

13.11.2020



EMISSION INVENTORY - BOTTOM-UP REQUIREMENTS IN AGRICULTURE

VERIFY - CH₄/N₂O

Anais DURAND

Citepa

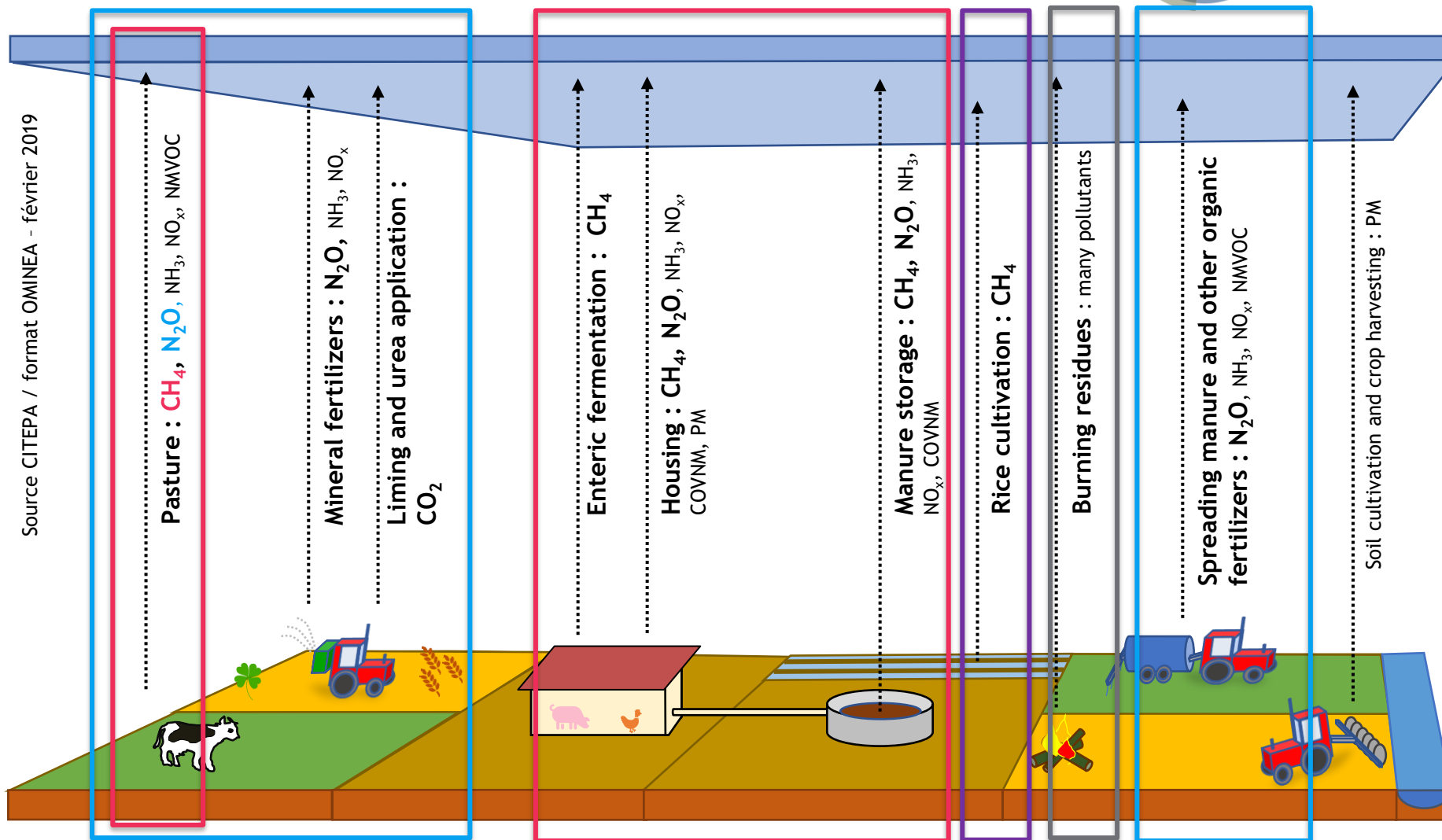
(French inventory agency)

anais.durand@citepa.org

GHG sources in agriculture



Source CITEPA / format OMINEA - février 2019



MRV requirements : main activity data used



According to the 2006 IPCC Guidelines

Enteric fermentation

- Livestock population - T1+T2
- Feed intake and digestibility - T2

Manure management

- Livestock population - T1+T2
- Feed intake and digestibility - T2
- Manure management practices - T1+T2
- Climate region or temperature - T1+T2

Rice cultivation

- Cultivated area and crop production - T1
- Characterisation of the system (water regime,...)

