

September 2005

Content

This NewsLetter is dedicated a project under DaNet about “Real time modelling; monitoring and management of ammonia emission”.

Authors: Bjarne Bjerg, KVL & Anya Vinstrup, DIAS

Real Time Modelling; monitoring and management of ammonia emission

The main objective of the project is to develop a real time decision support model and monitoring system for ammonia emission from animal buildings that sustain efficient ways of ammonia conservation by optimised management of the production system.

The scientific work is focused on model development and knowledge synthesis on animal nutrition and animal housing effects on ammonia emission. The project is organized in the following phases:

1. Effect of nutrition on ammonia emission.
2. Effect of animal housing on ammonia emission.
3. Development of an ammonia emission model.
4. Development and validation of an online monitoring system.
5. Validation of a monitoring system and model in commercial production units.

The monitoring system including the model will be installed in selected production units. The system and the collected data will be validated regarding detection accuracy, calibration



Figure 1 Test set-up of detection instruments for real time modelling of ammonia emission at the Climate Lab at Research Centre Bygholm

and management. The decision support model combined with the monitoring system will support a development aimed to introduce more efficient ways to control ammonia emission, resource utilization and optimisation of the production system. E. g. it will be possible for

the producers to obtain knowledge on how changes in management or production system will influence the emission level from the production system.

It is known that ammonia emission from a livestock building depends on a number of different factors such as room temperature, air speed above manure surfaces, manure temperature, floor construction, distribution of manure on floor surfaces, manure removal frequency, feed composition and use of feed and manure additives. However, in practical husbandry the producer has no knowledge on the emission level from the actual production unit or on how the mentioned factors interact in a specific production unit and consequently, it is not possible to optimise the management in order to find the most beneficial way to obtain a certain reduction of ammonia emission. This constraint is obviously a significant obstacle for reduction of ammonia emission from livestock production.

Online information on the actual ammonia emission is basis for development of a model for revealing how the ammonia emission from a production unit is affected by changes in the way the specific unit is operated. Such changes could involve;

- Change in feed composition
- Introduction of a manure additive
- Change in indoor temperature set points
- Change in heat supply capacity, set points or strategy.
- Change in air inlet area and, consequently, assumed change in air speed above manure surfaces
- Change in manure removal frequency

The task of the model is to predict the expected ammonia emission without changes in the way the unit is operated. This requires a qualified prediction of the ammonia emission using parameters that the producer has no or only limited influence on. Animal live weight and outdoor climate are parameters that fulfil this condition. It is possible for a pig producer to influence the indoor air temperature and ventilation rate by adjustment of the climate control system, but if the actual change has no connection to the indoor climate conditions it is natural to include the indoor air temperature and ventilation rate in the estimations of the

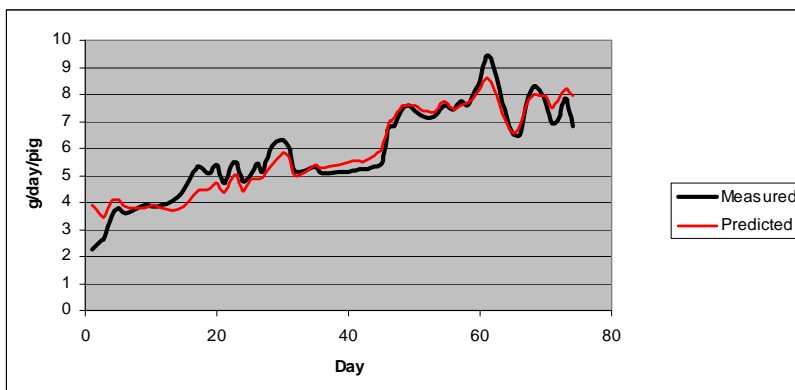


Figure 2: Measured and predicted ammonia emission from slaughter pigs (30-100 kg). Source Bjerg et.al.: A model for revealing the influence of housing system and management of ammonia emission from pig production units. AgEng 2004.

expected ammonia emission assuming that no change has taken place.

Changes in the way a production unit is operated can either take place between two batches of pigs or during an ongoing production period. If the change takes place between two batches it is natural to compare batches

after the change with batches before the change. But if a change take place during a production period it would be relevant to compare the ammonia emission before and after the change in the same production period. Changes in ammonia emission during the production period can either be related to planed actions as change in feed composition or to unforeseen incidences as change in animal manure behaviour.



Figure 3: Slaughter pigs in Climate Lab at Byghom

Analyses of data from 10 batches of growing and finishing pigs shows that daily ammonia emission per animal is closely related to animal live weight and outdoor temperature, and further improved prediction of ammonia emission can be obtain by including effects of indoor temperature and ventilation rate.

The development of the online version of the modelling system is in progress and a prototype is expected to be implemented in a commercial pig unit at the end of august 2005. Further information – see:

<http://www.ihh.kvl.dk/htm/bb/Ammonia/>

Project participants:

Project co-ordinator Bjarne Bjerg, André Chwalibog, Anne-Helene Tauson & Jørgen Pedersen, KVL Svend Morsing, Hans Benny Rom & Lis Jacobsen, DIAS, Bygholm

Topics of coming newsletters

Farm Wet Scrubber

HortiBot - A Plant Nursing Robot

