitive impairment (low concentrations) and death (high concentrations).

Carbon monoxide (CO) detectors are essential in the UK for detecting poisonous fumes from fuel-burning appliances. Laws in England, Scotland, and Wales require them in rooms with boilers, fires, or stoves.

9 ppm	Maximum indoor safe CO level over 8 hours	Safe short-term exposure
200 ppm	Physical symptoms (headache, dizziness, nausea)	Fatal in hours
800+ ppm	Severe symptoms, unconsciousness	Fatal within minutes

IAQ | What do we measure?

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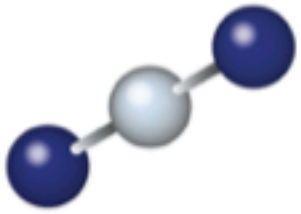

Carbon dioxide (CO2), is a **natural metabolic waste product** that is exhaled during breathing, but it is also a **greenhouse gas** produced by human activities (like burning fossil fuels) that impacts the environment and human health at high concentrations.

CO2 is not a pollutant but is used as an indicator of the level of ventilation.

Status	Reference
Poor	1501~5000
Fair	1001~1500
Good	400~1000

IAQ | What do we measure?

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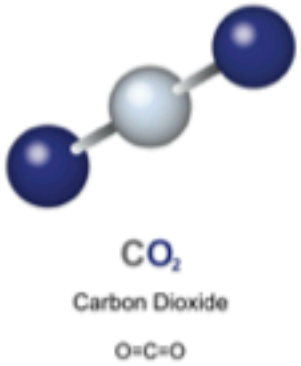

Carbon dioxide (CO2), is a **natural metabolic waste product** that is exhaled during breathing, but it is also a **greenhouse gas** produced by human activities (like burning fossil fuels) that impacts the environment and human health at high concentrations.

- Breathing, humans & pets
- Combustion
- Smoking

Status	Reference
Poor	1501~5000
Fair	1001~1500
Good	400~1000

How do we improve our IAQ?

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How do we improve our IAQ?

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- Ventilate - cooker hoods, bathroom fans, trickle vents overnight
- Purge ventilate - at 5°C outside temp = 5 mins
- Keep indoor doors ajar
- Use more natural cleaning products
- Use temp/humid sensor to monitor and alert

How do we improve our IAQ?

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The Solution: Stoßlüften / House Burping

How to Do It

- Open Wide: Open windows fully (not just ajar) and open interior doors for cross-ventilation.
- Short Burst: Keep them open for the recommended time, creating a "shock" of fresh air.
- Repeat: Aim for twice a day, often in the morning and evening, or after cooking/ showering.

Why It Works

- Prevents Mould: Quickly removes moisture
- Saves Energy: The walls and furniture stay warm, quickly reheating the fresh air, making it more efficient than leaving windows slightly open for hours.

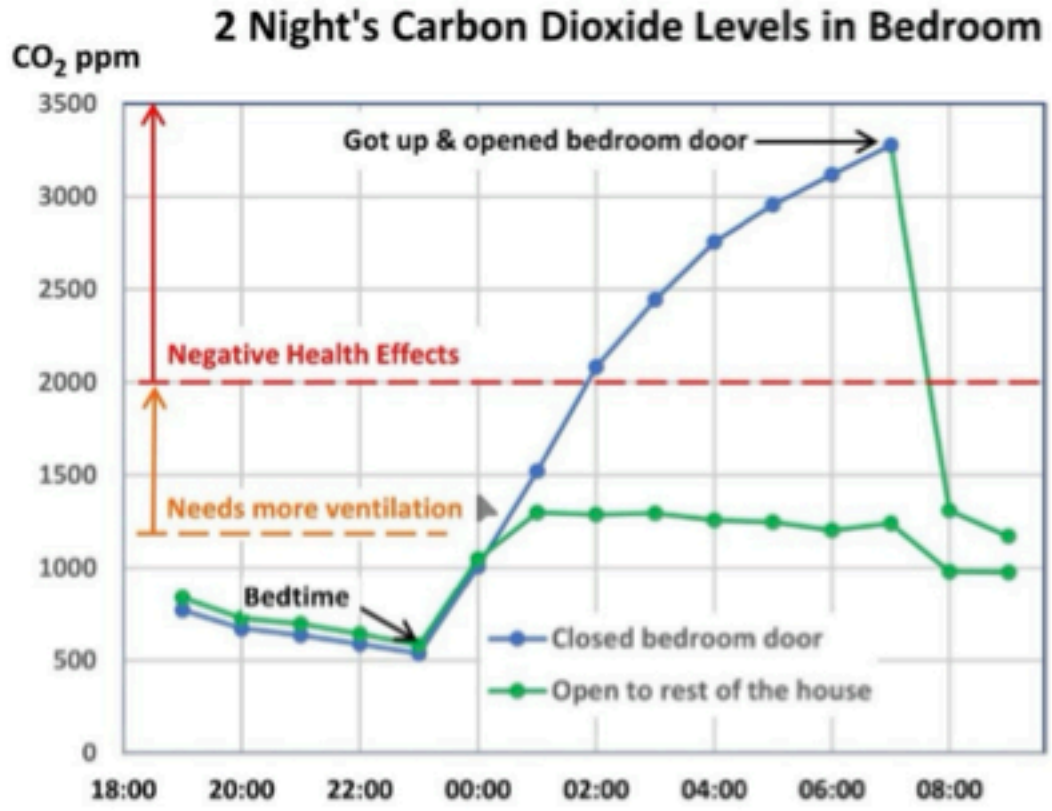
How Long?

