



Norwegian
Meteorological
Institute

Condensable organics - The Gothenburg (NMR) workshop and follow-up

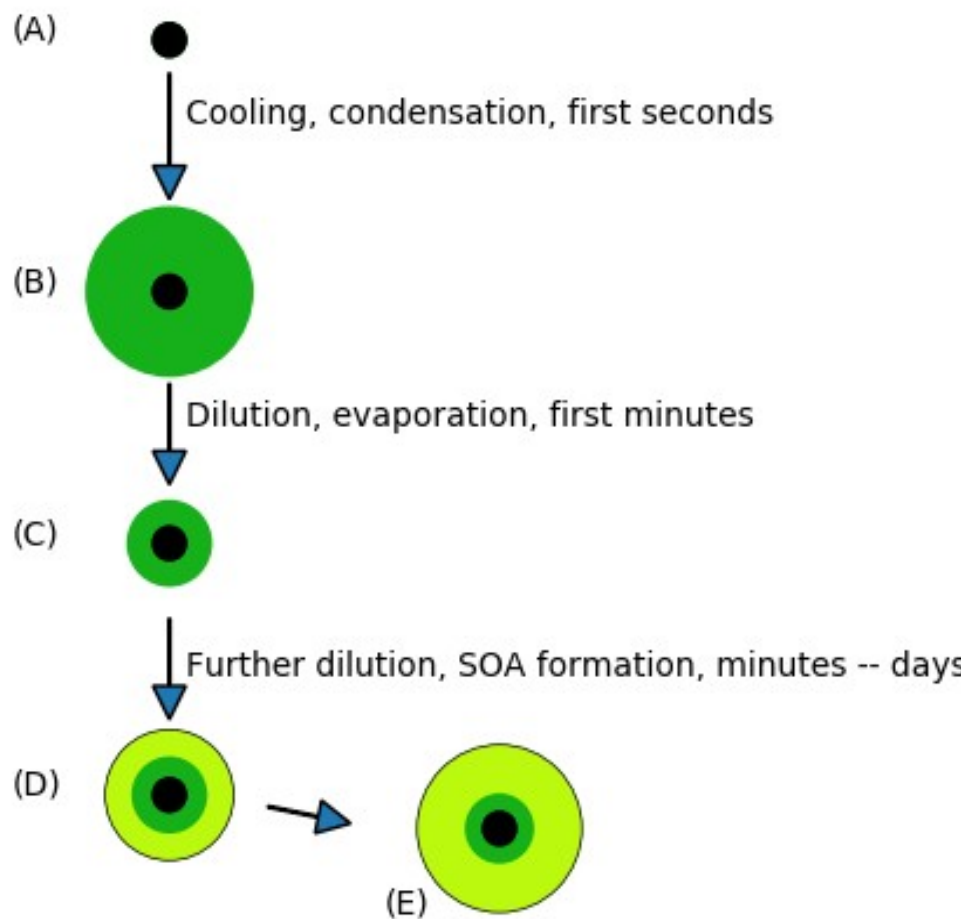
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Univ. Technology, Sweden

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15.04.2021

Primary organic aerosol emissions? Gas or particle?

- Condensables = ~ semivolatile VOC
- Condensables may be missing from both PM and VOC inventories!
- Europe: Denier van der Gon et al., ACP, 2015, Simpson and Denier van der Gon, EMEP 2015, Ots et al., ACP, 2016, Jiang et al, 2019
- Basically, countries report **apples** and **oranges**!



Emission factors – depends on where you measure them....

