



Ricardo
Energy & Environment

Ammonia: emissions, effects and abatement

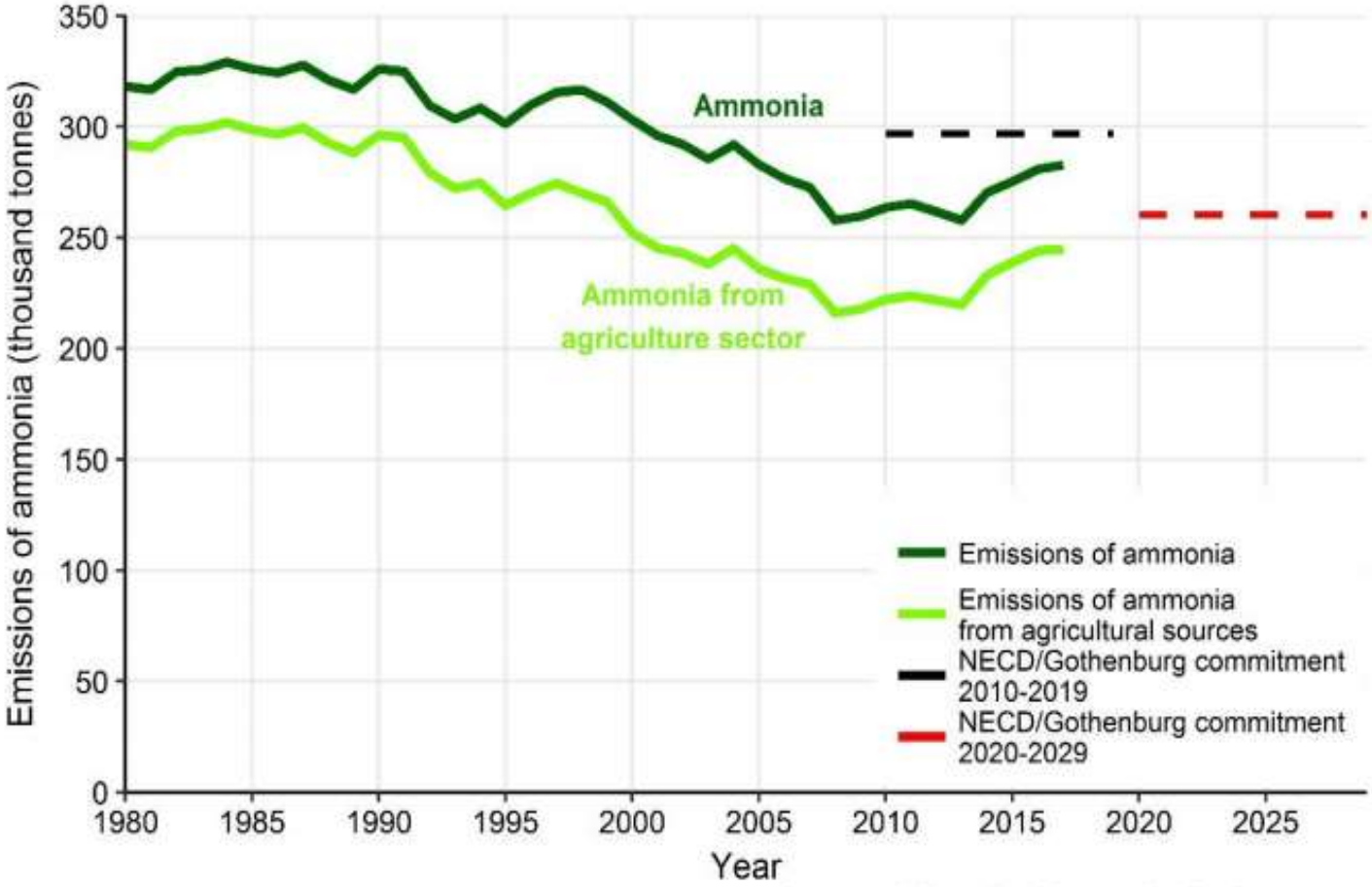
4th March 2020

Dr Jeremy Wiltshire

Ammonia: why are we concerned?



