Ammonia emission abatement in agriculture

The case of Flanders - Belgium

1 June 2017 – WGSR 55, special session on agriculture and air pollution
Towards Cleaner Air
Scientific Assessment Report 2016

△ Models suggest that the share of grassland species threatened by nitrogen deposition in 2020 under the revised Gothenburg Protocol will be greatest for regions in northwestern Europe with the most intensive agriculture.\textsuperscript{xii}
Agriculture in Flanders

Land use in Flanders, 2014
(source: VRIND 2016)

- Agriculture: 45%
- Other open space: 28%
- Living area: 12%
- Industry: 10%
- Public facilities: 4%
- Other land use: 1%

Livestock numbers, 2015
(source: VRIND 2016)

- Cattle (dairy and meat): 1,321,005
- Pigs: 5,981,191
- Poultry: 32,128,295

Final production value, 2015 (M Euro)

- Livestock farming: 591
- Horticulture: 1,587
- Arable: 3,250
Agriculture in Flanders

Specialisation of farming in Flanders (number of farms)

- Mixed farming: 11%
- Horticulture: 13%
- Arable crops: 23%
- Meat cattle: 13%
- Dairy cattle: 12%
- Mixed cattle: 6%
- Other grazing (sheep, goat,...): 5%
- Pigs: 9%
- Poultry: 3%
- Mixed livestock: 5%
- Livestock: 53%
Evolution of ammonia emissions in Flanders

- **Agriculture**
- **Houses (warming and septic tanks)**
- **Industry**
- **Road transport**
2 main contributors:

- Land application of manure and fertilisers
- Animal housing
Land application of manure
Broadcast spreading + no incorporation

1991 Nitrates Directive + Manure Decree
- Maximum nitrogen application rates
- Closed period
- Manure incorporation within 24 hours

Since 2000
- Incorporation within 4 hours on bare arable land
- Injection / trailing shoes or hoses on grasland and cropped arable land

Since 2007
- Incorporation within 2 hours or injection on arable land
- Grassland: Sod-injection – trailing shoes – trailing hoses

+ decreasing inputs of N (link with Nitrates Directive: animal numbers, feed management, balanced fertilisation, manure processing)
Ammonia emission associated with land spreading of manure

- 1990: 51,540 ton NH₃
- 2000: 19,651 ton NH₃
- 2010: 13,662 ton NH₃
- 2013: 9,520 ton NH₃
Table 4.201: Bonus for conserved nitrogen, achieved by applying low-emission spreading techniques for slurry

<table>
<thead>
<tr>
<th>Technique</th>
<th>Example from Germany</th>
<th>Example from UK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Associated</td>
<td>Associated</td>
</tr>
<tr>
<td></td>
<td>NH₃ emission</td>
<td>NH₃ emission</td>
</tr>
<tr>
<td></td>
<td>reduction (%)</td>
<td>reduction (%)</td>
</tr>
<tr>
<td>Trailing hose</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>(EUR/m³ slurry)</td>
<td></td>
</tr>
<tr>
<td>Trailing shoe</td>
<td>50</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>(EUR/m³ slurry)</td>
<td></td>
</tr>
<tr>
<td>Open slot injector (discs)</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>(EUR/m³ slurry)</td>
<td></td>
</tr>
<tr>
<td>Closed slot injector (cultivator)</td>
<td>90</td>
<td>NI</td>
</tr>
<tr>
<td></td>
<td>(EUR/m³ slurry)</td>
<td></td>
</tr>
<tr>
<td>Immediate incorporation</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td>Incorporation within 1 h</td>
<td>90</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>(EUR/m³ slurry)</td>
<td></td>
</tr>
<tr>
<td>Incorporation within 4 h</td>
<td>70</td>
<td>NI</td>
</tr>
<tr>
<td></td>
<td>(EUR/m³ slurry)</td>
<td></td>
</tr>
</tbody>
</table>


