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# Air Pollution

Dr Alison Greig,



- What is air pollution?
- Where does it come from?
- Air Pollution in the UK – a brief historical perspective
- Air Pollution today
- Pollution impacts
- Air Pollution and sustainability

Caveat...

The **presence** in or **introduction** into the air of a substance which has **harmful** or poisonous effects (Oxford English Dictionary)

Harmful to who/what?

Doesn't matter where it comes from

# 'Natural' Pollution



Lake Nyos: Cameroon  
1986 eruption CO<sub>2</sub> emissions killed people and animals



Particles  
Sulphur dioxide  
Toxic gases

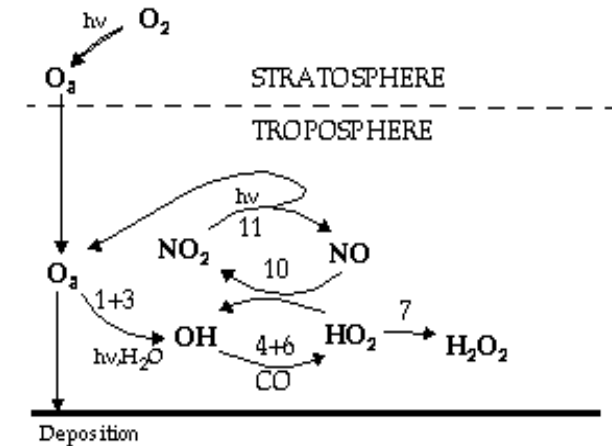


# Human pollution



# Characteristics of air pollution

- Not the presence *per se* but the concentration and composition which is important
- Once in the atmosphere can not be retrieved!
- Cocktail of gases and particles
- Primary and secondary pollutants
  - Secondary pollutants often subject to complex/ photo-chemical reactions



# Most common air pollutants

Carbon Dioxide

Carbon Monoxide

Oxides of Nitrogen  
(NO<sub>x</sub>), - NO and NO<sub>2</sub>

Sulphur Dioxide

Volatile Organic  
Compounds (VOCs)



Small Particles

Ozone (in lower  
atmosphere)

