Links to the IRPP BREF revision and Guidance document on preventing and abating ammonia emissions from agricultural sources (GP Guidebook)

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Introduction

The EIPPCB has assessed about one third of the TWG comments received on Draft 2 (so over 530 comments on a total of 1550 comments related to the BAT conclusions) of the IRPP BREF, and has started to draft the background paper with the topics to be discussed during the final TWG meeting. Given the type and amount of comments remaining to be assessed, the EIPPCB believes that the final IRPP TWG meeting will not be held before Summer of 2014. (EIPPCB, March 14).

The Directive on industrial emissions 2010/75/EU (IED) previously the Directive on integrated pollution, prevention and control (IPPC) among others covers in the Annex 1 of the directive the following activities: 6.6. Intensive rearing of poultry or pigs: (a) with more than 40 000 places for poultry; (b) with more than 2000 places for production pigs (over 30 kg), or (c) with more than 750 places for sows. These installations are forced to use the BATs for fulfilment of requirements set down by the directive to operate the installation by utilisation of low-emission housing systems. These BATs are described in the IRPP BREF. The Annex IX of the revised Gothenburg protocol (May 2013) lays to the Parties following obligations. Parties shall use, for new animal housing systems and for new slurry stores on large pig and poultry farms of 2000 fattening pigs, or 750 sows or 40 000 poultry, low-emission housing and storage systems, which are published in the Guidance document on preventing and abating ammonia emissions from agricultural sources (GP Guidebook).

The BREF is intended for farms with intensive pigs and poultry rearing only, while the GP Guidebook includes also some abatement measures for farms of cattle breeding. This is a difference between the both documents; however both documents are focused on the same objects. This fact demonstrates a direct link between both legislative tools and its targets. Fulfilment of the BAT-associated environmental performance levels (AEPL) mentioned in the conclusions of the BREF will be legally mandatory for operators of large installation for intensive pigs and poultry rearing.

Comparison of data presented in the 2. Draft of the BREF with data of the revised GP Guidebook

In this chapter data of technologies suggested as BAT for pigs presented in the second draft of the BREF are compared with data available in the already revised and published Guidance document on preventing and abating ammonia emissions from agricultural sources (GP Guidebook). The aim of comparison is finding of mutual agreement/disagreement of both document to raise a discussion on potential differences. The main goal should be clarification of potential differences in approaches of both processes.

1) Nutritional management for pigs

Nutritional management is the most effective way to abate of ammonia emissions. In principle, there is possible to avoid or rapidly reduce of ammonia emissions production by using of balance diet.

2. Draft of the BREF	GP Guidebook (category 1)	Comparison
Use a balanced diet with an optimum feed conversion rate based on net energy, low crude protein content and digestible amino acids	The CP content of the pig ration can be reduced if the amino acid supply is optimised through the addition of synthetic amino acids	Fully in compliance
Phase feeding with a diet formulation adapted to the specific requirements of the production period	Feeding measures in pig production include phase feeding, formulating diets based on digestible/available nutrients	Fully in compliance
Add controlled amounts of essential amino acids to a low crude protein diet	Using low-protein amino acid-supplemented diets	Fully in compliance
Use additives that improve the animal growth and promote performance in feed conversion	Using feed additives/supplements	Fully in compliance

Measures described in the second Draft of the BREF are fully in compliance with measures described in the GP Guidebook. No significant differences have been found.

Comparison of N excretion

Generally speaking nutritional management has significant impact on excretion of nitrogen in animal faeces. Below are compared data regarding amount of excreted nitrogen by different categories of pigs. As a source of data comparison the conclusion of the 2. Draft of the BREF; the EMEP/EEA emission inventory guidebook and the Guidelines for a common methodology produced in the scope of the Methodological studies in the field of Agro-Environmental Indicators have been used.

Animal category	**(kg N excreted/animal place/year)**		
	BAT-AEPL (2. Draft of BREF)	Default values (EMEP/EEA emission inventory guidebook 2013	Default excretion coefficients Methodological studies in the field of Agro-Environmental Indicators. Lot 1 excretion factors Guidelines for a common methodology – Oenema et all 2014
Weaners	2 – 3.5		2.8-3.8 (7.5 – 25 kg)
Fattening (growers and finishers)	8 – 12	12.1 (pigs 8-110 kg)	10.5-14.3 (25-110 kg) 11.2-14.9 (25-110 kg) depending on N conversion coefficient
Mating, gestating sows	17 – 22		
Lactating sows	23 – 28	34.5 (Sows and piglets to 8 kg)	19-23 (Sows and piglets to 1 kg)

It is possible to say that BAT-AEPL are in compliance with default excretion coefficients mentioned in the Guidelines for a common methodology for categories weaners and fattening pigs. For fattening pigs it is also in compliance with default values of EMEP/EEA emission inventory guidebook. For especially lactating sows there is needed an additional discussion on presented values.

