EXPERT PANEL COMBUSTION & INDUSTRY
Small combustion chapter updates | Jeroen Kuenen
WHY SMALL COMBUSTION?

PM2.5 emissions reported in 2014
WHY (AGAIN) SMALL COMBUSTION?

- Small combustion becomes more and more important, given reduction of emissions in most other sectors.
- Yet, the emission estimates remain uncertain due to various reasons:
  - Activity data
  - Appliance type
  - Burning practices (wet/dry wood, how it is loaded, etc.)
  - Emission factor basis (condensables or not)

- Discussion around condensables is very relevant for small combustion, in particular for biomass.
PM REPORTING BASIS

- Last year the TFEIP discussed the topic of condensables, and a sector-specific approach was adopted.
- This implies that on a sector basis we decide whether or not condensables are to be included in the PM emission factors:
  - Road transport: yes
  - Energy and manufacturing industry: no
  - Small combustion: ???

- This year we will need to decide on whether or not we propose to include condensable component in emission inventories.
QUESTIONS TO EVERYONE

- Mainly for countries using the Guidebook for small combustion
  - What are your experiences with the updated methodology?
  - Who is still using Tier 1?

- Emission factors are there for the key technologies. Information on technology split is provided for PM from biomass if you don’t have any country specific data yourself.

- What can we do to help you further?
CONDENSABLES

- 2016: joint workshop TFEIP-TFMM where modellers stressed the need to achieve consistent & complete information from the inventories

- Current reporting is a mix of countries reporting on a basis including / excluding condensables
the US EPA defines particulate matter (PM) as consisting of a filterable fraction (FPM) and a condensable fraction (CPM).

Filterable PM is directly emitted:
- Solid or liquid
- Captured on filter
- PM_{10} or PM_{2.5}

Condensable PM is in vapor:
- Reacts upon cooling and dilution
- Forms solid or liquid particle
- Always PM_{2.5} or less

where should the PM mass be that forms almost instantaneously?
INFLUENCE AND IMPORTANCE OF SAMPLING AND MEASUREMENT TECHNIQUES ON EMISSION

- **Industrial stack PM emissions** are defined as particulates (aerosols) that are present in waste- or flue gas streams and not the condensable gases in these streams. Condensable particulate matter is by definition excluded.

- **Road transport exhaust PM emissions** by definition capture most of the condensable PM because measurements include dilution and cooling to 51 °C.

- **For residential combustion** stoves various methods circulate which capture the condensable PM in various degrees (from 0-100%)

- How should AQ modellers know about this, when the inventory compilers don’t even know.....
A uniform approach would be the best from a user perspective.

However, this would require currently used measurement techniques to be changed across Europe.

- Road transport: all measurement cycles include condensables.
- Industrial: all stack measurements exclude condensables.

As a solution, it was agreed in Krakow (2017) that we will adopt a sector-specific approach for including condensables or not.

- Road transport: PM includes condensables.
- Industrial stack measurements: PM excludes condensables.
WHY NOT INCLUDING CONDENSABLES?

- It’s not formed instantly in the combustion process, but rather a little bit later upon dilution and cooling of the hot flue gases.

- PM emissions for some countries could strongly increase which might be hard to explain.

- Including condensable component might create problems for some countries to meet the ceilings.
WHY INCLUDING CONDENSABLES?

- The combination of appliance type (fire place, pellet stove, boiler) and amount of solid fuel (wood, coal) determines how much \( PM_{\text{condensible}} \) is emitted. Using one overall “fudge factor” will give bad results. The information on appliance type and activity data can only come from the inventory community.

- If not present in the EI, any analysis on dominant sources gives misleading information, leading to non cost-efficient measures e.g. when complying with NEC.

- In transport EFs \( PM_{\text{condensable}} \) is already (mostly) included –because the cooling goes to \( 51^\circ \). This is not quite ambient ;-. Especially during wintertime some will still be missing, but the bulk is captured.

- It is inconsistent and confusing if some anthropogenic sources are dealt with by modellers others by inventories

- RWC is not the only, nor the last source with \( PM_{\text{cond}} \)….a quick fix now by asking modellers to modify reported emissions leads to parallel diverging universes…
WHAT ARE WE DOING NOW?

Emission per capita (kg/person/year)
SOME COUNTRIES HAVE CHANGED

Small combustion PM2.5 emissions (kton) for 2010

- Reported in 2012
- Reported in 2013
- Reported in 2014
- Reported in 2015
- Reported in 2016
- Reported in 2017
FOLLOW-UP ACTIONS

- Depending on the decision, the Guidebook needs to be reflected in this way to avoid confusion
  - Include only EFs including / excluding condensables
  - Review corresponding guidance in the text
PROPOSAL

- Move towards reporting **including condensable component** to ensure that our emissions represent the complete range of PM emissions
- If we don’t do this, users will still have to “guess” what the non-filterable part is (it depends strongly on technology split)
- Small combustion is thé key source where the condensable issue plays, in industry this issue is much smaller
- Number of countries already made the step in last years
- Compliance issues can be solved by adjustments
THANK YOU FOR YOUR ATTENTION