The UK has agreed ammonia emission limits under the 1999 Gothenburg Protocol



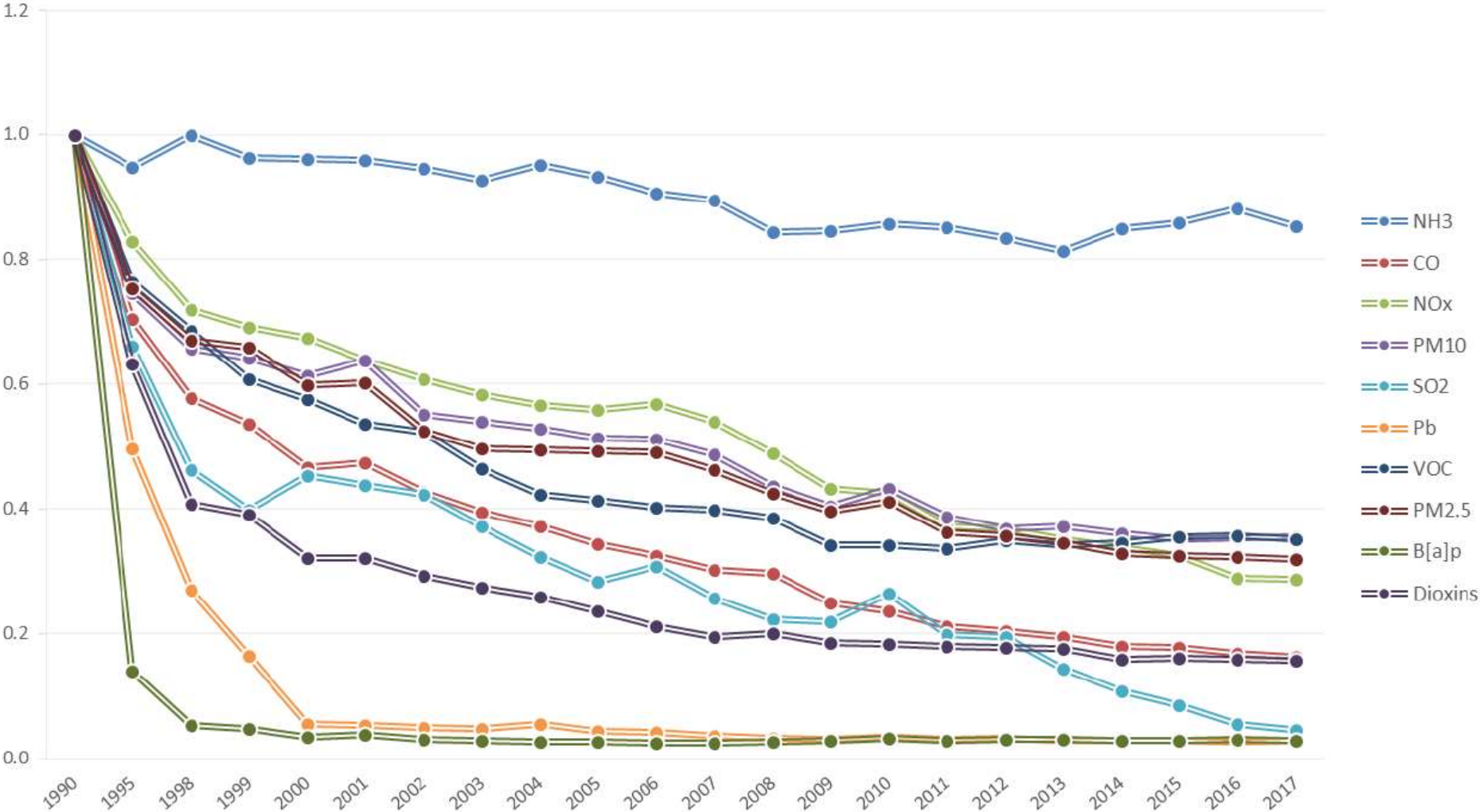
Source: Ricardo Energy & Environment



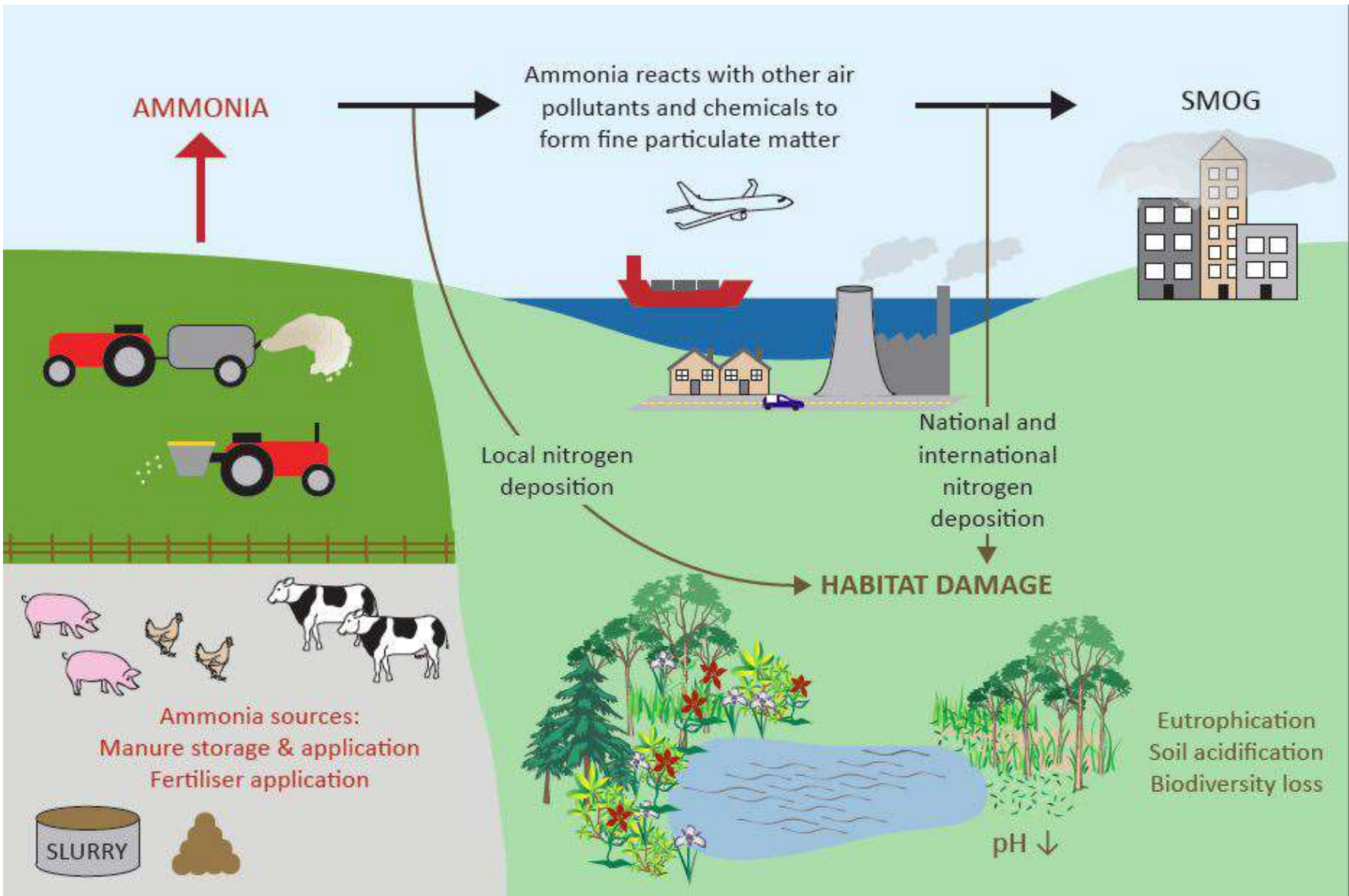
7.4.2 We will regulate to reduce ammonia emissions from farming

1. Introduce rules on specific emissions-reducing practices
2. Regulate to minimise pollution from organic and inorganic fertiliser use
3. Extension of environmental permitting to dairy and intensive beef farms by 2025

