

4 Ammonia emissions in the Czech Republic

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Abstract

Within the years 2000 – 2002 some legal regulations on air protection and on integrated pollution prevention and control were established and developed in the Czech Republic. Four hundred and twenty two farms for intensive pigs and poultry breeding come under the IPPC directive. These farms have to obtain an integrated permission for their operation by utilization of best available techniques (BAT). In this study an evaluation of used BAT systems for pig and poultry housing and manure storage is presented. During the years 1990 - 2010 the total amount of livestock has declined in the Czech Republic. This situation was accompanied by a proportional reduction of ammonia emissions. During the past 20 years ammonia emissions were reduced by more than 60% in the Czech Republic.

4.1 General country information

The Czech Republic ratified the Gothenburg protocol in 1999 (CLRTAP, 1999). Since that year a serious and major attention has been paid to the implementation of ammonia abatement techniques in the Czech agriculture, to meet the requirements of the Annex IX of Gothenburg protocol. Within the years 2000 – 2002 a new legislation on air protection was established and developed. This effort was completed by laying down of the Decree 86/2002 on the air protection. Implementary regulation no 353/2002 of the Law on the air protection includes some principles of the Annex IX, which is focused on agricultural sources. In the same year 2002 by adopting the Law No. 76 of 2002 concerning Integral Prevention Pollution and Control EC Directive 96/61 was implemented in the Czech legal system. Both regulations were prepared parallelly, but in harmony with principles of Gothenburg protocol.

The Czech agriculture is characterized by a high amount of extra large enterprises with intensive poultry, pigs or cattle breeding. Four hundred and twenty two enterprises come under the IPPC directive (Table 4.1) (Dedina and Jelinek, 2012). Integrated prevention pollution and control Directive 96/61/EC like the Annex IX of the Protocol deals with an extra large installation for more than 2,000 places for rearing pigs over 30 kilo or 750 sows or 40,000 places for poultry. According to currently available information from the Czech Ministry of Agriculture approximately 89% of laying hens, 86% of chicken broilers, 32% of rearing pigs and 32% of sows are hold in installations covered by IPPC Directive. According to Eurostat about 35% of total numbers of pigs and about 85% of total numbers of poultry are housed in these installations under IPPC. It means above mentioned sources of data are consistent.

Table 4.1 Amounts of pigs and poultry farms coming under the IPPC Directive.

Category according to Annex 1 of the IPPC Directive	Total amount of installations	Category of animals	Total projected capacity of all installations under IPPC Directive (places)
Installation for more than 40,000 places for poultry	153	Chicken broilers	19,922,883
	59	Adult laying hens/	6,138,392
		Young laying hens	4,111,980
		Hens for parent eggs production	1,261,614
		Turkey	33,600
1	Ducks	30,000	
Total	233		
Installation for more than 2,000 places for rearing pigs over 30 kilo or 750 sows	189	Rearing pigs	844,786
		Sows	147,402
Total	189		

Figure 4.1 shows the livestock amount development during 1990 - 2010 in the Czech Republic. Except poultry and sheep total amount of livestock has declined since 1990. Reasons for this declination are different. One of many causes is a liberalization of the trade joined with increased import of beef or pork meat. The other cause is a change in composition of meat consumption joined with consumer preference of poultry meat against pork meat.

Figure 4.2 presents the livestock distribution and ammonia hot spots areas in the Czech agriculture.

Development of ammonia emissions in the Czech Republic

According to a rough estimate 80 - 95% of total ammonia emissions in Europe comes from the agricultural practice. Emissions from the animal excrements represent more than 80% share in total ammonia emission while the fertilizers application contributes by less than 20% of share (Aarnink, 1997). For national estimation of ammonia emissions from animal husbandry in the Czech Republic the simpler approach is used according to the EMEP/CORINAIR Emission

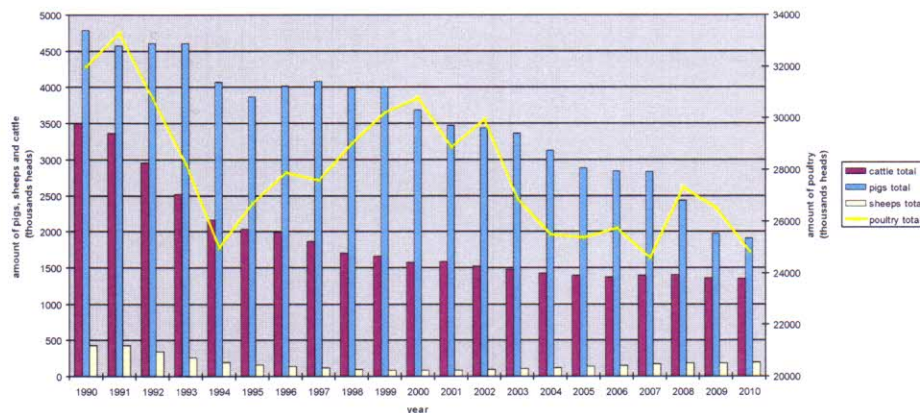


Figure 4.1. Livestock amount development during 1990-2010 in the Czech Republic.