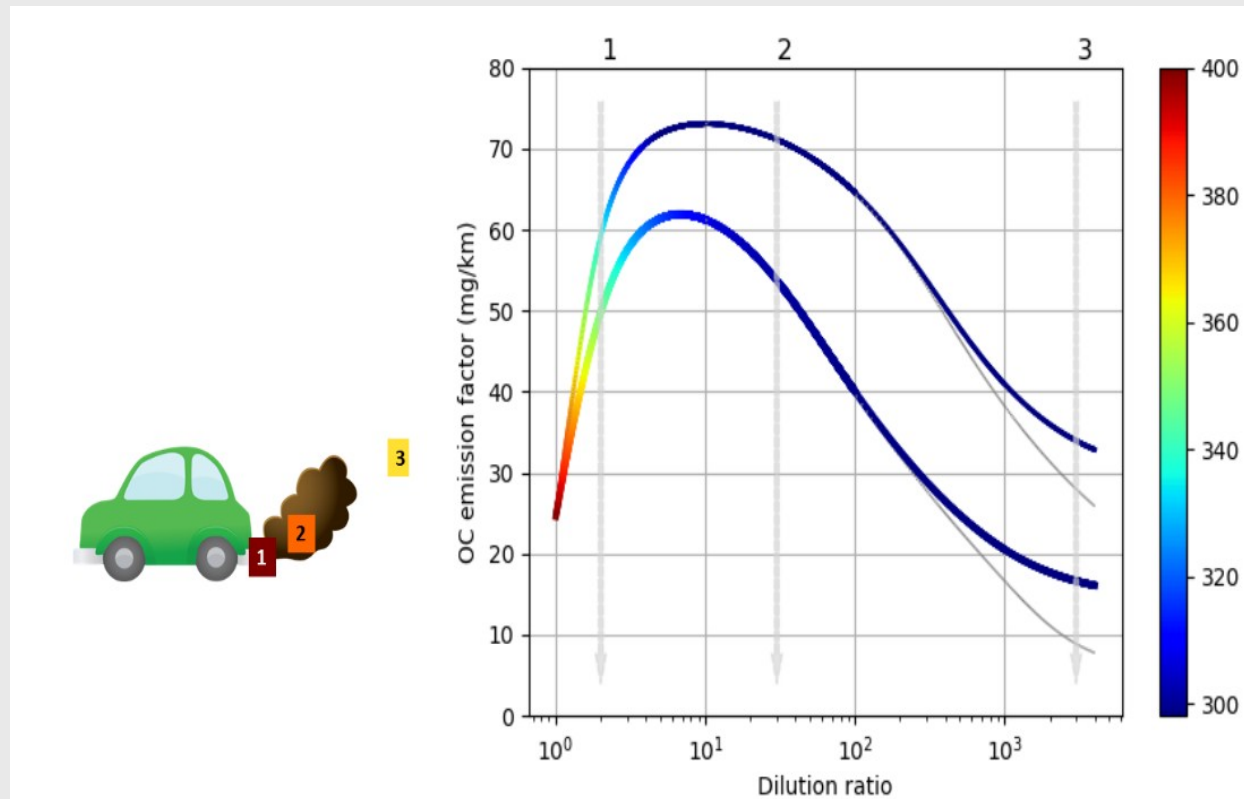
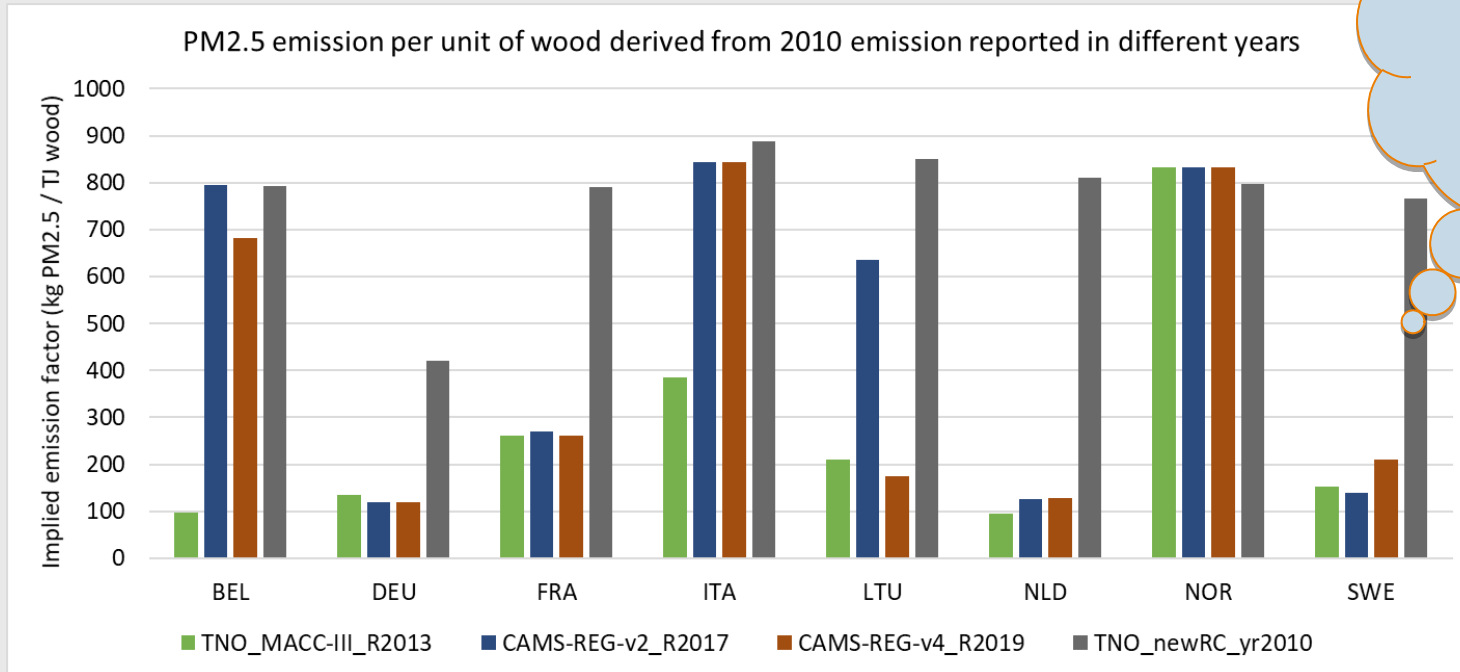


