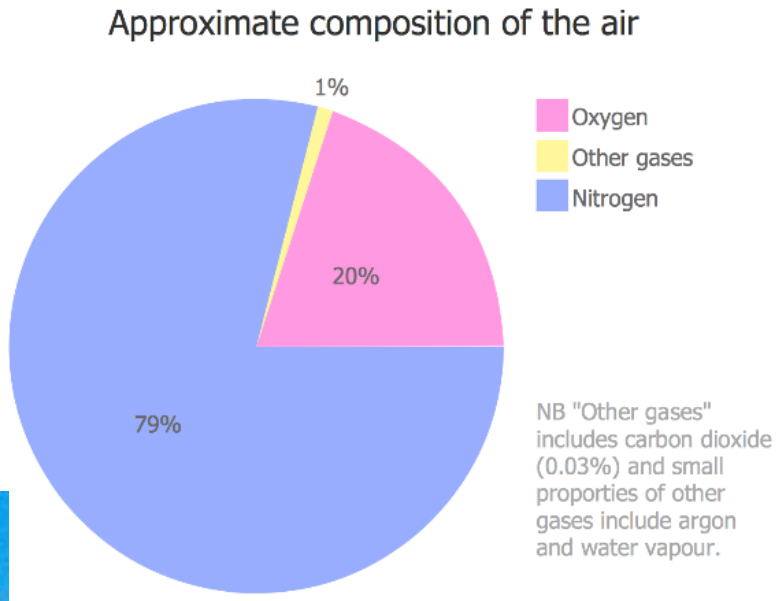
Air Pollution and Health, Smoke Control Areas, Air Quality Management Areas, and Clean Air Zones

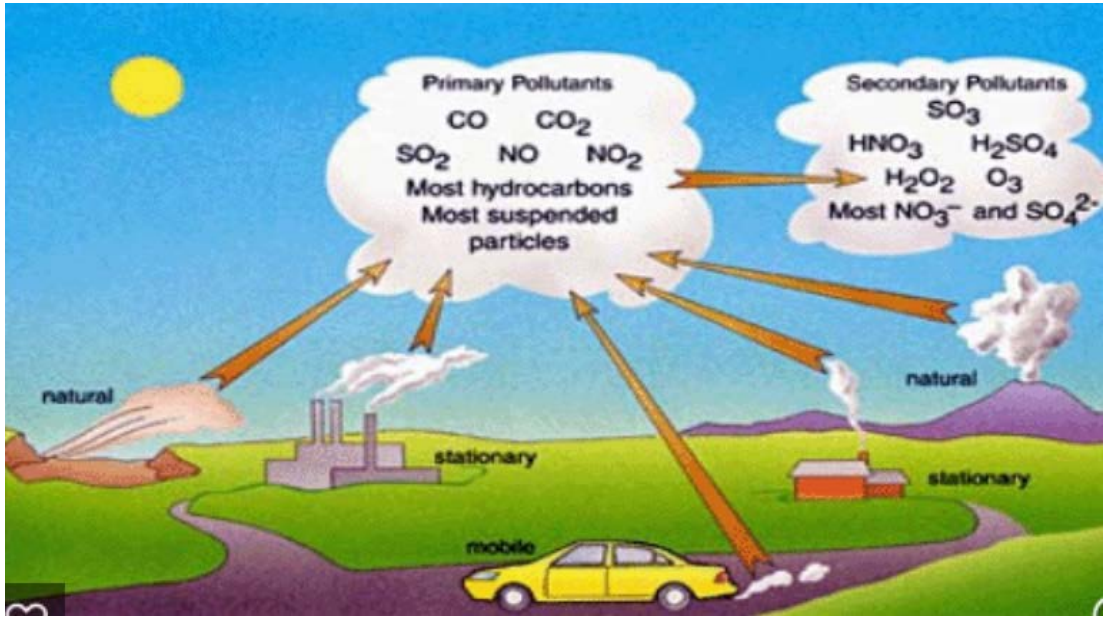
Richard Taylor
Community Protection: Environmental Health and Safer Places Team
Nottingham City Council

