SNAP CODE:	**100401**	**100406**
	100402	**100407**
	100403	**100408**
	100404	**100409**
	100405	**100410**
		100412
SOURCE SUB-SECTOR TITLE:		**ENTERIC FERMENTATION**
	Dairy Cows	***Mules and Asses***
	Other Cattle	***Goats***
	Sheep	***Laying Hens***
	Fattening Pigs	***Broilers***
	Horses	***Other Poultry***
		Sows
NOSE CODE:	**110.04.01**	**110.04.06**
	110.04.02	**110.04.07**
	110.04.03	**110.04.08**
	110.04.04	**110.04.09**
	110.04.05	**110.04.10**
		110.04.12
NFR CODE:		**N/A**

1 ACTIVITIES INCLUDED

This chapter deals with the methane emissions from animal husbandry which originate from enteric fermentation. Methane emissions from manure management are considered under SNAP code B1050.

2 CONTRIBUTION TO TOTAL EMISSIONS

Of global methane emissions, about 25 % originate from animal husbandry. These are dominated by enteric fermentation. The remaining emissions arise from rice cultivation, natural gas and oil systems, biomass burning, waste treatment, and landfills (Table 1).

Table 1a: Methane emission from animal husbandry in 1990 (units in $Tg=10^9$ kg CH_4)

	Europe	**World**
enteric fermentation	19.6	80
- cattle	16.2	58.1
- sheep	2.5	7.6
animal waste management	5.9	14
- cattle	3.4	6.1
- swine	1.8	5.3
all methane sources		354

Source: EPA, 1994 (Tables 2-9 and 9-6)

CORINAIR 1990 provide some alternative estimates of European emissions.

Table 1b: Contribution to total emissions of the CORINAIR90 inventory (*28 countries*)

Source-activity	**SNAP-code**	**Contribution to total emission [1%]**							
		SO_2	NO_X	NMVOC	CH_4	CO	CO_2	N_2O	NH_3
Enteric fermentation	100400	-	-	-	20.5	-	-	-	0.5

0 = emissions are reported, but the exact value is below the rounding limit (0.1 per cent)
- = no emissions are reported

3 GENERAL

3.1 Description

Methane is produced in herbivores as by-product of enteric fermentation, a digestion process by which carbohydrates are broken down by micro-organisms into simple molecules for absorption in the bloodstream. Both ruminant animals (like cattle and sheep) and some non-ruminants like pigs produce methane. The amount of released methane depends on the type, age and weight of the animals, the quality and quantity of their feed and their energy expenditure.

Ruminant breath also contains also contains dimethyl sulphide (DMS) and acetone in quantities not to be neglected.

3.2 Controls

Although the quality of the feed influences the methane emission, it is difficult to change the diet in practice for the purpose dealt with here. Increasing milk production per dairy cow means more feed intake per animal, but the amount of feed necessary for maintenance of the dairy cow remains the same. The result is a decreasing methane emission per kg of milk produced.

4 SIMPLER METHODOLOGY

The simpler approach for estimating methane emission from animal husbandry is to use one average emission factor per animal for each class of animal and to multiply this factor with the number of animals counted in the annual agricultural census. For enteric fermentation and for animal waste management, Table 2 presents the recommended IPCC methane emission factors for the different classes of animals (IPCC, 1997, 2000).

5 DETAILED METHODOLOGY

The detailed methodology makes use of country specific information on all the parameters involved like feed intake of the animals, digestibility or animal performance, using either the calculation procedure described as IPCC Tier 2 approach (IPCC, 1997, 2000) or emission factors derived from measurements. Also more sub-animal categories can be used than mentioned in Table 2 to reflect the fact that the herd composition may vary between countries.

6 RELEVANT ACTIVITY STATISTICS

For the simpler methodology, data is required on animal numbers for each of the categories listed in Table 2. The annual agricultural census can supply these data. Otherwise the statistical information from Eurostat or the FAO Production Yearbook can be used.

For the detailed methodology, matching animal numbers for cattle sub-categories, animal performance and feed characteristics are needed.