CFCs

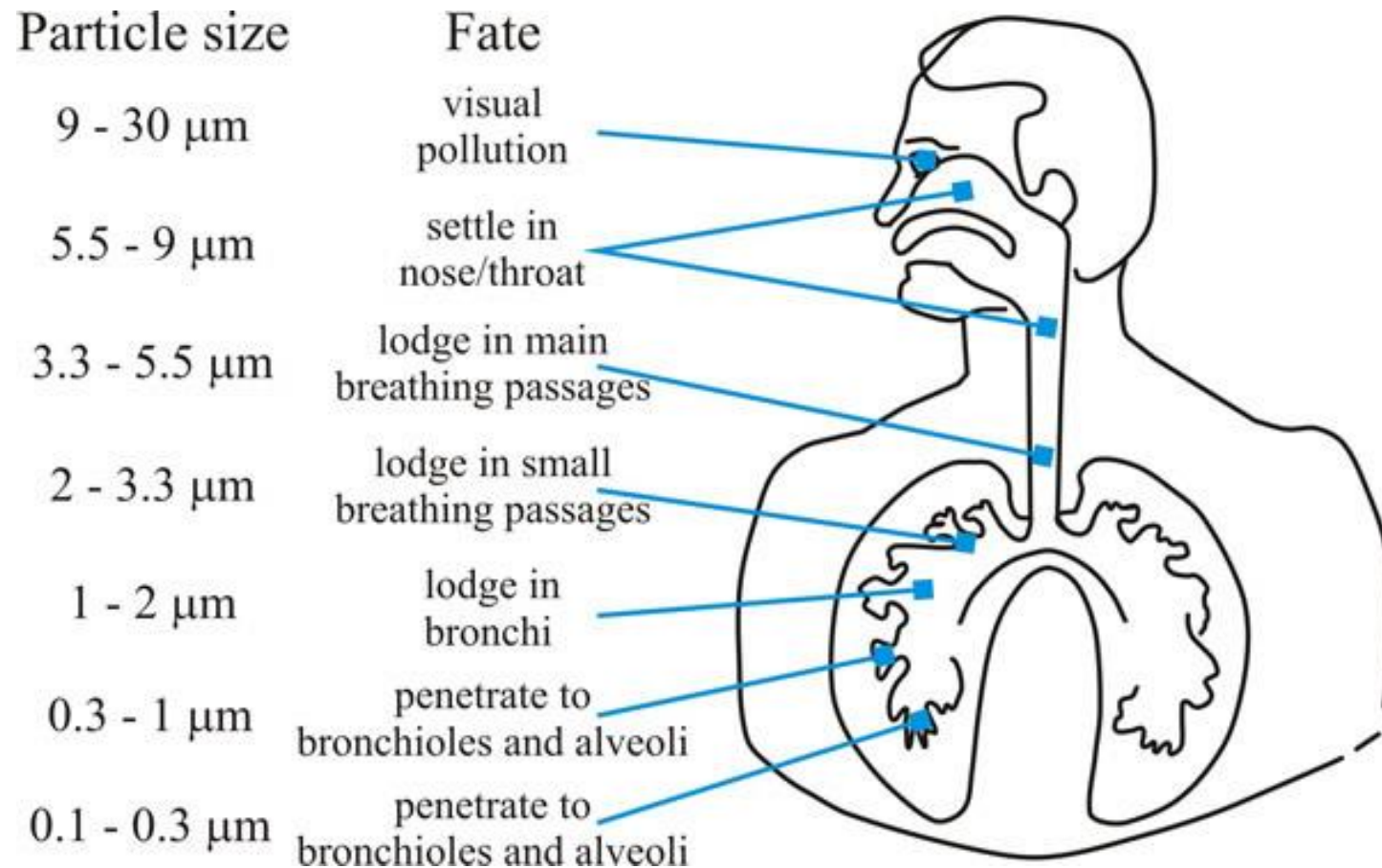
HC

Lead and heavy metals



# Particles: Size matters

We measure their size and report their weight per unit volume  
We don't measure their composition



