



# **Memorandum: Measurement of ammonia emission from two housing unit sections – test of Active NS**

**FORCE Technology**

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## Contents:

Bilag A Introduction .....	2
Bilag B Results.....	2
B.1 Graphic to show emissions .....	3
Bilag C Calculated emissions.....	4
C.1 Comments on the results .....	5

## Bilag A Introduction

As part of an ETV test of slurry additive Active NS, FORCE Technology undertook measurements of ammonia during two periods in 2016 and 2017.

The ETV test has not been concluded but the results from the two periods give a preliminary indication of the effect of Active NS.

The testing and measuring methods are described in FORCE Technology report 116-20216<sup>1</sup>.

As data from 2017, which was used in this report, is to be used in connection with an ETV test ending in mid-2018, the data and calculations have not been reviewed by anyone other than the report writer. Implementation of quality assurance has been planned in connection with final reporting on the ETV test. Data from 2016 has been quality assured.

## Bilag B Results

The test, which is described in the aforesaid report<sup>1</sup>, is an initial test to assess methods and efficacy. The ETV test was initiated in May 2017, and the period described is the first period, during which measurements were taken from the pigs' first day in the housing unit until the date when the first pigs were removed from the housing unit.

During those two periods, approximately 480 and approximately 460 were involved – information about numbers is given in the results tables. For practical reasons, the pigs could not be put into both sections at the same time; for that reason, there is approximately two weeks' displacement between them. In order to make the most realistic comparison, the emissions were calculated for periods of the same length from the same day the pigs were in the housing units (i.e. Day 6 to 26 and day 1 to 68). The emissions were not calculated any further on than when the first pigs were removed for slaughter.

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□ FORCE Technology report dated 15 July 2016: Two pig housing units in Hammerum  
Measurements of ambient emissions  
Measurement of effectiveness of Active NS.

The emissions are shown on graphs as emissions per hour per 1,000 kg of animal and calculated in the tables of results as emissions per tonne of added growth.

During brief periods, there were data logging/data transmission errors; for that reason, there are gaps in the rows of results – seen as gaps in the graphs in Figure 2.

### B.1 Graphic to show emissions

Figure 1 Showing emissions per 1,000 kg of animal during the measurement period in 2016. Active NS was added in housing unit 1, where the results are displayed on the blue graph.