2) Housing systems for pigs and sows

In breeding practice there is used a large amount of different housing technologies and their combinations. Comparison of housing technologies for pigs and sows has been focused on technologies mentioned in the 2. Draft of the BREF as BAT candidates and technologies considered as category 1 in the GP Guidebook.

a) housing systems for mating and gestating sows

2. Draft of the BREF	GP Guidebook (category 1)	Comparison
The reference system is fully-slatted floor with a deep pit	*The reference system for housing of mating and gestating sows is the fully slatted floor (concrete slats) with a deep pit. NH3 emission (4.2 kg NH3/ place/year)*	fully in compliance
Fully-slatted floor with vacuum system for slurry removal	Frequent manure removal with vacuum system (emission reduction 25% - 3.15 kg NH3/ place/year)	in compliance
Partly-slatted floors with vacuum system for slurry removal	Frequent manure removal with vacuum system (emission reduction 25% - 3.15 kg NH3/ place/year)	in compliance
Partly-slatted floors with slanted walls in the manure channel	(Group) housing with feeding stalls and manure pit with slanted walls (emission reduction 45% - 2.3 kg NH3/ place/year)	in compliance
Partly-slatted floors or fully-slatted flat decks with a scraper		
Partly-slatted floor with reduced manure pit		generally in compliance
Frequent slurry removal by flushing		
Kennel or hut housing on partly slatted floors		generally in compliance
Solid concrete floor with full litter		
Litter-based pens with feeding/lying boxes on solid floor		
Partly-slatted floors with slurry cooling	Cooling manure surface (emission reduction 45% - 2.3 kg NH3/ place/year)	in compliance
Partly-slatted floors with manure surface cooling fins.	Cooling manure surface (emission reduction 45% - 2.3 kg NH3/ place/year)	in compliance
Wet acid scrubber	Air scrubbing techniques (emission reduction 70% - 1.26 kg NH3/ place/year)	in compliance
Two-stage or three-stage air cleaning system	Air scrubbing techniques (emission reduction 70% - 1.26 kg NH3/ place/year)	in compliance

Majority of housing systems for mating and gestating sows intended as BATs are in compliance with systems of category 1 of the GP Guidebook. System with partly or fully slatted floors and scraper is not considered as a category 1 of GP Guidebook. In previous BREF this system was considered as a conditional BAT for installation, where was already in use. Systems using litter/straw are not considered as a category 1 of GP Guidebook although it is known that theirs utilisation will be increase due to welfare reasons. Additional discussion for inclusion in BATs will be needed.

b) housing systems for farrowing, lactating sows

2. Draft of the BREF	GP Guidebook (category 1)	Comparison
Reference system: fully-slatted floor with a deep pit	*Reference system: Farrowing sows are housed in crates with steel or plastic slatted floors and a deep manure pit underneath*	fully in compliance
Partly-slatted floors with slanted walls in the manure channel		generally in compliance
Partly-slatted floors or fully-slatted flat decks with a scraper		
Partly-slatted floor with reduced manure pit		generally in compliance
Frequent slurry removal by flushing		
Stall housing with partly-slatted floors		generally in compliance
Crates with fully-slatted floors and a combination of water and manure channels	Water and manure channel (emission reduction 50% - 4.15 kg NH3/ place/year)	in compliance
Crates with fully or partly-slatted floors and manure pan	Manure pan underneath (emission reduction 65% - 2.9 *kg NH3/ place/year)*	in compliance
Litter-based pens with feeding/lying boxes on solid floor		
Partly-slatted floors with slurry cooling	Cooling manure surface (emission reduction 45% - 4,56 kg NH3/ place/year)	in compliance
Wet acid scrubber	Air scrubbing techniques (emission reduction 70% - 2.49 *kg NH3/ place/year)*	in compliance
Two-stage or three-stage air cleaning system	Air scrubbing techniques (emission reduction 70% - 2.49 kg NH3/ place/year)	in compliance

Many housing systems for lactating sows intended as BATs are in compliance with systems of category 1 of the GP Guidebook. Some systems intended as BATs are in compliance with general principles to decrease area for emitting of emissions mentioned in the GP Guidebook.

