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<b>Category</b>		<b>Title</b>
<b>NFR:</b>	5.B.1	Biological treatment of waste – composting
<b>SNAP:</b>	091005	Compost production
<b>ISIC:</b>		
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# 1 Overview

This chapter covers the emissions from the biological treatment of waste - composting. As this source category is not considered to be significant on a national level for any pollutant, there will only be a brief description and a set of emission factors presented in this chapter.

## 2 Description of sources

### 2.1 Process description

In many areas organic domestic waste is gathered separately. Composting the organic waste produces a reusable product.

### 2.2 Techniques

Not relevant.

### 2.3 Emissions

Emissions to air from this source category include odours. Also, small amounts of ammonia are produced. These are considered in this chapter.

### 2.4 Controls

No specific information available for this source category.

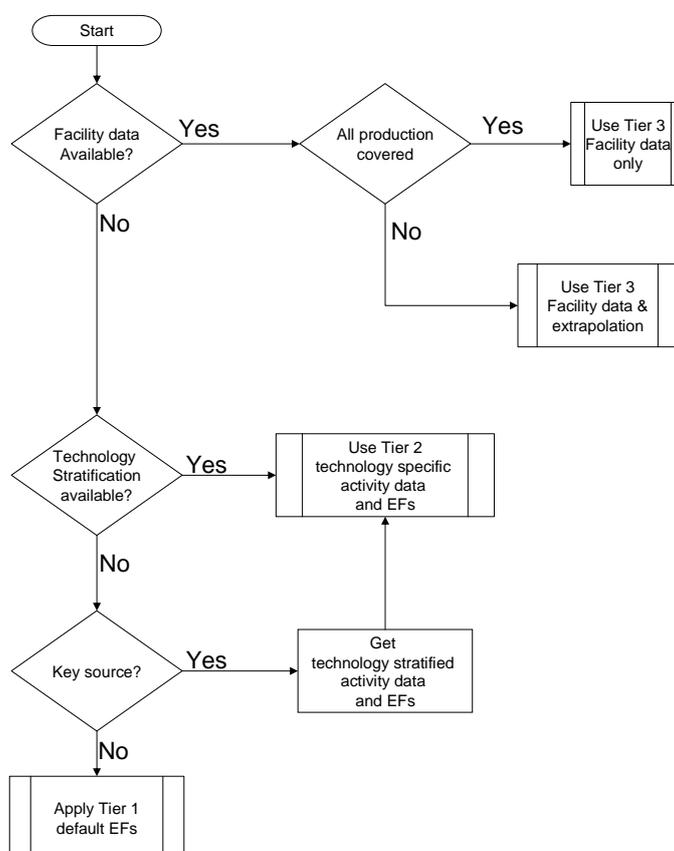
## 3 Methods

### 3.1 Choice of method

Figure 3-1 presents the procedure to select the methods for estimating emissions from this source category. The basic idea is:

- if detailed information is available; use it;
- if the source category is a key category, a Tier 2 or better method must be applied and detailed input data must be collected. The decision tree directs the user in such cases to the Tier 2 method, since it is expected that it is more easy to obtain the necessary input data for this approach than to collect 'facility level' data needed for a Tier 3 estimate;
- the alternative of applying a Tier 3 method, using detailed process modelling, is not explicitly included in this decision tree. However, detailed modelling will always be done at facility level and results of such modelling could be seen as 'facility data' in the decision tree.

**Figure 3-1 Decision tree for source category 5.B.1 Biological treatment of waste - composting**



## 3.2 Tier 1 default approach

No Tier 1 emission factors are provided for this source category, emission factors have been defined at a Tier 2 level. If the decision tree directs the user to a Tier 1 approach, it is recommended to use the Tier 2 approach provided in the next section. It is good practice to use Tier 2 when activity data is available.

## 3.3 Tier 2 technology-specific approach

### 3.3.1 Algorithm

To apply the Tier 2 approach, both the activity data and the emission factors need to be stratified according to the different process types that may occur in the country.

The approach followed to apply a Tier 2 approach is as follows.

Stratify the processes in 'Biological treatment of waste - composting' in the country to model the different process types occurring in the national industry into the inventory by:

- defining the production using each of the separate process types (together called 'technologies' in the formulae below) separately; and

- applying technology-specific emission factors for each process type:

$$E_{pollutant} = \sum_{technologies} AR_{production,technology} \times EF_{technology,pollutant} \quad (1)$$

where:

$AR_{production,technology}$  = the production rate within the source category, using this specific technology,

$EF_{technology,pollutant}$  = the emission factor for this technology and this pollutant.

A country where only one technology is implemented will result in a penetration factor of 100 % and the algorithm reduces to:

$$E_{pollutant} = AR_{production} \times EF_{technology,pollutant} \quad (2)$$

where:

$E_{pollutant}$  = the emission of the specified pollutant,

$AR_{production}$  = the activity rate for this specific technology,

$EF_{pollutant}$  = the emission factor for this pollutant.

