SNAP CODE:	**100401** **100402** **100403** **100404** **100405** **100406** **100407**
SOURCE SUB-SECTOR TITLE:	**ENTERIC FERMENTATION** ***Dairy Cows*** ***Other Cattle*** ***Ovines*** ***Fattening Pigs*** ***Horses*** ***Mules and Asses*** ***Goats***
NOSE CODE:	**110.04.01** **110.04.02** **110.04.03** **110.04.04** **110.04.05** **110.04.06** **110.04.07**
NFR CODE:	**N/A**

1 ACTIVITIES INCLUDED

This chapter deals with the methane emissions from animal husbandry. Two sources of methane emission are distinguished: enteric fermentation of agricultural animals and animal waste management. Ammonia emissions from animal husbandry are considered in chapter B1090.

2 CONTRIBUTION TO TOTAL EMISSIONS

From the global methane emissions about 25% originates from animal husbandry. The remaining emissions arise from rice cultivation, natural gas and oil systems, biomass burning, waste treatment, landfills and from animal husbandry is responsible for approximately 7% of the global methane emissions.

Table 1: 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.

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

Enteric fermentation
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 on the animal, the quality and quantity of the feed and the energy expenditure of the animal.

Animal waste management
Methane is produced from the decomposition of organic components in animal waste. The amount of released methane depends on the quantity of waste produced and the portion of the waste that decomposes anaerobically. When the animal waste is store or treated as a liquid (as in lagoons and pits) it tends to decompose anaerobically and methane can be produced. When the waste is handled as a solid (as in stacked piles) or when it is deposited on pastures, it tends to decompose aerobically and little or no methane is produced.

3.2 Controls

Enteric fermentation
Although the quality of the feed influences the methane emission, in practice it is difficult to change the diet. 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.

Animal waste management
There are tow strategies to decrease the methane emissions from animal wastes.

First by preventing the creation of methane by frequently removing settled sludge and solid material from the manure storage. This results in a low number of methane producing bacteria in the storage.

The second method to decrease the methane emission is by creating favourable conditions for the methane producing bacteria in the manure storage or by building a biogas plant. The produced biogas has to be collected and can be used for different purposes (heating, producing electricity). There is very little emission of methane to the atmosphere.

4 SIMPLER METHODOLOGY

The simpler approach for estimating methane emission from animal husbandry is to use an 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.

5 DETAILED METHODOLOGY

With the simpler methodology default methane emission factors are used. The detailed methodology makes use of country specific information on all the parameters involved like feed intake of the animals, animal waste management systems, emission factors derived from measurements, etc. Also more sub-animal categories can be used than mentioned in Table 2. 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 2. 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. The data and assumptions used for finer levels of detail should also be reported to ensure transparency and replicability of methods.

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 can be used or the FAO Production Yearbook.

For the detailed methodology, the data is required on animal numbers. Beside information is needed for all the parameters mentioned in section 5.

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.

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

SNAP Code	Description	enteric fermentation		manure management			
		west Europe	east Europe	west Europe		east Europe	
				cool[1]	temperate[2]	cool[1]	temperate[2]
100401	dairy cows	100	81	14	44	6	19
400402	other cattle (young cattle, beef cattle and suckling cows)	48	56	6	20	4	13
100403	pigs (fattening pigs, sows and piglets)	1.5	1.5	3	10	4	7
100404	sheep (adults and lambs)	8	8	0.19	0.28	0.19	0.28
100405	goats (adults and kids)	5	5	0.12	0.18	0.12	0.18
100406	horses	18	18	1.39	2.08	1.39	2.08
100407	mules and asses	10	10	0.76	1.14	0.76	1.14
100408	poultry (chickens, ducks and turkeys)	not estimated		0.078	0.117	0.078	0.117

[1]cool climate: annual average temperature less than 15E C
[2]temperature climate: annual average temperature between 15E C

Source: IPCC, 1995

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 Code	description	methane emission factors			number of animal	total methane emission
		enteric fermentation	manure management	total A + B		C * D
		A	B	C	D	E
100401	dairy cows					
400402	other cattle (young cattle, beef cattle and suckling cows)					
100403	pigs (fattening pigs, sows and piglets)					
100404	sheep (adults and lambs)					
100405	goats (adults and kids)					
100406	horses					
100407	mules and asses					
100408	poultry (chickens, ducks and turkeys)					
	TOTAL					

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.

12 SPATIAL DISAGGREGATION CRITERIA FOR AREA SOURCES

National total emission should be disaggregated to the appropriate territorial unit on the base of animal numbers.

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.

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 (1995).

16 VERIFICATION PROCEDURES

17 REFERENCES

EPA, 1994. International anthropogenic methane emissions: estimates for 1990. EPA 239-R-93-010. US Environmental Protection Agency, Washington, D. C., US.

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19 RELEASE VERSION, DATE AND SOURCE

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20 POINT OF ENQUIRY

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