Figure 2.3: Predicted changes in OC emission factors (EFs) as a function of dilution ratio, derived from a diesel-engine setup similar to that used by Robinson et al. (2010).

(Fig from: Simpson et al., EMEP Report 4/2020)

EMISSION PER UNIT OF WOOD

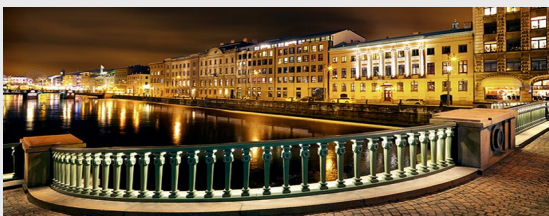
Best to burn wood in SWE, NLD, DEU?



- Implied emission factors show range of 3-8 difference (“crude” analysis)
- Bottom-up (TNO_newRWC) more consistent (though less access to detailed national data)

(NB “old” slide; Swedish emissions now include condensables)

NMR-SVOC Workshop, March 2020



- Workshop to bring together experts in:
 - emission measurements,
 - atmospheric chemistry,
 - inventory experts, and
 - Modellers
- to systematically consider and recommend best approaches for dealing with semi-volatile emission with regard to PM_{2.5}.
- => guidance for UN-ECE, EU

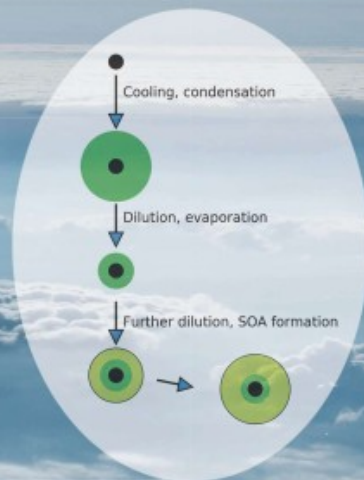
The main questions:

- For which source categories are condensable organics important?
- How much condensables are produced from different:
 - combustion technologies?
 - measurement techniques?
- What is included in EMEP and other emission inventories?
- Can we specify the volatility distribution of condensables from major sources?
- Can we recommend a practical approach for inclusion (or exclusion) of condensables in (a) inventories, and (b) chemical transport models?

How should condensables be included in PM emission inventories reported to EMEP/CLRTAP?

Report of the expert workshop on condensable organics
organised by MSC-W, Gothenburg 17-19th March 2020

David Simpson, Hilde Fagerli,
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Chris Dore, Mattias Hallquist,
Hans Christen Hansson, Rob Maas,
Laurence Rouil, Nadine Allemand,
Robert Bergström, Bertrand Bessagnet,
Florian Couvidat, Imad El Haddad,
Johan Genberg Safont, Franziska Goile,
Andrew Grieshop, Isaline Fraboulet,
Åsa Hallquist, Jacqui Hamilton,
Kristina Juhrich, Zbigniew Klimont,
Zlatko Kregar, Ingrid Mawdsely,
Athanasios Megaritis, Leonidas Ntziachristos,
Spyros Pandis, André S.H. Prévôt,
Sabine Schindlbacher, Morten Seljeskog,
Natalia Sirina-Leboine, Jacob Sommers,
Stefan Åström



Nordic Council
of Ministers

Report gives overview of field, with focus on RWC and road transport, and provides list of key messages and recommendations.

