Public Health England

Protecting and improving the nation's health

Air Quality, Episodes & Events

PHE Centre for Radiation, Chemicals & Environmental Hazards (CRCE)
Environmental Hazards & Emergencies Department

Scale of the problem

It is estimated that **long-term exposure to man-made air pollution in the UK** has an annual effect equivalent to:

28,000 to 36,000 deaths

Over the following 18 years a **1 µg/m³ reduction in fine particulate air pollution in England** could prevent around:

50,900 cases of coronary heart disease

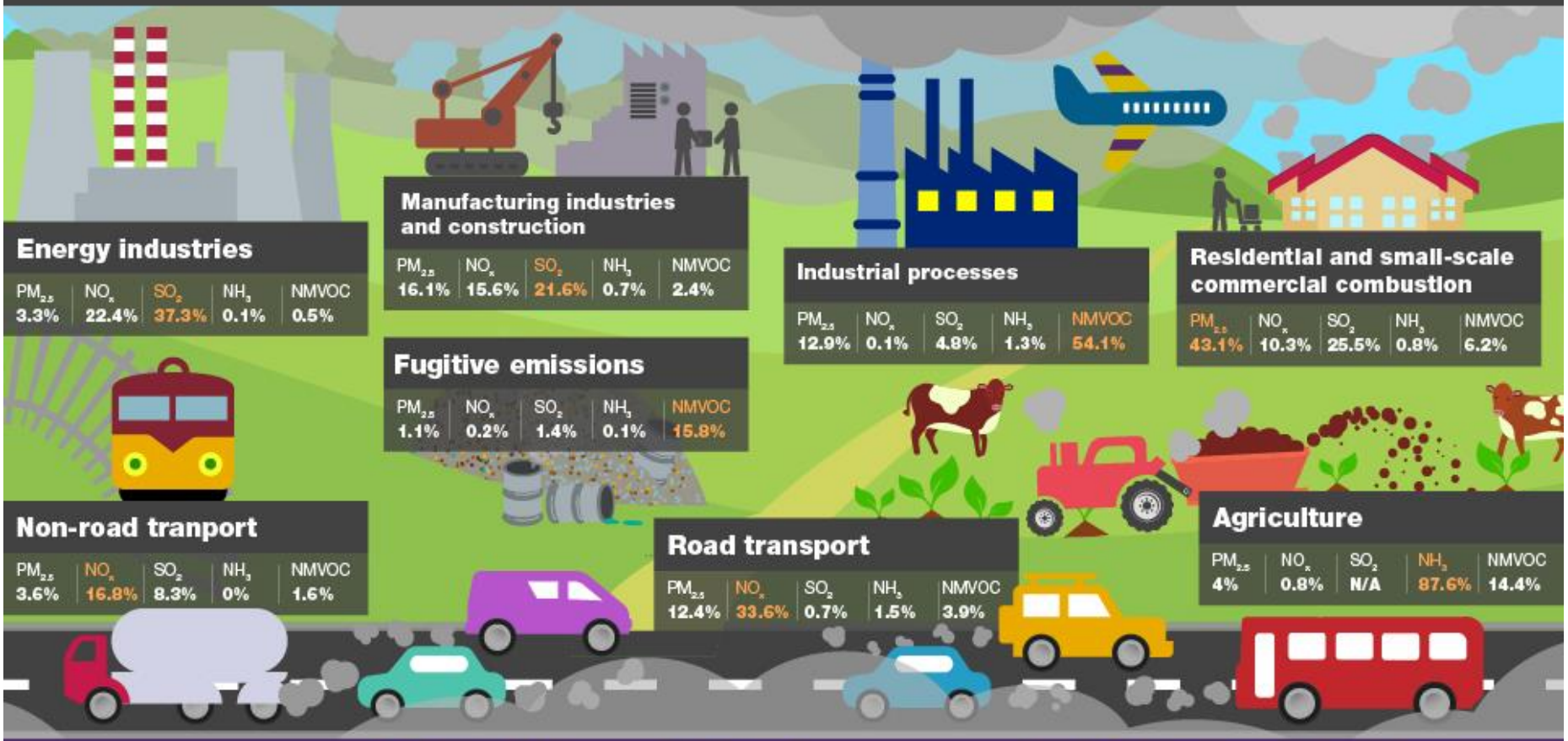
16,500 strokes

9,300 cases of asthma

4,200 lung cancers

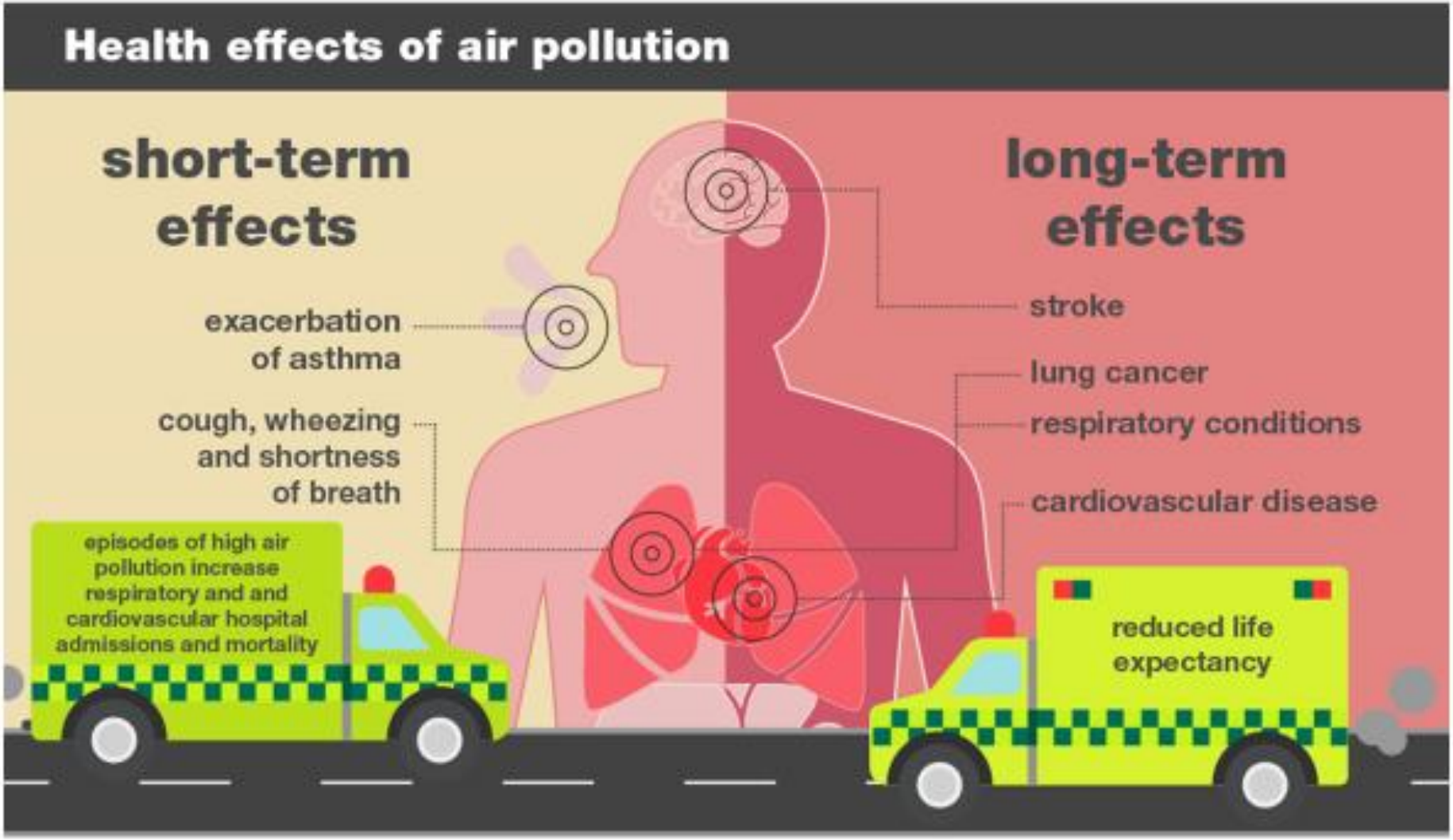
www.gov.uk/government/publications/health-matters-air-pollution