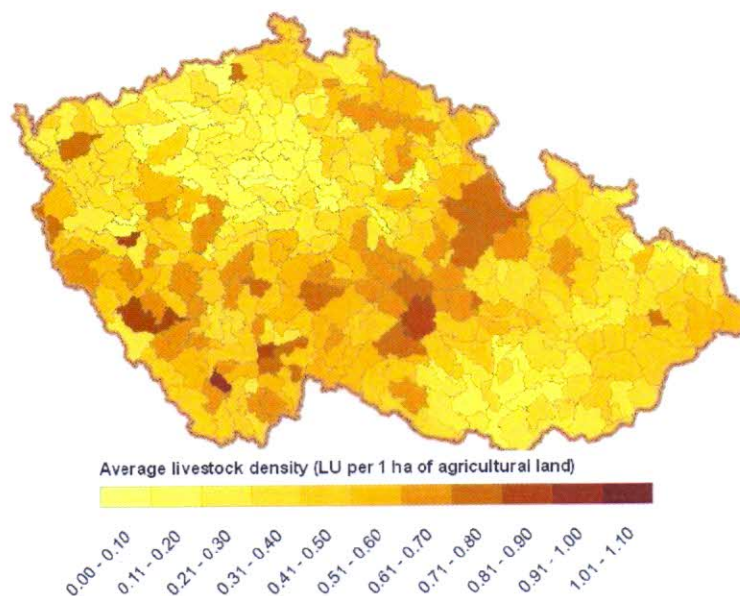


Figure 4.2. Livestock distribution in the Czech agriculture.

Inventory Guidebook. Each category of animals is multiplied by the country specific emissions factors. Number of animals is taken from annual agricultural census. The used country specific emission factors for the Czech Republic are introduced in Table 4.2 (Regulation no 353/2002 of the Law on the air protection). These emission factors have been used since 2002 and should be probably revised in the future.

Table 4.2 The Czech ammonia emissions factors.

Animal category	Emission factor (kg NH ₃ per AAP)			Total emission factor
	Housing	Storage	Application	
Cattle				
Solid manure				
dairy cattle	10	2.5	12	24.5
heifers, bulls, calves	6	1.7	6	13.7
Liquid manure				
dairy cattle	10	2.5	12	24.5
heifers, bulls, calves	5.5	2.5	5	13
Sheep and goats	0.3	0.03	0.1	0.43
Pigs				
piglets	2	2	2.5	6.5
sows	4.3	2.8	4.8	11.9
farrowing sows	7.6	4.1	8	19.7
rearing pigs	3.2	2	3.1	8.3
Rabbits				
rearing rabbits	0.45	0.02	0.5	0.97
female rabbits	0.8	0.01	0.9	1.71
Poultry				
laying hens	0.12	0.02	0.13	0.27
broilers	0.1	0.01	0.1	0.21
ducks and geese	0.35	0.03	0.35	0.73
turkeys	0.35	0.03	0.35	0.73
Horses	2.9	0.9	2.2	6.0

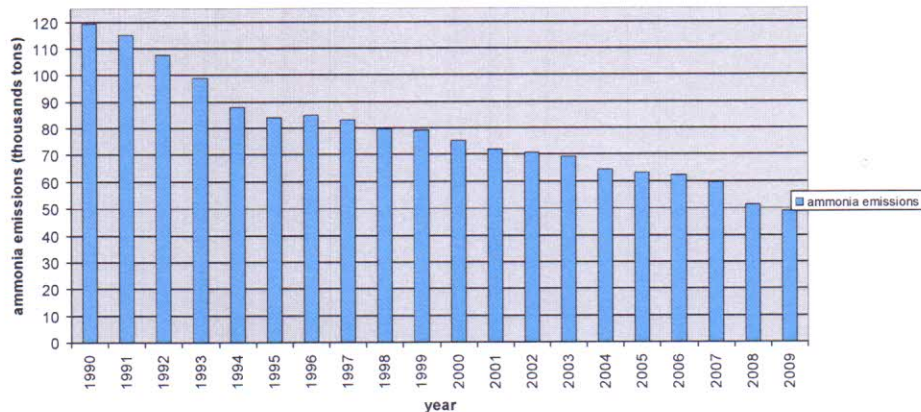


Figure 4.3. Development of ammonia emissions during 1990–2009 in the Czech agriculture.

In relation to declination of livestock numbers, also ammonia emissions have decreased in the Czech Republic. The development of ammonia emissions during the years 1990 – 2009 is shown in Figure 4.3. Emissions determined before the year 2002 have been recounted according to national emission factors officially set down in 2002 in the Czech legislation (Jelinek et al., 2003).