Trends in emissions, Scotland

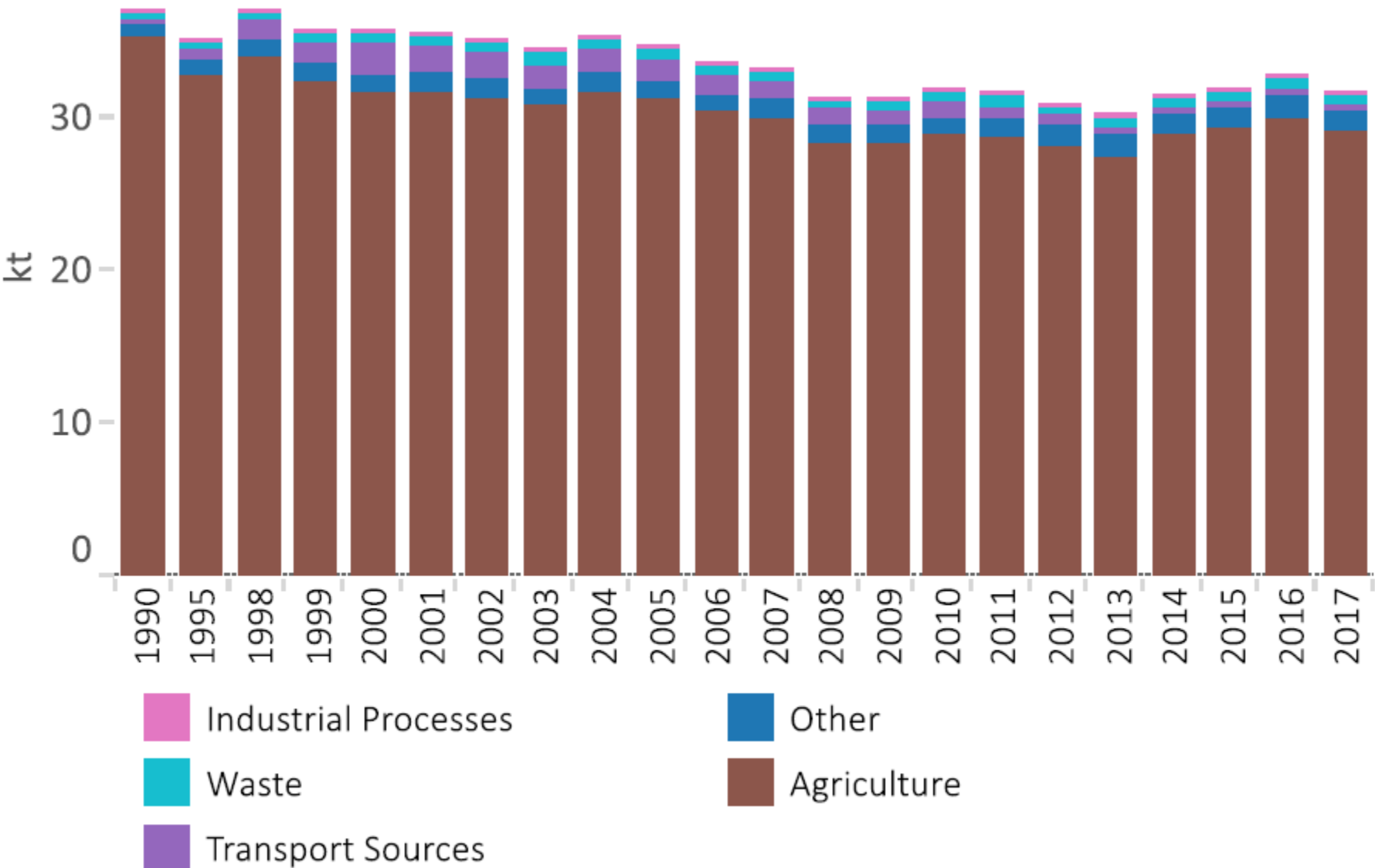


Ammonia: why are we concerned?



From Defra 2018: Code of Good Agricultural Practice (COGAP) for Reducing Ammonia Emissions