Sources of air pollution

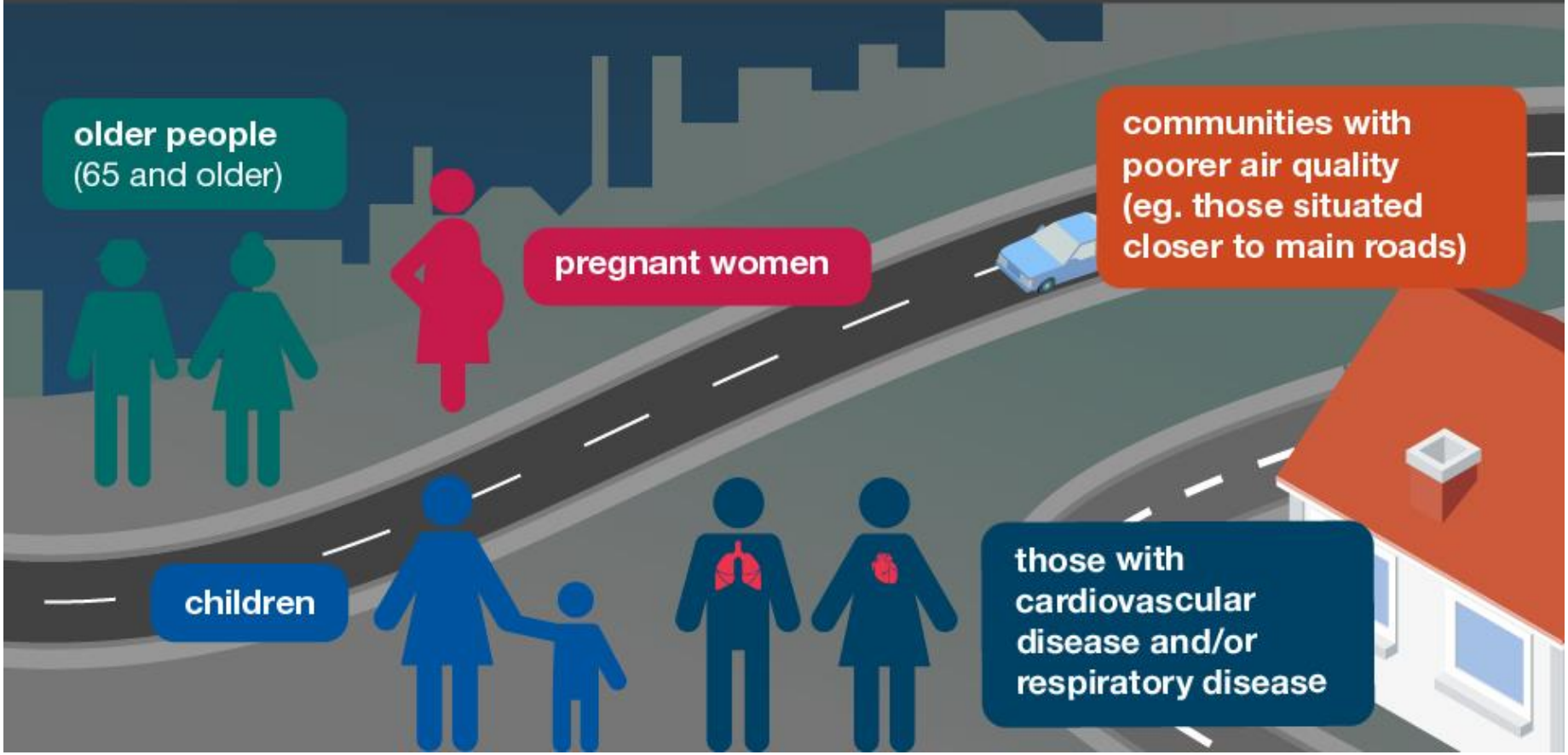


Pollution substances:

