Discussion paper – Review of consistency for Manufacturing Industries

(1A2)

The chapter on combustion in manufacturing industries and construction provides tier 1 emission factors (EFs) for the main four fuel groups (solid, gaseous, liquid and biomass). The chapter also includes a large number of tier 2 EF tables for a variety of processes. In the previous GB update it was decided that only emissions of NOx, SO2 and CO should be attributed to fuel combustion (1A2) while the remaining pollutants should be considered under industrial processes (2A-G). This choice will not be revisited in the current review of the GB. Therefore, only limited work has been done for the tier 2 EFs since they with the exception of cement production do not include EFs of PM, HM and POPs.

Tier 1

As mentioned the tier 1 EFs consists of four EF tables for the four major fuel groups. The allocation of different fuels to fuel groups is presented in table 3-1. This allocation should be reconsidered considering the typical fuel properties. E.g. considering refinery gas as a liquid fuel could lead to significant overestimation of emissions in particular for PM and HM. The same is the case for LPG and natural gas liquids, which presumably has more in common with gaseous fuels than with the other liquid fuels. Biogas has been added in fuel category gaseous fuels.

Existing fuel correspondence table (table 3-1)

<table>
<thead>
<tr>
<th>Fuel group</th>
<th>Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>Hard coal, coking coal, other bituminous coal, sub-bituminous coal, coke, brown coal, lignite, oil shale, manufactured ‘patent’ fuel, peat</td>
</tr>
<tr>
<td>Gaseous</td>
<td>Natural gas, gas works gas, coke oven gas, blast furnace gas</td>
</tr>
<tr>
<td>Liquid</td>
<td>Residual fuel oil, refinery feedstock, petroleum coke, gas oil, kerosene, naphtha, natural gas liquids, liquefied petroleum gas, orimulsion, bitumen, shale oil, refinery gas</td>
</tr>
<tr>
<td>Biomass</td>
<td>Wood, charcoal, vegetable (agricultural) waste</td>
</tr>
</tbody>
</table>

Suggestion for new fuel correspondence table

<table>
<thead>
<tr>
<th>Fuel group</th>
<th>Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>Hard coal, coking coal, other bituminous coal, sub-bituminous coal, coke, brown coal, lignite, oil shale, manufactured ‘patent’ fuel, peat</td>
</tr>
<tr>
<td>Gaseous</td>
<td>Natural gas, gas works gas, coke oven gas, blast furnace gas, natural gas liquids, liquefied petroleum gas, biogas, refinery gas</td>
</tr>
<tr>
<td>Liquid</td>
<td>Residual fuel oil, refinery feedstock, petroleum coke, gas oil, kerosene, naphtha, orimulsion, bitumen, shale oil</td>
</tr>
<tr>
<td>Biomass</td>
<td>Wood, charcoal, vegetable (agricultural) waste</td>
</tr>
</tbody>
</table>
The text basically states that EFs from either chapter 1A1 or 1A4 should be used, wherefore it perhaps is unnecessary to have the fuel related tier 1 EFs in chapter 1A2. The vast majority of the EFs refer to the previous version of the GB (chapter B216). The following inconsistencies have been identified:

- Wrong reference in table 3-2. Should refer to B216.
- PM EFs in table 3-3 are wrongfully referenced to B216. It has not been possible to find the origin of the PM EFs.
- In table 3-5 the EF for selenium is referenced to B216, which is incorrect. It has not been possible to find the origin of the selenium EF.

## Tier 2

A final BREF document for iron and steel has been published in 2012 (EIPPCB, 2012a). The EFs referenced to the 2008 draft version has been checked.

For blast furnaces (GB table 3-7) the upper limit for CO in the final BREF document is reported as 36 g per tonnes. It is proposed to correct this in table 3-7 and calculate the EF as the geometric mean of the upper and lower limit.

For pelletizing plants the lower and upper limits for NOx are reported as 150 and 550 g per tonnes in the final BREF document. It is proposed to correct this in table 3-9 and calculate the EF as the geometric mean of the upper and lower limit.