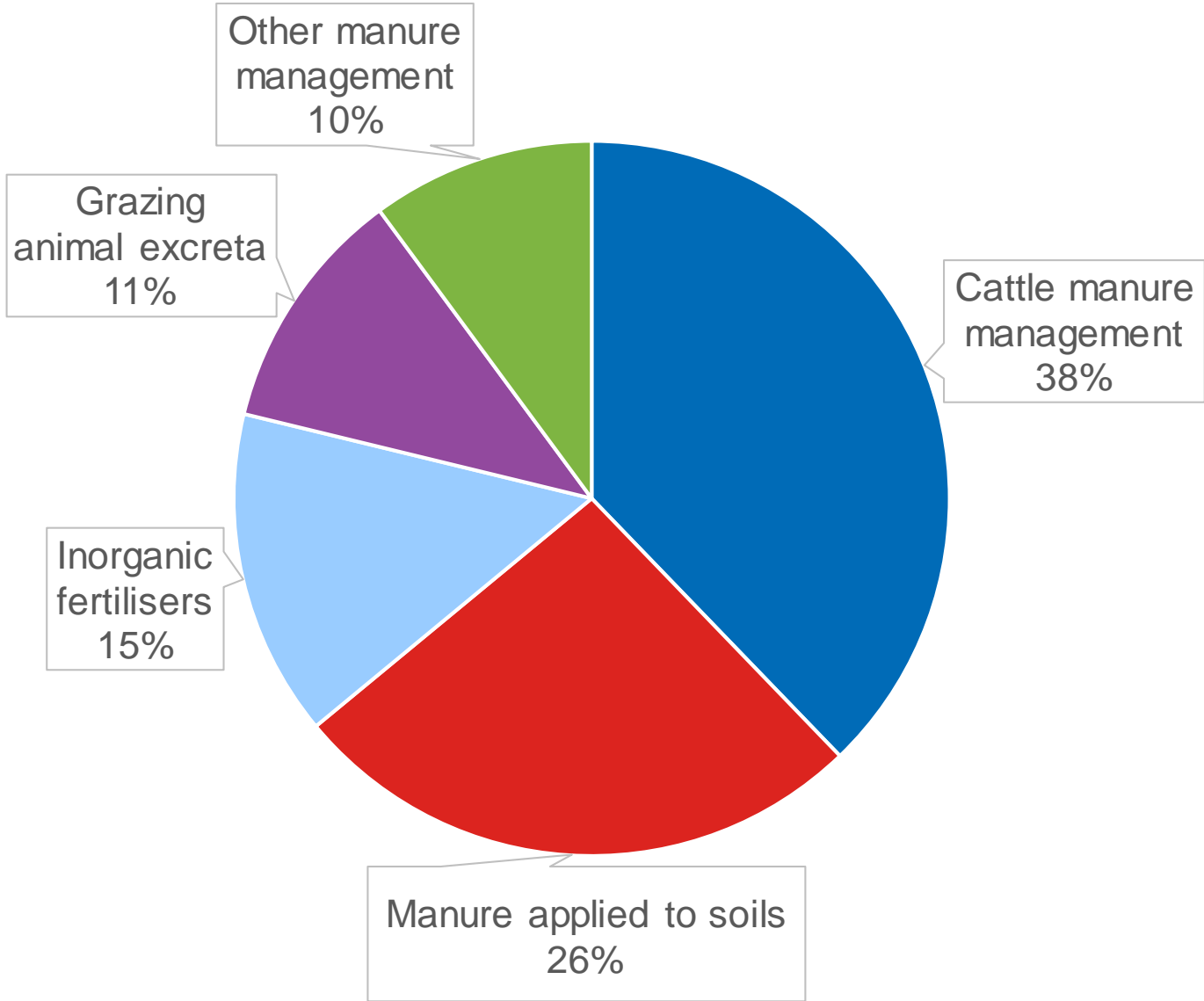
Ammonia emissions by source, Scotland