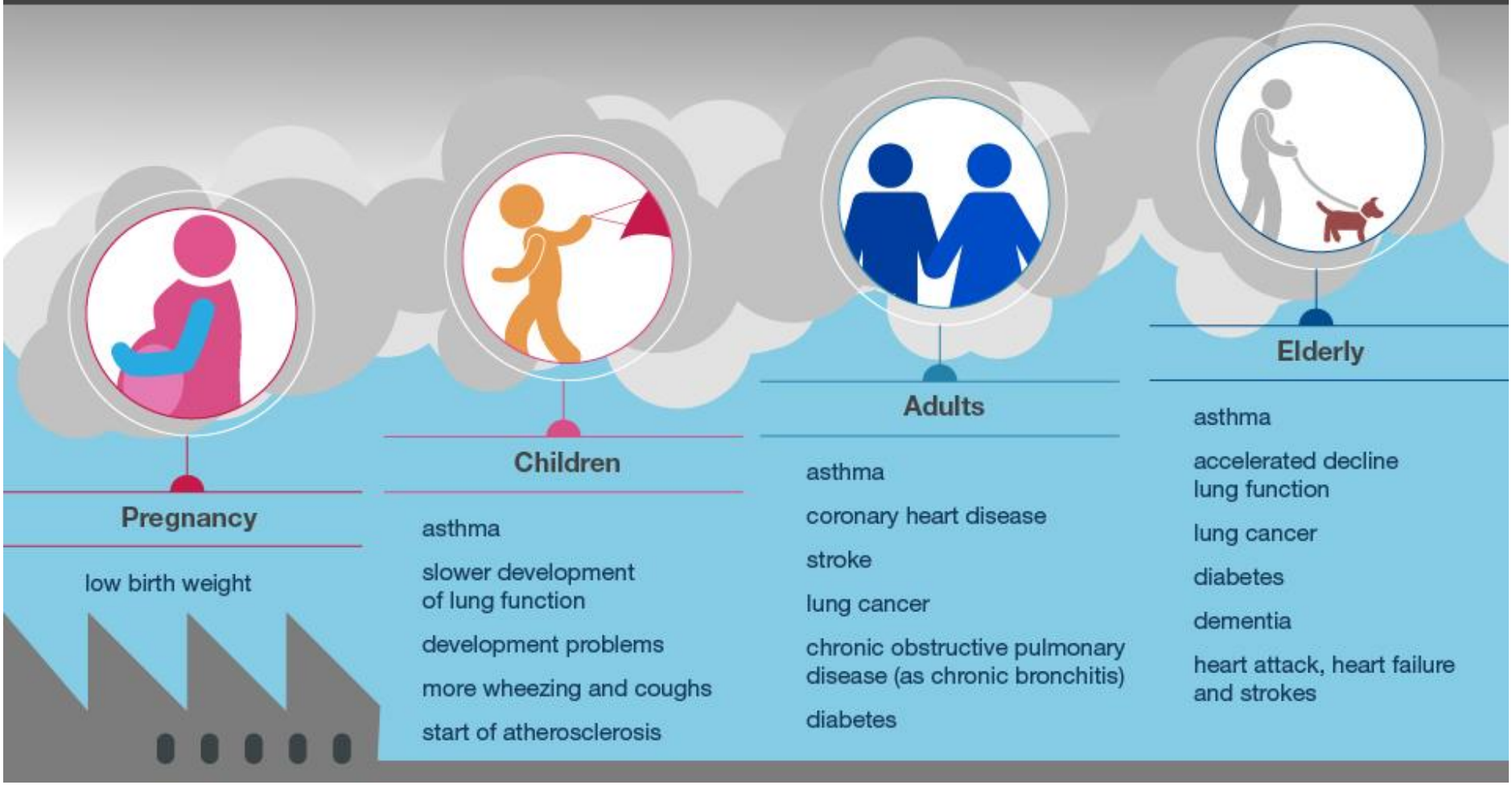
SO_2 - Sulphur dioxide
NO_x - Nitrogen oxides
NH_3 - Ammonia
$PM_{2.5}$ - Primary particulate matter
NMVOCs - Non-methane volatile organic compounds


Health effects of air pollution
short-term effects
exacerbation of asthma
cough, wheezing and shortness of breath
episodes of high air pollution increase respiratory and and cardiovascular hospital admissions and mortality
long-term effects
stroke
lung cancer
respiratory conditions
cardiovascular disease
reduced life expectancy

Air pollution affects everyone but there are **inequalities in exposure** and **the greatest impact on the most vulnerable**