For grey iron foundries the EFs refer to a previous version of the GB. It is proposed to change the EFS to refer to the BREF document on smtheries and foundries (EIPPCB, 2005). EF values could be taken from table 3.1 of the BREF document for NOx, SO2 and CO. Using the lower and higher values provided and then calculating the EF as the geometric mean.

The second draft version of the BREF document for non-ferrous metals (EIPPCB, 2009) contains revised SO2 values for primary and secondary copper production.

The second draft version of the BREF document for non-ferrous metals (EIPPCB, 2009) contains EFs for secondary aluminium production that could replace the current EFs referenced to a previous version of the GB.

For lime production a final version of the BREF document has been published (EIPPCB, 2010). There are slight revision to the lower limit for NOx and SO2. This should be implemented in table 3-23 of the GB.

For cement production all pollutants except PM are included in the 1A2 chapter. Most EFs refer to the draft BREF document. The final BREF document was published in 2010 (EIPPCB, 2010). The lower and upper limits for most gaseous pollutants are slightly changed. For HM the EFs presented in the GB seem to be recalculated from the values in the BREF document assuming a flue gas flow of 2000 Nm3 per tonnes. It is not possible to find a reference for this assumption and it should be checked in the future. The BREF document contains values for the EF of PCDD/F of 0.0276-627 ng per tonnes. The current EF range is 30-500 ng per tonnes referenced to UNEP. It is recommended to change the reference to the BREF document.

The EFs of PAHs refer to AP42 (US EPA, 1995). It has not been possible to find a better reference for the EFs of PAHs.
The EFs for HCB and PCBs refer to Kakareka et al. (2004) and a previous version of the GB. It has not been possible to get a copy of Kakareka et al. (2004) wherefor the review has been complicated. According to SINTEF (2006) measurements of HCB from cement production plants have shown an emission level of between 1 and 4 ng per Nm$^3$. With an assumed flue gas flow of 2300 Nm$^3$ per tonnes clinker this would equate to an EF range of 2.3-9.2 µg per tonnes clinker. This is slightly lower than the current range of 6-17 µg per tonnes clinker. Using the geometric mean the revised HCB EF would be 4.6 µg per tonnes rather than the current value of 11 µg per tonnes.

The PCB EF is referenced to a previous version of the GB. The current value is 1 µg per tonnes and the range is 0.5-10 µg per tonnes. According to VDZ (2011) the PCB emission were measured at 12 kilns. In 8 measurements PCBs were not detected. The remaining 27 measurements are all below 0.1 µg per m$^3$. Most values are significantly below. According to the report by VDZ the measuring method does not provide reliable results for concentrations below 0.02 µg per m$^3$. Based on the data from VDZ the range can be assumed to be 0.02-0.1 µg per m$^3$. With an assumed flue gas flow of 2300 Nm$^3$ per tonnes clinker this would equate to an EF range of 46-230 µg per tonnes clinker. Using the geometric mean the revised PCB EF would be 103 µg per tonnes rather than the current value of 1 µg per tonnes.

For glass production there is currently only one set of EFs available (table 3-26). However, the BREF document (EIPPCB, 2012b) contains EFs (NO$\_x$ and SO$\_x$) for container glass, flat glass, glass fibres, domestic glass and special glass. It would also make the chapter consistent with the level of disaggregation in chapter 2A7d. However, CO EFs are not included in the final BREF document, so it is not possible to review the current EFs. It has not been prioritised to search for alternative references for CO EFs.

For mineral wool the BREF data allows for the disaggregation between glass wool and stone wool. This split should be made for both the fuel related EFs in chapter 1A2 and the process related emissions in chapter 2A7d.

For bricks and tiles the EFs refer to AP 42 (US EPA, 1997). However, EFs are available from the BREF document on ceramics (EIPPCB, 2007). It is suggested to change the reference for the EFs from bricks and tiles production from US EPA to BREF since the latter is presumed to better reflect European conditions.

For enamel production (table 3-30), it is not possible to reproduce the EFs for NO$\_x$ and SO$\_x$ attributed to a draft version of the BREF document on glass production. EFs should be updated to reflect the final BREF document published in 2012.

References

