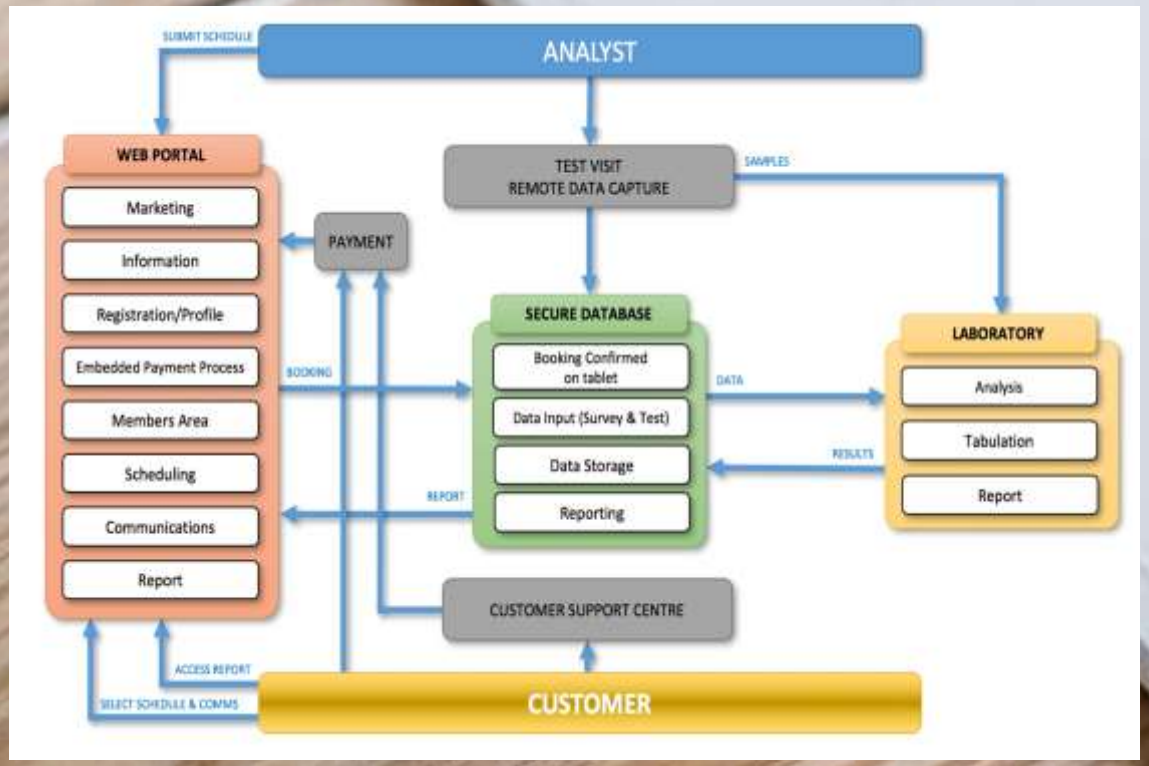
WORKING TOGETHER TO IMPROVE INDOOR AIR QUALITY

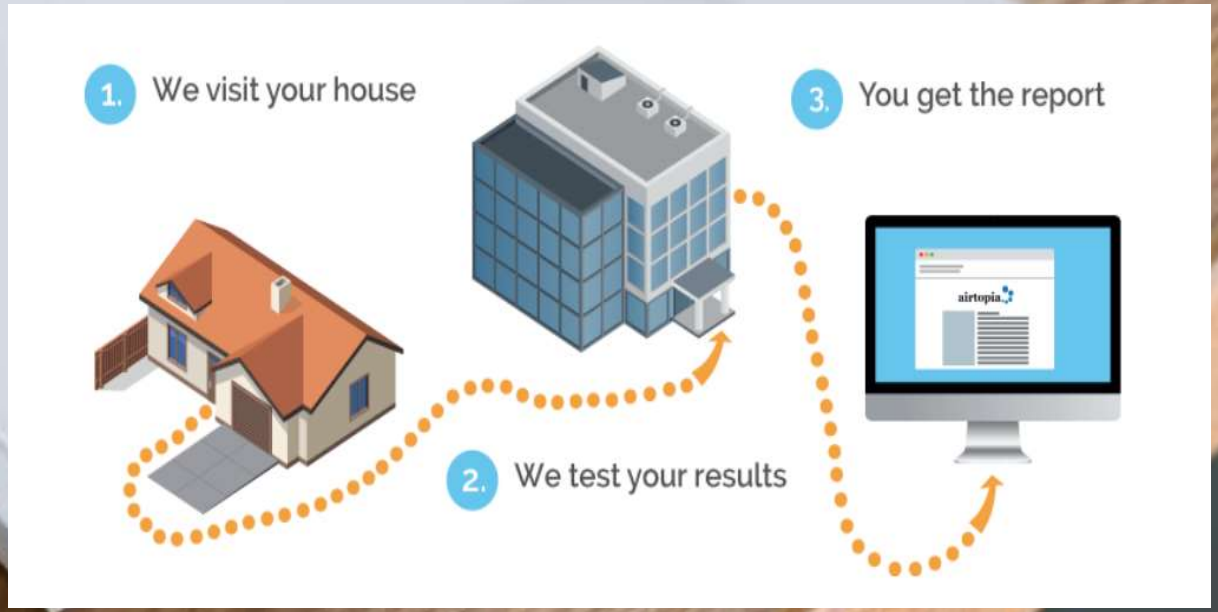
Mission: To improve the health of the nation and its homes by raising awareness of indoor air quality.

