Reducing Nitrogen Deposition in the UK

evidence, mitigation options

Presented by: Peter Coleman, Atmosphere and Noise
Date: 3 December 2013
Structure

- Defra’s priorities
- Understanding of the problem
- Changes in the UK nitrogen budget
- Measures in energy, transport and agriculture
- Emission trends to 2030
Priorities for Defra Air Quality

• Our aim is to protect and improve the environment and human health by ensuring:

  1. concentrations of pollutants in outdoor air meet EU limits and targets

  2. UK emissions remain within existing 2010 ceilings set in EU and UNECE legislation;

  3. current/planned policies deliver the expected emission reductions to meet more stringent UNECE targets for 2020;
Spatial pattern of emissions

UK Emissions Map of NOx 2005 t/1x1km

UK Emissions Map of Ammonia 2005 kg/1x1km
Changes in the atmosphere are changing the processing; reduction in UK emissions (45%) has reduced export (46%) more than deposition (22%).
Critical Level Exceedance

AEAT 1km SO$_2$ concentrations 2009

SO$_2$ (ug m$^{-3}$)
- <=10
- 10-20
- >20

AEAT 1km NO$_x$ concentrations 2009

NO$_x$ (ug m$^{-3}$)
- <=30
- >30

CEH 5km NH$_3$ concentrations 2009-11

NH$_3$ (ug m$^{-3}$)
- <=1
- 1-3
- >3
Critical Load Exceedance in 2025

Exceedance of 5th-percentile critical loads by FRAME 2025 UEP45 deposition scenario

(a) Acidity

Exceedance (keq ha\(^{-1}\) year\(^{-1}\))

- Not exceeded
- <=0.5
- 0.5-1.0
- 1.0-2.0
- >2.0

(b) Nutrient nitrogen

Exceedance (kg N ha\(^{-1}\) year\(^{-1}\))

- Not exceeded
- <=7
- 7-14
- 14-28
- >28

Date: 09/09/2013
Changes in Deposition Budgets
Agricultural activity is the major source of ammonia pollution

- Almost 90% of UK ammonia emissions come from agriculture (approx 250 kilotonnes p.a.)
  - 47% from cattle
  - 30% other livestock
  - 11% synthetic urea- and ammonium-based inorganic fertilisers

- Emissions from agriculture have decreased by 21% since 1990, mainly as a result of declining livestock numbers and improved fertiliser use efficiency.

- Current projections are highly uncertain but suggest an 8% decline in ammonia emissions to 2020 largely due to assumptions about a continued near term decline in cattle numbers.

- Ammonia emissions are expected to increase over the 2020-2030 period driven by increases in the use of urea fertiliser and increased animal numbers.
Ammonia: measures

- the Industrial Emissions Directive (IED) controls emissions from large pig and poultry units,
- there are no other regulatory drivers in place with the primary purpose of reducing ammonia emissions.
- Voluntary actions to reduce ammonia adopted by the industry can be found in the Campaign for the Farmed Environment and co-benefits exist with measures deployed in other voluntary schemes (e.g. Catchment Sensitive Farming). May if widely adopted lead to significant falls in emissions.
- A barrier to uptake is low farmer/farm advisor awareness of ammonia impacts
- In England Defra is working to try and incorporate ammonia messages into Farm Advisory Service and other advice streams while not over complicated messaging
- The Rural Development Regulation allows the use of RDR funding for ammonia measures. These are a devolved matter in the UK.
- Options to mitigate emissions which are verifiable and meet the criteria for inclusion appear limited.
- In the absence of regulation communication of the opportunities for the sector to be more competitiveness through preserving N need to be taken.
Key mitigation options for ammonia

- **Farm productivity measures**
  - Improved animal housing e.g. heat exchangers reduce manure wetness
    reduce ammonia emissions drop energy bills
  - Roofing slurry stores reduce spreading costs and capacity needs

- **Nitrogen management measures**
  - N management planning - avoid wasteful application
  - Precision application techniques of slurry, manures and fertiliser
  - Rapid incorporation e.g. AD digestate
  - Reduce manure heap emissions
  - Apply urea based fertiliser only with inhibitors - gives more plant N

- **Dietary measures**
  - Optimise the N content of feed
  - Improve N use efficiency

- **Maximising co-benefits with productivity water and climate measures and minimising trade-offs**
Measures to address Nitrogen Oxides

- Measures taken have reduced emissions 64% 1990 to 2011. Gothenburg Target 55% reduction.
- \( \text{NO}_x \) Mainly from combustion sources power, transport, heating
- Integrated pollution control from 1990
- Transport vehicle standards Euro 1/I to 6/VI
- Regulation of medium combustion plant 20-50MW
- Decarbonisation policies lead to continuing improvements in energy efficiency and reduced use of fossil fuel particularly the likely closure of coal power stations over the next decade
- Decarbonisation of transport slower; measures to assist electrification of road vehicles plans to electrify some rail lines, note biofuels do not necessarily help with \( \text{NO}_x \) emission reduction
- Introduced \( \text{NO}_x \) (and PM) requirement for subsidised wood burning boilers
- IMO agreement on shipping emissions will in longer term benefit
UK NO$_x$ Emission Projections to 2030
UK NH₃ Emission Projections to 2030