# Air pollution is not new



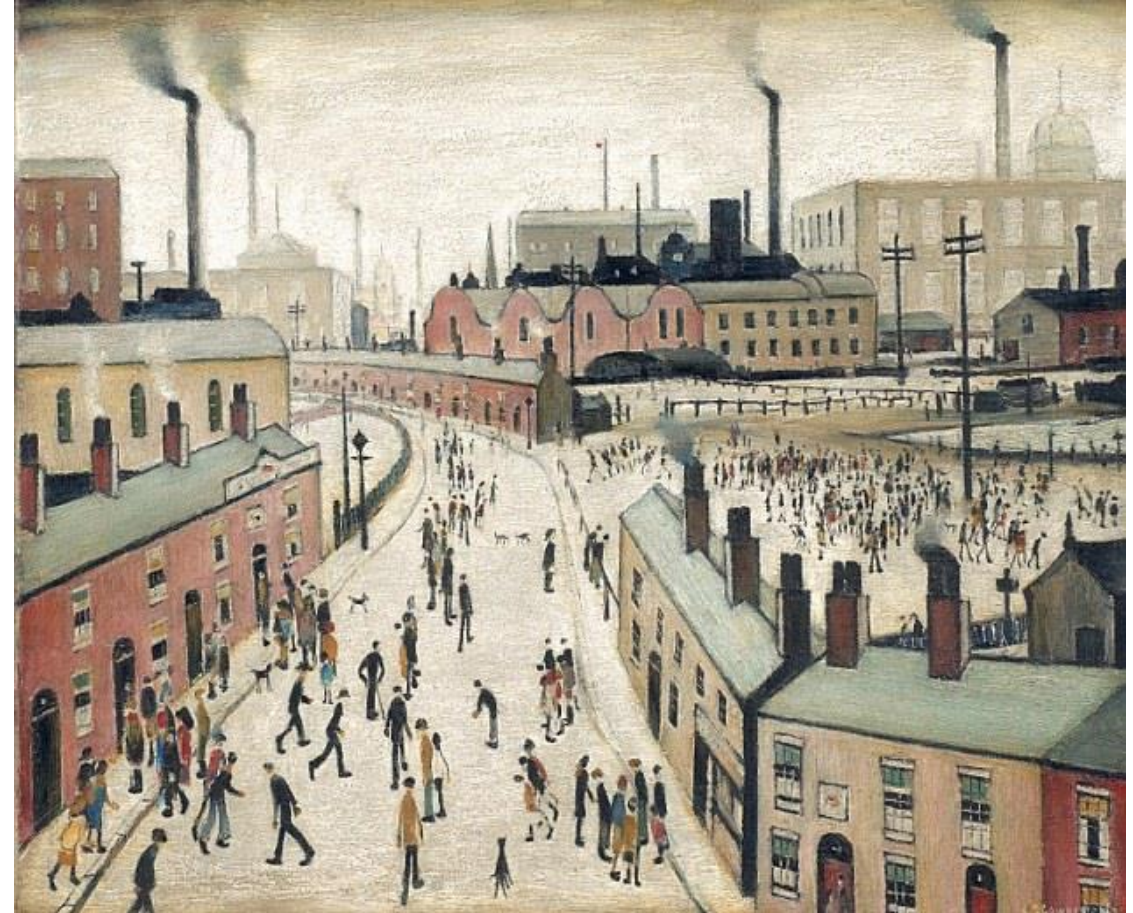
- Urbanisation
- Fuel changes

Queen Eleanor of Provence visited Nottingham castle in 1257

# Industrial revolution



*Coalbrookdale by Night de Louthembourg 1801*



Industrial landscape: Lowry 1887-1976



London had 1 million chimneys by mid 20<sup>th</sup> century

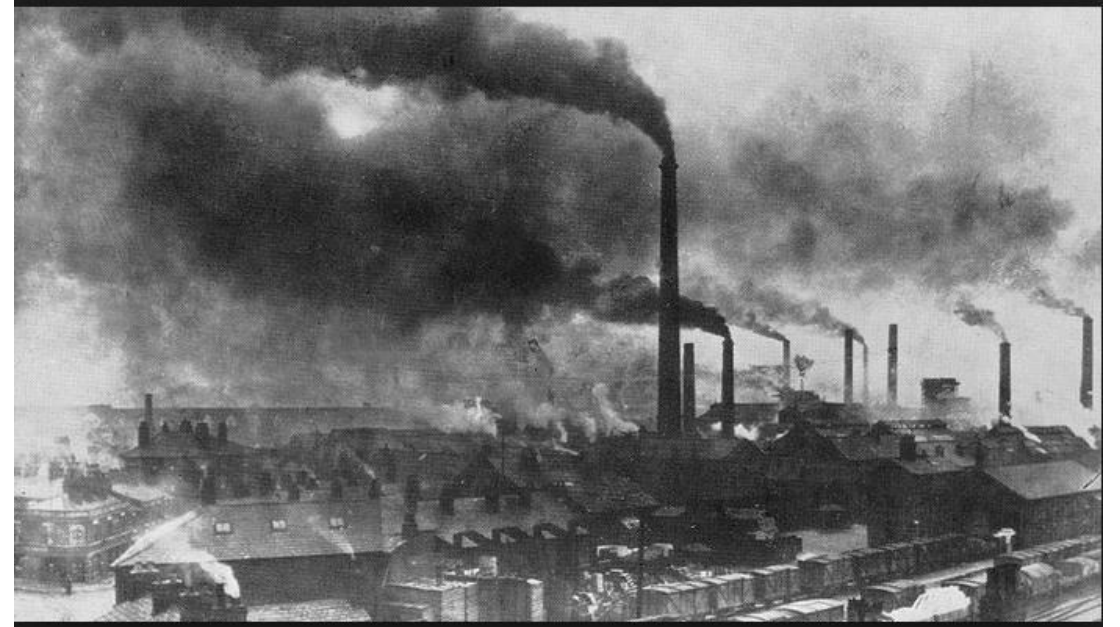
# Great Smog 1952



# Cambridge smoke control area



# 19 and 20<sup>th</sup> Century



Soot (particles)