Chris Pentland: Social Housing Specialist
Steven Saxty: Director of Operations

Cartrefi Cymunedol Cymru | Community Housing Cymru

Airtopia:





Airtopia is a social enterprise and is proud to support the David Evans Grass Roots Foundation, a registered charity that helps deliver a well-rounded education to children and young people in the UK.

Acting on IAQ

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Department for Environment Food & Rural Affairs

CLEAN AIR STRATEGY 2018

2018 & 2019

CleanAirDay

appg

Air Pollution

Policy paper
Environment Bill: policy paper
Published 19 December 2018

Contents
Our vision: World-leading law for a greener future
Governance and accountability
Leaving the EU
Wider ambition of the Bill
Conclusion

HOUSEHOLD HEALTH & WELLBEING

- **51%** of properties below standard (11% are severe) on IAQ
- **20%** of households live with seriously elevated CO2 levels
- **57%** of homes have a temperature / humidity issue balance risking mould and damp problems
- **47%** of households dry washing inside without ventilation
- **45%** of homes have elevated VOC levels
- **15%** of homes with no visible mould showed evidence of hidden active mould growth (MVOCs)
- **20%** of homes show elevated light hydrocarbons, a possible gas safety indicator
- **21%** of households have elevated levels of formaldehyde, 13% above WHO guidelines

Estimated 9,000+ premature deaths every year in the UK due to IAQ problems alone.

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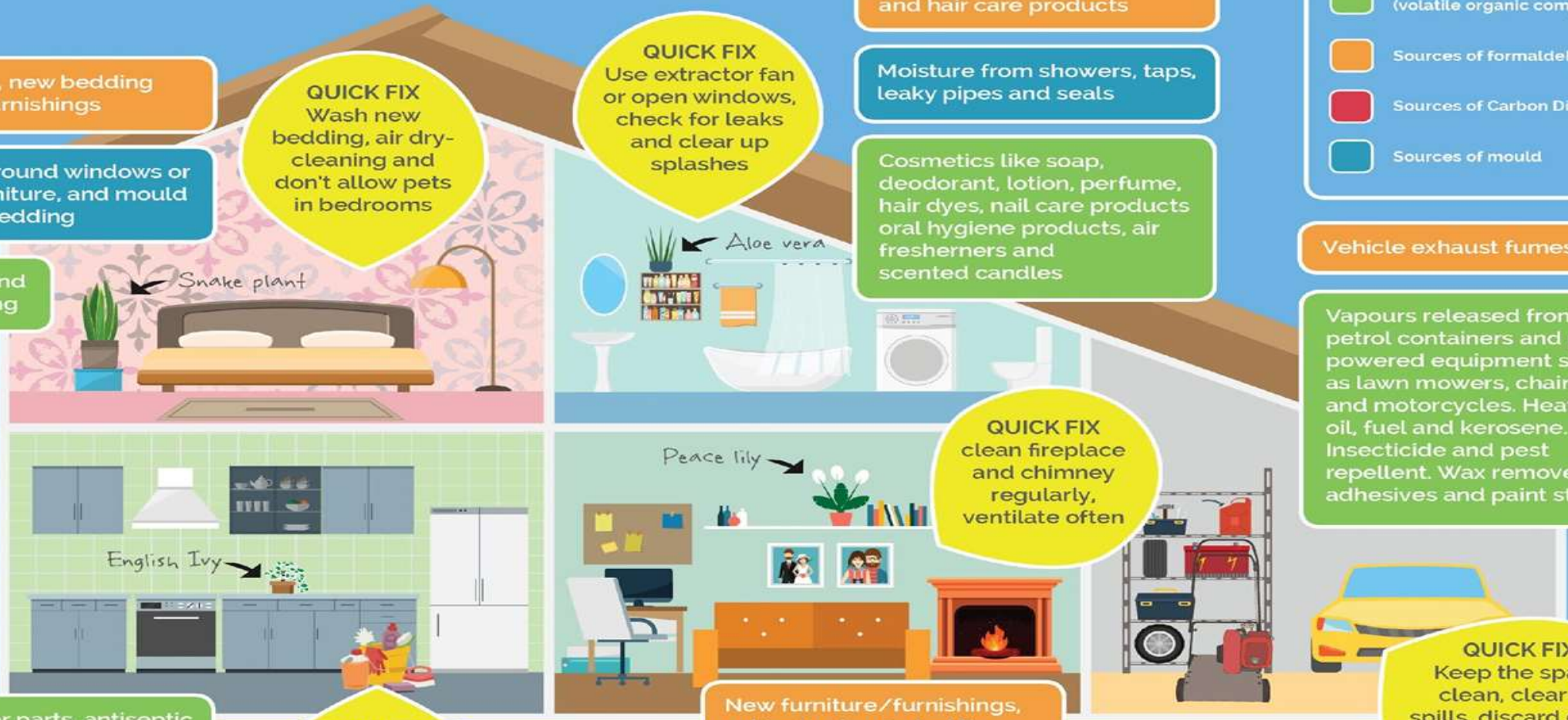
- Ventilation fans switched off
- Trickle vents ignored or unnoticed
- Vents blocked
- Unused rooms un-heated
- Airbricks sealed
- Windows never opened

YOUR HOME'S **HIDDEN DANGERS**



Wallpaper, new bedding and soft furnishings

Moisture around windows or behind furniture, and mould spores in bedding

Mattress and dry cleaning

QUICK FIX
Wash new bedding, air dry-cleaning and don't allow pets in bedrooms

QUICK FIX
Use extractor fan or open windows, check for leaks and clear up splashes