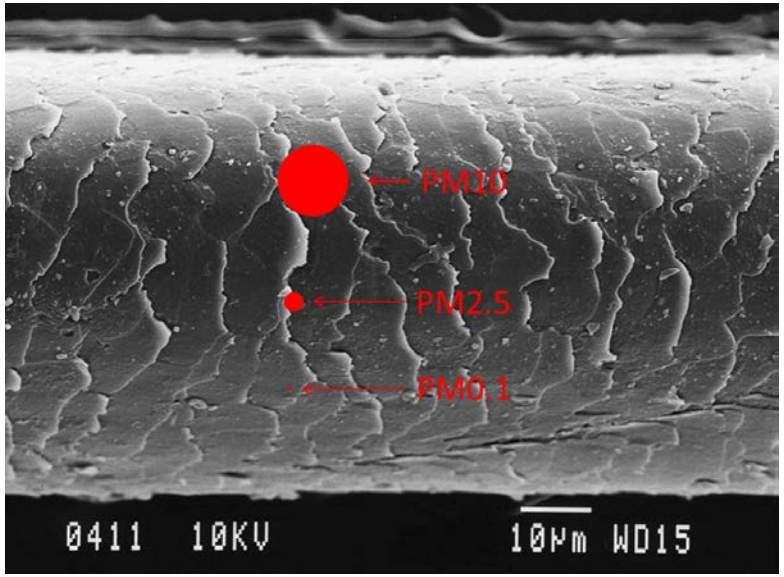
The Air we all breathe

is mostly nitrogen, oxygen and water vapour.

Natural and human activities emit other gases and particles into the air which affect our health and the environment







The health effects of the ‘pollutants of concern’ and Local Air Quality Management

Health Effects

Generally if you are young and in a good state of health, moderate air pollution levels are unlikely to have any serious short term effects. However, elevated levels and/or long term exposure to air pollution can lead to more serious symptoms and conditions affecting human health. This mainly affects the respiratory and inflammatory systems, but can also lead to more serious conditions such as heart disease and cancer. People with lung or heart conditions may be more susceptible to the effects of air pollution.

The table below shows the types of health effects experienced by the most common pollutants at elevated levels:

Pollutant	Health effects at very high levels
Nitrogen Dioxide, Sulphur Dioxide, Ozone	These gases irritate the airways of the lungs, increasing the symptoms of those suffering from lung diseases
Particles	Fine particles can be carried deep into the lungs where they can cause inflammation and a worsening of heart and lung diseases
Carbon Monoxide	This gas prevents the uptake of oxygen by the blood. This can lead to a significant reduction in the supply of oxygen to the heart, particularly in people suffering from heart disease

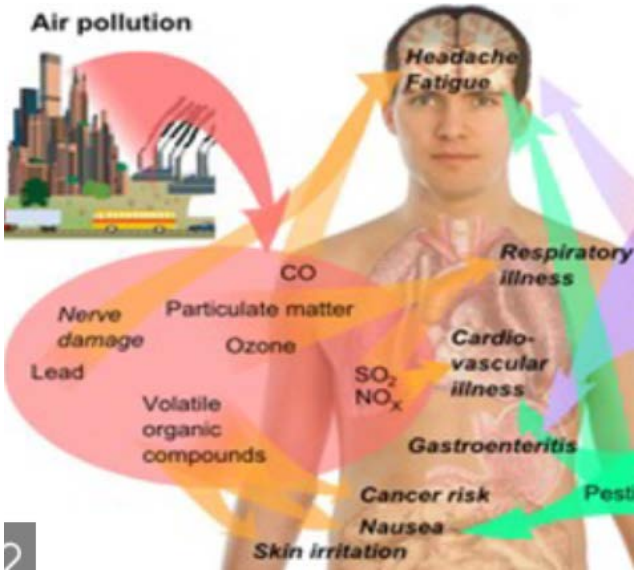
In the UK air pollution is estimated to shorten life expectancy by an average of 7 months – this means just a few weeks for some to **11 years for others…**

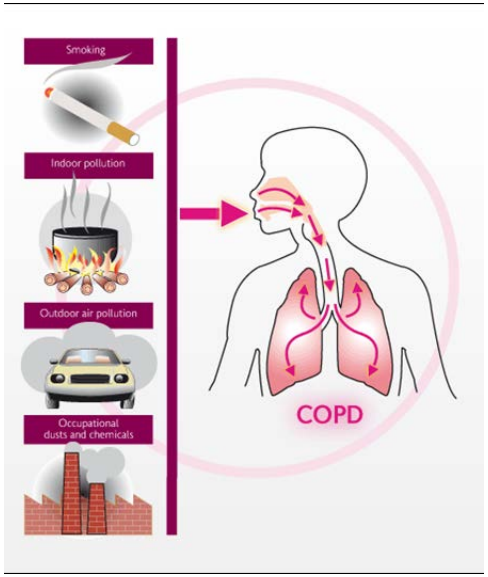
Air Pollution shortens lives

1952 – it was estimated 12000+ ‘died early’ due to ‘the great smog’

2008 - it was estimated 29,000 ‘died early’ from **invisible air pollution**

Jan 2016 – 29,000 revised upward to 40,000





Air pollution ‘episodes’ – prolonged periods of high concentrations have the most noticeable effect

LAQM: Air Quality Objectives to protect health

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Nitrogen dioxide	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu g/m^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

