

RuFaS manure emissions by processor type quick reference guide

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How to use this document

The two tables below provide a quick reference for which manure processors estimate which types of emissions, which variables directly influence the calculation of different emissions in each processor (“Y variables”), and the scientific reference for each emission.

For the Y variables, most variables included here are either directly determined by or indirectly modified by user inputs. For clarity, where possible, the direct user input information is shown here, rather than the indirect outcome. For example, “daily air temperature” (which originates from the user-provided weather inputs) is listed, though daily air temperature is not utilized directly in many emissions calculations. Instead, air temperature is used to model manure temperature, which is utilized to calculate emissions. Other variables like manure N, manure VS, etc. are determined by multiple upstream variables such as animal number/type, diet formulation, dry matter intake, etc. that cannot be listed here in full.

Note that while the table labeled “Housing area emissions” covers emissions from processors representing manure management occurring in housing areas, these processors may be labeled differently in the RuFaS codebase (e.g., bedded packs and open lots are storage-type processors).

Terms and abbreviations:

- **B₀**: Manure methane production potential (m³ CH₄ per kg manure VS)
- **Methane conversion factor (MCF)**: CH₄ emissions (kg) per kg of manure volatile solids received by a processor.
- **N-based emission factor**: N emissions (as N₂O or NH₃) per unit of manure N received by a processor.
- **Received manure**: the quantity of manure entering a processor (e.g., added to a compost pile, deposited on an open lot, etc.) on any one day
- **Stored manure**: the quantity of manure present (accumulated) in a storage processor on any one day
- **TAN**: total ammoniacal nitrogen
- **VS**: volatile solids
- **VSd**: degradable VS
- **VSnd**: non-degradable VS

Housing area emissions

	Freestall, tiestall ¹	Conventional or Compost Bedded Pack	Open Lot
Methane (CH₄)			
Y variables	- Daily air temperature - Soiled barn floor surface area²	- Annual mean air temp. - Presence of mixing - Manure VS received - B₀	- Daily air temperature - Manure VS received - B₀
Reference	Based on Chianese, Rotz, and Richard (2009)	From IPCC, 2019	From IFSM (2023)
Ammonia N (NH₃-N)			
Y variables	- Daily air temperature - Soiled barn floor surface area - Manure TAN received	- Annual mean air temp. - Presence of mixing - Manure N received	- Annual mean air temp. - Manure N received
Reference	Based on Rotz and Oenema (2006)	From Hanson, Itle, and Edquist (2024)	From Hanson, Itle, and Edquist (2024)
Nitrous Oxide N (N₂O-N)			
Y variables	No emission	- Annual mean air temp. - Presence of mixing - Manure N received	- Annual mean air temp. - Manure N received
Reference		From IPCC, 2019	From IPCC, 2019
Nitrate N leaching (NO₃-N)			
Y variables	No emission	- Annual mean air temp. - Presence of mixing - Manure N received	- Annual mean air temp. - Manure N received
Reference		From IPCC, 2019	From IPCC, 2019

¹ Emissions from tiestall and freestall barn floors are covered in the Manure Handler section of the [RuFaS Scientific Documentation](#).

² Soiled surface area is determined from user-inputted number of stalls in pen, multiplied by a per-stall constant specific to the animal class and housing type.

Manure treatment and storage emissions

	Slurry storage	Anaerobic lagoon
Methane (CH₄)		
Y variables	- Location (under barn or outdoors) - Daily air temperature - Accumulated manure VSd and VSnd¹	- Daily air temperature - Accumulated manure VSd and VSnd¹ - Presence of flare
Reference	Based on Petersen et al. (2024)	Based on Petersen et al. (2024)
Ammonia N (NH₃-N)		
Y variables	- Location (under barn or outdoors) - Daily air temperature - Accumulated manure TAN¹ - Presence and type of cover or crust	- Daily air temperature - Accumulated manure TAN¹ - Presence and type of cover or crust
Reference	Based on Rotz and Oenema (2006)	Based on Rotz and Oenema (2006)
Nitrous Oxide N (N₂O-N)		
Y variables	- Annual mean air temp - Manure N received - Presence and type of cover or crust	- Annual mean air temp - Manure N received - Presence and type of cover or crust
Reference	From IPCC, 2019	From IPCC, 2019
	Anaerobic digestion	Composting
Methane (CH₄)		
Y variables	- Manure VS received - B₀ - Leakage rate (% of CH₄ generated)	- Annual mean air temperature - Composting type - Manure VS received - B₀
Reference	Expert opinion; see Anaerobic Digestion section in RuFaS scientific documentation	From IPCC, 2019
Ammonia N (NH₃-N)		
Y variables	No emission	- Annual mean air temperature - Composting type - Manure N received

Reference		From Hanson, Itle, and Edquist (2024)
Nitrous Oxide N (N₂O-N)		
Y variables	No emission	• Annual mean air temperature • Type of composting • Manure N received
Reference		From IPCC, 2019
Nitrate N leaching (NO₃-N)		
Y variables	No emission	• Annual mean air temperature • Type of composting • Manure N received
Reference		From Hanson, Itle, and Edquist (2024)

¹ Note that the accumulated quantity of manure constituents (e.g. VS or TAN) in manure storages is dynamic (i.e. updated daily) and is influenced by factors like the user-defined manure storage and manure application frequency, losses of substrate to gas emissions, and quantity of substrate in received manure. See the [RuFaS Scientific Documentation](#) for more information on how the quantity of manure constituents in storage is updated each day.