Air pollution affects people throughout their lifetime



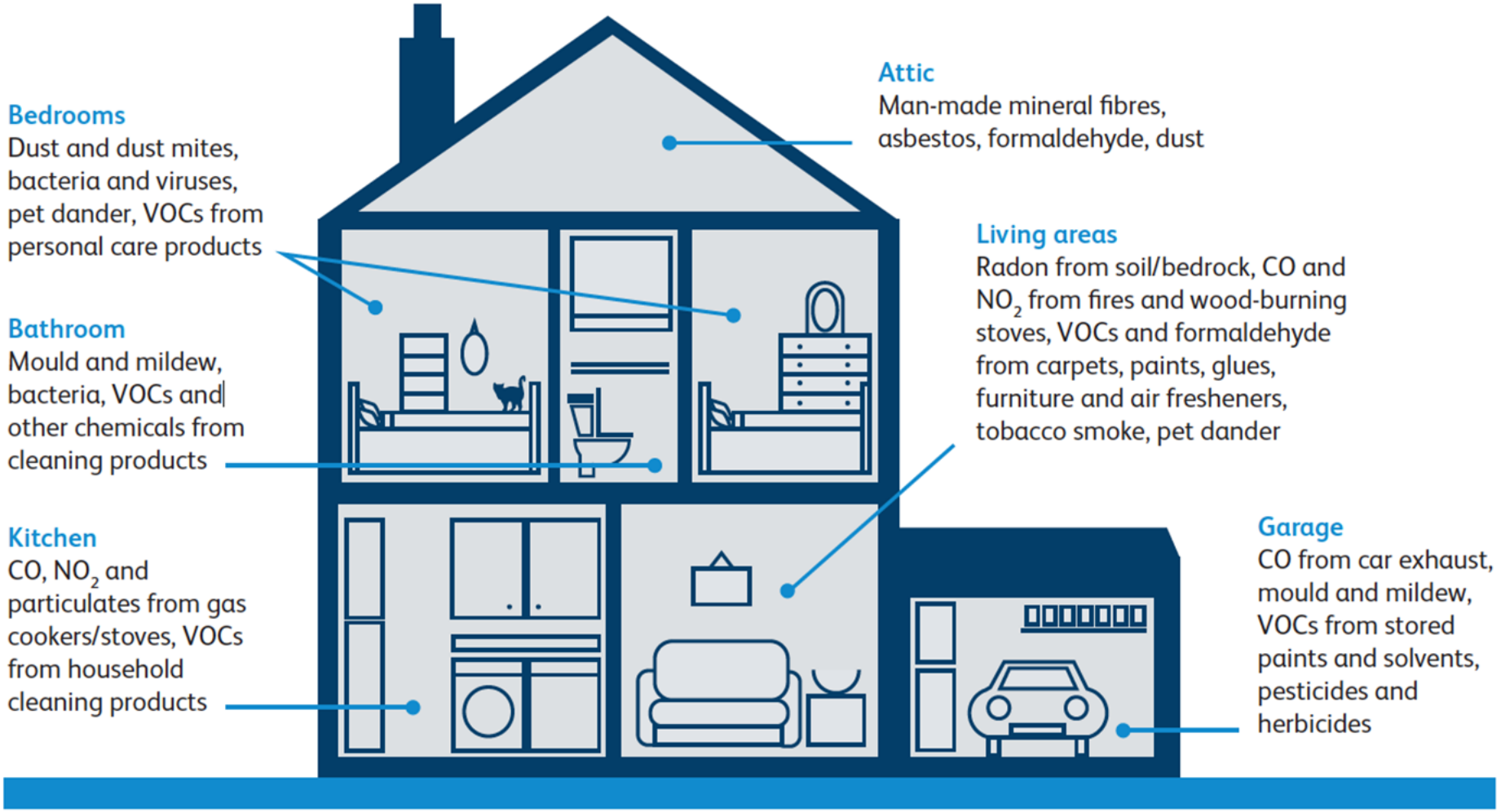


Fig 3. Sources and types of indoor pollution encountered in homes. VOCs = volatile organic compounds. Please note that these lists are not exhaustive and that the actual pollutants present, and their amounts, will vary from household to household.

Indoor air pollution

NICE

Limited association between exposure to indoor air pollution and ill health in the *healthy population*

Pre-existing conditions (respiratory or cardiovascular conditions or allergies) are particularly affected

Cough or *wheeze, nasal* or *throat symptoms*, and *eye irritation*

RCPCH

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

Improving indoor air quality

NICE National Institute for Health and Care Excellence

Actions for local authorities

Checking people's homes and giving advice

Use inspections and home visits to identify poor indoor air quality.

Staff who visit people's homes should:

- know about sources of indoor air pollutants and their effects on health
- give advice on avoiding activities that increase pollutants and improving ventilation (see below)
- know who can provide help with repairs and necessary improvements
- give advice on requesting a housing assessment if poor indoor air quality is suspected.

Advise private and social tenants to contact their landlord if:

- ventilation is inadequate
- repairs are needed to prevent water from entering the home
- improvements are needed to heating or insulation to prevent condensation.

Advise tenants to contact their local authority if no action is taken to improve ventilation or carry out repairs.

Advice on reducing damp and condensation

- Use background ventilation (trickle vents or whole-house mechanical ventilation)
- Use extractor fans and open windows (if possible and safe)
- Avoid moisture-producing activities (such as air-drying clothes) or, if unavoidable, improve ventilation
- Repair sources of water damage and remove residual moisture

Advice on increasing ventilation

Use extractor fans in bathrooms and kitchens, or open windows (if possible and safe) when:

- using cookers, especially gas cookers
- using open solid-fuel fires or free-standing gas heaters
- using candles
- using cleaning products, household sprays or aerosols and paints
- having a bath or shower
- air-drying clothes

Other advice

- Do not use unflued paraffin heaters
- Follow product instructions if using, for example, paint, glue and solvents
- Choose low-emission materials if replacing furniture or flooring
- Ensure adequate ventilation when installing a new cooker, especially for gas cookers
- Do not use gas cookers to heat a room
- Avoid smoking in the home

Actions for healthcare professionals

Advice for people with breathing or heart problems

- Explain that indoor air pollutants can trigger or exacerbate asthma, other respiratory conditions and cardiovascular conditions
- If repeated or worsening cough or wheezing, ask about housing conditions and help request a housing assessment if concerned
- If household sprays or aerosols trigger asthma, advise avoiding them or using non-spray products

Advice for people allergic to house dust mites

Advise on how to reduce exposure to to house dust mites, including:

- avoiding second-hand mattresses if possible
- using allergen barriers such as mattress and pillow covers
- washing bedding regularly

Advice for pregnant women and babies under 12 months

- Advise on the increased risks from poor indoor air quality
- Explain the risks of tobacco smoke
- Ask about housing conditions and help request a housing assessment if concerned
- Advise on reducing use of household sprays and aerosols
- Advise on avoiding or reducing use of open solid-fuel fires or candles
- Advise on avoiding smoking in the home or around the woman and baby

Actions for architects, designers, builders and developers

These recommendations apply both to building new homes and renovating or refurbishing existing homes.

Building materials and products

- Architects and designers should consider specifying materials and products that emit low levels of formaldehyde and volatile organic compounds (VOCs)
- Builders and developers should use materials as specified or substitute with products of the same or lower emission levels
- Builders and developers should ensure materials and products comply with building regulations, design specifications and the manufacturer's guidance

Designing heating and ventilation systems

- Adopt a whole-building approach to heating and ventilation, balancing indoor air quality with standards for energy use
- Use heating systems that minimise exposure to particulate matter
- Ensure there is permanent, effective ventilation
- Include provision for removing indoor air pollutants in designs, for example, windows that open and extractor fans that extract to outside
- Design ventilation to reduce exposure to outdoor air pollution, for example, with windows that face away from busy roads

Installing heating and ventilation systems

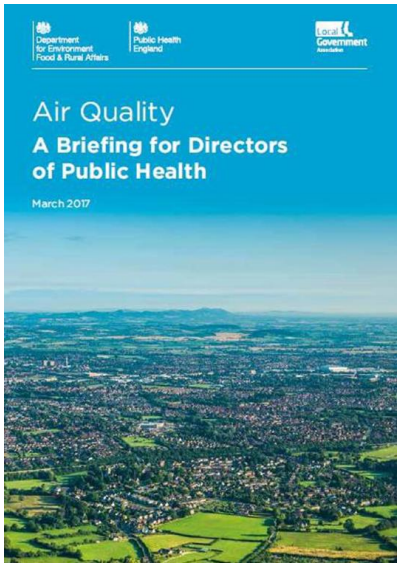
- Ensure heating and ventilation is installed and commissioned in accordance with the manufacturer's instructions and meets building regulation requirements
- When installing heating and ventilation systems, ensure they are easily accessible for regular maintenance
- Ensure any variations to the heating and ventilation specification comply with design specifications and building regulations