4.2 Successful activities leading to the Annex IX principles fulfillment

As mentioned above, all farms for pigs and poultry breeding under IPPC / Annex IX of the Protocol are forced by EU legislation to fulfill of all ammonia emissions abatement measures. On these farms only Best Available Techniques (BAT) can be operated and every operator of these farms (installations) has to obtain an integrated permission of operation. The integrated permission granted by the local authority contains some environmental conditions, which have to be fulfilled. This measure presents at minimum 20% of ammonia emissions abatement leaking from stables into the air.

On cattle farms also ammonia abatement measures are introduced by the Czech legislation focused on air protection. These principles follow all measures presented in the Guidance Document (ECE/EB.AIR/WG.5/2007/13) and are pointed especially on slurry storage and manure application abatement techniques. Moreover, according to the Czech legislation focused on management with fertilizers all slurry independently on farm size has to be incorporated within 24 hours after application. This measure represents at least 30% ammonia emission reduction.

In 2011 an evaluation study of all integrated permissions was carried out. The study has been focused on comparison of operated technologies for animal housing, excrements storage and their application on the field with the current Best Available Techniques Reference Document (BREF) for intensive pigs and poultry breeding. An evaluation of all 422 farms falling under IPPC has been carried out. The following results have been found.

In the Czech Republic all chicken broilers are housed in well-insulated fan ventilated houses with a fully littered floor and equipped with non-leaking drinking systems. Approximately 90% of laying hens is kept in the systems of enriched cages. Rest of the hens is kept in non-cage systems.

The large scale BAT systems presented in the BREF and used for pigs breeding in Czech Republic are presented in Table 4.3.

Table 4.3. Proportion of BAT systems for pig housing in the Czech Republic.

Housing system	NH ₃ abatement (%)	Proportion of used BAT (%)	Total projected capacity used BAT (places)
A partly slatted floor with a reduced manure pit	20 – 33	45	370,438
A partly slatted floor with a vacuum system for frequent removal of slurry	27	32	271,857
A partly slatted floor with a manure scraper underneath	40	22	188,031

All categories of pigs, sows and poultry use phase-feedstuff containing amino acids as lysin, methionin, threonin, and tryptophan. For ammonia emissions abatement in 91% of poultry farms utilization of feed additives has been found. On pigs and sows farms a lower level of utilization of approximately 75% was found.

In Table 4.4 utilization of BAT systems for liquid and solid manure storage is presented. In Czech Republic a prevailing part of manure is transferred to contractors for application on land.

Table 4.4. Utilization of BAT systems for liquid and solid manure storage.

Animal category	Proportion of used system (%)	Method of handling
Chicken broilers	90	Transfer to contractor
	10	Anaerobic fermentation on a heap
Laying hens	89	Transfer to contractor
	9	Anaerobic fermentation on a heap
	2	Storage under the cages
Pigs and sows	61	Reference system: Storage of slurry in uncovered concrete or steel tank
	20	Storage of slurry in concrete or steel tank covered by natural crust
	7	Storage of slurry in concrete or steel tank covered by a rigid lid or roof
	5	Slurry treatment by slurry additives
	3	Anaerobic fermentation on a heap
	4	Biogas production

4.3

Problems faced and to be addressed

What problems have appeared in the past and their solution

In the past two most significant problems have appeared. Firstly, costs of abatement measures, secondly lack of relatively cheap measures for ammonia abatement. There have not been any experiences with implementation of whichever abatement measures. On the first look the costs needed for implementation of all measures were too high. As a solution of the problem the following approach has been chosen. A preliminary case study of used techniques has been carried out. As a result of the study we found that many of the abatement measures have been already used on farms. It meant, the first assessment of costs needed for implementation could be decreased. Moreover, since the entrance of Czech Republic into EU some European funds have been utilized as a support of reconstruction and modernization of the Czech agriculture.

Solution of the second problem was implementation of feed and slurry additives into agricultural practice. Feed additives showed up as a measure with an immediate effect on ammonia emissions abatement (Jelinek et al., 2007). Moreover, they could be implemented on farms without investment costs. These additives have brought on many farms also some positive effects on efficiency of production.

Problems to be solved in the future

The EMEP/EEA Emission Inventory Guidebook or other guidebooks do not contain a simple methodology for incorporation of abatement measures into calculations. For that reason the Czech Republic will probably need to develop an own approach for incorporation NH₃ emission abatement effects into calculation or will need to adopt an other more sophisticated approach or methodology. The Czech Republic will also need improve some statistical data collection and databases interconnection.

In the Czech Republic some activities are focused on implementation of new modern abatement techniques as utilization of bioscrubbers has been started. At the moment we found possibilities for their financial support.

Research and development in the future

Research activities joined with ammonia emissions will be focused on development or wide spreading of techniques using information technologies as GPS for precise agriculture to decrease the amount of nitrogen applied.

Acknowledgments

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4.4

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