

## Background paper: Emissions of condensable and semi-volatile organic particulate matter

Joint workshop of the Task Forces on Emission Inventories and Projections (TFEIP), and Measurements and Modelling (TFMM)

### Identifying the issue

Over recent years, it has become clear that there are often very high discrepancies in particulate matter (PM) emission factors (EF) used in certain countries to estimate PM from a range of sources e.g. residential combustion. One of the reasons for the differences in the PM EFs is that they have been derived from different measurement techniques:

- some EFs ('filterable') do not include the condensable fraction of PM, and instead allow estimation of just the 'primary' PM emitted from a source.
- some EFs include both the 'primary' and condensable fraction of PM (the latter being PM subsequently formed after the emissions of certain precursor gaseous species cool in the flue gas),

EFs for these respective approaches can differ by up to a factor of 5<sup>1</sup>.

The different approaches being used by Parties lead to two immediate challenges:

- i. Inconsistent methods are being applied by Parties under the Convention which can affect compliance with the future national reduction commitments for PM<sub>2.5</sub> under the 2012 amended Gothenburg Protocol. More specifically, those Parties that include the condensable fraction of PM may be at a relative disadvantage.
- ii. The air quality modelling community under EMEP (TFMM/MS-CW) use the reported emissions data to estimate air quality concentrations and impacts. They do not separately estimate condensables, resulting in underestimates where countries do not include them in their reporting.

These issues have previously been highlighted by various groups working under the Convention, including e.g.:

- The TFEIP at its 2014 workshop on residential/commercial combustion (and NRMM),
- The EMEP/TFMM air quality community, see e.g. Chapter 6 'Problematic emissions - particles or gases?' of the 2015 EMEP Status report<sup>2</sup>;
- TFIAM/CIAM when trying to reconcile the different national approaches with emissions calculated in the GAINS integrated assessment model. This has also effectively meant national reduction commitments have not always been made on the same technical basis for Parties.

The issue is further complicated by the fact that the term "PM" is broadly used by different technical communities under the Convention, with no indication of which PM components are included.

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<sup>1</sup> van der Gon, et al (2015). <http://www.atmoschem-phys.net/15/6503/2015/>

<sup>2</sup> [http://emep.int/publ/reports/2015/EMEP\\_Status\\_Report\\_1\\_2015.pdf](http://emep.int/publ/reports/2015/EMEP_Status_Report_1_2015.pdf)

## On-going activities under the Convention

- a. The TFEIP earlier identified as a high priority the need to undertake a comprehensive review of the PM EFs included in the EMEP/EEA Guidebook, to understand whether the various PM EFs provided include the condensable fraction or not. This work was subsequently funded by the European Union. The updated Guidebook, scheduled for publication in early autumn 2016, will describe whether the provided default EFs are representative of i) filterable or ii) filterable and condensable PM fractions.
- b. The TFEIP and TFMM agreed in 2015 on the need for a technical workshop to address the issue with a view to increasing understanding of the technical issues and moving towards solutions that may improve the consistency of information being generated under the Convention. This workshop is planned for 16<sup>th</sup> May 2016, back-to-back with the annual TFEIP meeting in Zagreb, Croatia.
- c. In advance of the workshop, a group of contributors from the TFMM have prepared a technical position paper that identifies, from the air quality modelling perspective, the additional information on semi-volatile organic compounds needed to improve current AQ model performance. Three proposals are described ('a minima', 'intermediate', and 'idealistic'), each with increasing complexity of additional information required from the emissions community e.g. on speciation, volatility, oxidation degree, dilution curves etc. The position paper is being circulated as a paper ahead of the TFEIP/TFMM workshop.

## Objectives of the joint TFEIP/TFMM workshop

The joint workshop on condensables provides the opportunity for the emissions and air quality modelling communities to come together to discuss and develop a shared understanding of the issue. It is however a priority to also agree on concrete short and long-term actions, with a view to resolving the issue and improving the situation. Discussions at the workshop will therefore focus upon the following topics:

### 1. *Identifying where research is needed, to address e.g.:*

- poor reliability of VOC emission factors (regardless if including condensables or not);
- lack of reliable data about the speciation of VOCs and PM;
- lack of information about the distribution of organic compounds between volatility bins.

### 2. *Identifying potential short- and long-term solutions* for emission inventory reporting and the associated implications of each (costs, time required, need for subsequent adjustment procedures etc.) e.g.

- A **short-term** solution could be that Parties should report asap whether they included condensables for specific sources such as domestic heating in their PM emissions or not. This would enable modellers (e.g. CEIP/CIAM/MSC-W) to construct a more consistent dataset of PM emissions.
- **Longer-term option 1** – Parties harmonise reporting to ensure PM emissions **include** condensables. Impact: for certain Parties an adjustment of emission reduction obligations would be required, which would increase the workload for CEIP. No action for TFMM required.

- **Longer-term option 2** – Parties harmonise reporting to ensure PM emissions **exclude** condensables. Impact: for certain Parties an adjustment of emission reduction obligations would be required, which would increase the workload for CEIP. TFMM develops routines to include condensables in atmospheric models (comparable to routines for effective stack height) and makes this routine also available to national and local modellers.

Other longer-term options are also available. For example, a “compromise” option could be to require reporting of PM emissions excluding condensables, but to add periodic reporting (perhaps every 4 years) of the condensable component.

### **3. Agreeing on next steps**

- The TFEIP has been instructed to report back to the EMEP Steering Body on this issue. So the following next steps need to be discussed and agreed at the TFEIP meeting:
- Develop an overall plan/timeline across 2016 and into 2017 for addressing this issue;
- Propose some longer-term goals and short-term actions;
- Decide how to report decisions and proposals to the EMEP Steering Body etc.