PARTICULATES FROM INDUSTRY

Rob Kinnersley
Evidence Directorate
Environment Agency

Who is involved in Industrial Particle Regulation?

EU (AQ Directives, LCPD, ECD, HD)

DEFRA

EA, SEPA, NIEA
(environmental agencies)

Local Authorities

NE, SNH, CCW
(conservation agencies)

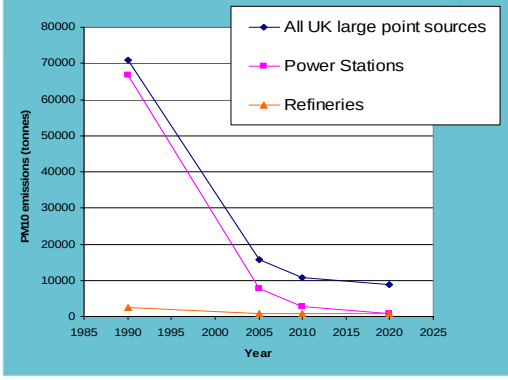
Who is involved in Industrial Regulation?

Environment Agency, SEPA, NIEA

- Large and complex industry
- Waste
- Intensive Agriculture
- Food Processing
- AQ in Major Incidents
- Statutory consultee for AQS
- Consultee for Local Authority action plans
- Pollution Inventory
- Report on State of the Environment
- NOT transport or smaller industry

The Good News

- Large reductions in particle emissions from regulated plant (with respect to baseline year of 1990)
- AQ Objectives for PM_{10} now met at most background sites in the UK
- Average PM_{10} and $PM_{2.5}$ concentrations in the UK would have been **3 µgm^{-3}** higher in 2005 without industrial emission regulations
- 997 fewer dbf in 2005
- 1052 fewer hospital respiratory admissions in 2005
- 1055 fewer hospital cardiovascular admissions in 2005
- Loss of ~1 000 000 life years prevented for population alive in 2005



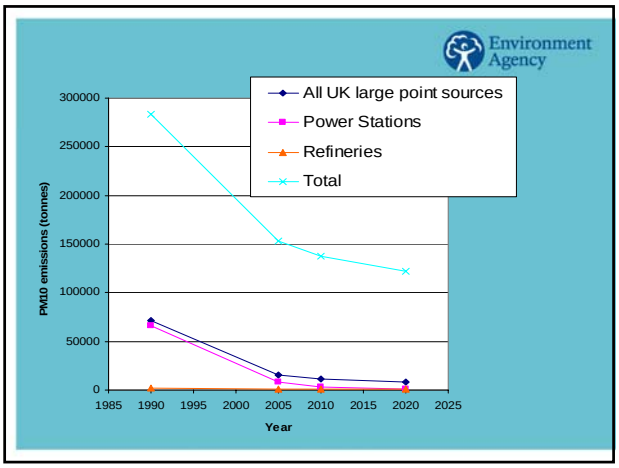
The Good News

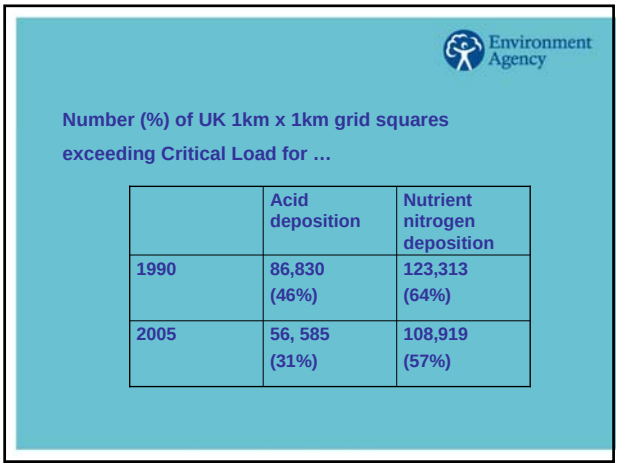
The trend in PM_{10} has been, and continues to be, downwards

UK emissions (Ktonnes)	PM_{10} (regulated)	PM_{10} (counter-factual)
1990	283.8	
2005	153.1	182.7
2010	137.5	141.1
2020	122.4	125.1

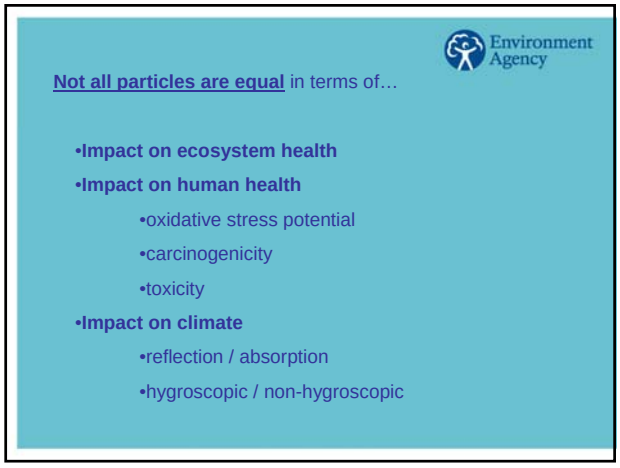
Air quality and deposition benefits from Environment Agency regulation.