Agricultural soils

- Amount of N applied to soils (synthetic N fertilizers, organic N, N from pasture...) - T1+T2
- Crop area and crop production - T1+T2

Field burning of agricultural residues

- Crop area and crop production - T1+T2
- Share of residues that is burnt

Liming and urea application

- Amount of lime and urea applied to soils

Monitoring - estimation of emissions



General equation : $E = A \times EF$

Example here with enteric fermentation

T1 : default EF

TABLE 10.11
TIER 1 ENTERIC FERMENTATION EMISSION FACTORS FOR CATTLE¹

Regional characteristics	Cattle category	Emission factor ^{2,3} (kg CH ₄ head ⁻¹ yr ⁻¹)	Comments
North America: Highly productive commercialized dairy sector feeding high quality forage and grain. Separate beef cow herd, primarily grazing with feed supplements seasonally. Fast-growing beef steers/heifers finished in feedlots on grain. Dairy cows are a small part of the population.	Dairy	128	Average milk production of 8,400 kg head ⁻¹ yr ⁻¹ .
	Other Cattle	53	Includes beef cows, bulls, calves, growing steers/heifers, and feedlot cattle.
Western Europe: Highly productive commercialised dairy sector feeding high quality forage and grain. Dairy cows also used for beef calf production. Very small dedicated beef cow herd. Minor amount of	Dairy	117	Average milk production of 6,000 kg head ⁻¹ yr ⁻¹ .
	Other	57	Includes bulls, calves, and growing

TABLE 10.10
ENTERIC FERMENTATION EMISSION FACTORS FOR TIER 1 METHOD¹
(KG CH₄ HEAD⁻¹ YR⁻¹)

Livestock	Developed countries	Developing countries	Liveweight
Buffalo	55	55	300 kg
Sheep	8	5	65 kg - developed countries; 45 kg - developing countries
Goats	5	5	40 kg
Camels	46	46	570 kg

T2 : calculation of specific EF using detailed activity data

EQUATION 10.21
CH₄ EMISSION FACTORS FOR ENTERIC FERMENTATION FROM A LIVESTOCK CATEGORY

$$EF = \left[\frac{GE \cdot \left(\frac{Y_m}{100} \right) \cdot 365}{55.65} \right]$$

EQUATION 10.16
GROSS ENERGY FOR CATTLE/BUFFALO AND SHEEP

$$GE = \left[\frac{\left(\frac{NE_m + NE_a + NE_1 + NE_{work} + NE_p}{REM} \right) + \left(\frac{NE_g + NE_{wool}}{REG} \right)}{\frac{DE\%}{100}} \right]$$

T3 → Models (mechanistic or empirical) including detailed national parameters, mitigation strategies...

Main uncertainties and gaps



Enteric fermentation

- feed characterization (especially digestibility)
- estimates of default Y_m

Manure management

- amount and characteristics of the manure produced
- characterization of manure management systems (MCF parameter) and future use of the manure
- control of the complex nitrogen flow
- leaching and run-off
- default N_2O EF

Rice cultivation

- characterization of the rice cultivation system

Agricultural soils

- default N_2O EF (natural variability, strong influence of environmental factors such as climate, soils organic C content, soil texture, drainage, soil pH)
- leaching and run-off

Field burning of agricultural residues

- activity data, as it is usually forbidden

Liming and urea application

- low stake regarding the usual % of contribution to the agricultural total emissions and uncertainties associated

Uncertainties in agriculture - France

- Strong uncertainty associated to N₂O emissions (direct and indirect from soils).
- Contribution from enteric fermentation more due to the level of emission than the level of uncertainty.