Cosmetics such as nail polish and hair care products

Moisture from showers, taps, leaky pipes and seals

Cosmetics like soap, deodorant, lotion, perfume, hair dyes, nail care products oral hygiene products, air fresherners and scented candles

QUICK FIX
clean fireplace and chimney regularly, ventilate often

Vehicle exhaust fumes

Vapours released from petrol containers and petrol-powered equipment such as lawn mowers, chainsaws and motorcycles. Heating oil, fuel and kerosene. Insecticide and pest repellent. Wax remover, adhesives and paint stripper

Refrigerator parts, antiseptic wipes, alcohol and cleaning products

Cooker hob and boiler

QUICK FIX
Ventilate regularly, check extractors work well, use natural cleaning products

New furniture/furnishings, cabinetry, laminated floors, engineered wood products. Smoke from fireplace

Open fire or wood-burning stove

Ink from home printer

QUICK FIX
Keep the space clean, clear up spills, discard old or leaking tins, jars or bottles containing VOC emitting products

- Sources ofVOCs (volatile organic compounds)
- Sources of formaldehyde
- Sources of Carbon Dioxide
- Sources of mould

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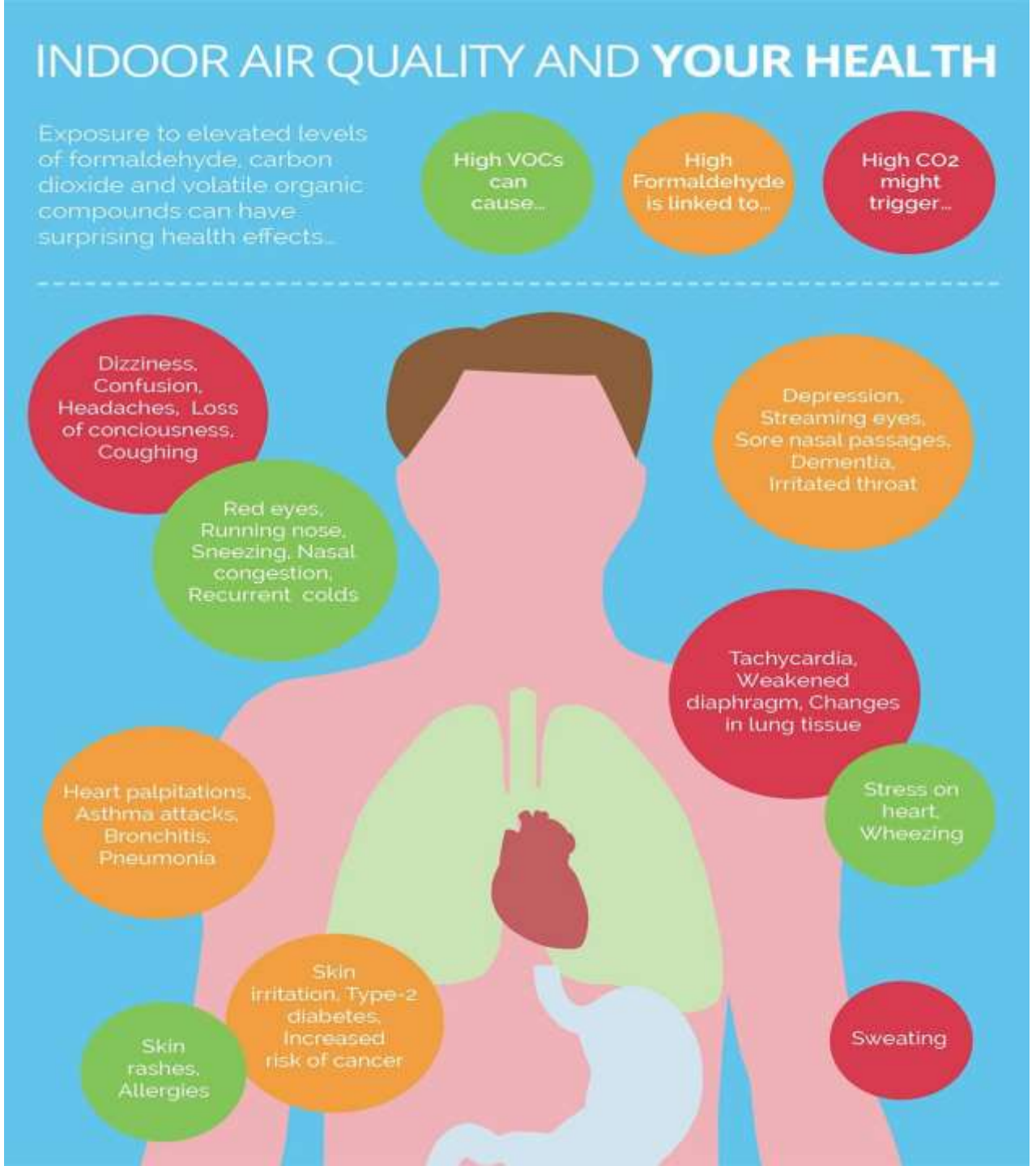

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- Visionary.
- Best practice operator.
- Best duty of care.
- Proactivity on public health.

- Cost savings.
- Minimize liability.
- Extend asset life.
- Protect investment in ECO projects.
- Added value service to tenants (VFM).