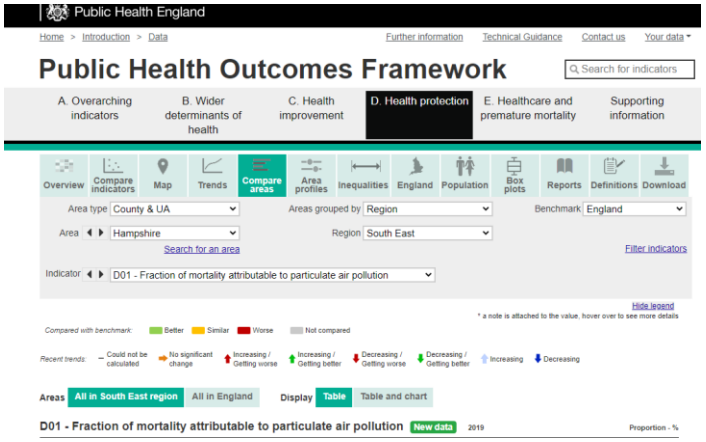
This is a summary of the recommendations on advice and information for the general population, healthcare professionals, architects and designers, and builders, contractors and developers in NICE's guideline on indoor air quality at home. See the original guidance at www.nice.org.uk/guidance/NG149

Published: January 2020

Resources

https://khub.net/group/phe-air-quality-and-public-health





www.gov.uk/government/publications/air-pollution-applying-all-our-health/air-pollution-applying-all-our-health

https://portal.e-lfh.org.uk/Component/Details/603166

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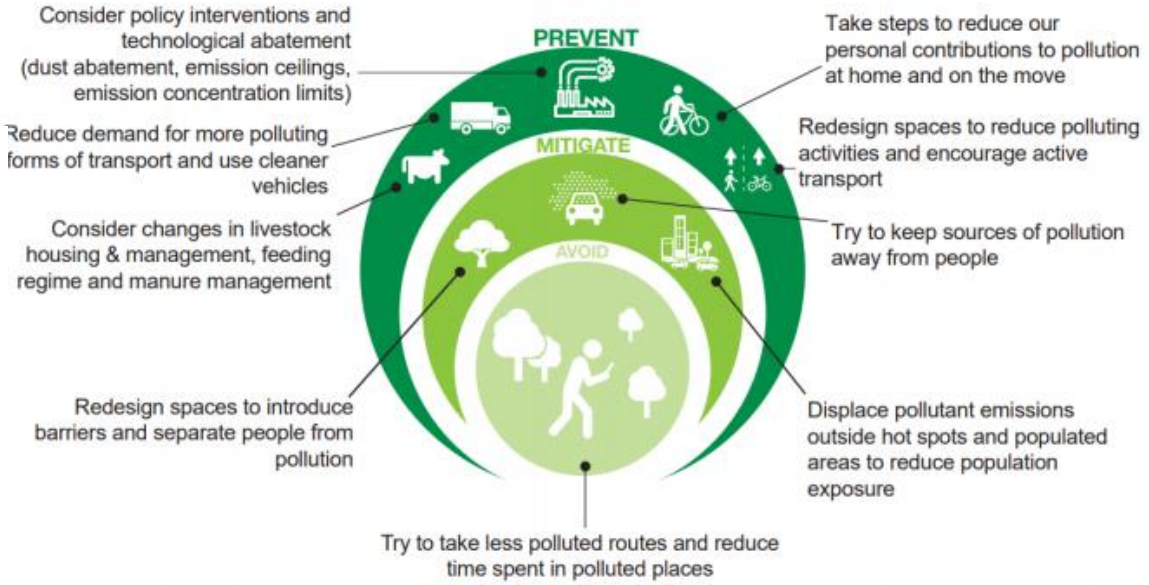
Protecting and improving the nation's health

Review of interventions to improve outdoor air quality and public health

Public Health England

Protecting and improving the nation's health



Review of interventions to improve outdoor air quality and public health:

Principal interventions for local authorities

Air Quality Hub
Practitioner's guide

Defra funded airqualityhub.co.uk/
aimed primarily at local authority practitioners

My local authority | My bookmarks | Strategy measures | Advice notes | **Case studies** | Forum | News | Events

Search case studies

Advanced search

Categories

- Agricultural emissions
- Alternative fuels/low emission vehicles
- Bus initiatives
- Car sharing and car clubs
- Clean Air Zones/Low Emission Zones
- Coach initiatives
- Commercial and domestic heat and power
- Cycling initiatives
- Development planning
- Electric vehicle (EV) charging

Clean Air Zones/Low Emission Zones

Birmingham City Council – Implementing a Type D Clean Air Zone

Birmingham City Council's establishment, implementation and operation of a Type D Clean Air Zone.

Local authority: Birmingham City Council

Read this case study

Traffic management initiatives

Welsh Government – Speed restrictions to tackle roadside nitrogen dioxide levels

Use of speed restrictions to reduce exposure levels at five locations in Wales, where the DEFRA PCM Model projected NO2 concentrations higher than the legal limit.

Organisation: Welsh Government

Read this case study

Schools/education

Newcastle City Council & Newcastle University – School Air Quality Monitoring

Newcastle City Council (NCC) and Newcastle University have been working in partnership to establish a monitoring network to more accurately assess air pollution at 22 schools across Newcastle.

Alternative fuels/low emission vehicles

Leeds City Council – CNG fuelled Refuse Lorries

Decreasing vehicle emissions in Leeds has been an ongoing project; since 2009, the council has trialled one gas powered refuse lorry and one which is dual fuelled.

Local authority: Leeds City Council

Daily Air Quality Index (DAQI) bands

Public Health England

https://uk-air.defra.gov.uk/air-pollution/daqi?view=more-info&pollutant=pm10#pollutant

Ozone | Nitrogen Dioxide | Sulphur Dioxide | PM2.5 Particles | PM10 Particles

PM_{10} Particles

Based on the daily mean concentration for historical data, latest 24 hour running mean for the current day.

