Assessment of emission factors for different dairy cattle housing systems in Germany – Measurement approach and first results

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Ammonia emissions in Germany
Aim of the project

Emission data is needed for:

● the national inventory

● authorization processes – e. g. animal friendly housing systems with outdoor access/yard

● data platform with representative and consistent data basis on emission factors from livestock
EmiDaT

- Duration of the project 2015 – 2018
- KTBL (Association for Technology and Structures in Agriculture) is coordinating the project
- Scientific input via two groups – what, where and how to measure
- In addition: practice farms, measuring institutes
Measuring program

- **animal categories:**
  dairy cows (DC), fattening pigs (FP)

- **housings systems:**
  DC: naturally ventilated systems
  FP: naturally ventilated with yard

- **measurements:**
  4 practicle barns for each housing system

- **emissions:**
  ammonia, methane, nitrous oxide, dust, odour

- **measurement duration:**
  6 measurement periods at each location/barn, 1 week each period, over one year (summer, winter, between seasons)
Measuring methods

- According to the VERA protocol „Test Protocol für Livestock Housing and Management Systems“ ([www.veracert.eu](http://www.veracert.eu))

- CO₂ balance method for calculating the ventilation rate
- NH₃, CH₄, CO₂ concentration: measuring with FTIR
- Backup for NH₃ with impinger
- Other parameters: e.g. wind speed, wind direction, temperature, feed and manure composition, milk yield, milk urea....
Emission factor for dairy housings

4 kg NH$_3$-N/(TP a) $\times 3$ \rightarrow 12 kg NH$_3$-N/(TP a)
Four different types of cubicle housings

1. Walking area solid floor – external slurry storage
2. Walking area slatted floor – external slurry storage
3. Walking area slatted floor – slurry storage beneath the floor, slurry pit
4. Cubicle housing with grazing (min. 120 days grazing, min. 6 h/d)

100 – 200 animals per barn
Not older than 10 years
No other barns or emission sources in the way of the air flow
Distribution

4x slatted floor with ext. storage
4x solid floor with ext. storage
4x slurry pit (slatted floor)
1x grazing

Measuring institutes

- DLG
- LUFA Nord-West
- SGS Fresenius
- Müller BBM
Measuring installation at one barn
very closed housing
Outdoor area
Where to put the lines?
CO$_2$ measurements

Milking times
NH$_3$ measurements

[Graph showing NH$_3$ measurements over time for different areas: Feeding area (Futtertisch), middle (Stallmitte), outer line (Außengang), ring line (Ringleitung).]
very open housing
CO$_2$-Measurements

Wind from north to south

Wind from south east, south and north

Wind from south to north

30.05.2017
NH₃ measurements

Konzentration [ppm]

- NH₃ Line 1 Innen Nord
- NH₃ Line 2 Innen Mitte
- NH₃ Line 3 Innen Süd
- NH₃ Line 4 Außen Nord
- NH₃ Line 5 Außen Süd
Next steps

- Lines, how many are needed minimum?
- Database
- Comparative tests for the measuring institutes, workshop planned
- ??
## Housings systems fattening pigs

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<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td></td>
<td>Naturally ventilated building</td>
<td>Closed building</td>
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<td>Outdoor area….</td>
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<tr>
<td>1</td>
<td>Solid floor with litter</td>
<td>slatted floor</td>
<td>Solid floor with litter</td>
<td>Solid floor with litter</td>
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<tr>
<td>2</td>
<td>Semi open housing Pigport</td>
<td>Semi open housing Pigport</td>
<td>Very open housing with a hut/box</td>
<td>Ventilation only through the windows</td>
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## EmiDaT Working group

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<tr>
<th>Name</th>
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<tbody>
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https://www.ktbl.de/inhalte/themen/ueber-uns/projekte/emidat/
Thank you for your attention