INDOOR AIR AWARE
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RCPCH
Royal College of Paediatrics and Child Health
Leading the way in Children's Health

The inside story:
Health effects of indoor air quality on children and young people

Published January 2020

Birth and infancy

- Respiratory problems – wheeze, rhinitis, atopic asthma, respiratory infections
- Low birthweight and pre-term birth

Pre-school

- Respiratory problems – wheeze, allergies, asthma, risk of respiratory diseases and pneumonia
- Eczema and atopic dermatitis
- Greater hyperactivity, impulsivity and inattention

School age

- Respiratory problems – wheeze, rhinitis, asthma, throat irritation, nasal congestion, dry cough
- Eczema, dermatitis, conjunctivitis, skin and eye irritation
- Reduced cognitive performance, difficulty sleeping

'Urgent action is needed to address the problems of poor indoor air quality. Children are potentially being exposed to harmful levels of pollutants throughout their daily lives in the buildings where they live, play and learn. '

Key Recommendations for Housing Providers:

- Local authorities and housing providers should offer indoor air quality testing for their residents.
- Building managers must keep the air quality under review as they maintain and operate the property, providing residents with an effective channel to raise concerns.

'...building owners have a duty of care toward their occupants. This should include standards for maintaining air quality.'

'Children have a right to health and to be safeguarded when it comes to the air they breathe indoors.'

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NICE National Institute for Health and Care Excellence

Indoor air quality at home

NICE guideline
Published: 8 January 2020
www.nice.org.uk/guidance/ng149

RECOMMENDATIONS FOR HOUSING PROVIDERS, PROPERTY MANAGERS AND LOCAL AUTHORITIES:

- **Advise landlords on the health risks associated with poor indoor air quality and methods to control and minimise identified sources of indoor air pollution.**
- **Develop a structured process… to help people request a housing assessment if poor indoor air quality has been identified or is suspected.**
- **Raise awareness of poor indoor air quality in the home...**

'Exposure to indoor air pollutants… is widespread and can cause respiratory and other conditions, and premature death in some people. Asthma is a common respiratory condition, with over 5 million people receiving treatment for it in the UK.'

WHY THE COMMITTEE MADE THE RECOMMENDATIONS

Because poor indoor air quality is a hidden health threat, raising awareness is a first step in reducing the risk of long-term health issues, especially for vulnerable groups.

'[The committee] were concerned that property managers and landlords might not be aware of how mould, damp and other indoor air pollutants affect people's health. So they made a recommendation to advise on this and their general responsibilities to safely maintain their properties. The evidence showed that flooring and furniture… are often sources of VOCs or formaldehyde. Based on the evidence, the committee agreed it was important that these dangers were highlighted to property managers and landlords, because both can damage people's health.'

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Preserving Environment & Property

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- Reducing tenant behaviour that causes property degradation (condensation – mould- etc)
- Helping make energy efficiency initiates work better
- Educating tenants to use the tools provided
- Helping reduce fuel poverty whilst protecting health
- Avoiding unnecessary property adaptations for those suffering avoidable ailments
- Clarifying personal responsibilities to avoid future liability claims

Corporate Social Responsibility

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- Establishing best practice operations, caring for all stakeholders
- Supporting public health initiatives, focussing on what you can change
- Balancing energy efficiency policy, mitigating unintended consequence
- Generating Positive PR, volunteering to act responsibly
- Driving positive user reviews, in an age of public judgement
- Building joint ownership with tenants on issues that can be addressed collectively for the common good
- Facilitating community cohesion on an issue that can be addressed together
- Contributing to wider understanding of IAQ problems, a public health crisis
- Setting a great example…

Overview

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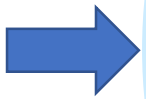
Outdoor Air

- ***Combustion gases from vehicles & stationary source emissions***
- ***Pesticides & insecticides***
- ***Ozone (naturally occurring & from smog)***



Occupant Comfort
(Temperature, Humidity, Airflow)

Particulates
(Lifestyle & building related)

Radon
(Regional geology)

Indoor Air Quality

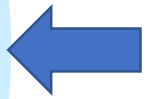
CO, CO_2, NO_x, SO_x
(Combustion / metabolism)

Allergens
(Pet Dander, Dust Mites & Pollen)

Mould
(Spores, Mycotoxins, Debris, MVOCs)

Ozone
(O_3)

Volatile Organic Compounds (VOCs)
(VVOCs, VOCs & SVOCs)



Outdoor Air

- ***Particles, including dust, smoke, fine (PM2.5) & ultrafine (<0.1µm) combustion particles***
- ***Allergens (pollen)***
- ***Mould spores***

First Considerations

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Temperature

Humidity

Air Flow (ventilation, draughts)

- Affect how we feel indoors – influences productivity & health
  - **Temperature**:

    Subjective & depends on individuals' metabolic rate & clothing
  - **Humidity**:

    <30%: RH can affect mucous membranes

    >50%: evaporation of moisture via sweat is limited (reduces body's effective heat loss)
- Influences IAQ pollutants such as levels of airborne chemicals & mould growth

Inorganic Gases

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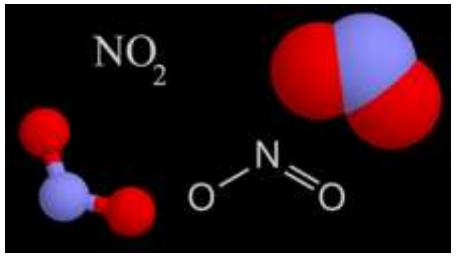
Gas	Indoor source	Health effects
Nitrogen dioxide (NO_2)	Gas cookers, gas heaters	Respiratory issues, eyes, nose & throat irritation
Carbon monoxide (CO)	Heaters, stoves, furnaces; incomplete combustion	Responsible for 50 deaths/year & 4,000 medical visits (UK)
Carbon dioxide (CO_2)	Combustion, exhaled breath	Fatigue, headaches, suffocation at very high concentrations
Radon (Rn)	Seepage from ground; dependent on local geology	Second largest cause of lung cancer in the UK; 2,000 fatal cancers in UK
Ozone (O_3)	Formed by the presence of VOCs & NOx in the presence of UV light	Damage to lungs & respiratory issues