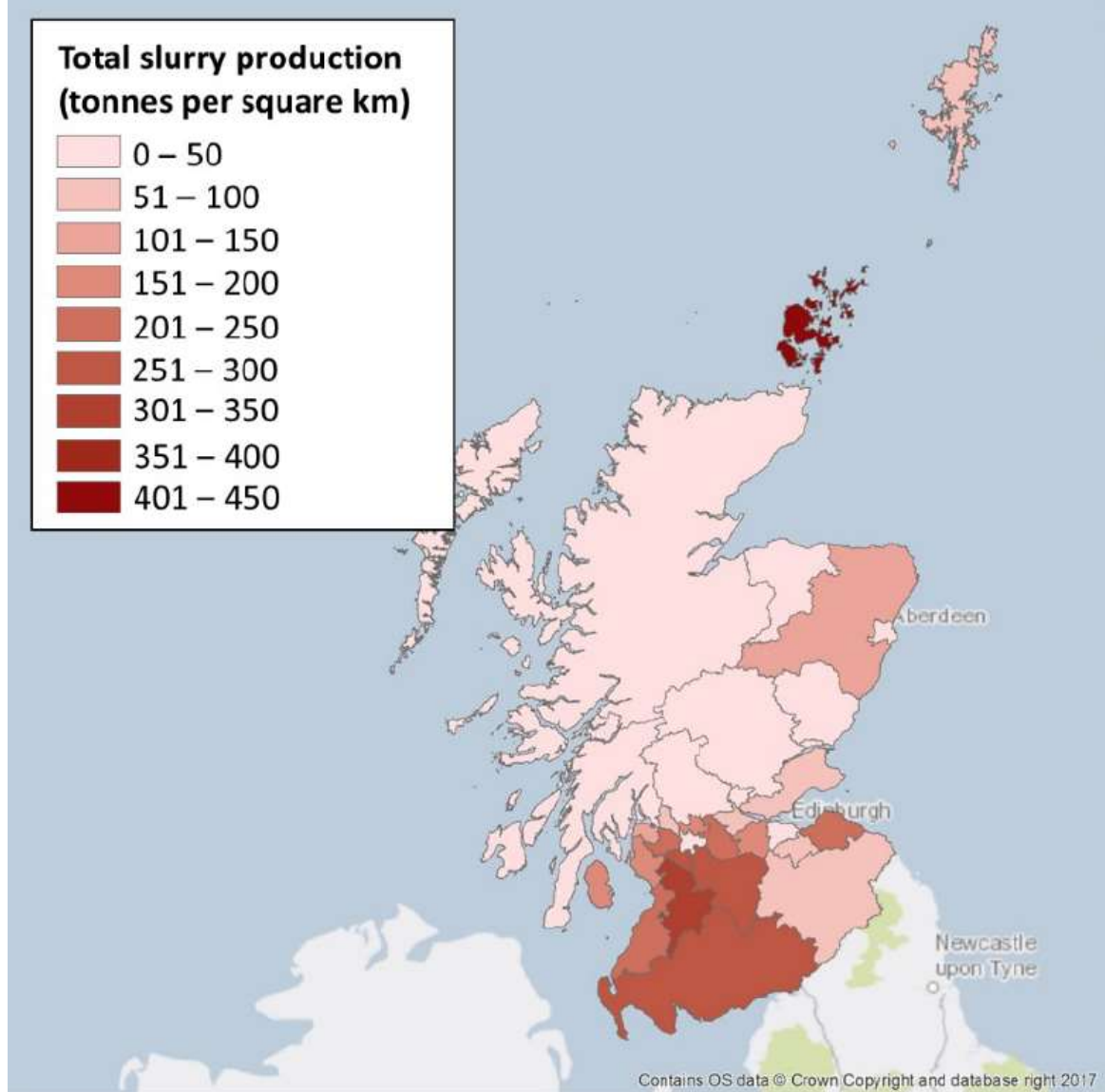
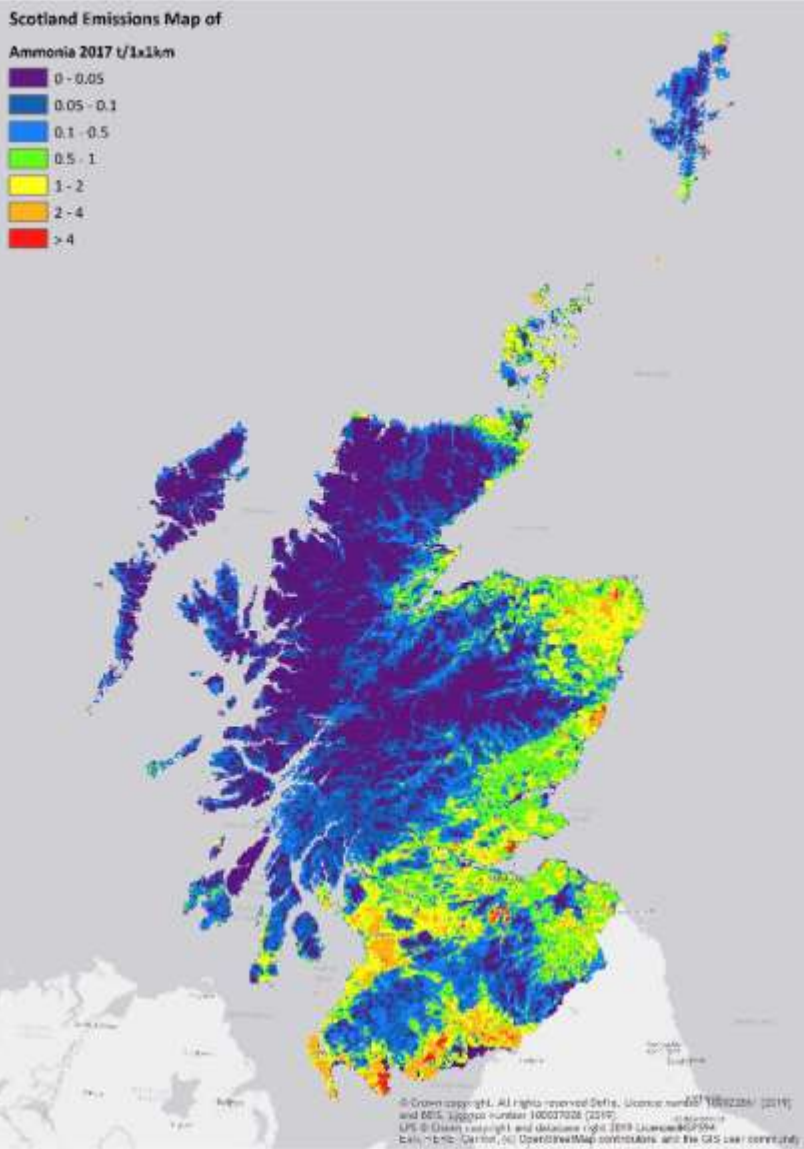


