Review of the consistency of PM, HM and POP emission factors – 4B Animal Husbandry and Manure Management

Chapter 4B contains tier 1 (Table 3.4) and tier 2 (Table 3.10) PM$_{10}$ and PM$_{2.5}$ emission factors (EFs) for selected animal species. The main chapter does not contain TSP EFs. However, in the annex to the chapter the derivation of the EFs is described.

The tier 1 and tier 2 EFs as currently in the Guidebook (GB) are included below.

### Table 3.4 Default Tier 1 estimates of EF for particle emissions from animal husbandry (housing).

<table>
<thead>
<tr>
<th>Code</th>
<th>Livestock</th>
<th>EF for PM$_{10}$ (kg AAP$^{-1}$. a$^{-1}$)</th>
<th>EF for PM$_{2.5}$ (kg AAP$^{-1}$. a$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100901</td>
<td>Dairy cows</td>
<td>0.36</td>
<td>0.23</td>
</tr>
<tr>
<td>100902</td>
<td>Other cattle (including young cattle, beef cattle and suckling cows)</td>
<td>0.24</td>
<td>0.16</td>
</tr>
<tr>
<td>100903</td>
<td>Fattening pigs</td>
<td>0.50</td>
<td>0.08</td>
</tr>
<tr>
<td>100904</td>
<td>Sows</td>
<td>0.58</td>
<td>0.09</td>
</tr>
<tr>
<td>100905 +100911</td>
<td>Sheep (and goats)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>100906 +100912</td>
<td>Horses (and mules, asses)</td>
<td>0.18</td>
<td>0.12</td>
</tr>
<tr>
<td>100907</td>
<td>Laying hens (laying hens and parents). cages</td>
<td>0.017</td>
<td>0.002</td>
</tr>
<tr>
<td>100908</td>
<td>Broilers (broilers and parents)</td>
<td>0.084</td>
<td>0.016</td>
</tr>
<tr>
<td>100909</td>
<td>Other poultry (ducks, geese, turkeys)</td>
<td>0.032</td>
<td>0.004</td>
</tr>
<tr>
<td>100910</td>
<td>Fur animals</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>100913</td>
<td>Camels</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>100914</td>
<td>Buffalo</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Source:** Schneider and Büscher, 2006; Hinz, 2005; Hinz and Tamoschat-Depolt, 2007

### Table 3-10 Default Tier 2 EF for particle emissions from animal husbandry (housing).

<table>
<thead>
<tr>
<th>Code</th>
<th>Livestock</th>
<th>Manure</th>
<th>EF for PM$_{10}$ (kg AAP$^{-1}$. a$^{-1}$)</th>
<th>EF for PM$_{2.5}$ (kg AAP$^{-1}$. a$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100901</td>
<td>Dairy cows</td>
<td>slurry</td>
<td>0.70</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>0.36</td>
<td>0.23</td>
</tr>
<tr>
<td>100902</td>
<td>Other cattle (including young cattle, beef cattle and suckling cows)</td>
<td>slurry</td>
<td>0.32</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>0.24</td>
<td>0.16</td>
</tr>
<tr>
<td>100903</td>
<td>Fattening pigs</td>
<td>slurry</td>
<td>0.42</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>0.50</td>
<td>0.08</td>
</tr>
<tr>
<td>100904</td>
<td>Sows</td>
<td>slurry</td>
<td>0.45</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>0.58</td>
<td>0.09</td>
</tr>
<tr>
<td>100905</td>
<td>Sheep (and goats)</td>
<td>solid</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>+100911</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100906</td>
<td>Horses (and mules, asses)</td>
<td>solid</td>
<td>0.18</td>
<td>0.12</td>
</tr>
<tr>
<td>+100912</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100907</td>
<td>Laying hens (laying hens and parents)</td>
<td>cages</td>
<td>0.017</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>perchery</td>
<td>0.084</td>
<td>0.016</td>
</tr>
<tr>
<td>100908</td>
<td>Broilers (broilers and parents)</td>
<td>solid</td>
<td>0.052</td>
<td>0.007</td>
</tr>
<tr>
<td>100909</td>
<td>Other poultry (ducks, geese, turkeys)</td>
<td>solid</td>
<td>0.032</td>
<td>0.004</td>
</tr>
<tr>
<td>100910</td>
<td>Fur animals</td>
<td>solid</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>100913</td>
<td>Camels</td>
<td>solid</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>100914</td>
<td>Buffalo</td>
<td>solid</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Source:** Schneider and Büscher, 2006; Hinz 2005; Hinz and Tamoschat-Depolt, 2007
As noted the tables do not contain TSP emission factors. Furthermore, there are no EFs (neither tier 1 nor tier 2) available for sheep, goats, fur animals, camels and buffalos. Tier 2 EFs are available for cattle, swine and laying hens. For cattle and swine the tier 1 EFs are based on the tier 2 EFs for solid animal waste management systems. The tier 1 EFs for laying hens are identical to the tier 2 EFs and cannot be considered as tier 1. The references provided to both tables are incorrect. The EFs mainly refer to Takai et al. (1998) with additional information and assumptions from Seedorf and Hartung (2001).