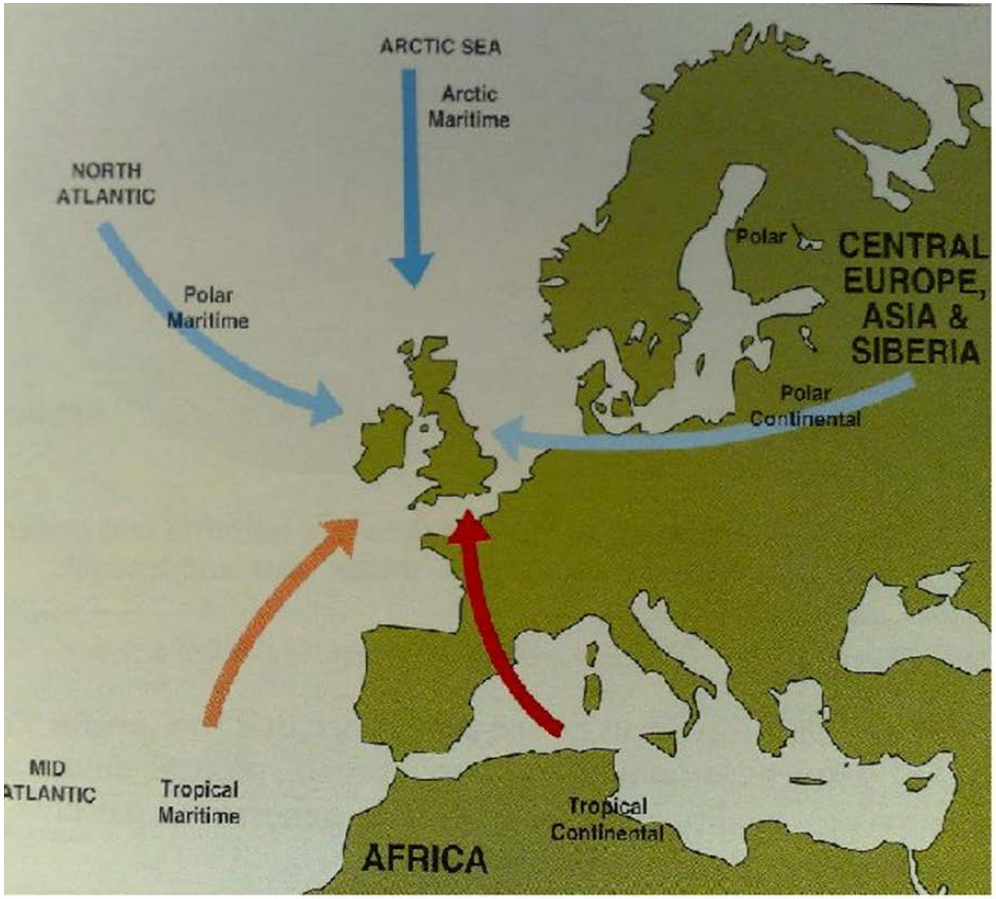
Meteorology and pollution episodes

Air pollution knows no boundaries.

Generally global air masses and weather systems disperse and dilute air pollution as they move and mix.

Under certain conditions air masses don't mix much, they simply carry the pollution within them from one place to another (e.g. Saharan dust/smoke from scrub fires in Portugal/Spain carried in the Tropical Continental Air Mass to the UK (2015 & 2017), or Icelandic volcanic dust carried in the Polar Maritime Air Mass to the UK (2016)),
Alternatively an air mass can remain over an area for a few days/week, allowing air pollution levels to increase,

both of these situations can lead to 'air pollution episodes'.



Air Pollution episodes (seasonal)

UK-AIR data: 03/04/2014 (View Latest)
Summary from 129 monitoring sites

Index Bands

1 2 3	4 5 6	7 8 9	10
Low	Moderate	High	Very High

You should follow the 3 steps below to use the Daily Air Quality Index.

Step 1: Determine whether you (or your children) are likely to be at-risk from air pollution.

Information on people who may be affected is provided on the Additional information on the short-term effects of air pollution page. Your doctor may also be able to give you advice.

Step 2: If you may be at-risk, and are planning strenuous activity outdoors, check the air pollution forecast.

Step 3: Use the health messages below corresponding to the highest forecast level of pollution as a guide.