Sulphur Dioxide

Nitrogen oxides

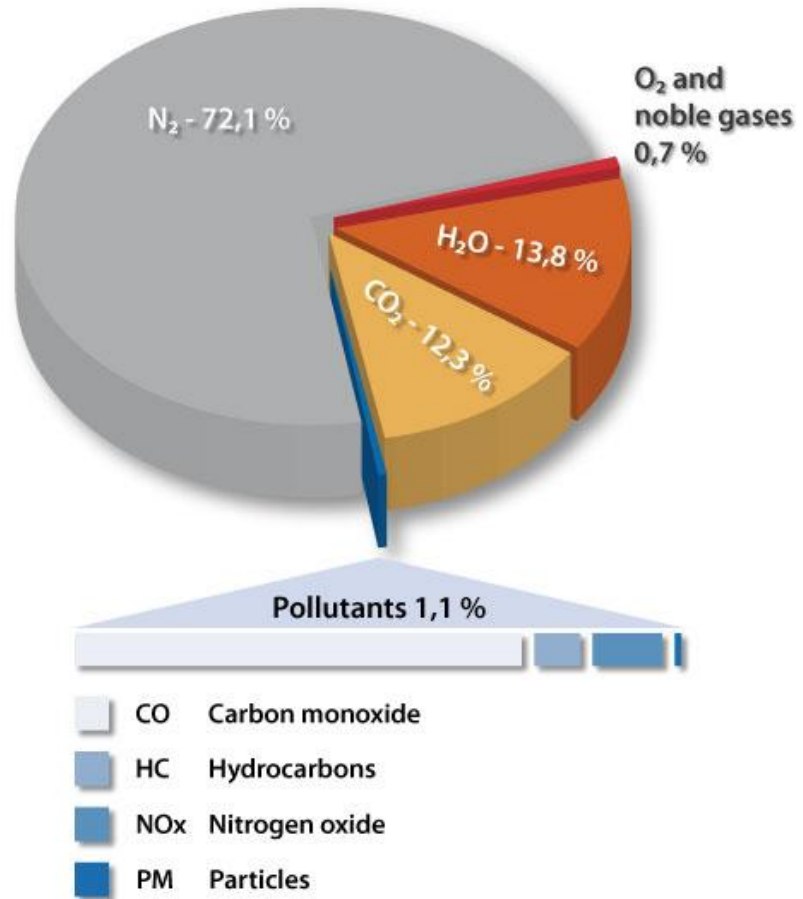
# 21<sup>st</sup> century pollution: a new cocktail