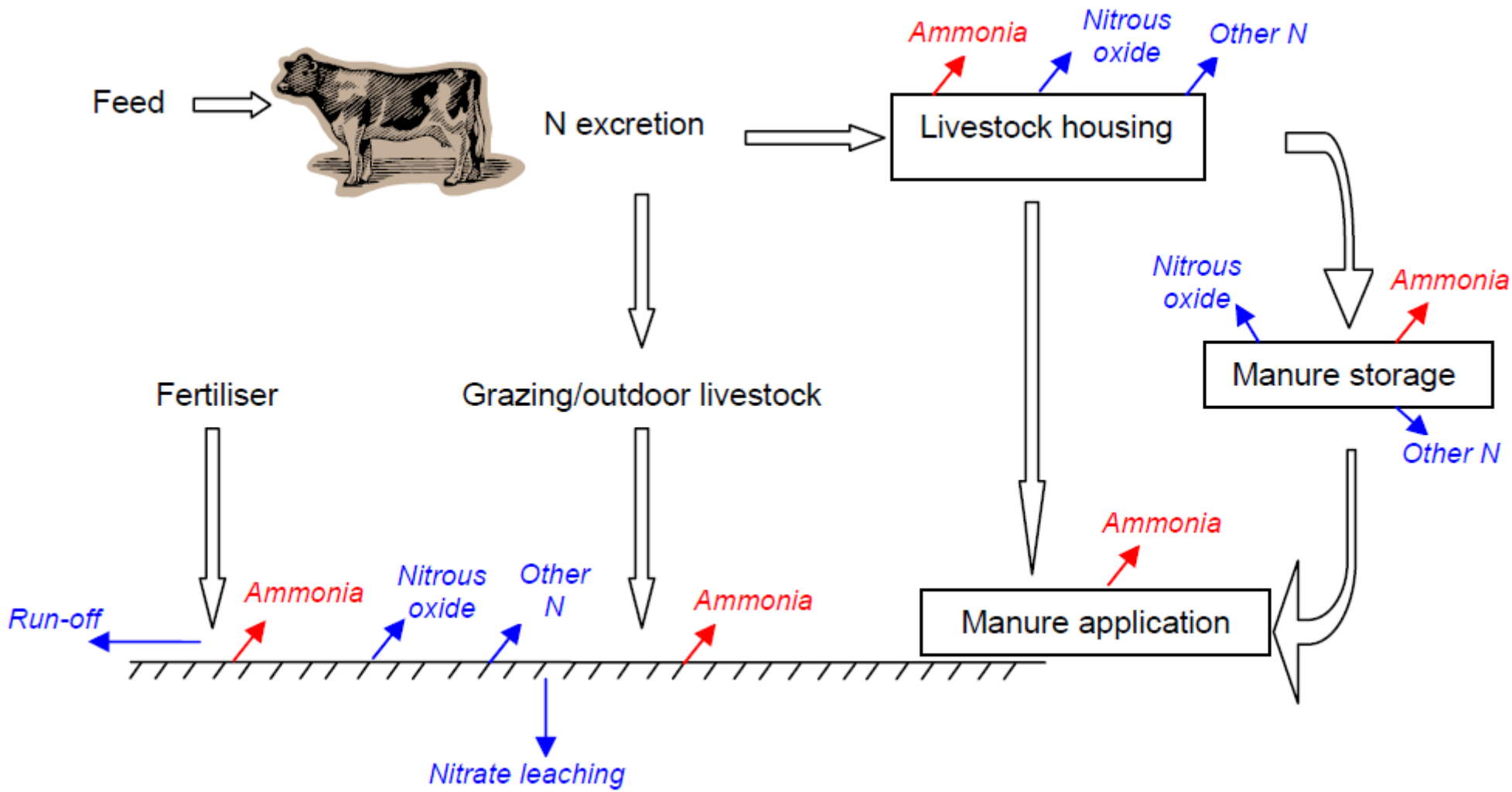
Agriculture emits around 92% of Scotland's ammonia emissions