Once emissions have been calculated at whatever is determined by the national experts to be the most appropriate level of detail, results should also be aggregated up to the minimum standard level of information as given in Table 3. This will allow for comparability of results among all participating countries. The data and assumptions used for finer levels of detail should also be reported to ensure transparency and replicability of results among all participating countries.

7 POINT SOURCE CRITERIA

Emission from this sub-sector should be considered as area sources.

8 EMISSION FACTORS, QUALITY AND REFERENCES

The emission factors are presented in Table 2. Appropriate factors should be selected and inserted into blank Table 3. The new table allows calculation of animal class emission factors which are combined with animal numbers to provide total methane emissions for a country.

9 SPECIES PROFILES

10 CURRENT UNCERTAINTY ESTIMATES

Uncertainties in methane emission factors are in the magnitude of 30%.

Uncertainties in animal numbers per class of animals are in the magnitude of 10%.

11 WEAKEST ASPECT/PRIORITY AREAS FOR IMPROVEMENT IN CURRENT METHODOLOGY

The simpler methodology suffices with the methane to the appropriate territorial unit on the base of animal numbers. At present the lack of sufficient information to calculate NMVOC emissions is felt to be a minor weakness.

12 SPATIAL DISAGGREGATION CRITERIA FOR AREA SOURCES

National total emission should be disaggregated to the appropriate territorial unit on the base of animal numbers, if emission factors and populations densities vary within the national territory.

13 TEMPORAL DISAGGREGATION CRITERIA

The simpler methodology suffices with the methane emissions estimate without temporal disaggregation.

The detailed methodology should provide temporal disaggregation if data are available, thus reflecting the role of methane in atmospheric chemistry.

14 ADDITIONAL COMMENTS

15 SUPPLEMENTARY DOCUMENTS

No supplementary documents are needed to calculate national methane emissions, as outlined for the simpler methodology. The scientific basis of the emission factors is described in detail in IPCC (1997, 2000).

16 VERIFICATION PROCEDURES

Table 2: Methane emission factors for simpler methodology
Annually averaged emission in kg CH_4 per animal, as counted in the annual agricultural census

Description	Enteric fermentation			Manure management				
	SNAP Code	West Europe	East Europe	SNAP Code	West Europe		East Europe	
					cool[1]	temperate[2]	cool[1]	Temperate[2]
dairy cows	100401	100	81	100501	14	44	6	19
other cattle (young cattle, beef cattle and suckling cows)	100402	48	56	100502	6	20	4	13
sheep (adults and lambs)	100403	8	8	100505	0.19	0.28	0.19	0.28
pigs (fattening pigs, sows and piglets)	100404 & 100412	1.5	1.5	100503 & 100504	3	10	4	7
Horses	100405	18	18	100506	1.39	2.08	1.39	2.08
mules and asses	100406	10	10	100512	0.76	1.14	0.76	1.14
goats (adults and kids)	100407	5	5	100511	0.12	0.18	0.12	0.18
poultry (chicken, ducks and turkeys)	100408 - 100410	not relevant		100507 – 100509	0.078	0.117	0.078	0.117

[1]cool climate: annual average temperature less than 15° C
[2]temperature climate: annual average temperature between 15° C and 25 °C

Source: IPCC, 1997

Table 3: Total methane emission based on methane emission factors and animal class numbers
Emission factor in kg CH_4 per animal, as counted in the annual agricultural census

SNAP Codes		Description	Methane emission factors			Number of animals	Total methane emissions
Enteric fermentation	Manure management		Enteric fermentation	Manure management	Total A + B		C * D
			A	B	C	D	E
100401	100501	dairy cows					
100402	100502	other cattle (young cattle, beef cattle and suckling cows)					
100403	100505	sheep (adults and lambs)					
100404 & 100412	100503 & 100504	pigs (fattening pigs, sows and piglets)					
100405	100506	Horses					
100406	100512	mules and asses					
100407	100511	goats (adults and kids)					
100408 – 100410	100507 - 100509	poultry (chicken, ducks and turkeys)					
		TOTAL					

17 REFERENCES

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19 RELEASE VERSION, DATE AND SOURCE

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20 POINT OF ENQUIRY

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