Recommended Actions and Health Advice

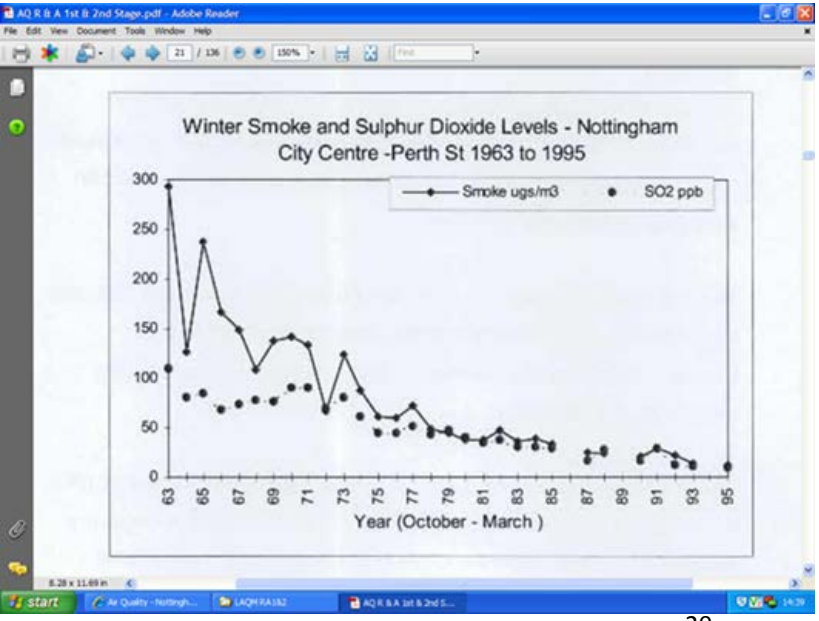
Air Pollution Banding	Value	Accompanying health messages for at-risk individuals*	Accompanying health messages for the general population
Low	1-3	**Enjoy** your usual outdoor activities.	**Enjoy** your usual outdoor activities.
Moderate	4-6	Adults and children with lung problems, and adults with heart 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.

*Adults and children with heart or lung problems are at greater risk of symptoms. Follow your doctor's usual advice about exercising and managing your condition. It is possible that very sensitive individuals may experience health effects even on Low air pollution days. Anyone experiencing symptoms should follow the guidance provided below.

Clean Air Acts 1956, 1968, 1993

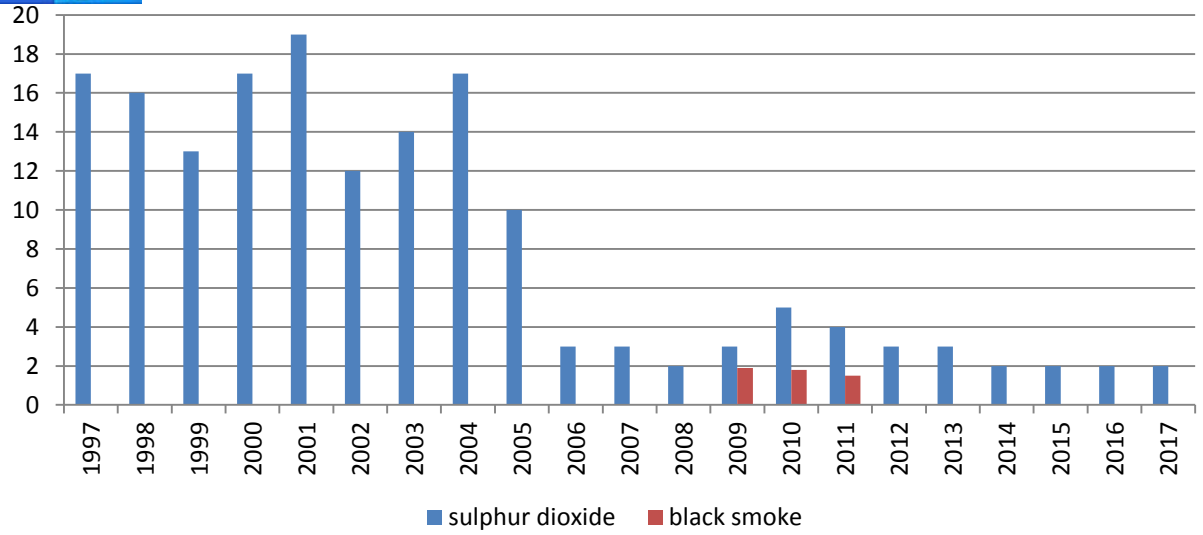
- Introduced smoke control areas better known as smokeless zones and made the air visibly cleaner (most of the time) and significantly and dramatically reduced concentrations of sulphur dioxide (acidic toxic gas produced by burning coal) and visible/black smoke

Clean Air Act and effect on particles and sulphur dioxide in Nottingham c.1963- present