**Consistency of the current emission factors**

The original basis for the PM EFs is Takai et al. (1998) for all animal species except horses, where the EFs refer to Seedorf and Hartung (2001). The original results are presented for inhalable dust (ID) and respiratory dust (RD). The EFs are shown below.

**Table A3–1 Measured dust emissions (all data except horses: Takai et al. 1998; horses: Seedorf and Hartung, 2001)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Livestock Category</th>
<th>Housing type</th>
<th>Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ID mg LU⁻¹ h⁻¹</td>
<td>RD mg LU⁻¹ h⁻¹</td>
</tr>
<tr>
<td>100901</td>
<td>Dairy cattle slurry</td>
<td>172.5</td>
<td>28.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>89.3</td>
</tr>
<tr>
<td>100902</td>
<td>Other cattle (including young cattle, beef cattle and suckling cows) slurry</td>
<td>113.0</td>
<td>13.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>85.5</td>
</tr>
<tr>
<td>100902</td>
<td>Calves slurry</td>
<td>127.5</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>132.0</td>
</tr>
<tr>
<td>100903</td>
<td>Fattening pigs slurry</td>
<td>612.3</td>
<td>66.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>725.5</td>
</tr>
<tr>
<td>100903</td>
<td>Weaners slurry</td>
<td>1 021.0</td>
<td>75.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>n.a.</td>
</tr>
<tr>
<td>100904</td>
<td>Sows slurry</td>
<td>345.8</td>
<td>47.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>448.5</td>
</tr>
<tr>
<td>100906</td>
<td>Horses solid¹</td>
<td>55</td>
<td>n.a.</td>
</tr>
<tr>
<td>100907</td>
<td>Laying hens cages</td>
<td>636.3</td>
<td>78.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>perchery</td>
<td>3 080.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>3 965.8</td>
</tr>
</tbody>
</table>

Notes:

1. n.a.: not available; ID: inhalable dust; RD: respirable dust.
2. ¹ Wood shavings.

The EFs are provided in terms of livestock units corresponding to 500 kg live weight.

The original EFs are converted using transformation factors based on Seedorf and Hartung (2001) and personal communication.
The transformation factors for poultry are not correct considering the column headers used since the factor of 1 for PM\textsubscript{2.5} relates to RD and not ID. Therefore a footnote should be added for poultry stating that “The transformation factor for PM\textsubscript{2.5} relates to respiratory dust and not inhalable dust”.

When trying to reproduce the EFs currently in the GB (Table A3–4), there are small deviations for fattening pigs, weaners and sows for PM\textsubscript{10}. This is highlighted in Table 1 below.

### Table A3–3 Transformation factors for the conversion of inhalable dust (ID) into PM\textsubscript{10} and PM\textsubscript{2.5}

<table>
<thead>
<tr>
<th>Code</th>
<th>Livestock type</th>
<th>Transformation factor for PM\textsubscript{10} kg PM\textsubscript{10} (kg ID)\textsuperscript{-1}</th>
<th>Transformation factor for PM\textsubscript{2.5} kg PM\textsubscript{2.5} (kg ID)\textsuperscript{-1}</th>
</tr>
</thead>
<tbody>
<tr>
<td>101001</td>
<td>Dairy cows</td>
<td>(^10.46)</td>
<td>(^20.30)</td>
</tr>
<tr>
<td>101002</td>
<td>Other cattle</td>
<td>(^10.46)</td>
<td>(^20.30)</td>
</tr>
<tr>
<td>101003</td>
<td>Fattening pigs (including weaners)</td>
<td>0.45</td>
<td>0.08</td>
</tr>
<tr>
<td>101004</td>
<td>Sows</td>
<td>0.45</td>
<td>0.08</td>
</tr>
<tr>
<td>101006</td>
<td>Horses(^3)</td>
<td>(^10.46)</td>
<td>(^20.30)</td>
</tr>
<tr>
<td>100907, 100908, 100909</td>
<td>Poultry</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Note:
1. \(^1\)Seedorf and Hartung (2001), the same conversion factor for horses is assumed as for cattle
2. \(^2\)Seedorf (personal communication).