c) housing systems for weaners

2. Draft of the BREF	GP Guidebook (category 1)	Comparison
Reference technique for weaners: Weaners are group-housed. Pens and flat decks are comparable designs and are both made up of it is a combination of the classic pen crate with a fully-slatted floor made of plastic or metal elements, with manure removal at the end of the cycle.	*Reference technique for weaners: Weaners are group housed either in conventional pens or flat decks (raised pens). NH3 emission (0.65 kg NH3/ place/year)*	fully in compliance
Pens or flat decks with fully or partly slatted floor with vacuum system for slurry removal	Frequent manure removal with vacuum system (emission reduction 25% - 0.49 kg NH3/ place/year)	in compliance
Partly-slatted floors or fully-slatted flat decks with a scraper		
Partly-slatted pens with convex floor and separated manure and water channels		
Frequent slurry removal by flushing	Partly slatted floors and flushing gutters (emission reduction 25% - 0.49 kg NH3/ place/year)	in compliance
Solid concrete floor with full litter with or without external features		
Pens with partly-slatted floors	Partially slatted floor with reduced pit (emission reduction 30% - 0.45 kg NH3/ place/year)	in compliance
Pens or flat decks with fully-slatted floors and concrete sloped underground floor		
Manure collection in water		
Pens with solid concrete floor with litter		
Fully or partly-slatted floors with manure surface cooling fins.	Cooling manure surface (emission reduction 75% - 0.16 kg NH3/ place/year)	
	Partly slatted floor and manure channel with slanted walls (emission reduction 65% - 0.23 kg NH3/ place/year)	
	Partly slatted floor and collection in acidified liquid (emission reduction 60% - 0.26 kg NH3/ place/year)	
Wet acid scrubber	Air scrubbing techniques (emission reduction 70% - 0.19 kg NH3/ place/year)	in compliance
Two-stage or three-stage air cleaning system	Air scrubbing techniques (emission reduction 70% - 0.19 kg NH3/ place/year)	in compliance

In basic principles the 2. Draft of the BREF and GP Guidebook are in compliance. The 2. Draft of the BREF offers a larger range of housing systems for weaners or its combination than the GP Guidebook. More technical information would be needed for a deeper comparison and assessment.

d) housing systems for fattening pigs

2. Draft of the BREF	GP Guidebook (category 1)	Comparison
Reference system: fully-slatted floor with a deep pit	*Reference technique for growers/finishers:* The reference system, used commonly in Europe, is a fully slatted floor with a deep manure pit underneath and mechanical ventilation. *NH3 emission (3.0 kg NH3/ place/year)*	fully in compliance
Fully-slatted floor with vacuum system for slurry removal	Frequent manure removal with vacuum system (emission reduction 25% - 2.25 *kg NH3/ place/year*)	in compliance
Partly-slatted floors with vacuum system for slurry removal	Frequent manure removal with vacuum system (emission reduction 25% - 2.25 *kg NH3/ place/year*)	in compliance
Partly-slatted floors with slanted walls in the manure channel		generally in compliance
Partly-slatted floors or fully-slatted flat decks with a scraper		generally in compliance
Partly-slatted pens with convex floor and separated manure and water channels	Partially slatted floor with water channel and manure channel with slanted walls (emission reduction 60% - 1.2 *kg NH3/ place/year*)	in compliance
	Partially slatted floor with water and manure channel (emission reduction 40% - 1.8 *kg NH3/ place/year*)	generally in compliance
Partly-slatted floors with slurry Vshaped manure belts	Partially slatted floors and separated removal of liquid and solid manure fraction by V-shaped belt (cat. 2) (emission reduction 70% - 0.9 *kg NH3/ place/year*)	in compliance
Partly-slatted floor with reduced manure pit	Partially slatted floor with reduced pit (emission reduction 20% - 2.4 *kg NH3/ place/year*)	in compliance
Frequent slurry removal by flushing	Flushing gutters (emission reduction 40% - 1.8 *kg NH3/ place/year*)	in compliance
Kennel or hut housing on partly slatted floors		generally in compliance
Solid concrete floor with full litter		
Litter-based pens with feeding/lying boxes on solid floor		
Solid concrete floors with littered external alley		
Straw flow system		
Partly-slatted floors with slurry cooling	Cooling manure surface (emission reduction 45% - 1.65 *kg NH3/ place/year*)	in compliance
Partly-slatted floors with manure surface cooling fins.	Cooling manure surface (emission reduction 45% - 1.65 *kg NH3/ place/year*)	in compliance
Wet acid scrubber	Air scrubbing techniques (emission reduction 70% - 0.9 *kg NH3/ place/year*)	in compliance
Two-stage or three-stage air cleaning system	Air scrubbing techniques (emission reduction 70% - 0.9 *kg NH3/ place/year*)	in compliance