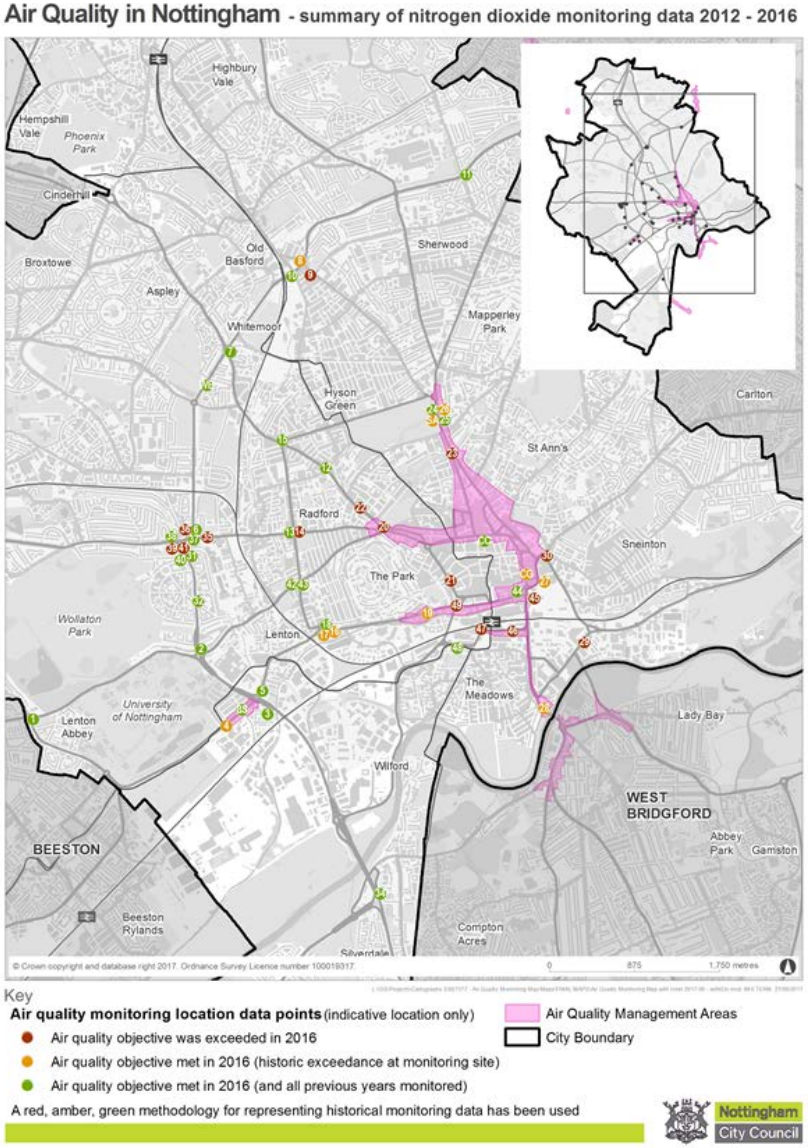


- Note black smoke particles range in size from <0.1 to 100 microns.
- 1963-1995 monitoring using 8-port volumetric apparatus (reflectometer and hydrogen peroxide titration)
- 1997 onwards UV fluorescence for SO2 and aethelometer for black smoke