The transformation factors for poultry are not correct considering the column headers used since the factor of 1 for PM\textsubscript{2.5} relates to RD and not ID. Therefore a footnote should be added for poultry stating that “The transformation factor for PM\textsubscript{2.5} relates to respiratory dust and not inhalable dust”.

When trying to reproduce the EFs currently in the GB (Table A3–4), there are small deviations for fattening pigs, weaners and sows for PM\textsubscript{10}. This is highlighted in Table 1 below.
## Table A3–4  EFs for inhalable dust, respirable dust, PM$_{10}$ and PM$_{2.5}$

<table>
<thead>
<tr>
<th>Code</th>
<th>Animal category</th>
<th>Housing type</th>
<th>Animal weight kg animal$^{-1}$</th>
<th>Conversion factor LU animal$^{-1}$</th>
<th>Emission factors EF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ID kg AAP$^{-1}$.a$^{-1}$</td>
<td>RD kg AAP$^{-1}$.a$^{-1}$</td>
</tr>
<tr>
<td>100901</td>
<td>Dairy cattle</td>
<td>slurry</td>
<td>500</td>
<td>1.0</td>
<td>1.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>500</td>
<td>1.0</td>
<td>0.78</td>
</tr>
<tr>
<td>100902</td>
<td>Beef cattle</td>
<td>slurry</td>
<td>350</td>
<td>0.7</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>350</td>
<td>0.7</td>
<td>0.52</td>
</tr>
<tr>
<td>100902</td>
<td>Calves</td>
<td>slurry</td>
<td>150</td>
<td>0.3</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>150</td>
<td>0.3</td>
<td>0.35</td>
</tr>
<tr>
<td>100903</td>
<td>Fattening pigs</td>
<td>slurry</td>
<td>80</td>
<td>0.12</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>80</td>
<td>0.12</td>
<td>1.02</td>
</tr>
<tr>
<td>100903</td>
<td>Weaners</td>
<td>slurry</td>
<td>20</td>
<td>0.04</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>20</td>
<td>0.04</td>
<td>n.a.</td>
</tr>
<tr>
<td>100903</td>
<td>Sows</td>
<td>slurry</td>
<td>150</td>
<td>0.3</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solid</td>
<td>150</td>
<td>0.3</td>
<td>1.18</td>
</tr>
<tr>
<td>100906</td>
<td>Horses</td>
<td>solid$^{1)}$</td>
<td>400</td>
<td>0.8</td>
<td>0.39</td>
</tr>
<tr>
<td>100907</td>
<td>Laying hens</td>
<td>cages</td>
<td>1.55</td>
<td>0.0031</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td></td>
<td>perchery</td>
<td>1.55</td>
<td>0.0031</td>
<td>0.084</td>
</tr>
<tr>
<td>100908</td>
<td>Broilers</td>
<td>solid</td>
<td>0.75</td>
<td>0.0015</td>
<td>0.052</td>
</tr>
</tbody>
</table>

Notes:
1. n.a. not available.
2. $^{1)}$ wood shavings.

1. Table A3–4 recalculated based on the information provided in annex 3.
Furthermore, table A3-4 list the conversion factor for fattening pigs as 0.12, while the correct factor is 0.16, which also appears to have been used in the calculations. Some of the animal weights used to convert the EFs seem low, and for many animal species there is no connection between the animal weights listed in table A3-2 and table A3-4. Since the assumed weight directly impacts the emission factors, it is essential that the animal weights are representative.

Table 2 below contains the animal weights currently used to convert the PM EFs, the animal weights listed in table A3-2 and the proposed new animal weights to be used.

<table>
<thead>
<tr>
<th>Code</th>
<th>Animal category</th>
<th>Housing type</th>
<th>Animal weight kg animal(^1) Table A3-4</th>
<th>Animal weight kg animal(^1) Table A3-2</th>
<th>Animal weight kg animal(^1) Proposed value</th>
</tr>
</thead>
<tbody>
<tr>
<td>100906</td>
<td>Horses</td>
<td>solid</td>
<td>400</td>
<td>0.8</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.39</td>
<td>0.12</td>
</tr>
<tr>
<td>100907</td>
<td>Laying hens</td>
<td>cages</td>
<td>1.55</td>
<td>0.0031</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.017</td>
<td>0.0021</td>
</tr>
<tr>
<td>100908</td>
<td>Broilers</td>
<td></td>
<td>0.75</td>
<td>0.0015</td>
<td>0.052</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0068</td>
<td>0.052</td>
</tr>
</tbody>
</table>