Majority of housing systems for fattening pigs intended as BATs are similar to housing systems for mating and gestating sows and are in compliance with systems of category 1 of the GP Guidebook. System with partly or fully slatted floors and scraper is not considered as a category 1 of GP Guidebook. In previous BREF this system was considered as a conditional BAT for installation, where was already in use. Systems using litter/straw are not considered as a category 1 of GP Guidebook although it is known that theirs utilisation will be increase due to welfare reasons. Additional discussion for inclusion in BATs will be needed.

Comparison of ammonia production

Every housing system is characteristic by a different potential for ammonia emission production. Common method for calculation ammonia emission reduction of selected abatement housing system is utilisation of ammonia production value of the reference system and percentage of emission reduction of the system. Below are compared data regarding ammonia emission values of housing systems for different categories of pigs between the 2. Draft of BREF and GP Guidebook.

Animal category	(kg NH3/animal place/year)		
	BAT-AEPL (2. Draft of BREF)	GP Guidebook (category 1)	comparison
Weaners	0.2-0.4	0.19-0.49	partly in compliance
Mating, gestating sows	1.2-2.5	1.26-3.15	partly in compliance
Farrowing, lactating sows	2.5– 4.0	2.49-4.56	partly in compliance
Fattening (growers and finishers)	1.0-1.7	0.9-2.4	partly in compliance

The emission data are partly in compliance. Technologies with lower reduction potential mentioned in the GP Guidebook does not fulfil a range of the BAT-AEPL in the BREF. For example, the emission level of reference system mentioned in the GP Guidebook for mating sows is 4.2 kg NH3/place/year. If there on the farm will be used an abatement system based on frequent manure removal with vacuum system with reduction ammonia emission potential on the level of 25% then this technology should produce ammonia emission on the level of 3.15 NH3/place/year. This housing system is also BAT candidate (partly-slatted floors with vacuum system for slurry removal page 699 of the BREF). However the BAT-AEL mentioned in the 2. Draft of BREF for mating sows is in the range of 1.2 – 2.5 NH3/place/year. It means that this housing system with lower reduction potential is out of the recommended range. This differences could probably originate from different method of abatement calculation and it would be very useful to clarify these unclearness.

3) Manure storage

Inseparable part of the installation for pigs and sows rearing is storage of manure most often of liquid slurry.

2. Draft of the BREF	GP Guidebook (category 1)	Comparison
reference technique: Store with no cover or crust	*reference technique: Store with no cover or crust*	fully in compliance
Use stable tanks that are able to withstand mechanical, chemical and thermal influences		
Reduce the ratio between the surface area and volume of the slurry tank		
Use slurry tanks with a sufficient capacity that allows operating at a lower level of fill		
Empty slurry tanks in spring before the warm season, in order to reduce the quantity of stored slurry		
For slurry stored in open storage containers, use discharge points as close as possible to the base of the containers		
Cover slurry stores. Rigid cover	"Tight" lid	in compliance
Cover slurry stores. Flexible covers: o Tent cover o Dome-shaped cover o Cover tended flat	roof or tent structure (cat. 1)	in compliance
3. Floating covers: o Natural crust o Straw and/or high dry matter content manure o Plastic pellets o Peat and light bulk materials o Rape seed oil and grains o Floating flexible covers o Geometrical plastic tiles	Plastic sheeting (floating cover) Allowing formation of natural crust by reducing mixing and manure input below the surface (floating cover) Floating LECA balls, Hexa-Covers Low technology" floating covers (e.g., chopped straw, peat, bark, etc.	in compliance
	Replacement of lagoon, etc., with covered tank or tall open tanks (depth > 3 m)	
	Storage bag	

Technical measures for abatement of ammonia emission escaping from manure storage mentioned in the 2. Draft of BREF are fully in compliance with measures mentioned in the GP Guidebook. Moreover in the BREF there are described some general procedures which are part of manure management leading to emission abatement.

4) Manure application

Techniques far manure application

Emissions originating after manure application will vary with the composition of the slurry and solid manure and are dependent on weather and soil conditions. Choice of application technique is also dependent on farm size, ownership of soil and total economical conditions of the farm. Below are compared systems for slurry application, suggested as BAT.