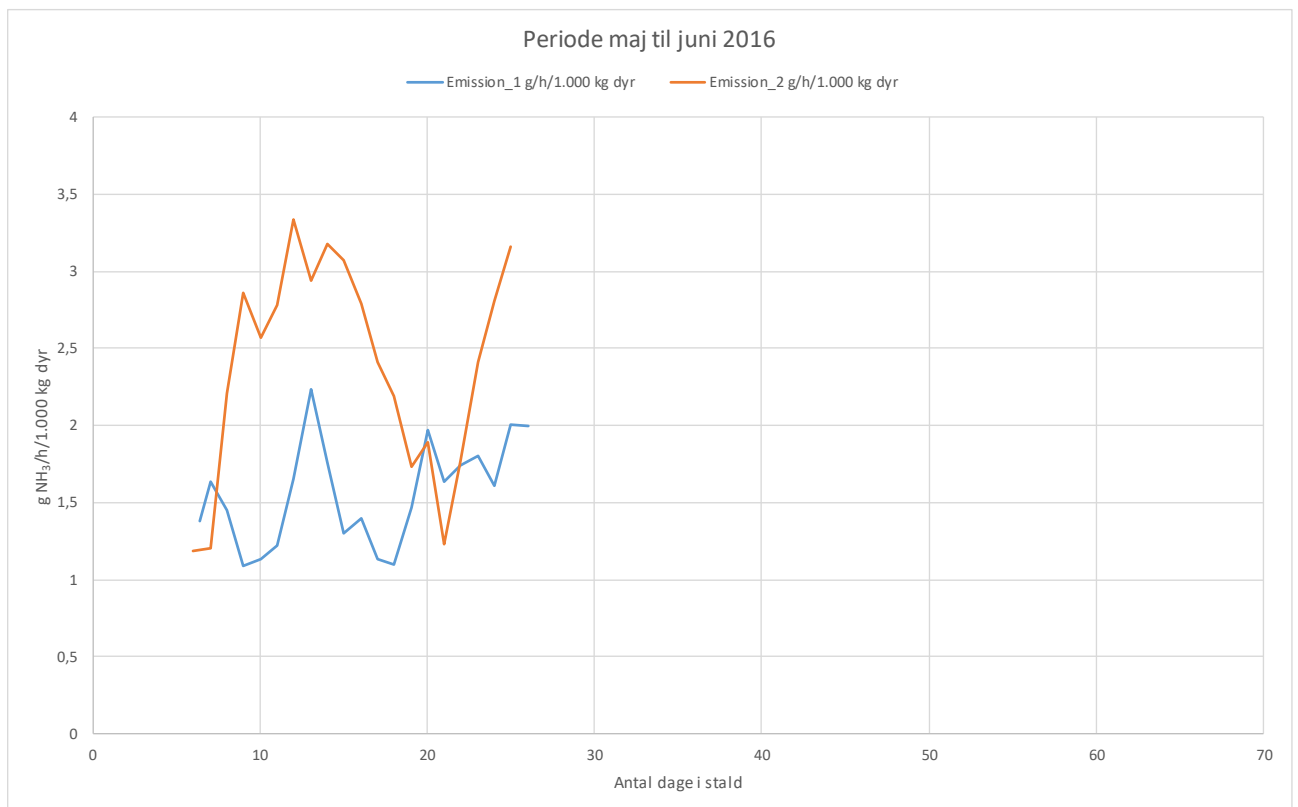


Figure 1 Results for two housing unit sections, May to June 2016

Figure 2 Showing emissions per 1,000 kg of animal during the measurement period in 2017. Active NS was added in housing unit 1, where the results are displayed on the blue graph.