Available at: www.emep.int/mscw

Conclusions - short term

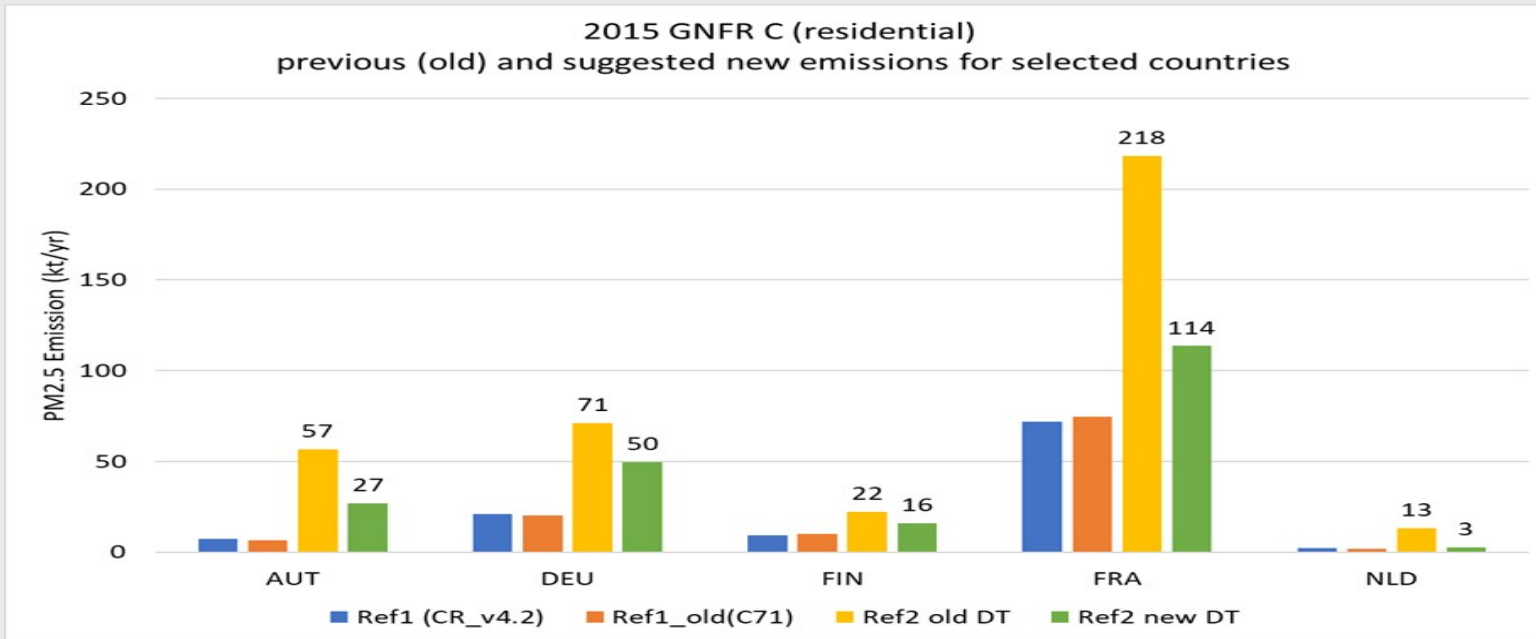
- The TNO Ref2 emission inventory is a good first no-regret step for describing condensable emissions from residential wood combustion in emission dispersion modelling
- Ref2 needs to be further documented, and evaluated against national emission and IIASA estimates: focus on RWC in first steps.
- Identify needs for more detailed emission reporting, and communicate clearly to parties. This could for example entail requests for types of wood-stoves, or exhaust standards on road-transport
- Much data and experience is available from the US EPA, and work towards consideration of this can begin now.

Generally - prepare for more detailed emission reporting requirements - nationally and in Guidebook.

NMR SVOC Workshop ... activities continue

- The issues are COMPLEX! Work has continued offline, addressing specific issues and other sources - documenting both problems and solutions
- “Implied” emission factors (IEFs, emissions per unit of fuel burned) give clues as to which countries include condensables ...
- IEF system and reporting (IIR) will be used to identify countries where condensables are not included, Emissions for some countries will be replaced by TNO estimates for 2021 EMEP model runs.
–
- Expert group to be set up to continue process within EMEP and Task Forces.