Latest data for 2017

Agricultural ammonia emissions by source







From Misselbrook et al, 2008: Ammonia Mitigation User Manual

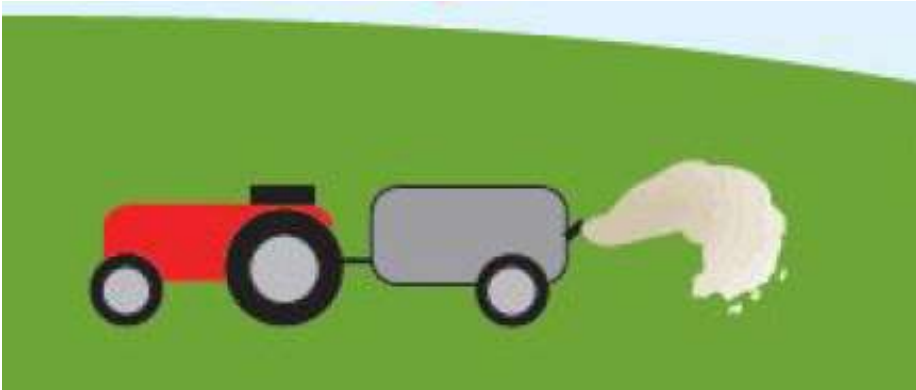
Ammonia emission abatement

- Minimising exposure to air minimises emission
- Most exposure to air happens in housing and at spreading
- Minimise housing