(¹) Values are calculated at the exchange rate of EUR/GBP = 0.88.
NB: NI = no information provided.
Table 4.202: Costs for slurry spreading and associated ammonia emission reduction costs for different application techniques and farm sizes, in Germany

<table>
<thead>
<tr>
<th>Farm size and characteristics</th>
<th>1000</th>
<th>3000</th>
<th>10000</th>
<th>30000</th>
<th>100000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual process capacity (m³/year)</td>
<td>1000</td>
<td>3000</td>
<td>10000</td>
<td>30000</td>
<td>100000</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Single farm, with necessary equipment</td>
<td>Slightly larger farm or a cooperative of smaller farms, using the equipment cooperatively</td>
<td>A cooperative or a larger farm</td>
<td>Contractors and large farms</td>
<td></td>
</tr>
<tr>
<td>Process capacity (m³/h)</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>low</td>
<td>-</td>
</tr>
</tbody>
</table>

**Spreading costs (EUR/m³ slurry)**

| | 1000 | 3000 | 10000 | 30000 | 100000 |
| Broadcast spreader (¹) | 6.61 | 3.22 | 4.31 | 3.04 | 3.19 | 2.49 |
| Trailing hose | 8.76 | 3.99 | 5.08 | 3.38 | 3.32 | 2.57 |
| Trailing shoe | 9.68 | 4.63 | 5.87 | 4.11 | 4.10 | - |
| Open slot injector (discs) | 9.97 | 4.89 | 6.16 | 4.37 | 4.67 | 2.89 |
| Closed slot injector (cultivator) | 10.38 | 5.71 | 7.49 | 4.96 | 5.30 | 3.04 |
| Incorporation within 1 h | 7.43 | 4.04 | 5.13 | 3.86 | 4.02 | 3.31 |
| Incorporation within 4 h | 7.10 | 3.71 | 4.80 | 3.53 | 3.69 | 2.98 |
| Dilution with water 1:1 | 11.1 | 6.08 | 8.81 | 6.49 | 5.95 | 4.4 |

**Ammonia emissions reduction costs (EUR/kg NH₃)**

| | 1000 | 3000 | 10000 | 30000 | 100000 |
| Trailing hose | 8.80 | 3.16 | 3.16 | 1.42 | 0.50 | 0.34 |
| Trailing shoe | 6.29 | 2.89 | 3.20 | 2.20 | 1.86 | - |
| Open slot injector (discs) | 4.60 | 2.28 | 2.53 | 1.82 | 2.02 | 0.55 |
| Closed slot injector (cultivator) | 3.43 | 2.27 | 2.89 | 1.75 | 1.91 | 0.50 |
| Incorporation within 1 h | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Incorporation within 4 h | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Dilution with water 1:1 | 7.37 | 4.69 | 7.37 | 5.65 | 4.52 | 3.13 |

(¹) Reference system.

*Source:* [EJS, UBA 2011]
Low emission housing
2004: Low emission housing mandatory for new stables (and thorough renovation)

- Pigs and poultry
- 50% emission reduction compared to traditional housing
- Slow process
- New techniques: approval procedure → ministerial decree
Two ways of implementing:

- Low emission by technical interventions in building stables
- Air scrubber
  - Chemical (sulphuric acid)
  - Biological
Ammonia emission associated with housing and internal storage of manure

- 1990: 28,176 ton NH₃
- 2000: 27,089 ton NH₃
- 2010: 23,758 ton NH₃
- 2013: 23,003 ton NH₃
Totale vermestende depositie in 1990 berekend met VLOPS16 (kgN/ha.j)

- < 25.01
- 25.01 - 30
- 30.01 - 35
- 35.01 - 40
- 40.01 - 45
- 45.01 - 55
- 55.01 - 70
- > 70.01

Totale vermestende depositie in 2013 berekend met VLOPS16 (kgN/ha.j)

- < 25.01
- 25.01 - 30
- 30.01 - 35
- 35.01 - 40
- 40.01 - 45
- 45.01 - 55
- 55.01 - 70
- > 70.01
More information

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