### 3.3.2 Technology-specific emission factors

This section presents Tier 2 technology-specific emission factors for compost production.

**Table 3-1 Tier 2 emission factors for source category 5.B.1 Biological treatment of waste - composting, compost production**

Tier 2 emission factors					
	Code	Name			
<b>NFR Source Category</b>	5.B.1	Biological treatment of waste - composting			
<b>Fuel</b>	NA				
<b>SNAP (if applicable)</b>	091005	Compost production			
<b>Technologies/Practices</b>	Compost production				
<b>Region or regional conditions</b>					
<b>Abatement technologies</b>					
<b>Not applicable</b>	Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, HCH, PCBs, PCDD/F, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, HCB				
<b>Not estimated</b>	NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> , TSP, PM <sub>10</sub> , PM <sub>2.5</sub> , BC				
Pollutant	Value	Unit	95% confidence interval		Reference
			Lower	Upper	
NH <sub>3</sub>	0.24	kg/Mg organic waste	0.1	0.7	EMEP/EEA (2006)

**Table 3-2 Tier 2 emission factors for source category 5.B.1 Biological treatment of waste - composting, composting of garden and park waste**

Tier 2 emission factors					
	Code	Name			
<b>NFR Source Category</b>	5.B.1	Biological treatment of waste - composting			
<b>Fuel</b>	NA				
<b>SNAP (if applicable)</b>	091005	Compost production			
<b>Technologies/Practices</b>	Windrow composting of garden and park waste				
<b>Region or regional conditions</b>	Denmark				
<b>Abatement technologies</b>	None				
<b>Not applicable</b>	SO <sub>2</sub> , Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCBs, PCDD/F, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, HCB, HCH				
<b>Not estimated</b>	NO <sub>x</sub> , NMVOC, TSP, PM <sub>10</sub> , PM <sub>2.5</sub> , BC				
Pollutant	Value	Unit	95% confidence interval		Reference
			Lower	Upper	
CO	0.56	kg/Mg waste	0.05	1	Boldrin et al. (2009)
NH <sub>3</sub>	0.66	kg/Mg waste	0.05	1	Boldrin et al. (2009)

### 3.3.3 Abatement

A number of add-on technologies exist that are aimed at reducing the emissions of specific pollutants. The resulting emission can be calculated by replacing the technology-specific emission factor with an abated emission factor as given in the formula:

$$EF_{technologyabated} = (1 - \eta_{abatement}) \times EF_{technologyunabated} \quad (3)$$

### Compost production

This section provides the abatement efficiency for compost production using a bio filter.

**Table 3-3 Abatement efficiencies ( $\eta_{abatement}$ ) for source category 5.B.1 Biological treatment of waste - composting, compost production**

Tier 2 Abatement efficiencies					
	Code	Name			
<b>NFR Source Category</b>	5.B.1	Biological treatment of waste - composting			
<b>Fuel</b>	NA	Not applicable			
<b>SNAP (if applicable)</b>	091005	Compost production			
<b>Not applicable</b>	NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> , TSP, PM <sub>10</sub> , PM <sub>2.5</sub> , BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCB, PCDD/F, HCB, HCH				
<b>Not estimated</b>	NMVOC, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene				
Abatement technology	Pollutant	Efficiency	95% confidence interval		Reference
		Default Value	Lower	Upper	
Biofilter	NH <sub>3</sub>	90 %	70 %	97 %	EMEP/EEA (2006)

### 3.3.4 Activity data

For compost production, the standard statistics on amounts of organic domestic waste produced may be used to estimate the emissions, taking into account only that fraction of the organic domestic waste that is composted.

### 3.4 Tier 3 emission modelling and use of facility data

Not available for this source.

## 4 Data quality

No source specific issues are applicable to this source category.

## 5 References

Boldrin, A., Andersen, J.K. & Christensen, T.H. LCA-report: Environmental assessment of garden waste management in Århus Kommune (Miljøvurdering af haveaffald i Århus kommune), Department of Environmental Engineering, Technical University of Denmark.

EMEP/EEA, 2006, *EMEP/CORINAIR Emission Inventory Guidebook, version 4 (2006 edition)*. European Environment Agency, Technical report No. 11/2006, (<https://www.eea.europa.eu/publications/EMEPCORINAIR4>), accessed 19 July 2019.

## 6 Point of enquiry

Enquiries concerning this chapter should be directed to the relevant leader(s) of the Task Force on Emission Inventories and Projection's expert panel on combustion and industry. Please refer to the TFEIP website ([www.tfeip-secretariat.org/](http://www.tfeip-secretariat.org/)) for the contact details of the current expert panel leaders.