Nottingham AURN annual mean black smoke and sulphur dioxide concentrations ug/m3



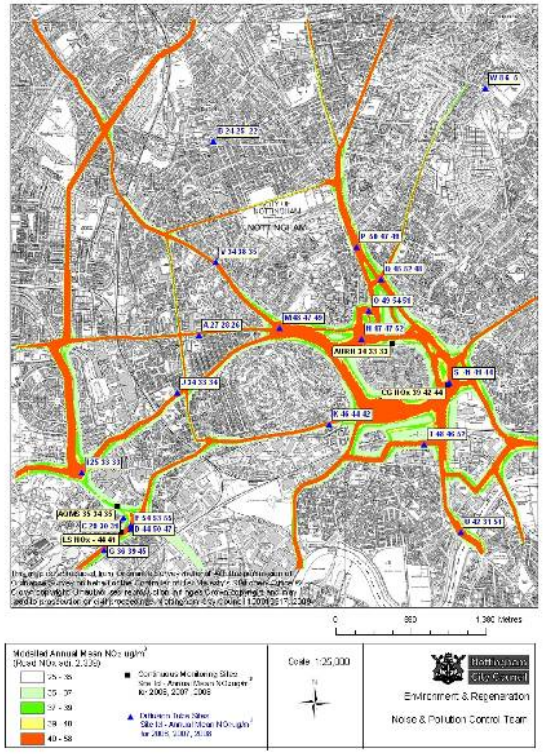
Local Air Quality Management



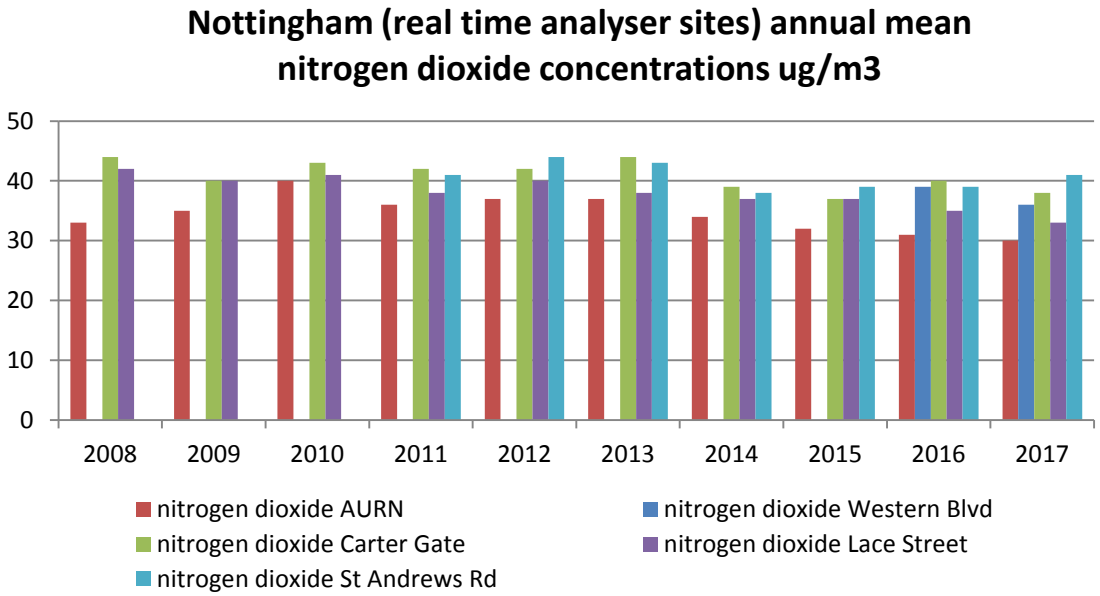
- Environment Act 1995 Part 3: Local Air Quality Management process identifies areas where the nitrogen dioxide annual mean air quality objective of 40ug/m3 is/will not be met, requiring Air Quality Management Areas and Action Plans. Two AQMAs were declared for NO2.
- The Air Quality Action Plan is currently contained in the Local Transport Plan
- The 2017 Annual Status Report (using monitoring data from 2016) identified several locations outside the two AQMAs where levels of NO2 exceeded the AQO of 40 *u*g/m3
- The Lace Street/Beeston Road AQMA has consistently met the AQO since 2012.
- This requires a further assessment that is likely to lead to the revocation of AQMA 3 (Lace Street/Beeston Road) and a variation of the spatial extent of AQMA 2 (City Centre) to encompass the new locations of exceedence.

Monitoring and Modelling to assess and predict air quality

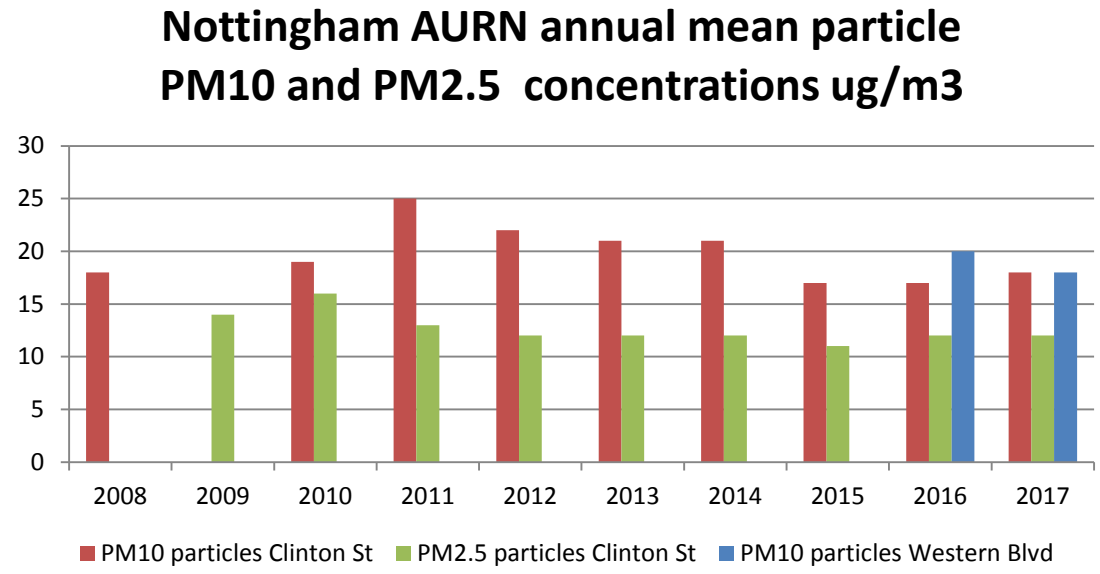
- Monitoring and modelling air pollution are balanced to make the most of resources (time/cost), accuracy, and spatial and temporal distribution.
- Modelling is the most practicable and systematic way of predicting future concentrations over a large geographical area.
- Monitoring is required to show actual air pollution levels (for comparison with Air Quality Objectives) .