2. Draft of the BREF	GP Guidebook (category 1)	Comparison
reference technique: The reference manure application technique is defined as untreated slurry or solid manure spread over the whole soil surface ("broadcast") and not followed by incorporation	*reference technique: The reference manure application technique is defined as untreated slurry or solid manure spread over the whole soil surface ("broadcast") and not followed by incorporation*	fully in compliance
Dilute slurry irrigators	Active dilution of slurry of > 4% DM to < 2% DM for use in water irrigation systems	in compliance
Pulse jet irrigators		
Band spreader (trailing hose or trailing shoe)	Band spreading slurry with a trailing hose or shoe	in compliance
Injector (open slot)	Injecting slurry (open slot)	in compliance
Deep injector (closed slot)	Injecting slurry (closed slot)	in compliance
Incorporation of manure into land within four hours after spreading	Incorporation within 4 hrs	in compliance
	Incorporation immediately by ploughing	

Abatement measures for slurry application mentioned in the 2. Draft of BREF are fully in compliance with measures mentioned in the GP Guidebook.

Comparison of manure storage and manure application abatement effects

The BAT-AEPL for manure storage and manure application have not been determined. It means that a direct comparison between data mentioned in the 2. Draft of BREF and the GP Guidebook is not possible. However, in the draft of BREF there is provided an assessment of combination of housing, storage and field application abatement techniques focused on optimisation of the whole-farm environmental impact – adoption of a whole-farm approach, which is fully in compliance with the key and basic GP principles.

Emission reduction measures applied to a specific stage of the animal rearing process have an influence on the emissions potential of the next stage, due to the interdependency of the various phases of livestock manure management. In general, a reduction of ammonia emissions from the housing system results in a higher concentration of nitrogen in the stored manure; while a measure to reduce emissions from manure storage results in an increased amount of available nitrogen for field application, with a consequent higher risk of ammonia emissions during landspreading and higher potential for nitrate leaching to water. On the basis of these observations, management strategies which retain ammonia during

one process step are only beneficial if they do not subsequently exacerbate losses from the following step. Therefore, an integrated approach for a whole-farm emissions reduction should be promoted, based on a manure management strategy that avoids pollution swapping. In the table below are examples of assessed combinations of techniques for fattening pigs with a total potential for ammonia reduction (whole farm approach).

Table 4.207 Examples of assessed combinations of techniques for fattening pigs

Combination	Nutrition	Housing system (with or without end-of-pipe technique)	Manure storage	Field application	NH_3 reduction (whole farm) %
Selected reference	One-phase feeding	Fully-slatted floor with deep pit	Open storage, no covering	Broadcast spreading, no incorporation within 24 hours	0
1	Low protein feed (N excretion reduced by 16 %)	Fully (or partly) slatted floor with vacuum system	Floating cover (natural crust)	Band spreader (trailing hose)	35.8
2	Phase feeding	Fully (or partly) slatted floor with vacuum system	Floating cover (natural crust)	Band spreader (trailing hose)	38.2
3	Phase feeding with addition of amino acids	Fully-slatted floor with vacuum system	Rigid cover (plastic)	Open slot shallow injection	55.0
6	Two-phase feeding	Fully-slatted floor with vacuum system for frequent slurry removal + wet scrubbing system	Floating cover (straw)	Band spreader (trailing hose)	69.3
6A	Two-phase feeding	Fully-slatted floor with vacuum system for frequent slurry removal + biofilter	Floating cover (straw)	Band spreader (trailing hose)	67.8
7	Two-phase feeding	Solid concrete floor with full litter	Rigid cover (concrete or tent)	Spreading with a suitable technique(e.g. rotaspreader, rear-discharge spreader) with incorporation within 4 hours	+60.6 ([1])
8	Two-phase feeding	Fully (or partly) slatted floor with vacuum system for frequent slurry removal + slurry acidification	Slurry acidification + storage without cover	Band spreader (trailing hose)	81.4
9	Two-phase feeding	Partly-slatted floor with vacuum system for frequent slurry removal + slurry cooling	Floating cover (straw) or rigid cover (concrete or tent)	Band spreader (trailing hose)	50.3
10	Two-phase feeding	Partly-slatted floor with vacuum system for frequent slurry removal + slurry cooling	Rigid cover (concrete or tent)	Shallow injection or acidification applied to grass and black soil and band spreader (trailing hose) in other crops	50.3

([1]) The combination of techniques is associated with an increase in ammonia emissions, compared to the selected reference.