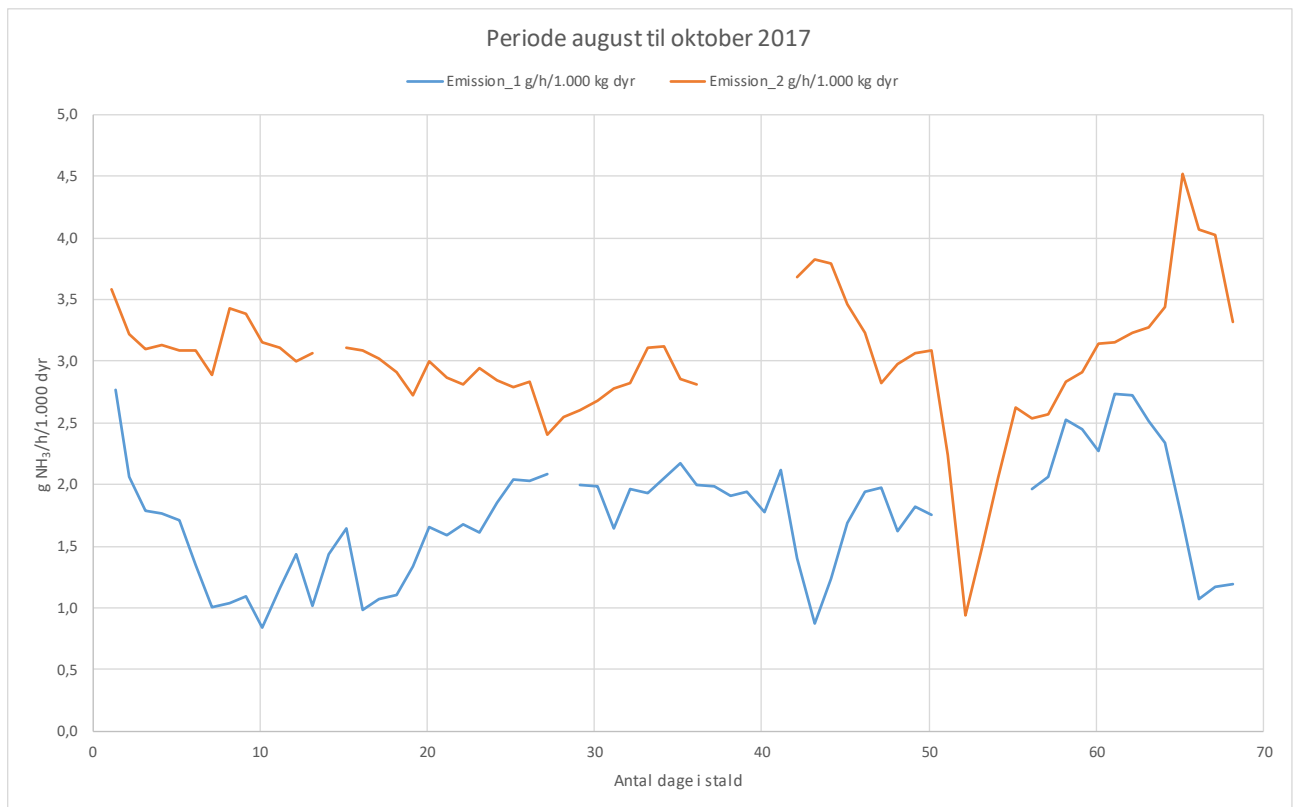


Figure 2 Results for two housing unit sections, August to October 2017

## Bilag C Calculated emissions

The tables of results show the lengths of the periods measured as the number of days the pigs were in the housing units from the start of the calculation until the conclusion of the calculation. The actual dates are also shown.

The tables of results show the number of pigs on the first day and the last day of the calculation period – minor differences are due to deaths, not removal for slaughter. 2–3 pigs of difference from start to finish is considered insignificant.

The tables of results also show the pigs' weight on the first day and the last day of the calculation period.

Table 1 Calculated emission per tonne of added growth, May to June 2016 – Active NS was added in housing unit 1

	Stald 1 - Active NS tilsat			Stald 2		
	27-05-2016	til	16-06-2016	07-06-2016	til	27-06-2016
Dag	6		26	6		26
Antal	478		477	480		480
Vægt	43,3		63,3	44,8		65,5
	Tilvækst	Emission	NH <sub>3</sub>	Tilvækst	Emission	NH <sub>3</sub>
	kg	kg NH <sub>3</sub>	kg NH <sub>3</sub> /ton tilvækst	kg	kg NH <sub>3</sub>	kg NH <sub>3</sub> /ton tilvækst
	9.511	20,1	2,1	9.910	31,9	3,2

Table 2 Calculated emission per tonne of added growth, August to October 2017 – Active NS was added in housing unit 1

	Stald 1 - Active NS tilsat			Stald 2		
	09-08-2017	til	15-10-2017	23-08-2017	til	29-10-2017
Dag	1		68	1		68
Antal	462		460	462		461
Vægt	38,6		103,6	34,7		100,2
	Tilvækst	Emission	NH <sub>3</sub>	Tilvækst	Emission	NH <sub>3</sub>
	kg	kg NH <sub>3</sub>	kg NH <sub>3</sub> /ton tilvækst	kg	kg NH <sub>3</sub>	kg NH <sub>3</sub> /ton tilvækst
	29.947	86,1	2,9	30.440	140,0	4,6

## C.1 Comments on the results

In relation to the VERA protocol, there should be the same number of pigs of the same weight in both the trial subject housing unit and the control housing unit, and they must be at the same level in the housing units – i.e. No time displacement.

In recognition of the fact that practicalities made it difficult to deliver a complete test setup in accordance with the VERA protocol, the graphs and the tables are both adjusted to take account of weight and time displacement. The calculation of emissions per 1,000 kg of animals has hitherto been used in publications by SEGES/the Danish Pig Research Centre.

The reductions achieved over the two periods are

May to June 2016: 34%

August to October 2017: 37%

During the period May to June 2016, there was no flushing out during the period under consideration (from 6 to 26 days), and in the period August to October 2017, flushing-out was performed once, after 40 days.

During the period August to October 2017, the initial weight of the pigs in the housing unit was approximately 11% higher. Obviously, that has an effect on emissions per 1,000 kg of animal, which in this case works in favour of the trial subject housing unit. Conversely, larger pigs, as mentioned above, produce more slurry in the containers and more manure on the floor.

The two periods are of different durations. Only in the period August to October 2017 were the results obtained for a whole period from entry of the pigs to removal of the first pigs for slaughter. Based on the duration of this period, equal note should be taken of the result from this period.

The requirement of the VERA protocol for there to be at least 50 animals in the housing units has been fulfilled, and the housing units are highly representative of realistic production conditions.

The test is ongoing and the next period is expected to conclude in mid-February 2018. This period is a winter period, whereas the others covered early summer and autumn respectively.