# Gaseous emissions from deep

# litter systems for dairy cows

Gert-Jan Monteny

Presentation for UNECE meeting Prague, April 2006





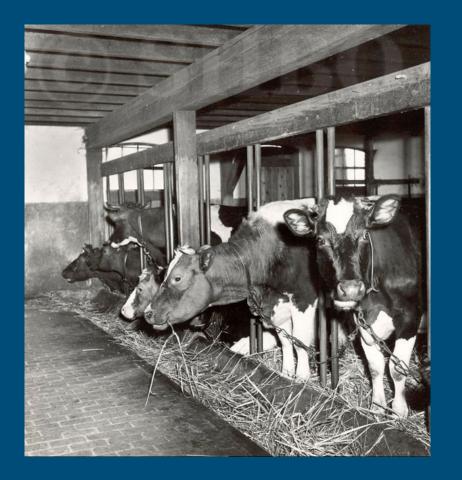
#### Deep litter systems for dairy cows

Work in the 90's by Groenestein et al.:

- Mechanically ventilated dairy cow house (loose house)
- 7 10 kg straw per animal and day
- Ammonia emission: 6.8 kg per cow (6,000 l)
- No N<sub>2</sub>O detected
- CH4: 1 kg per cow and day
- At that time, little attention paid to this type of cattle housing (mostly: loose housing with cubicles; tying stalls to some extent
- Nowadays: increased attention (animal welfare, biological farming), including gaseous emissions from storage



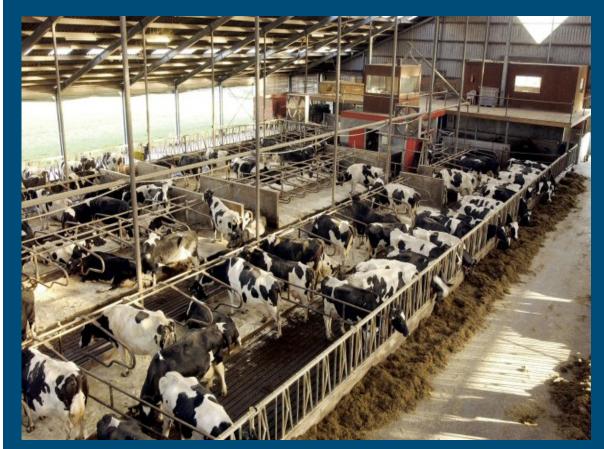
# Tying stalls ('the old days')







## An overview of a loose house cubicle stall







## What do deep litter systems look like ?







# **Current project**

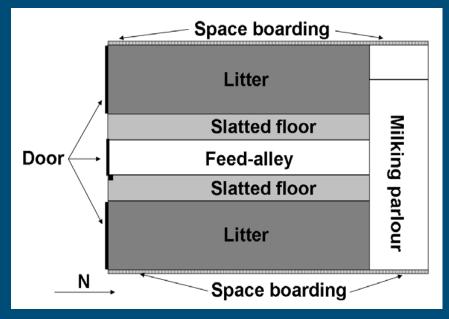
- Naturally ventilated dairy cow house
- Biological farm
- Measurements from November 2003 September 2004 (periodical monitoring)
- Ammonia, Methane, Nitrous Oxide and odour from the animal house, and from outdoor stored FYM



#### **Emission measurements**

#### Animal house:

- Internal tracer gas ratio method (SF<sub>6</sub>) to measure ventilation rate
- Sampling of indoor air using a circular sampling line
- NH<sub>3</sub> concentration with convertor + NO<sub>x</sub> analyser (continuous)
- CH<sub>4</sub> and N<sub>2</sub>O concentrations with GC (collected samples)





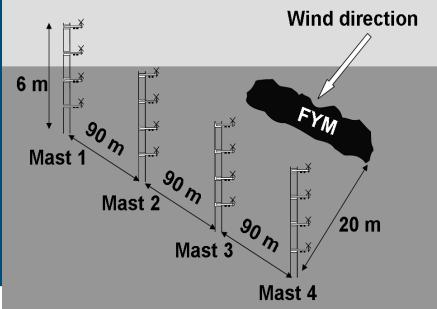
#### Emission measurements (cont'd)

# FYM storage outdoor (heap)

 External tracer gas method: SF<sub>6</sub> released at the heap

# Concentrations of SF<sub>6</sub> and other gases measured downwind (profile)

 Using wind speed profile and dispersion model to assess fluxes





# Results (cow house)

	Housing season		Grazing season	
	<u>Nov 03</u>	<u>Jan 04</u>	<u>May 03</u>	<u>Sep 04</u>
Days	6	5	14	4
Cows	49	62	55	53
Temp.	7.5	5.3	18.8	18.9
Vent m <sup>3</sup> /h	765	2876	849	431
NH₃ g/d	33	31	63	26
CH₄ g/d	900	700	2,800	900
N <sub>2</sub> O g/d	-	1.8	3.4	4.8



#### Findings (cow house)

Annual NH₃ emission: 13.9 kg/LU (assuming 175 days grazing)
Dutch EF for cubicle houses: 9.5 kg/cow (= LU)
Highest emissions during period with grazing; explained from T and N-concentrations, but ...

CH<sub>4</sub>: 0.7-2.9 kg/d.LU; traditional slurry: 0.5 kg/d

N<sub>2</sub>O: 1.8-4.8 g/d.LU; traditional slurry: approx. 0



#### Findings (FYM storage)

Significant NH<sub>3</sub> emissions directly upon storage Hardly any emission found after 2 weeks 7.9 kg/LU for this period of FYM Or...110 kg TAN emitted from the FYM heap 425 m<sup>3</sup> \* 0.6 kg/m<sup>3</sup> \* 1.3 g/kg = 350 kg TAN stored Emission factor = 30%

Significant CH<sub>4</sub> emissions after 2 weeks No N<sub>2</sub>O found



# Finally.....

# THANKS