- Winter: outside 5ºC approx 5 mins, can be less if windy or good cross ventilation
- Spring & Autumn: outside 10ºC approx 10-15 mins

How do we improve our IAQ?

Overnight

- 2 people
- Victorian Terrace
- Urban location



Indoor Air Quality when using a wood burning stove

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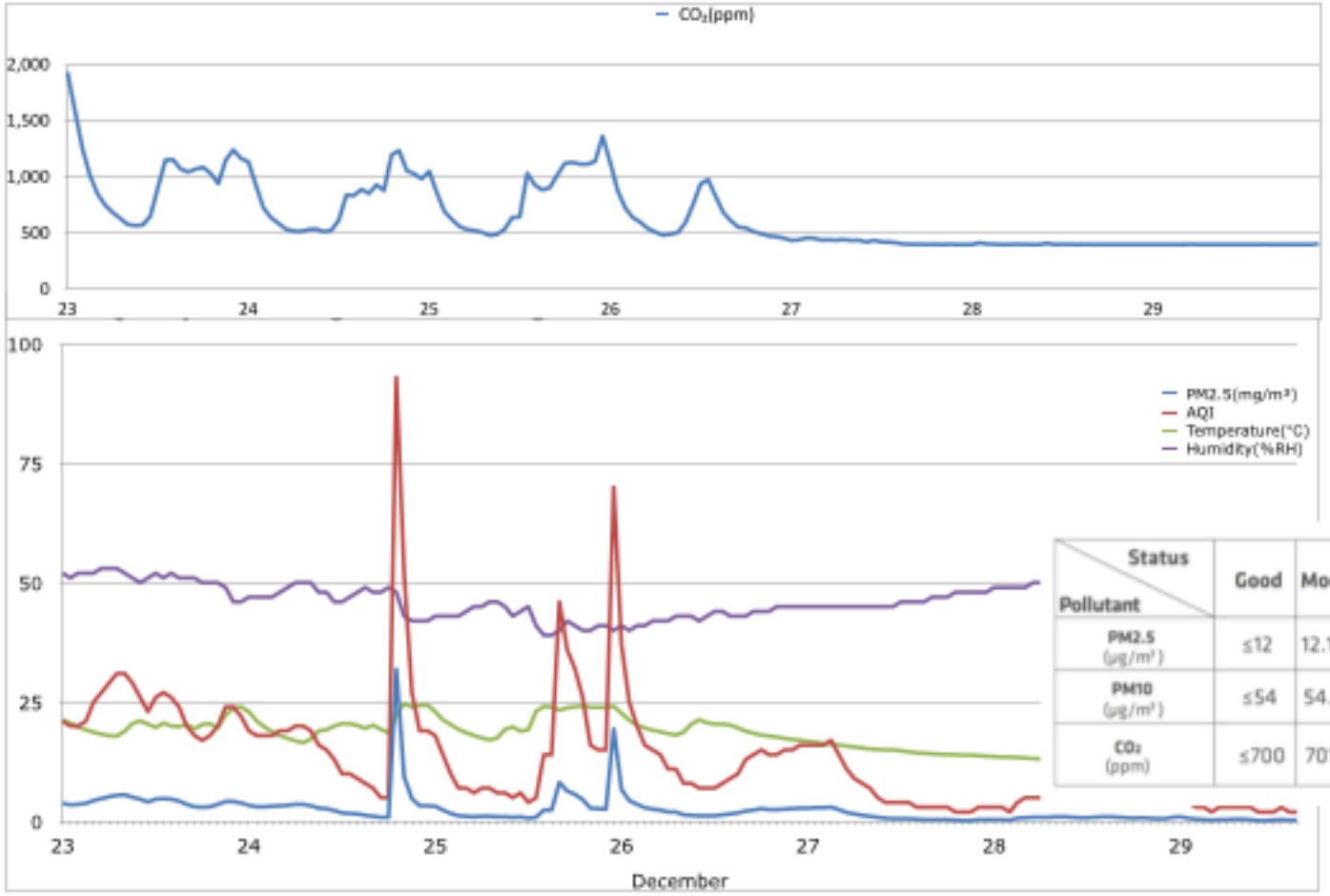