- Nox
- Very small particles
- Carbon monoxide
- Carbon dioxide

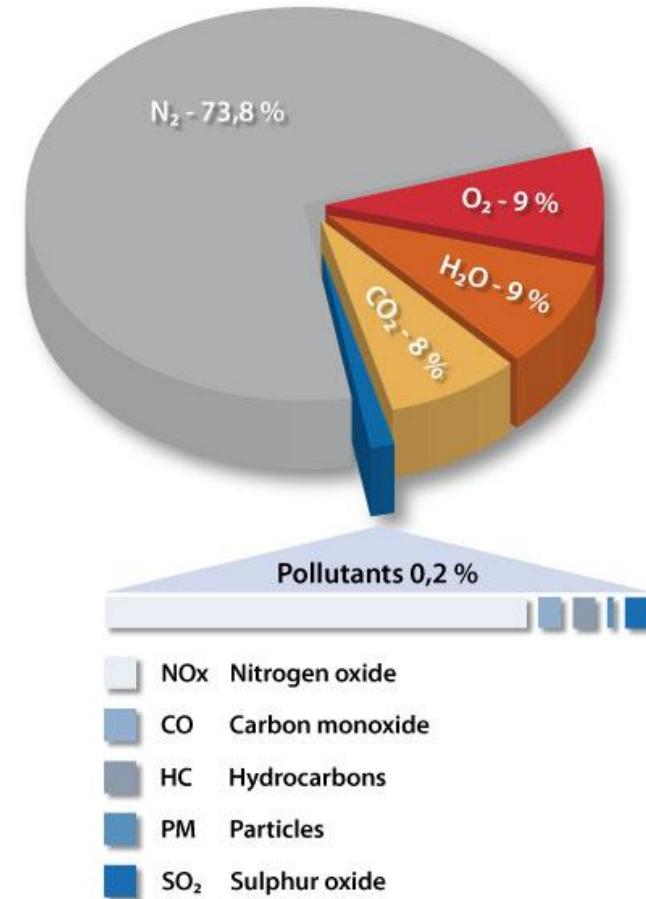


# Petrol v's Diesel

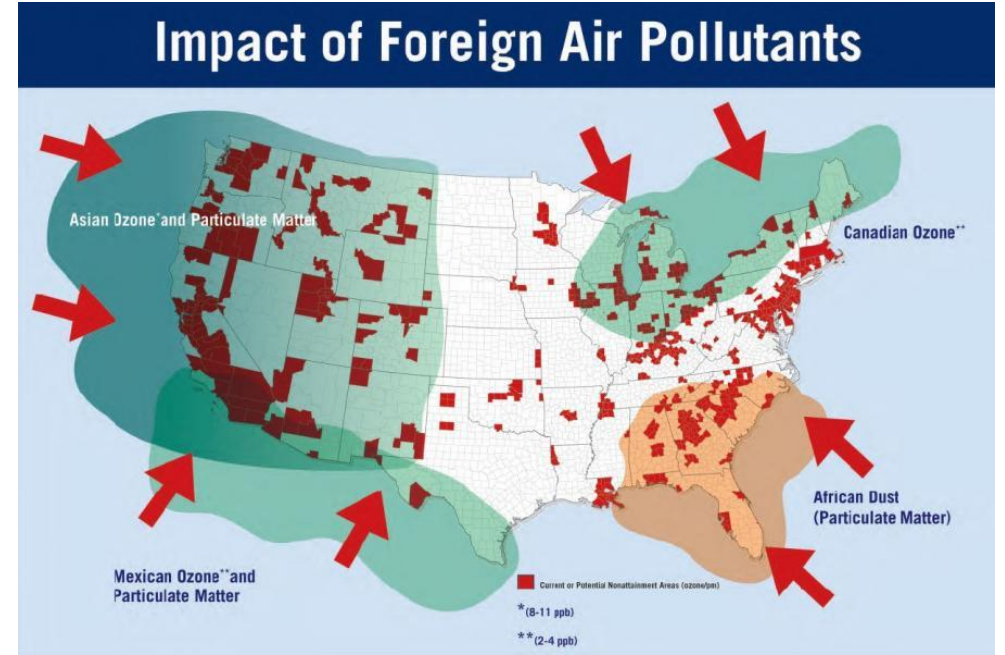
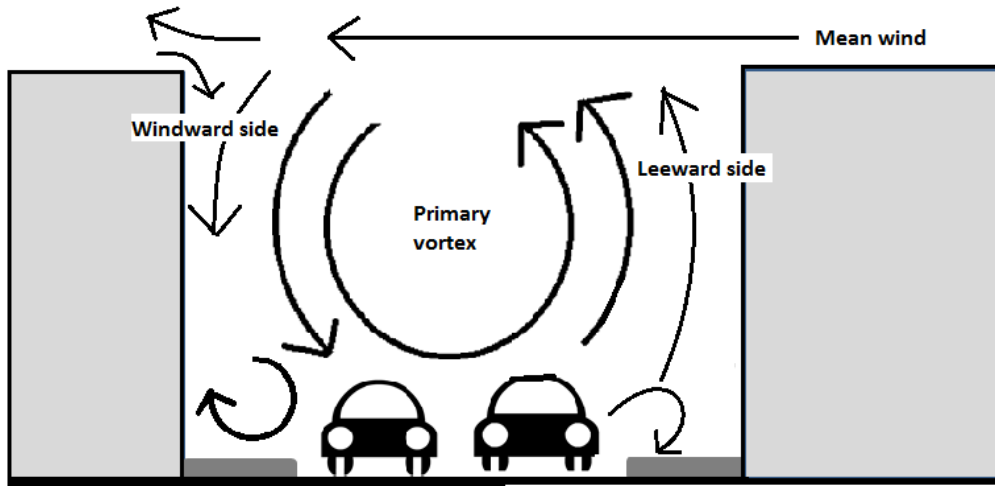


