



# Refinement of chapter 5.B.2

## Anaerobic digestion at biogas facilities

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TFEIP-meeting Sofia, 26.04.2018

- May 2016: TFEIP meeting in Zagreb. Discussion on revised chapter 5.B.2. for EMEP 2016 guidebook:
  - Need of improvement for existing revised chapter
- August 2016: final version of improved chapter sent to chairs of Ag & N-panel
- Mai 2017: TFEIP meeting in Krakow. Discussion of improved chapter 5.B.2
  - Further improvement needed to link 5.B.2 to 3.B. and 3.D.

- Technology description shortened/restricted to described methodology
- EF were checked and decided to stick to Cuhls et al. (other options not possible within time frame)

➔ General structure not changed

- Calculations and EF were transformed to be based on N-mass in feedstock (instead fresh matter)
- Information on N-content of various feedstocks for AD is given in case only fresh matter masses are known.
- Tier 1 method introduced (was missing so far)
- For emission control, reference is given to chapter 3B (storage)
- Clear linkages to chapter 3B (slurries entering AD) and 3D (digestate spreading) introduced.

## Further refinement (for this meeting)

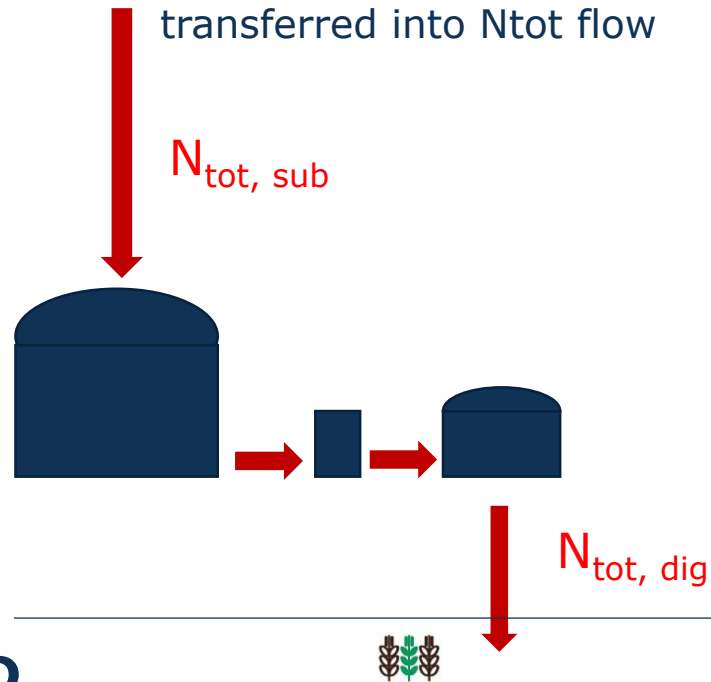
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- Improve links to 3.B. for manure and 3.D for energy crops and organic waste
- Add TAN-flow to 5.B.2 for manure
- Account for mineralization of organic N to TAN for manure during digestion

# Links between 5.B. and chapter 3

## 5.B Energy crops / Waste material

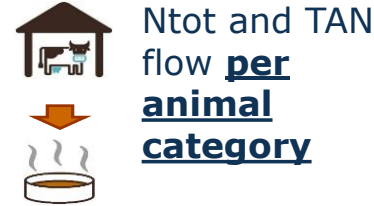
Activity data from national statistics transferred into Ntot flow



## 3.D

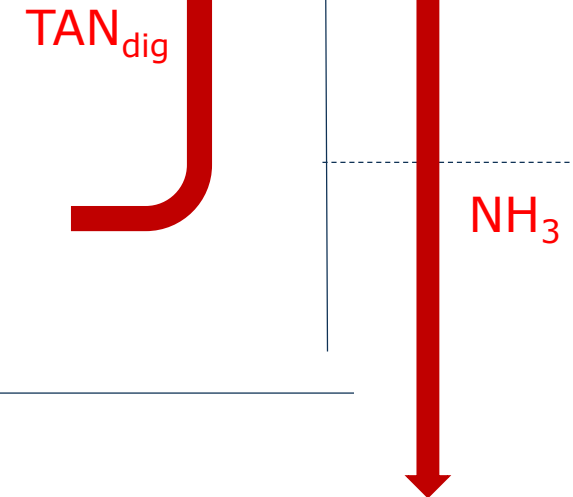
Calculation and reporting of emissions from application :  
**3Da2c** Other organic fertilisers applied to soils.