Index	1	2	3	4	5	6	7	8	9	10
Band	Low	Low	Low	Moderate	Moderate	Moderate	High	High	High	Very High
µg/m³	0-16	17-33	34-50	51-58	59-66	67-75	76-83	84-91	92-100	101 or more

$PM_{2.5}$, PM_{10} particulates	24 hour running mean
SO_2 sulphur dioxide	15 minute concentration
NO_2 nitrogen dioxide	hourly concentration
O_3 ozone	8 hour running mean

Public Health England

Daily Air Quality Index (DAQI)

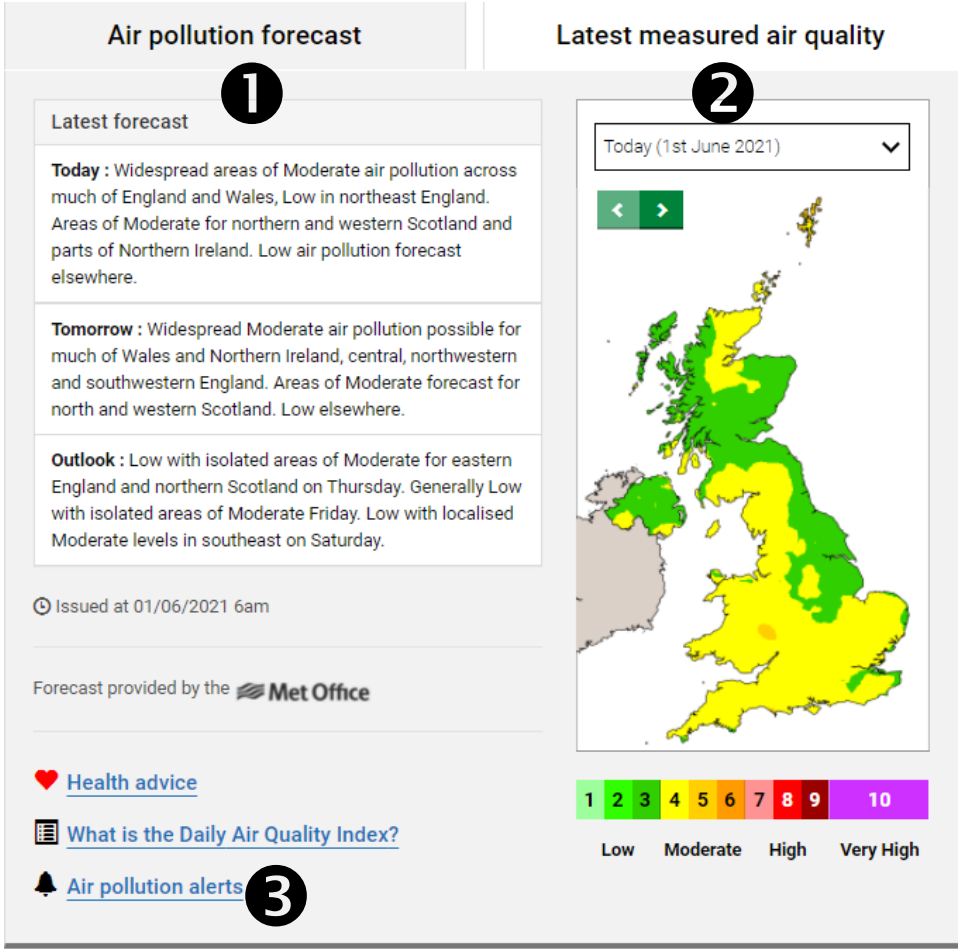
Recommended Actions and Health Advice

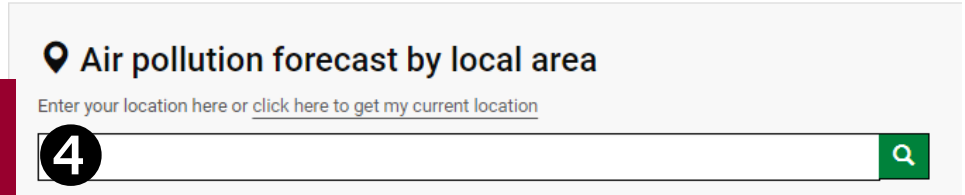
Air Pollution Banding	Value	Accompanying health messages for at-risk individuals*	Accompanying health messages for the general population
Low	1-3	**Enjoy** your usual outdoor activities.	**Enjoy** your usual outdoor activities.
Moderate	4-6	Adults and children with lung problems, and adults with heart problems, **who experience symptoms**, should **consider reducing** strenuous physical activity, particularly outdoors.	**Enjoy** your usual outdoor activities.
High	7-9	Adults and children with lung problems, and adults with heart problems, should **reduce** strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also **reduce** physical exertion.	Anyone experiencing discomfort such as sore eyes, cough or sore throat should **consider reducing** activity, particularly outdoors.
Very High	10	Adults and children with lung problems, adults with heart problems, and older people, should **avoid** strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	**Reduce** physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

Defra forecast, monitoring & alerts

https://uk-air.defra.gov.uk/

1. Forecast tab with today, tomorrow outlook and map view by day – selectable for +4 days.
2. Latest monitoring data tab – map view with more data selection links, e.g. from AURN network sites.
3. Air pollution alerts link – for high or very high. Can get ozone 180µg/m^3 1hr alert, but still at moderate for DAQI rolling. SO2 and NO2 unlikely.
4. Option to search for AQ forecast by area / city etc.