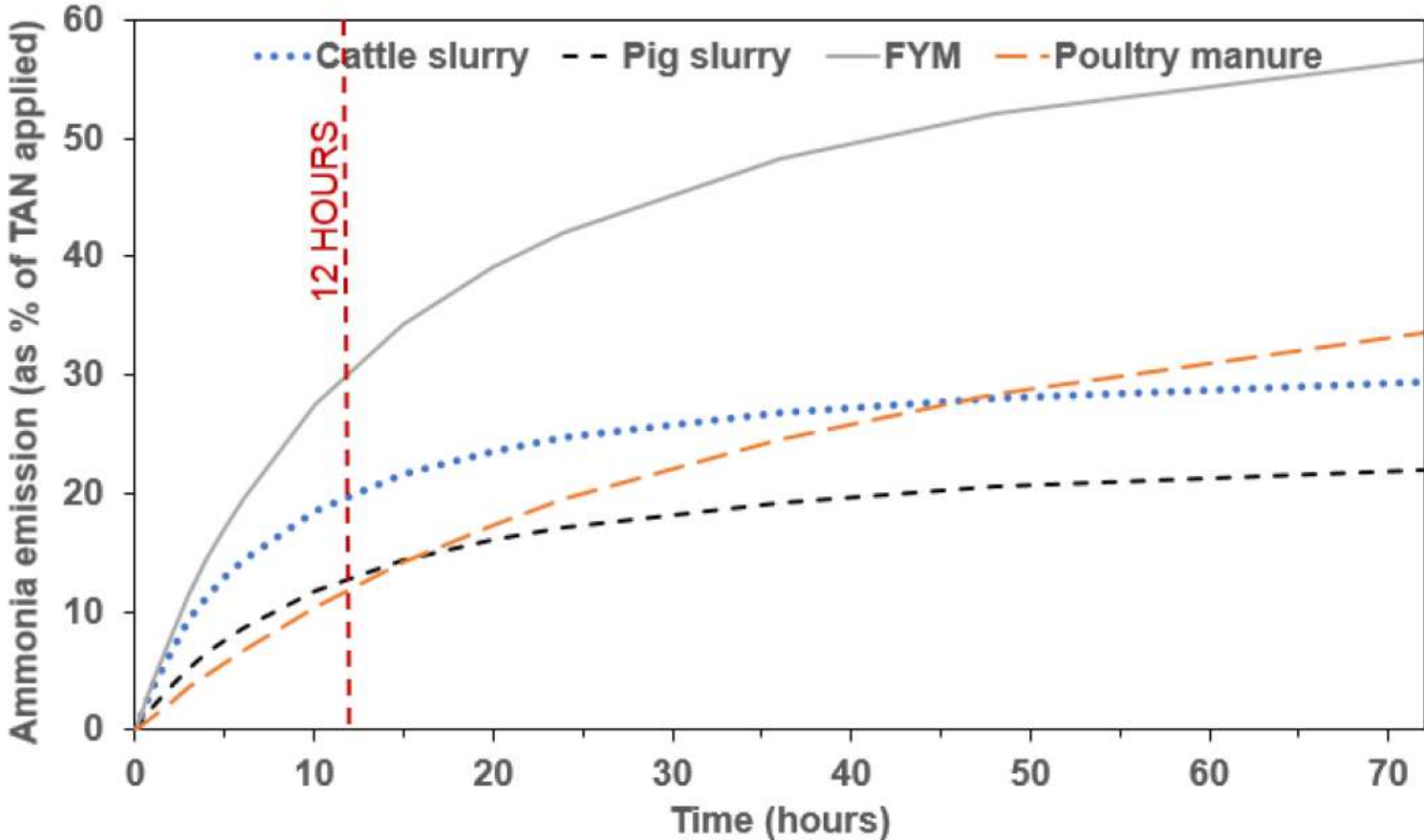
Ammonia emission abatement

- Spreading techniques can reduce exposure to air
- Around 40% of the readily available nitrogen content of manures is often lost following surface application to land
- Windspeed and temperature are important factors
- Time from spreading to incorporation is important



Source: Defra 2018. Code of Good Agricultural Practice (COGAP) for Reducing Ammonia Emissions.

Ammonia emission abatement



Source: Defra 2018. Code of Good Agricultural Practice (COGAP) for Reducing Ammonia Emissions.
<https://www.gov.uk/government/publications/code-of-good-agricultural-practice-for-reducing-ammonia-emissions>

Ammonia emission abatement

- Capture /filter at point of emission from buildings
- Only possible in buildings with forced ventilation – pigs and poultry



Ammonia emission abatement

Acidification

- Decreasing the pH from (e.g.) 7.5 to 5.5 shifts the balance between NH_3 and NH_4^+
- Acidification is used in Denmark and interest in the UK is increasing
- Relatively expensive



Emissions from fertiliser: urea hydrolysis

urea + water → ammonia + carbon dioxide

- Urease enzymes catalyse the hydrolysis of urea
- Urease inhibitors can be added to urea - reduces ammonia emissions by 70%
- Per kg fertilizer N ammonia emissions are reduced by c. 80% by using ammonium nitrate instead of urea

Practicalities in the farming industry

Uptake of most mitigation actions is limited by cost to the farmer

Uptake of some mitigation actions is limited by practical considerations

- Covering solid manure stores
- Covering some slurry stores

Uptake potential for abatement techniques is difficult to estimate

- Uptake depends on policy and economic drivers
- Further uptake depends on extent of current implementation



What can be done to encourage abatement?

Work with agriculture stakeholders

Awareness is low

Knowledge exchange is needed, e.g. through the Farm Advisory Service (FAS)

- Understand current practices better
- Demonstrate benefits of abatement
- Code of practice to help farmers understand what to do

Public goods for public money: are financial incentives needed?

Consider a risk-based approach? Prioritise emissions that cause most impact?

Monitoring to track progress?

Should we monitor ammonia concentrations, or farm practices?



Contact: Jeremy Wiltshire

Email: jeremy.wiltshire@ricardo.com

Direct Dial: +44 (0)1235 753 593

Mobile: +44 (0)7968 707 699

Reception: +44 (0)1235 753 000