## Manures



## 3.B

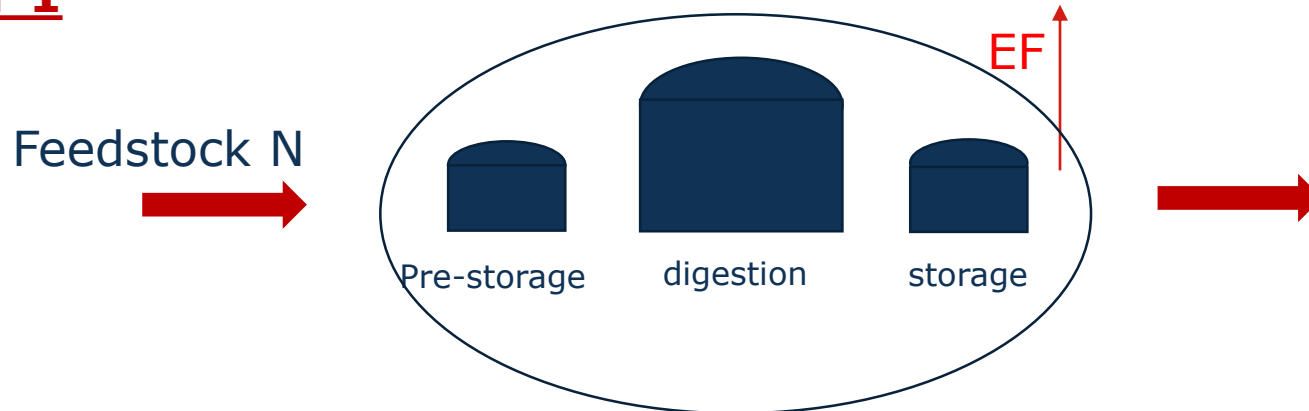
Calculation of emissions from application per animal category



Reporting:  
**3Da2a** Livestock manure applied to soils

# Calculation of emissions in chapter 5.B

## • Tier 1



All emissions calculated based on total N in feedstock

$$E_{\text{NH}_3} = AR_{\text{feedstock}} \times EF_{\text{NH}_3\text{-N, Tier 1}} \times 17/14 \quad (1)$$