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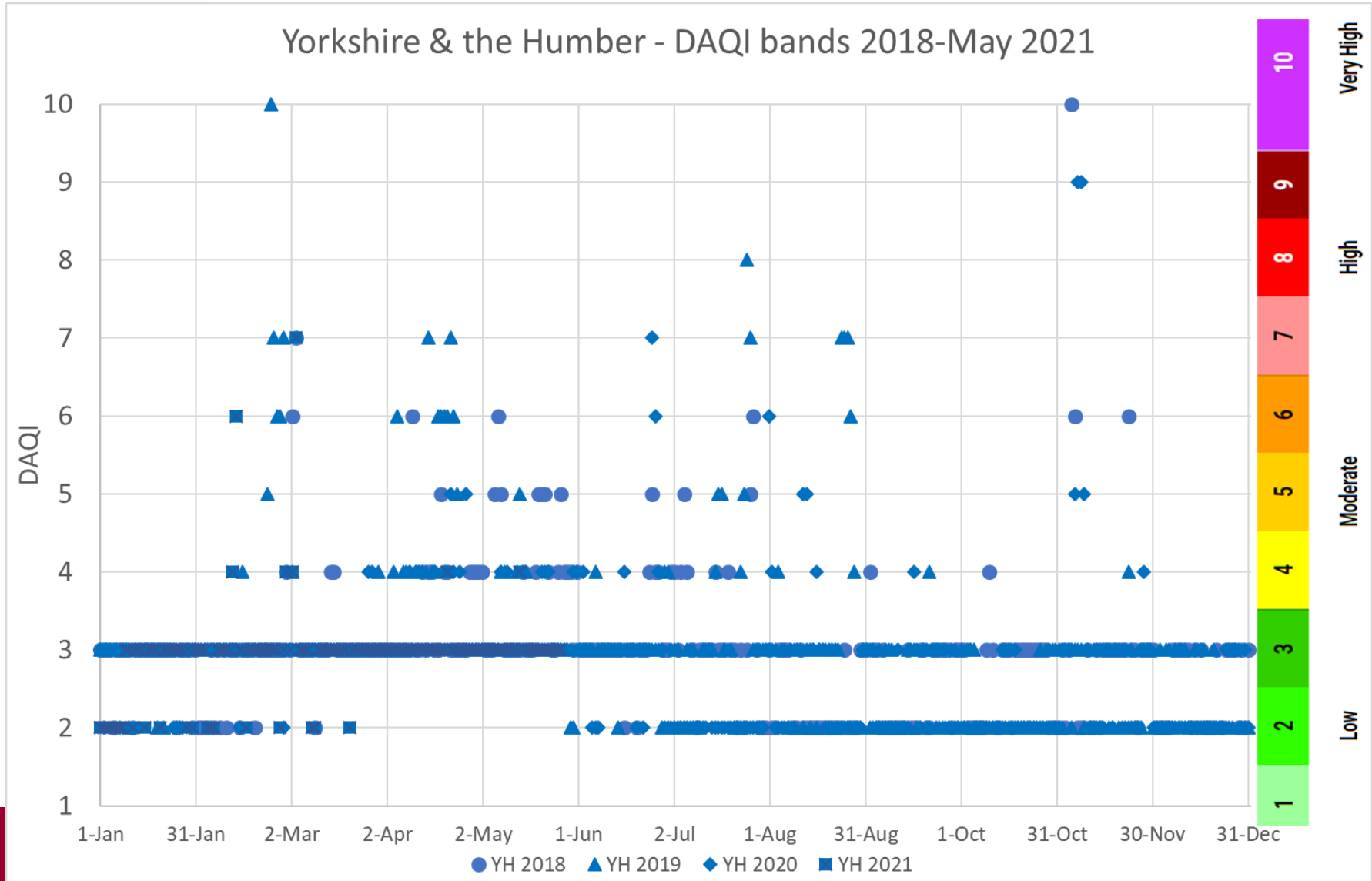
Air Pollution Episodes (APE)

Data from: https://uk-air.defra.gov.uk/data/DAQI-regional-data



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Air Pollution Episodes

Yorkshire & the Humber APE

DAQI band	2018	2019	2020	2021 to May
Moderate	48	42	30	6
High	**1**	**9**	**3**	**1**
Very High	**1**	**1**	**0**	**0**

- You can subscribe for alerts etc - https://uk-air.defra.gov.uk/subscribe
- Defra tweets forecasts, updates. https://twitter.com/DefraUKAir/
- Dependent on levels other organisations will cascade. Some councils have specific alerting systems which you can subscribe to.
- Further information: See p71–75 of https://www.local.gov.uk/publications/air-quality-briefing-directors-public-health

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UK Air pollution episode 2014

The Telegraph

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Smog shrouds London landmarks after 'perfect storm' increases pollution

Famous London landmarks hide behind the smog as high levels of air pollution causes problems across the east of England

NEWS

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UK | England | N. Ireland | Scotland | Alba | Wales | Cymru

Air pollution: High levels to spread across England

2 April 2014 | UK

theguardian

home > UK | education | media | society | law | all

Weather

UK air pollution: ambulance services report spike in 999 calls

Government helpline advises people to avoid exertion in areas of high pollution as experts warn smog will stay until weekend

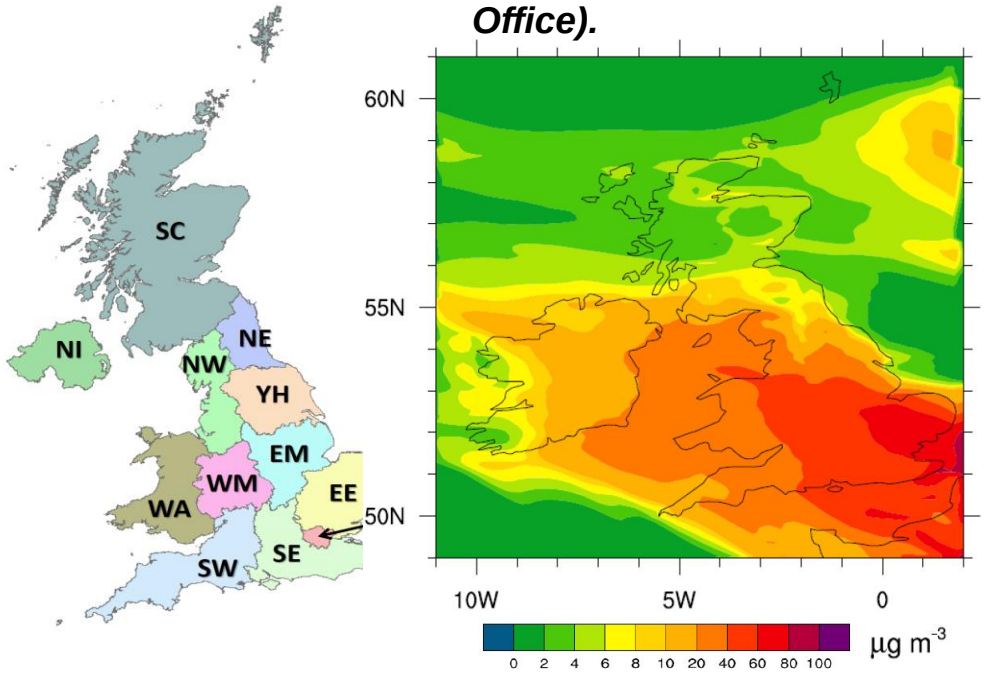
Public Health England

Health Impact Assessment

Focus on two episodes: 12th – 14th March, and 28th March – 3rd April 2014

- **$PM_{2.5}$ concentrations** from the AQUM met office model, 12 km [*Savage et al., 2013*]
- **Population** weighting of daily $PM_{2.5}$ using gridded 100 metre population
- Daily **mortality** and **emergency hospital admissions**
- Published **exposure-response coefficients** for short-term effects [*Atkinson et al., 2014*]. No threshold

