

Verification of emission-reducing procedures in naturally ventilated cow houses by using optimised measurement methods

Revision of the VERA test protocol “Housing Systems”

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Objectives

Make environmental efficiency and operational stability of emission-reducing procedures transnationally comparable!

- By using uniform and scientific test procedures and develop a revised test and verification standard
- Meet special challenges of emission measurements in naturally ventilated animal houses

Material & Methods

Connect expert knowledge and results of scientific studies from Denmark, the Netherlands, Germany, Belgium, France and Switzerland – as it is common practice during the creation of international standards.

Plan an inter-laboratory test to improve the assessment of measurement uncertainties under on-farm conditions

Results

Revised version of the VERA test protocol for ‘Housing and Management Systems’ focussing on:

- NH₃, odour, dust emissions
- Related parameters (e.g. ventilation rate, CO₂, agronomic conditions)
- Operational stability of the system (e.g. uptime of system, consumption of electricity, water, chemicals).

Key amendments of the revised protocol

General

Introduction of ‘Standard Reference Methods’ (ISO 14793) – for higher flexibility in measurement methods but still assuring high measurement quality:

- Ammonia: impinger system
- Odour: dynamic olfactometry (EN 13725)
- Dust: gravimetric measurement (relevant EN standards)
- Air volume: fan-wheel anemometer or emission values derived from tracer gas

Agronomic requirements

Aim: allow best possible transferability of the test results to other countries/farms.

- Comprehensive summary of agronomic requirements for an emission test
- Compliance with all national regulations on animal welfare, total environment, occupational health and safety and food safety
- Definition of standard dairy house = loose housing with cubicles
- Summary of national emission factors of VERA member countries

Criterion (Excerpt)	Example: Dairy cows
Animal occupation rate	90–100%
Herd composition	> 70% of house must be occupied by cows
Housing system in use before test	> 2 months
Production level	≥ 25 kg fat and protein corrected milk per cow and day
Feed composition	≥ 50% roughage, 160–180 g CP per kg dry matter



Inter-laboratory test

Plan phase 1:

Comparison of the measurement devices for NH₃, CO₂ and accompanying parameters without sampling variability

- Standardised gas measuring chamber with a mixture of different gases representing typical farm conditions.
- Test one measurement point in a ‘real-life’ animal house

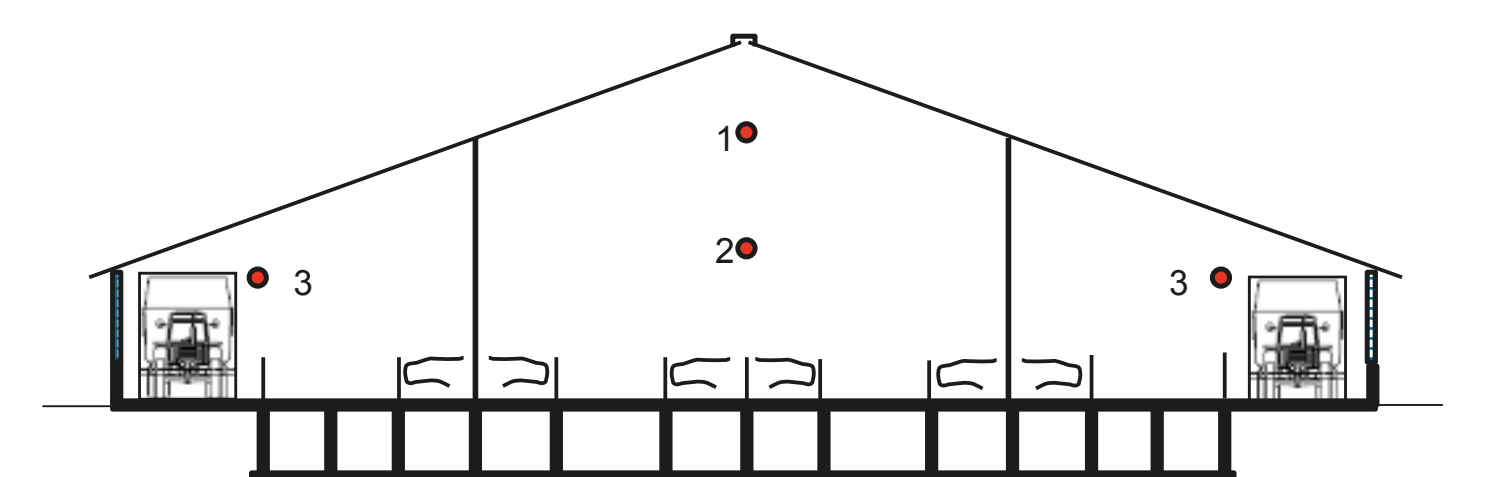
Naturally ventilated buildings

Key alterations and major requirements:

- **Test design**
Case-control design = preferred option or multi-site approach (more expensive, min. 4 test locations)
Deviation limits for a case-control approach
Alternative test designs (‘fixed case-control’ or ‘on-off’) with specific requirements

- **Emission patterns**
Depending on the animal weight and growth. ‘Growth’: stable (e.g. dairy cows), linear increase (e.g. fattening pigs) or exponential increase (e.g. broilers).
Must be considered in test plan.

- **Sampling points (CO₂ balance method)**



Ingoing air: ≥ 1 sampling point outside the house at all open side walls (≥ 5 m distance).
Other sources: to be considered/measured.

- **Sampling frequency**
≥ 6 measurement periods of ≥ 24 hours distributed over one year.
Number: depends on power of test design.
Distribution: depends on the emission pattern.
- **Calibration, validation, on-site verification**
Good laboratory practice emphasised (e.g. calibration procedures, estimates of measurement uncertainties according to the requirements of ISO 17025 to be documented and reported).
- **Calculation of the emission value**
CO₂ balance method: CIGR calculation rules.
→ open Excel calculation tool