Particulates

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Particle size:

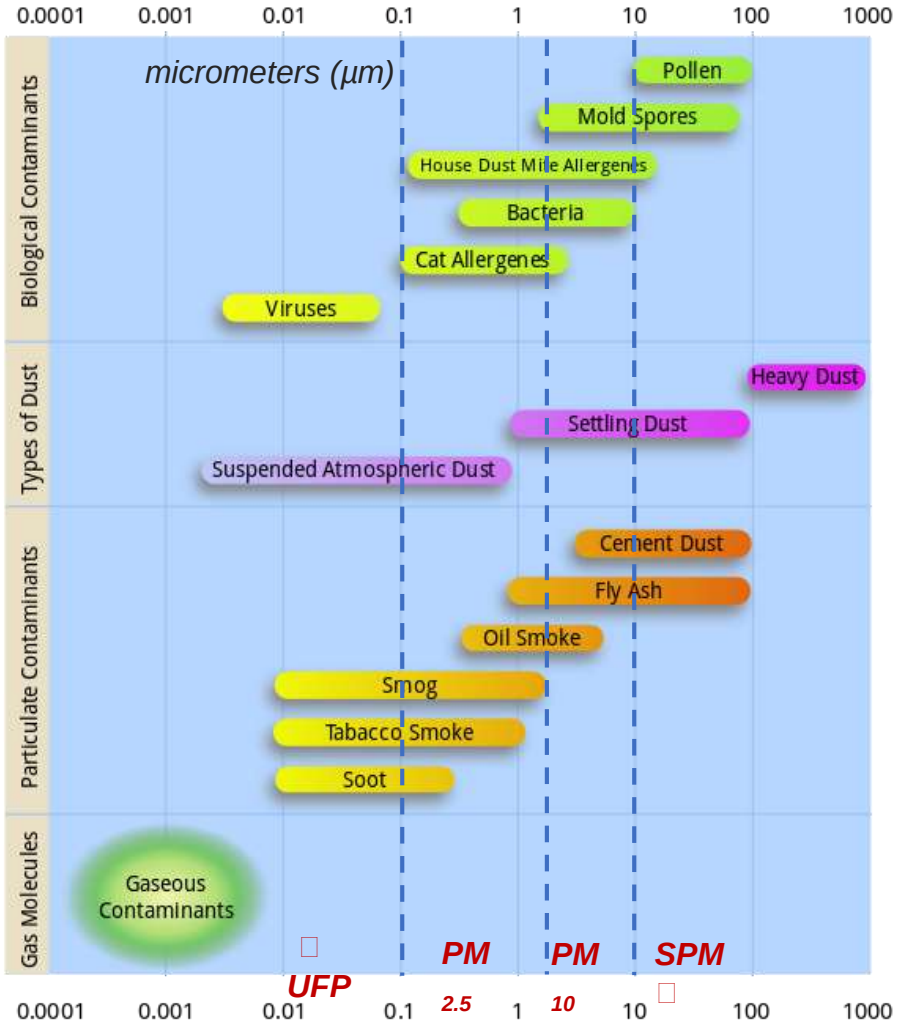
- Suspended Particle Matter (SPM): **>10µm**
- PM_{10} coarse, respirable: **2.5µm – 10µm**
- $PM_{2.5}$ fine particles: **0.1µm – 2.5µm**
- Ultra fine particles (nanometer scale): **<0.1µm**

Suspended Particle Matter (SPM):

- **Lifestyle associated:** Skin cells, dander, textile & paper fibres, smoke
- **Building associated**: Surface corrosion (ceiling, floors, walls), rust, insulation

Primary source of indoor particles below 10µm:

- High temperature/pressure combustion emissions from gas cookers, gas heaters & smoke from very hot cooking oil



GFDL, https://en.wikipedia.org/w/index.php?curid=48987967

Allergens

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Allergic reaction: Exaggerated response of immune system, often to common substances, in certain people

Common indoor allergens: House dust, mould spores, pollen, pet (dog & cat) dander, dust mites (debris & particles), rodents, certain foods

Allergy symptoms:

- Eczema
- Asthma
- Allergic rhinitis
- Allergic conjunctivitis
- Respiratory irritation (wheezing, sneezing, coughing)
- Hives
- Anaphylaxis

Pollen grains

Pet dander

Dust mites

Damp & Mould

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Mould-related contaminants:

- Mould spores
- Mould fragments
- Mycotoxins – toxic chemicals emitted by certain moulds
- Microbial VOCs (MVOCs) – emitted by growing mould

Alternaria

Observations:

15% of properties that showed little or no visual sign of mould, returned readings of greater than 10 ug-m3 of MVOC.

This suggests that they had potentially significant levels of active mould growth that was hidden from view.