SC060108 November 2008





	Acid deposition	Nutrient nitrogen deposition
1990	86,830 (46%)	123,313 (64%)
2005	56, 585 (31%)	108,919 (57%)



Secondary aerosols

Policy-makers need models

to target precursors, resolve non-linearities and co- or dis-benefits

For these **we need to identify**

- Inputs and outputs
- Model scenarios (e.g.2050)
- Required resolutions
- Validation
- Variability
  - *Fluctuations*
  - *uncertainties*

Competing pressures

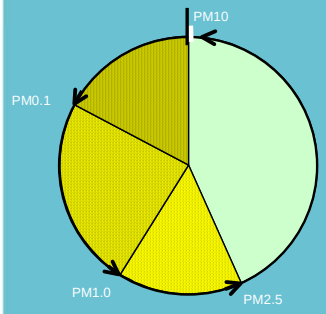
Air Quality

versus **Climate Change**

versus **socio-economics**

The Challenges

- Speciation
- Size



Epidemiology currently based on PM_{10}

PM_{10} includes impact of smaller fractions

The New Frontier:

$PM_{2.5}$

- limit and dose-reduction targets in place
- emissions now being recorded in Pollution Inventory
- questions arising include:
  - relationship between in-stack measurements and resulting ambient contribution
  - ratio of $PM_{2.5}$ to PM_{10} for various sources

Ultrafine particles (<100nm)

- growth of nanotechnology industries is likely to lead to production of new particle classes, which may also exhibit new properties.
- materials in ultrafine form can exhibit chemical and physical properties that are significantly different than those of the bulk material.
- vastly greater surface area presented as a material is more finely divided.
- relatively easy to trap by filtration
- joint NERC – EA research programme

The Challenges

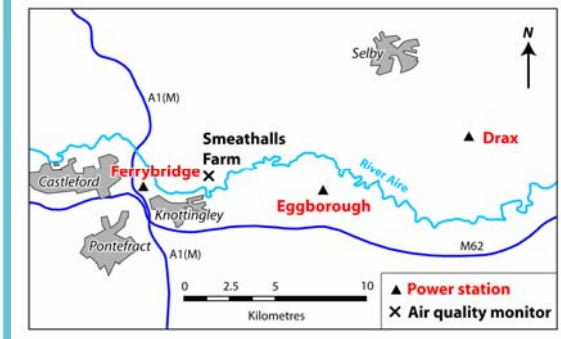
- Speciation
- Size
- Source apportionment

Where are the particles coming from?

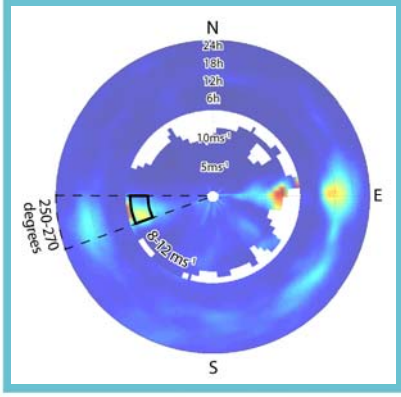
Who needs to clean up their act (and who doesn't?)

- **modelling**
  - detailed programme of work on CMAQ
- **monitoring**
  - smarter use of few sites

SO_2 in the Aire Valley, North Yorkshire



Smeathalls Farm SO_2



Conditional 'window' defined by:

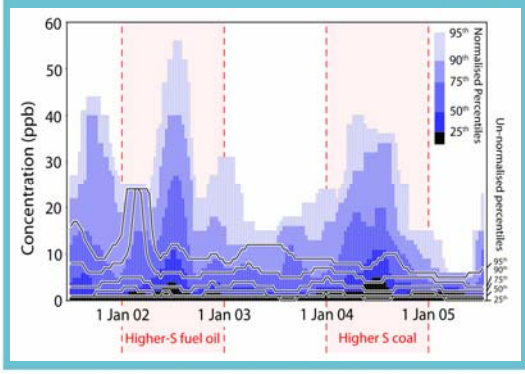
a) wind direction

(250-270 degrees)

b) wind speed

(8-12ms^{-1})

Normalised and un-normalised trends in SO_2 percentiles



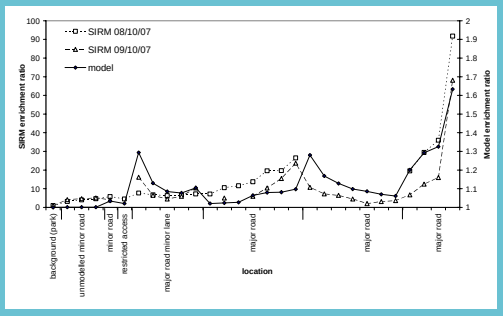
Where are the particles coming from?

Who needs to clean up their act (and who doesn't?)

- **modelling**
  - detailed programme of work on CMAQ
- **monitoring**
  - smarter use of few sites
  - use of many more sites

More monitoring points means **more monitors**

- distributed sensor networks
- surrogates
  - biomonitors
  - magnetic residue analysis



The Challenges

- Speciation
- Size
- Source apportionment
- Bioaerosols

Diversion of green waste from landfill

- rapid growth in bio waste facilities
- public concern re bioaerosols (allergens, micro-organisms)
- 250m trigger distance under close scrutiny
- rapid PCR test developed as monitoring tool
- sampling protocol development
- source term analysis
- reviews of health impact studies

Conclusions

- Particles from industry declining nationally
- Still significant local impacts
- Further decrease requires smarter targeting of causes
- Hot topics include
  - Source apportionment
  - Role of particle composition, physical form
  - Bioaerosols

We cannot pretend to offer proofs. Proof is an idol before whom the pure mathematician tortures himself. In physics we are generally content to sacrifice before the lesser shrine of Plausibility.

Sir Arthur Eddington