Ongoing and future



(Fig from: Hugo Denier van der Gon, 2021)

Following workshop:

- IIASA transferred more activity data to TNO
- France & Finland contacted TNO, and provided more data
- Much activity between TNO, CIAM, CEIP to understand and improve emission factors
- Revisions will be implemented in GP review process
- NMR 2021 – Revising historical PM2.5 emissions from RWC...

IEF CALCULATION APPROACH

- ▶ Currently based on the approach in NFR category 1A4bi (residential) only (largest sector in terms of energy consumption, and also most relevant for condensables)
- ▶ Countries with no or incomplete reporting excluded from analysis

- ▶ Basic idea: from the implied emission factor (EM/AD) it should be clear if condensables are included or not
 - ▶ Complication: fuel mix differs considerably between countries

- ▶ Reported activity data used to estimate contribution of each fuel to total emissions (%), using Tier 1 emission factors. Three cases:
 1. Only biomass is important (>5%), representing 2/3 of Parties (*in 2018*)
 2. Both biomass and solid fuels are important (>5%) representing 1/5 of Parties
 3. Contributions (>5%) from other fuels, representing few Parties, including some small ones

WHAT DOES THIS MEAN?

► **Preliminary calculation** based on data for 2020 submitted in 2018 - to be reassessed based on 2019 emissions

NFR	ISO2	Relevant fuels	IEF (kg/TJ)	Condensables included based on IEF?	Check in IIR?
1A4bi	AT	Biomass only	88	no	
1A4bi	BE	Biomass only	498	yes	yes
1A4bi	BG	Biomass and solid	655	yes	yes
1A4bi	BY	Biomass only	645	yes	yes
1A4bi	CH	Biomass only	87	no	
1A4bi	CY	Biomass and liquid	19	unclear	yes?
1A4bi	CZ	Biomass and solid	249	unclear	yes?
1A4bi	DE	Biomass only	74	no	
1A4bi	DK	Biomass only	208	no	yes?
1A4bi	EE	Biomass only	137	no	
1A4bi	ES	Biomass only	481	yes	yes
1A4bi	FI	Biomass only	173	no	yes?
1A4bi	FR	Biomass only	215	no	
1A4bi	GB	Biomass and solid	423	yes	yes
1A4bi	GE	Biomass only	744	yes	yes
1A4bi	GR	Biomass only	672	yes	yes
1A4bi	HR	Biomass only	508	yes	yes
1A4bi	HU	Biomass only	581	yes	yes
1A4bi	IE	Biomass and solid	402	yes	yes

NFR	ISO2	Relevant fuels	IEF (kg/TJ)	Condensables included based on IEF?	Check in IIR?
1A4bi	IS	Liquid only	1	not relevant	
1A4bi	IT	Biomass only	353	no	yes?
1A4bi	LT	Biomass and solid	112	no	
1A4bi	LU	Biomass only	610	yes	yes
1A4bi	LV	Biomass only	551	yes	yes
1A4bi	MC	Liquid and gas	2	not relevant	
1A4bi	ME	Biomass only	740	yes	yes
1A4bi	MK	Biomass only	742	yes	yes
1A4bi	MT	Biomass only	894	yes	yes
1A4bi	NL	Biomass only	97	no	
1A4bi	NO	Biomass only	637	yes	yes
1A4bi	PL	Biomass and solid	147	unclear	yes?
1A4bi	PT	Biomass only	571	yes	Yes
1A4bi	RO	Biomass only	713	yes	Yes
1A4bi	RS	Biomass and solid	673	yes	Yes
1A4bi	RU	All fuels relevant	3	unclear	
1A4bi	SE	Biomass only	142	no	yes?
1A4bi	SI	Biomass only	429	yes	yes
1A4bi	SK	Biomass and solid	541	yes	yes

› CROSS-CHECK WITH IIR

- › The selected Parties are then cross-checked with the IIR by CEIP
 - › In cases where the IIR confirms that condensables are indeed included, the reported data are found to be fit-for-use
 - › In case this is not clear, reported data are not used
- › All of this will be done in the next 3-4 weeks. The result will be a list of Parties where small combustion emissions are confirmed to include condensables. In these cases, the (spatially distributed) reported data are included in the air quality assessments
 - › For other Parties, the same approach as last year will be used (replace with [updated] REF2)
- › This approach will be continued in the next years as necessary
 - › Hopefully increasing the share of reported data every year and becoming obsolete in a few years

Acknowledgements

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