50% of the properties with high MVOC readings reported multiple respiratory issues

Stachybotrys chartarum – Black mould

Volatile Organic Compounds

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Non-Volatile Organic Compounds – Particle-Bound Organic Matter

PAHs (~370-500°C)
Pesticides (~100-450°C)
Phthalates (~280-380°C)
Flame Retardants (~220°C)

Semi-Volatile Organic Compounds

- BP 240-260 to 380-400 ºC
- Primarily semisolid/solid state

Limonene (176°C)
Benzene (80°C)
MEK (80°C)
Hexane (68°C)
Acetone (56°C)

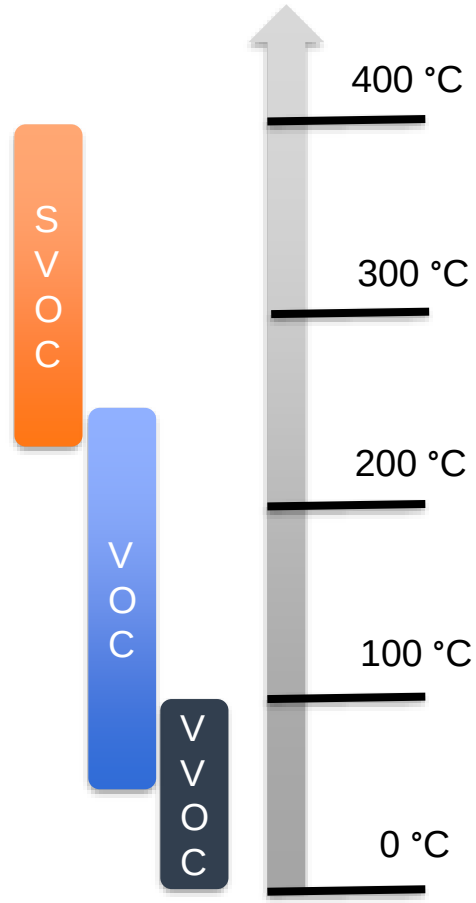
Volatile Organic Compounds

- BP 50-100 to 240-260 ºC
- Both gas and liquid/solid state

Very Volatile Organic Compounds

- BP < 50 to 100 ºC
- Permanent gases

Formaldehyde (-19°C)
CFCs (~ -40-50°C)
Ethane (-89°C)
Methane (-151°C)



World Health Organization (WHO) Definition

Sources of VOCs

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Sources of VOCs in indoor air:

Building related:

- Coatings (paints, varnishes…)
- Adhesives (flooring, dry wall…)
- Sealants – caulk
- Insulation materials

Lifestyle related:

- Air fresheners, perfumes & cosmetics
- Cleaning products & disinfectants
- Dry cleaning solvents

Mixed building & lifestyle related:

- Petrol & petroleum products
- Fuel oil, diesel fuel, kerosene
- Degreasing solvents (automotive & DIY-related)

Formaldehyde

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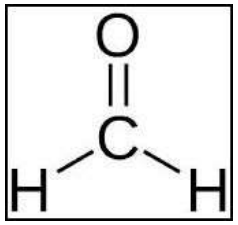
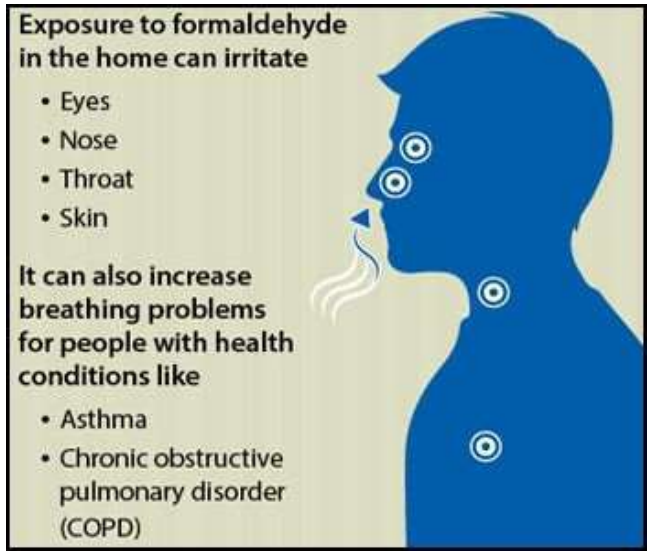
Formaldehyde:

- Naturally occurring VVOC (Boiling point -19°C)
- Highly reactive with a strong odour
- Used as a precursor in the production of many other products:
  - Very versatile for the manufacture of resins (urea-formaldehyde, phenol-formaldehyde, melamine)



Typical levels in air:

- Outdoor: 1-20 µg/m^3
- Indoor: 20-60 µg/m^3
- WHO guideline limit: 100 µg/m^3



Symptoms of exposure:

- Irritation of the mucus membranes – eyes, nose & throat
- Classified as a carcinogen

Sources of Formaldehyde

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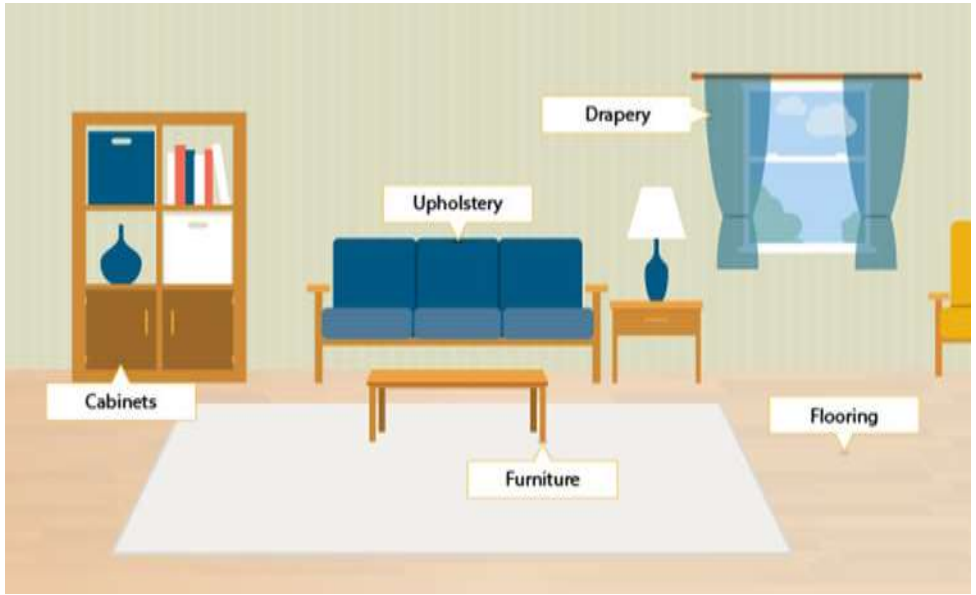
Indoor sources of formaldehyde:

- **Present in many construction materials:** Composite wood product (MDF, plywood, oriented strand board (OSB))
- Engineered hardwood & bamboo laminate flooring
- Cabinetry
- Insulation (glass & foam)
- Lifestyle/personal care products, including treated fabrics
- Emitted by combustion processes: heaters, wood burners/fireplaces, tobacco smoke
- **Significant levels often found in new or newly renovated homes**

Oriented Strand Board (OSB

MDF

Laminate flooring



Observations on VOCs

- **45% of homes had a level of TVOC measured at above 1000 ug-m3**
    - 1000 is the level that most modern homes now typically exhibit but it is also the level at which certain individuals, usually with a vulnerability or sensitivity, will begin to experience symptoms. Our research indicates day-to-day behaviour drives domestic contamination.
- **28% of homes with high TVOC readings reported multiple respiratory difficulties.**
    - Typically, the inhabitants of these properties reported some level of respiratory problem that affected them on a daily basis
- **17% of homes tested reported ratings of D&E on our scale**
    - This represents high to serious levels of contamination and, depending on the mix of VOCs involved, can be expected to have significant health impacts over time

Health impacts: heart and respiratory conditions including asthma; allergy symptoms; headache; drowsiness; skin irritation; confusion; nosebleeds; increased risk of cancer.

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Measuring and Reporting Indoor Air Quality

The test

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- **Temperature and Relative Humidity** – the temperature distribution and the amount of water vapour in the air across the house (moderated against conditions outdoors).
- **Carbon Dioxide** – a gas naturally found in the atmosphere but undesirable at elevated levels and a good proxy for air movement, measured in several locations.
- **Volatile Organic Compounds** (VOCs) – the overall levels of these airborne chemicals with full breakdown into 16 source categories.
- **Observed Mould & Microbial Volatile Organic Compound** (MVOC) – visual check and chemical analysis which identifies both visible evidence and invisible but actively growing mould.
- **Formaldehyde** – a colourless pungent gas used in building materials and many household products.
- **Observations and Questionnaire** – photos are taken, outdoor temperature and weather conditions are noted . Finally, the customer is taken through our simple health and lifestyle questionnaire, in order to create context for the specific property report (plus important research data for future analysis).

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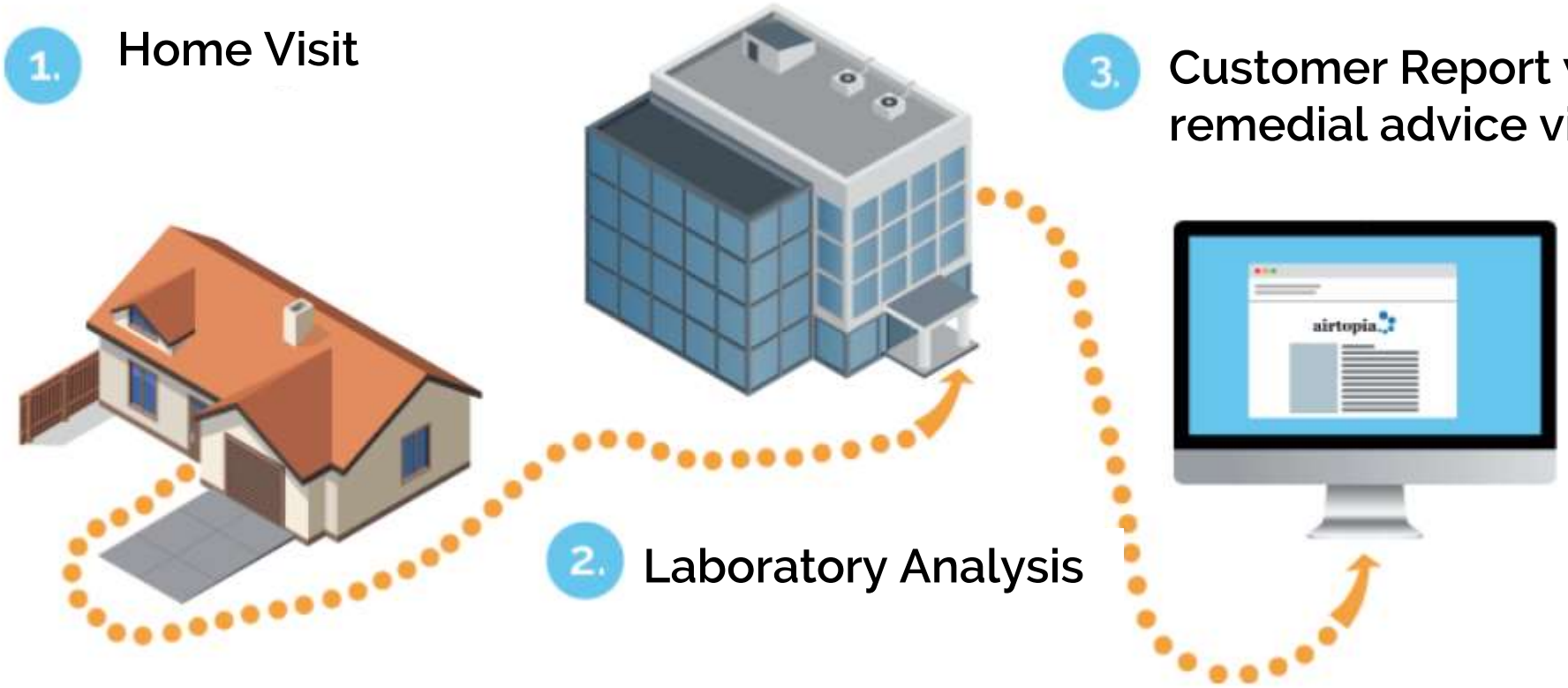
How it works