Petrol

Source: NGK spark plugs



Diesel



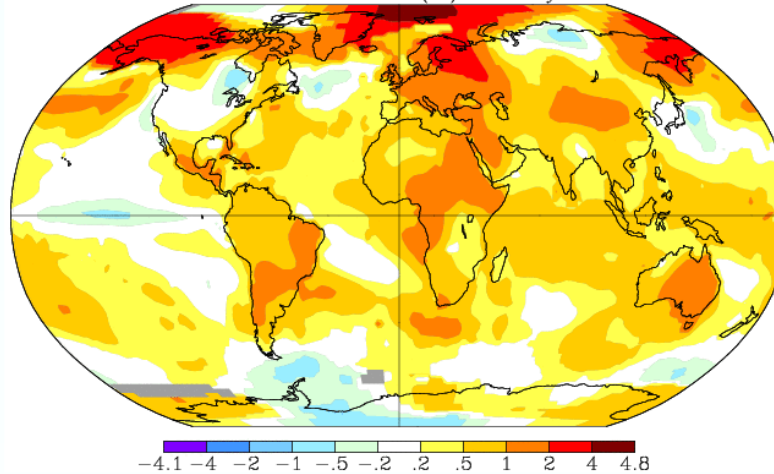
# Scale of Impacts

## GISS Surface Temperature Analysis

### Global Maps

Sources and parameters: [GHCN\\_GISS\\_ERSSST\\_1200km\\_Anom1203\\_2013\\_2014\\_1951\\_1980](#)

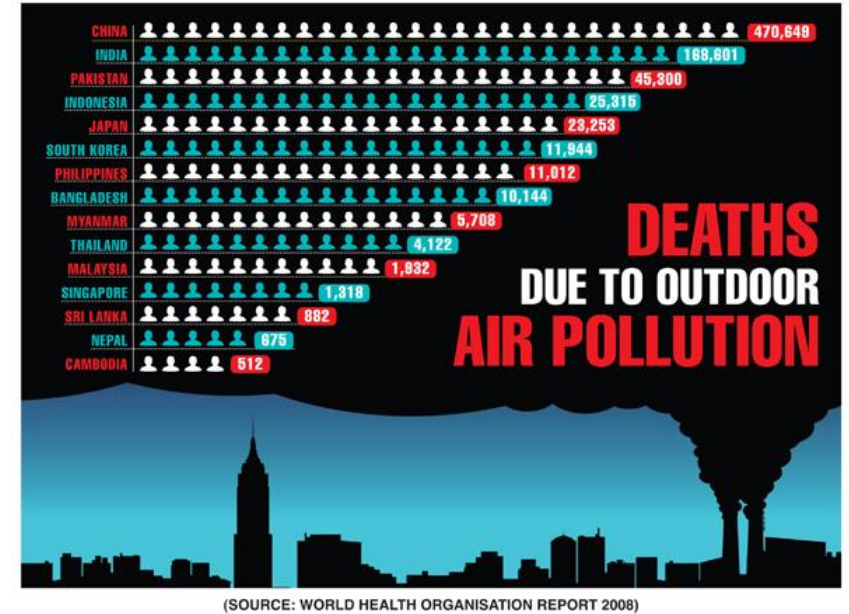
Dec-Jan-Feb 2013-2014 L-OTI(°C) Anomaly vs 1951-1980 0.56



Note: Gray areas signify missing data.  
 Note: Ocean data are not used over land nor within 100km of a reporting land station.

# Impacts – on humans

- Depends on the cocktail
- **Direct impacts include;**
  - Acute health impacts
  - Chronic health impacts



**7 million premature deaths annually linked to air pollution (WHO 2014)**

Stroke, Heart disease, lung disease, lung cancer, chest infections (esp children)

Indirect impacts include;

Climate change

Damage to plants and animals

Damage to water and land



The bad news is you've got advanced-stage humans. The good news is they've just about run their course and you should be on the mend soon.





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Thank you for participating

**Alison Greig,**



Ways Forward?