It is not clear why calves and weaners are included in the annex but not in the main chapter of the GB. For cattle and swine the tier 1 EFs are based on solid animal waste management systems (AWMS). For swine the AWMS distribution for solid/liquid in EU27 is 42/58 according to the EU reporting in 2011 to the UNFCCC. For dairy cattle the distribution is 49/51 and for non-dairy cattle 59/41. In that respect it should be reconsidered whether it is a reasonable choice to select the EFs for solid AWMS as the tier 1 EFs or if instead weighted EFs should be implemented.
Based on the information in the annex it is not clear how the EFs for other poultry have been derived. One possibility could be to scale the EFs for broilers according to animal weights (for ducks, geese and turkey).

**Implementation of TSP emission factors**

Based on Philips et al. (1998) and Mark & Vincent (1986), it would be reasonable to consider the ID EFs as TSP EFs in the Guidebook.

**Evaluation of missing emission factors**

Currently EFs are not available for sheep, goats, mules & asses, buffalos and fur animals. Mules and asses are mentioned with horses in the EF tables. However, since horses and mules differ in weight it has been considered as a missing EF and therefore countries reporting has been analysed. EFs for camels are not believed to be relevant and have therefore not been considered further. When analysing the reporting of Parties to CLRTAP, it becomes clear that some countries are reporting PM emissions for some of these animal species.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Countries reporting PM from animal species not currently included in the GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>Goats</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Czech Republic</td>
</tr>
<tr>
<td>Denmark</td>
<td>Denmark</td>
</tr>
<tr>
<td>France</td>
<td>France</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Switzerland</td>
</tr>
</tbody>
</table>

The information in the sections below is extracted from the Informative Inventory Reports (IIRs) of the different countries.

**Sheep**

France is using a TSP EF for sheep 153 g/animal and considers 40 % PM$_{10}$ and 12 % PM$_{2.5}$. Denmark is using the emission factors from France. The IIR of the Czech Republic does not contain detailed information on the emission factors used. Switzerland reports PM$_{10}$ and PM$_{2.5}$ EFs of 39 g/animal and 6 g/animal and assumes that TSP = PM$_{10}$. There is no reference for the values provided in the Swiss IIR. It is also not clear whether the EFs refer to AAP.

The assumption that TSP = PM$_{10}$ does not seem plausible considering the current data in the GB as well as e.g. the information from the French IIR and Takai et al. (1998).

**Goats**

The PM EFs used by Denmark, France and Switzerland are identical for the EFs for sheep. The Netherlands refer to a recent scientific study (Mosquera & Hol, 2011). Based on the study PM$_{10}$ EFs are derived for mature goats (19 g/animal) and young goats (10 g/animal). The PM$_{2.5}$ EFs are 5.3 g/animal and 2.8 g/animal. There is no information on TSP EFs.

**Mules and Asses**

France is using the same EFs for mules as for sheep (also identical to horses and goats) and Switzerland does the same. Germany assumes the same EFs as for horses and refers to the GB. Italy uses EFs from the GB corrected for country specific animal weights. While not explicitly stated, it seems that the same basic EFs are assumed for mules and asses as for horses. In the Romanian IIR there is no information on the EFs applied. Spain refers to the GB and assumes the same PM EFs as for horses.
Buffalos

Only Italy reports emissions from buffalos. According to Condor et al. (2008) the EFs are derived from the EFs for cows and other cattle and scaled according to animal weight.

Fur animals

No countries reported PM emissions from fur animal in the 2011 reporting to CLRTAP. However, a recent Dutch study provided PM$_{10}$ and PM$_{2.5}$ EFs for mink (Mosquera et al., 2011).

The EFs has been reported as:

- PM$_{10}$ emission: 8.1 ± 3.6 g/breeding mink place per year
- PM$_{2.5}$ emission: 4.2 ± 2.1 g/breeding mink place per year

There is no TSP EF available. The transformation factors currently available in the GB suggest factors between 0.45 and 1. As a first option a transformation factor of 0.45 could be considered similar to that for swine.

Recommendations

The tier 1 EFs for cattle and swine should be based on a weighted average of solid and liquid AWMS based on EU27 reporting of N amounts to UNFCCC in 2011. For swine the rounded distribution is 40/60 (solid/liquid), for dairy cattle the distribution is 50/50 and for non-dairy cattle 60/40.

