

# ELFE, A DATABASE TO DETERMINE GREENHOUSE GASES AND AMMONIA EMISSIONS FACTORS FROM LIVESTOCK

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## INTRODUCTION

Livestock sector represents a major source of gaseous emissions contributing to air pollution. In France, 17.8% of greenhouse gas (GHG) and 70% of ammonia (NH<sub>3</sub>) originates from this sector. Improving the knowledge on the magnitude and origin of gaseous emissions is, thus, essential to reduce emissions, to meet the societal requirement and to setup regulations at national and European levels. A French consortium involving research and extension services partners was created to draw up an inventory of GHG and NH<sub>3</sub> emissions resulting from livestock systems. The aim of this project was to develop a new methodology to provide emission factors (EF) characterizing the diversity of practices. A database called ELFE (ELevages et Facteurs d'Emission) containing EF from the international literature and related metadata was developed, allowing the calculation of gaseous emission per technical itinerary.

## MATERIAL AND METHODS

The first step was to create the structure of the database using Microsoft Excel® 2013. To organize it, five stages of manure management characterizing emission sources were defined: housing; pasture; outdoor manure storage; manure treatment and spreading. The housing database was created for each animal production (cattle, poultry and swine) to take into account production specificities. Technical itineraries were defined for each animal production and manure management stage. A review of the international literature references was performed to collect publications on GHG and NH<sub>3</sub> emissions in cattle, poultry and swine productions for the different stages of manure management: around 1 000 publications were recorded, corresponding to scientific papers, proceedings or study reports. EF and metadata taking into account livestock system practices and metrological information were integrated in the corresponding part of the database. EF were then classified according to two selection criteria: 1/ the level of information about metadata associated to emission values previously defined as determinant - three completeness classes depending on the level of information were defined: > 50%; 30-50%; <30%; 2/ a classification based on the measurement method/technology employed to obtain emissions values will also be proposed. Then, EF were converted into "reference units" to allow their analysis and comparison. The next steps focused on data analysis to determine average EF's per itinerary and EF-variability due to metadata (i.e. climate, housing system, animal type, diet, storage duration, storage type, etc.).

## RESULTS AND DISCUSSION

Table 1 presents the number of data integrated in the base (n EF) for housing (by animal production), outdoor manure storage and spreading and the corresponding number of publications.

Table 1. Number of integrated EF in the database and number of corresponding publication

Number	Housing			Storage	Spreading
	Cattle	Pig	Poultry		
Number of EF	545	1 758	313	1 567	860
Number of publications	46	152	28	106	56

According to the objectives, the database ELFE can be used in different ways: (i) to calculate an average emission value corresponding to a specific technical itinerary, (ii) to calculate an average emission value depending on selection criteria, and (iii) to carry out statistical analysis to provide emission references (under development).

(i) Average values were calculated for NH<sub>3</sub> emission from housing for a specific technical itinerary defined as reference system for dairy cattle (cubicle house, producing slurry) and swine production (growing-finishing pigs kept on fully slatted floor with vacuum system to remove the slurry from the pit at the end of the batch). The first results seem consistent with official reference documents values on gaseous emissions reported by Bittman et al. (2014) in UNECE report; in EMEP inventory (2016) and in IRPP BREF (Giner-Santonja et al., 2017):  $15.9 \pm 13.2$  and  $3.9 \pm 1.7$  kg NH<sub>3</sub>.animal place<sup>-1</sup>.year<sup>-1</sup> for dairy cattle (full-time housing of the animals) and fattening pig respectively.

(ii) At this time, EF were only obtained according to the first selection criterion (level of metadata provided in the publication). Figure 1 presents the distribution of data into the three completeness classes and shows a great variability between the different manure management stages and animal production for housing (more data need to be integrated in the database to calculate an average emission value per completeness classes).

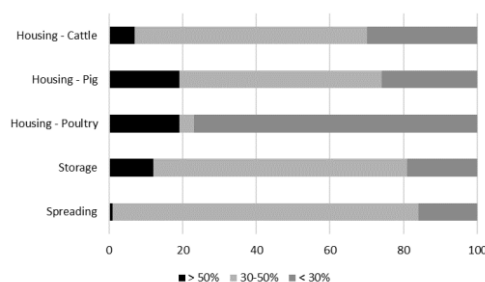


Figure 1. Distribution of EF into the three completeness classes

## CONCLUSION

This project proposes a global approach including different tools to provide an inventory and selection criteria of GHG and NH<sub>3</sub> emissions published in the literature. Despite the high variability of emission levels due to the large diversity of livestock systems, practices and measurement methods, this study allows to propose a detailed inventory of gaseous emission. This study also allows to identify the lack of data about the conditions for the acquisition of emission values reported in the literature that make difficult the comparison of EF.

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## REFERENCES

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