AQI

Status	Reference
Poor	151~500
Fair	51~150
Good	0~50

Pollutant \ Status	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy	Hazardous
PM2.5 (μg/m³)	≤12	12.1~35.4	35.5~55.4	55.5~150.4	150.5~250.4	≥250.5
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PM2.5 emissions of domestic heating methods

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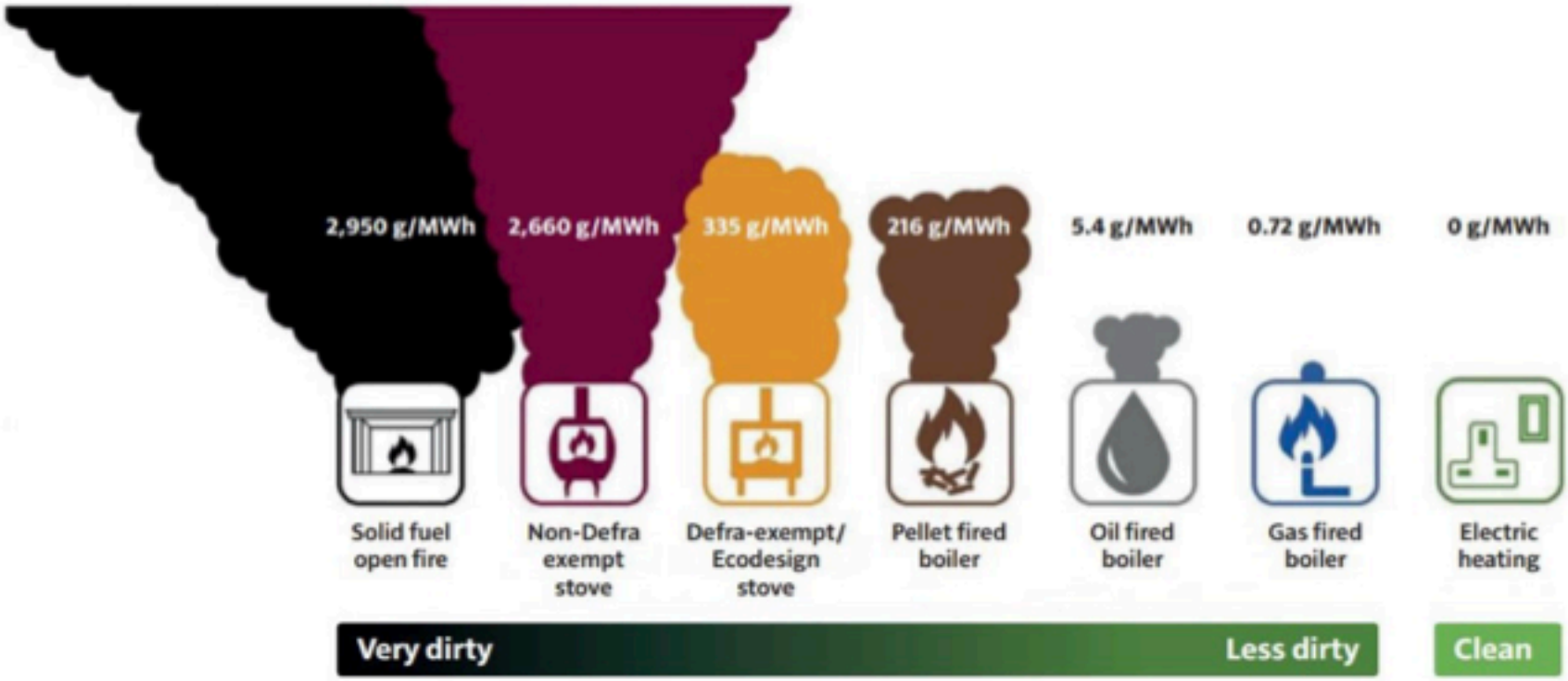

Source: Chief Medical Officer's Report, 2022[1]

Remember, it can be solved

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New Delhi, India Gate before and during lockdown