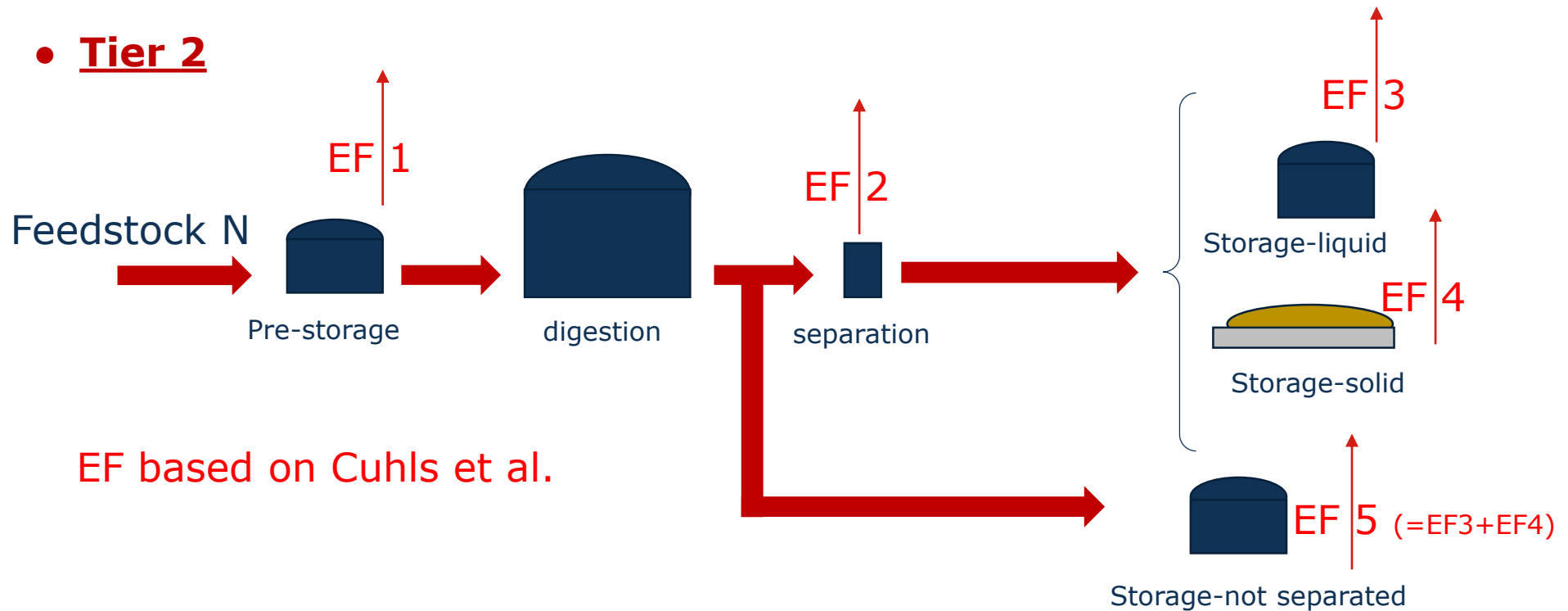
## If Tier 1 is used in 3.B:

- Emissions in 3.B. calculated on based on animal places
- Care needs to be taken to avoid double counting of N excreted by animals!!

➡ No consideration of digestate from manures in 3.B

# Calculation of emissions in chapter 5.B

- Tier 2**



All emissions calculated based on total N in feedstock

$$E_{\text{NH}_3} = AR_{\text{feedstock}} \times \sum_{\text{stages}} EF_{\text{NH}_3\text{-N, stage } i} \times 17/14 \quad (2)$$

# Calculation of N in digestate after storage

## For energy crops and waste

$$N_{\text{tot,dig}} = N_{\text{tot,sub}} - (E_{\text{NH}_3} \times 14/17) \quad (3)$$

with:

$N_{\text{tot,dig}}$  :  $N_{\text{tot}}$  in digestate after storage in  $\text{kg a}^{-1}$

➔ **3Da2c**

$N_{\text{tot,sub}}$  :  $N_{\text{tot}}$  of the feedstock entering 5.B.2 in  $\text{kg a}^{-1}$

$E_{\text{NH}_3}$ :  $\text{NH}_3$  emitted in  $\text{kg a}^{-1}$ , calculated in equation (1) or (2)

## For manures

$$\text{TAN}_{\text{dig}} = \text{TAN}_{\text{sub}} + f_{\text{min}} \times (N_{\text{tot}} - \text{TAN}_{\text{sub}}) - (E_{\text{NH}_3} \times 14/17) \quad (4)$$

with

$\text{TAN}_{\text{dig}}$  : TAN in digestate after storage in  $\text{kg a}^{-1}$

➔ **3B**

$\text{TAN}_{\text{sub}}$  : TAN in manure entering 5.B.2 in  $\text{kg a}^{-1}$

$f_{\text{min}}$ : relative share of organic N entering the digester that is mineralized to TAN in  $\text{kg kg}^{-1}$

$E_{\text{NH}_3}$ :  $\text{NH}_3$  emitted in  $\text{kg a}^{-1}$ , calculated from total N in equation (2)

- Germany: Survey showed, that mean TAN in digestion of manure rises from 45% to 62%

➔  $f_{\text{min}} = 0.32$



- Thorough review on emission factors (now: only based on one study)
  - If possible: TAN for every step based rather than based on N<sub>tot</sub> in feedstock
- Discussion needed on:
  - Consideration of separation
  - Use of digestates for other purposes than agriculture (fertilization)

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Revision should be aligned with IPCC revision process