1. Home Visit



2. Laboratory Analysis

3. Customer Report with remedial advice via website

The Kit Bag

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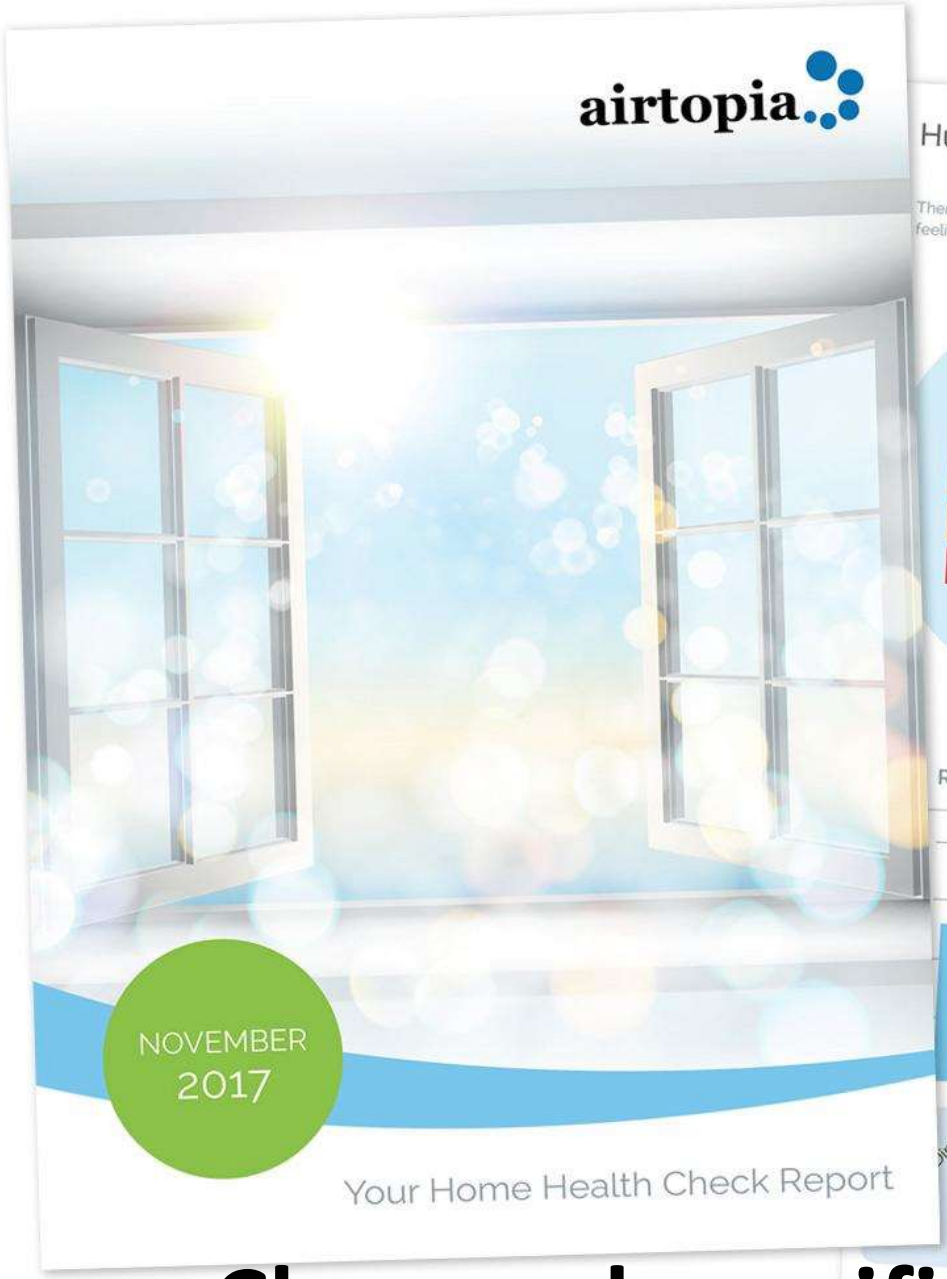

Clear and specific information upon which to act.

A social enterprise founded to create positive change

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- All profits are donated to the David Evans Grass Roots Foundation
  - Funding tests for those who need it most
  - Supporting educational opportunities to ‘future proof’ our youth
  - Improving the health opportunities of generations to come.

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Thank You!

THE HOUSE DOCTOR GROUP