Nottingham - Monitored levels 2008 - 2017



NO2 annual mean AQO =40 *u*g/m3
BUT health effects observed at 20-25 *u*g/m3



PM10 annual mean AQO = 40 *u*g/m3
WHO guide 20 *u*g/m3

PM2.5 indicative annual mean (England) = 25 *u*g/m3
WHO guide = 10 ug/m3

BUT no safe exposure limit

Identifying and delivering air quality improvements to meet the air quality objectives, and **protect health**

Nottinghamshire Air Quality Strategy 2008 – reviewed and revised 2016-18.

New format web based Strategy to be launched Summer 2018.

Nottingham City Air Quality Action Plan (new plan under development)

Local Transport Plan

'Go Ultra Low' program

awareness 'try before you buy'

+ charging infrastructure improvement

Workplace Parking Levy

Public Transport

tram, electric and low emission buses, taxi strategy (ULEV)

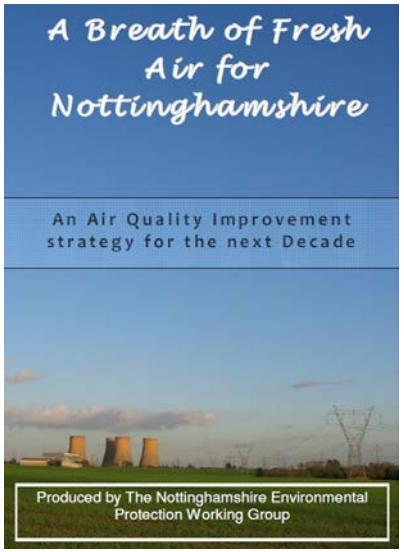
Active travel – walking and cycling

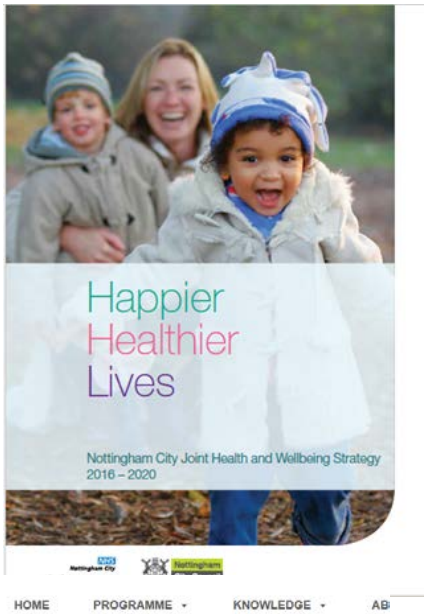
Joint Health and Wellbeing Strategy 2016-2020

Environment theme

NHS Sustainability and Transformation Plan(s)

Clean Air Zones – 2nd iteration of UK strategy successfully challenged by ClientEarth (21Feb2018). Nottingham working to original timescales/deadlines.





Clean Air Zones

First proposed by DEFRA in 2015

- Problem believed to be 800m stretch on ring-road at ‘Crown Island’

DEFRA revised modelling 2017

- Extended length of stretch of ring road and added Lower Parliament Street/London Road