CALCULATION OF UNCERTAINTY ON GHG EMISSIONS IN FRANCE (KYOTO) / TIER 1 METHOD FROM IPCC (*)

A	B	C	D	E	F	G	H	I
IPCC Source Category	Gas	Emissions 1990 kt CO ₂ e	Emissions 2018 kt CO ₂ e	Uncertainties on activity data - 2018 (%)	Uncertainties on emission factor - 2018 (%)	Combined uncertainty 2018 (%)	Combined uncertainty in % of total agricultural emissions 2018 (%)	Uncertainty in trend for total agricultural emissions 2018 (%)
3A Enteric Fermentation	CH ₄	38 630	34 201	5	15	16	7,2	2,9
3B Manure Management	CH ₄	3 463	3 826	5	30	30	1,6	0,4
3B Manure Management	N ₂ O	2 871	2 501	5	50	50	1,7	0,2
3C Rice Cultivation	CH ₄	140	63	-	-	92	0,1	0,0
3Da Direct N ₂ O emissions from managed soils	N ₂ O	28 532	25 898	-	-	142	49,2	21,9
3Db Indirect N ₂ O Emissions from managed soils	N ₂ O	6 819	6 206	-	-	282	23,4	2,5
3F Field burning of agricultural residues	CH ₄	69	46	30	80	85	0,1	0,0
3F Field burning of agricultural residues	N ₂ O	21	14	30	95	100	0,0	0,0
3G Liming	CO ₂	915	732	5	1	5	0,0	0,1
3H Urea application	CO ₂	850	1 287	5	1	5	0,1	0,1
3 TOTAL		82 312	74 774				55,0	22,2

Uncertainties in agriculture - EU level



CITEPA

Table 5.56 Sector Agriculture: EU-KP uncertainty estimates

Source category	Gas	Emissions Base Year	Emissions 2018	Emission trends Base Year-2017	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
3.A Enteric Fermentation	CO2	0	0		0.0%	
3.A Enteric Fermentation	CH4	251 983	193 792	-23.1%	10.6%	0.0%
3.A Enteric Fermentation	N2O	0	0		0.0%	
3.B Manure Mangement	CO2	0	0		0.0%	
3.B Manure Mangement	CH4	54 341	42 898	-21.1%	16.6%	0.0%
3.B Manure Mangement	N2O	30 900	23 016	-25.5%	61.3%	0.1%
3.C Rice Cultivation	CO2	0	0		0.0%	
3.C Rice Cultivation	CH4	2 716	2 099	-22.7%	29.9%	0.4%
3.C Rice Cultivation	N2O	0	0		0.0%	
3.D Agricultural Soils	CO2	0	0		0.0%	
3.D Agricultural Soils	CH4	0	0		0.0%	
3.D Agricultural Soils	N2O	198 786	163 135	-17.9%	119.9%	0.1%
3.E Prescribed burning of savannas	CO2	0	0		0.0%	
3.E Prescribed burning of savannas	CH4	0	0		0.0%	
3.E Prescribed burning of savannas	N2O	0	0		0.0%	
3.F Field Burning of Agricultural Residues	CO2	0	0		0.0%	
3.F Field Burning of Agricultural Residues	CH4	1 645	465	-71.7%	52.7%	0.3%
3.F Field Burning of Agricultural Residues	N2O	361	164	-54.6%	54.4%	0.2%
3.G Liming	CO2	10 174	5 985	-41.2%	23.3%	0.1%
3.G Liming	CH4	0	0		0.0%	
3.G Liming	N2O	0	0		0.0%	
3.H Urea application	CO2	3 479	3 783	8.7%	17.7%	0.0%
3.H Urea application	CH4	0	0		0.0%	
3.H Urea application	N2O	0	0		0.0%	
3.I Other carbon-containing fertilizers	CO2	590	299	-49.4%	10.2%	0.1%
3.I Other carbon-containing fertilizers	CH4	0	0		0.0%	
3.I Other carbon-containing fertilizers	N2O	0	0		0.0%	
3.J Other	CO2	0	0		0.0%	0.0%
3.J Other	CH4	271	1 542	468.7%	45.0%	2.0%
3.J Other	N2O	178	384	115.8%	89.2%	1.5%
3 (where no subsector data were submitted)	all	0	0		0.0%	0.0%
Total - 3	all	555 423	437 562	-21.2%	45.1%	2.4%

→ Greater uncertainties related to N₂O emissions

→ Strong uncertainties also from burning



THANK YOU

anais.durand@citepa.org