Modelled daily mean $PM_{2.5}$ across the UK for 2nd April 2014, from the AQUM. ***(Calculated from hourly output provided by Met Office).***



Health outcome	R_e $PM_{2.5}$
Mortality (all-cause excluding external)	**1.04%** increase per 10 µg m^{-3}
Emergency respiratory hospitalizations	**0.96%** increase per 10 µg m^{-3}
Emergency cardiovascular hospitalizations	**0.90%** increase per 10 µg m^{-3}

Public Health England

All cause mortality

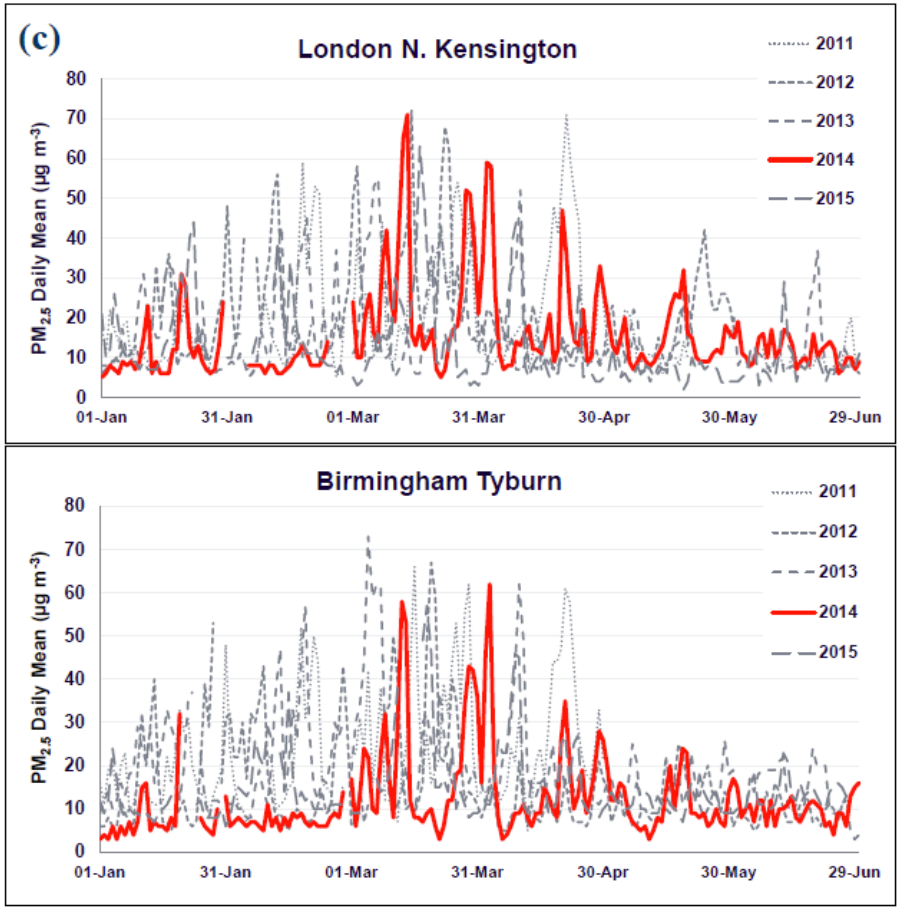
Analysed 12th – 14th March and 28th March – 3rd April

Total of around **600 deaths** due to short-term exposure to $PM_{2.5}$ summed across the UK

Estimate that around **300 of these would be expected** occur due to more typical levels of $PM_{2.5}$

Implies **two-fold increase** in mortality due to short-term exposure to $PM_{2.5}$

Macintyre *et al.* (2016), Environment International, Volume 97,2016,Pages 108-116



Observed daily mean $PM_{2.5}$ at an urban background site during January-June from 2012 to 2015 inclusive. *(Data from AURN via Defra website)*

Incidents

Public Health England

https://www.bbc.co.uk/news/live/uk-england-leeds-47384520

https://www.bbc.co.uk/news/uk-england-york-north-yorkshire-34812713

https://www.thetelegraphandargus.co.uk/news/18874103.live-huge-scrap-tyre-fire-breaks-bradford/

Air Quality Cell (AQC)

Public Health England

What? Multi-agency group of technical experts, meets virtually, assesses risk from acute chemical incidents involving an impact to air quality to help inform the public health and environmental risk assessment

Who?

Core members

Additional members

How? Decision to activate is made jointly by EA and PHE (CRCE EHE), initial meetings are rapid, information drawn from modelling, monitoring, previous incident experience etc. Provides interpretation and assessment of the air quality as the incident develops

Public Health England

Air Quality Cell

- Primary purpose of providing technical advice to multi agency incident response for major incidents
- Typically convened for incidents requiring battle rhythm of multiple daily meetings and interaction with Scientific, Technical Advice Cell, Strategic Coordination Group (SCG) or Tactical Coordination Group (TCG).
- AQC does not equate to monitoring – it is a Cell. Monitoring may be deployed, but for most AQC is not as evidence is available regarding messaging being appropriately protective. Local authorities should plan for monitoring if needed beyond early acute phase of an incident.

Further information for LRF members on Resilience Direct: https://collaborate.resilience.gov.uk/RDService/home/109280/LRF-Information-about-AQC-Response

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Thank You

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Selected Links:

- khub.net/group/phe-air-quality-and-public-health
- www.gov.uk/government/publications/health-matters-air-pollution
- www.gov.uk/government/publications/air-pollution-applying-all-our-health/air-pollution-applying-all-our-health
- www.gov.uk/government/publications/improving-outdoor-air-quality-and-health-review-of-interventions
- portal.e-lfh.org.uk/Component/Details/603166 (bite-sized training session)
- https://collaborate.resilience.gov.uk/RDService/home/109280/LRF-Information-about-AQC-Response
- uk-air.defra.gov.uk/
- airqualityhub.co.uk/
- www.local.gov.uk/publications/air-quality-briefing-directors-public-health
- www.nice.org.uk/guidance/ng149
- https://www.rcpch.ac.uk/resources/inside-story-health-effects-indoor-air-quality-children-young-people