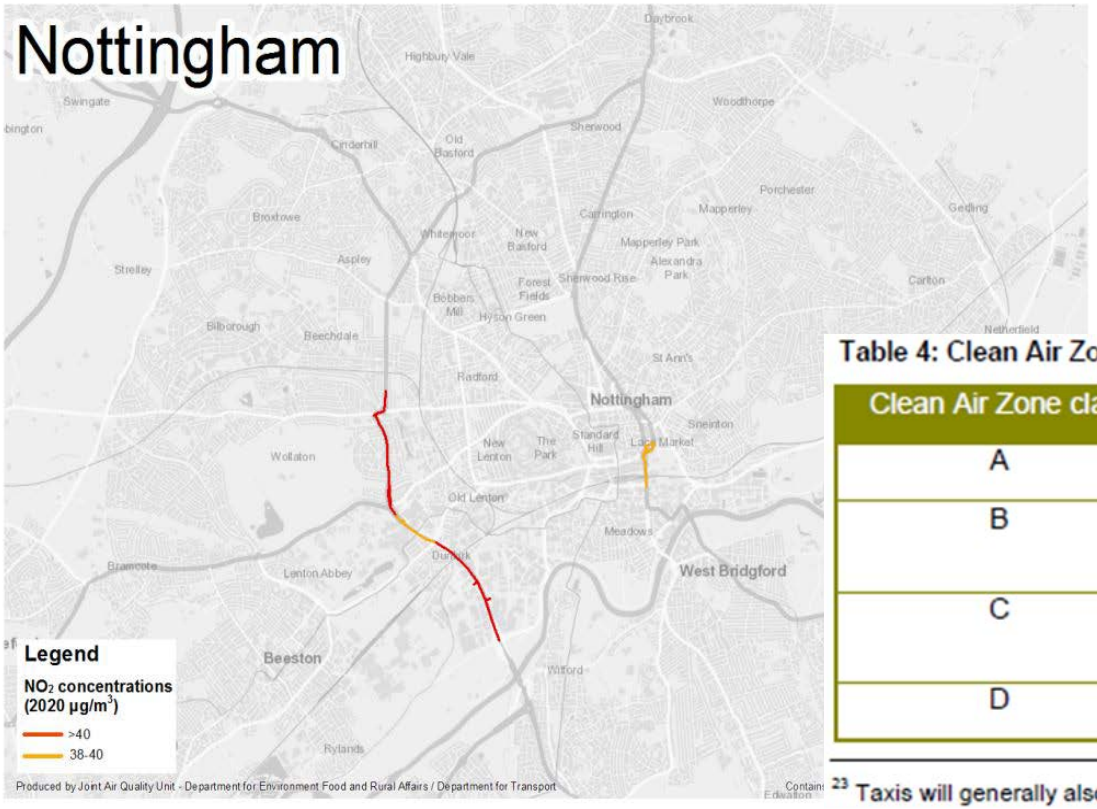


Figure 1: Map showing the extent of the Nottingham Urban Area ag

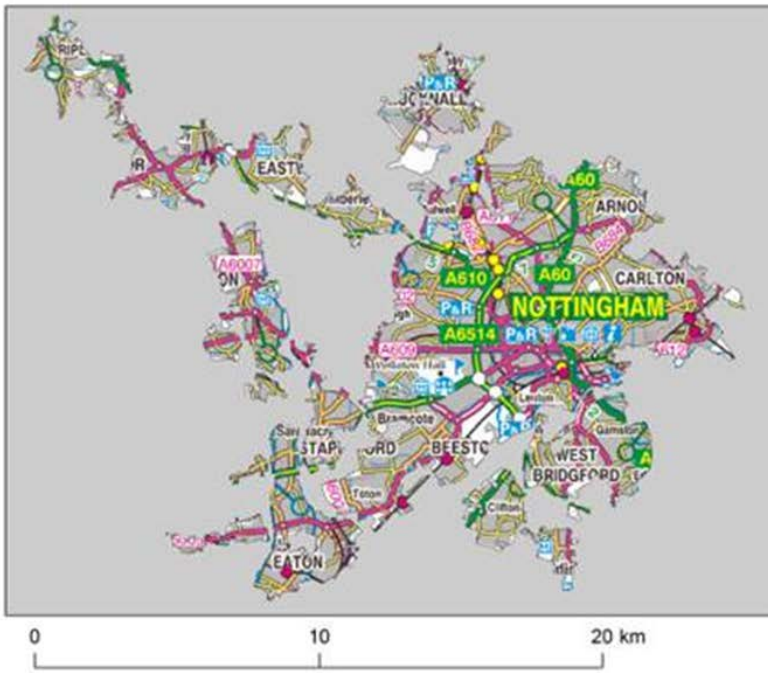


Table 4: Clean Air Zone Classes

Clean Air Zone class	Vehicles included
A	Buses, coaches and taxis[23]
B	Buses, coaches, taxis and heavy goods vehicles (HGVs)
C	Buses, coaches, taxis, HGVs and light goods vehicles (LGVs)
D	Buses, coaches, taxis, HGVs, LGVs and cars

[23] Taxis will generally also include private hire vehicles

CAZ – Nottingham's approach

- Working closely with the DEFRA/DfT 'Joint Air Quality Unit (JAQU)
- Consultants (specialising in traffic) model traffic flows, driver behaviour and predict traffic levels on all roads in study area for future years, and pass this information to :-
- Consultants (specialising in air quality) model effects of:- area, point source, and existing and future traffic emissions (and changes in vehicle technology), background pollution levels, meteorology and topography to predict 2016 and 2020 NO2 concentrations across the City.
- Iterative process.
- Initial preferred 'provisional' option will be submitted to DEFRA in Outline Business Case – currently a Class B BUT Geographic extent of CAZ to be determined.

Work plan/project programme for 2018-19

- CAZ modelling/assessment/development March-May
- LAQM Annual Status Report/Detailed Assessment
- Draft Supplementary Planning Guide: Development and Air Quality
- CAZ and air quality awareness raising - March
- British Lung Foundation Breathe Easy Week 18th -24th June
- (National) Clean Air Day 21st June
- FestEVal Nottingham's Ultra Low Emission Vehicle event 29th and 30th June
- LAQM ASR/DA submission to DEFRA for 30th June
- CAZ – public consultation June-July 2018
- New Nottinghamshire Air Quality Strategy website Summer 2018
- CAZ formalized by Secretary of State (Aug-Sept 2018)
- Air Quality Management Areas (revised/revoked) Oct-Nov 2018
- Nottingham Air Quality Action Plan
- Winter 2018-19 Clean Air Act Smoke Control awareness and enforcement.