Weaners and calves should be implemented in the EF tables. This has been done in the revised tables below (Table 4 and 5).

For other poultry it is proposed to scale separately for duck, geese and turkeys according to weight. The EF for broilers is used.

The choice of animal weights as indicated in Table 2 and Table 5 is made based on the following assumptions.

For animals with a lifetime of more than 1 year, e.g. dairy cattle the grown animal weight has been used. For animals with a short lifetime, e.g. broilers, the median weight during the production cycle has been used. When feasible the same weights have been chosen for the PM calculation as have been reported in the GB for the NH$_3$ calculation.

For the tier 1 EF for laying hens, the EF for perchery from tier 2 has been chosen. This is based on the fact that traditional cages are banned in the EU from 2012 and therefore this is considered the most representative housing type.

For sheep and goats, data are available from the French and Swiss inventories. However, both sets of EFs are not well documented in the IIRs. For illustrative purposes the values from the French IIR have been inserted in Table 4 and 5 below. It will be up to further discussion whether EFs for sheep and goats can be implemented based on the data from France and Switzerland or if there is knowledge of other data available.

Table 4 below shows the updated version of table A3-4 of the GB taking into account the correction of errors, the new animal weights and the EFs for animals not previously covered.
<table>
<thead>
<tr>
<th>Code</th>
<th>Animal category</th>
<th>Housing type</th>
<th>Animal weight (kg)</th>
<th>Conversion factor LU animal-1</th>
<th>Emission factors EF</th>
</tr>
</thead>
<tbody>
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</tr>
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<td>0.48</td>
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<td>Laying hens</td>
<td>Cages</td>
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<td>0.0044</td>
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<td>0.069</td>
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<td>Mules and asses</td>
<td>Solid</td>
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<td>0.34</td>
</tr>
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<td>Buffalos</td>
<td>Slurry</td>
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### Table 5  Revised tier 1 EFs (New Table 3-4 in the GB)

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<th>EF for TSP (kg AAP⁻¹, a⁻¹)</th>
<th>EF for PM₁₀ (kg AAP⁻¹, a⁻¹)</th>
<th>EF for PM₂·₅ (kg AAP⁻¹, a⁻¹)</th>
</tr>
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<tr>
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<td>Dairy cows</td>
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<td>0.63</td>
<td>0.41</td>
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<td>Other cattle (including young cattle, beef cattle and suckling cows)</td>
<td>0.59</td>
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<td>0.18</td>
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<tr>
<td>100902</td>
<td>Calves</td>
<td>0.34</td>
<td>0.16</td>
<td>0.10</td>
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<tr>
<td>100903</td>
<td>Fattening pigs</td>
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<td>0.02</td>
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<td>100904</td>
<td>Sows</td>
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<td>0.69</td>
<td>0.12</td>
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<td>Sheep</td>
<td>0.139</td>
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<td>0.139</td>
<td>0.0556</td>
<td>0.0167</td>
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<td>Horses</td>
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<td>0.22</td>
<td>0.14</td>
</tr>
<tr>
<td>100912</td>
<td>Mules and asses</td>
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<td>0.10</td>
</tr>
<tr>
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<td>Laying hens (laying hens and parents)</td>
<td>0.119</td>
<td>0.119</td>
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<td>0.069</td>
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<tr>
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<td>Ducks</td>
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<td>0.14</td>
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<tr>
<td>100909</td>
<td>Turkeys</td>
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### Table 6  Revised tier 2 EFs (New Table 3-10 in the GB)

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<th>EF for TSP (kg AAP⁻¹, a⁻¹)</th>
<th>EF for PM₁₀ (kg AAP⁻¹, a⁻¹)</th>
<th>EF for PM₂·₅ (kg AAP⁻¹, a⁻¹)</th>
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</thead>
<tbody>
<tr>
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<td>Dairy cows</td>
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<td>1.81</td>
<td>0.83</td>
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</tr>
<tr>
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<td>0.28</td>
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<td>Other cattle (including young cattle, beef cattle and suckling cows)</td>
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</tr>
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<td>0.34</td>
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<td>Perchery</td>
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<td>0.119</td>
<td>0.023</td>
</tr>
</tbody>
</table>
References


Phillips V R; Holden M R; Sneath R W; Short J L; White R P; Hartung J; Seedorf J; Schröder M; Linkert K H; Pedersen S; Takai H; Johnsen J O; Groot Koerkamp P W G; Uenk G H; Scholtens R; Metz J H M; Wathes C M

