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# REAL LIFE EMISSIONS PROJECT: MAIN OUTCOMES

Isaline Fraboulet,  
[isaline.fraboulet@ineris.fr](mailto:isaline.fraboulet@ineris.fr)



VSB TECHNICAL  
UNIVERSITY  
OF OSTRAVA

ENERGY  
AND ENVIRONMENTAL  
TECHNOLOGY CENTRE

ENERGY  
RESEARCH  
CENTRE

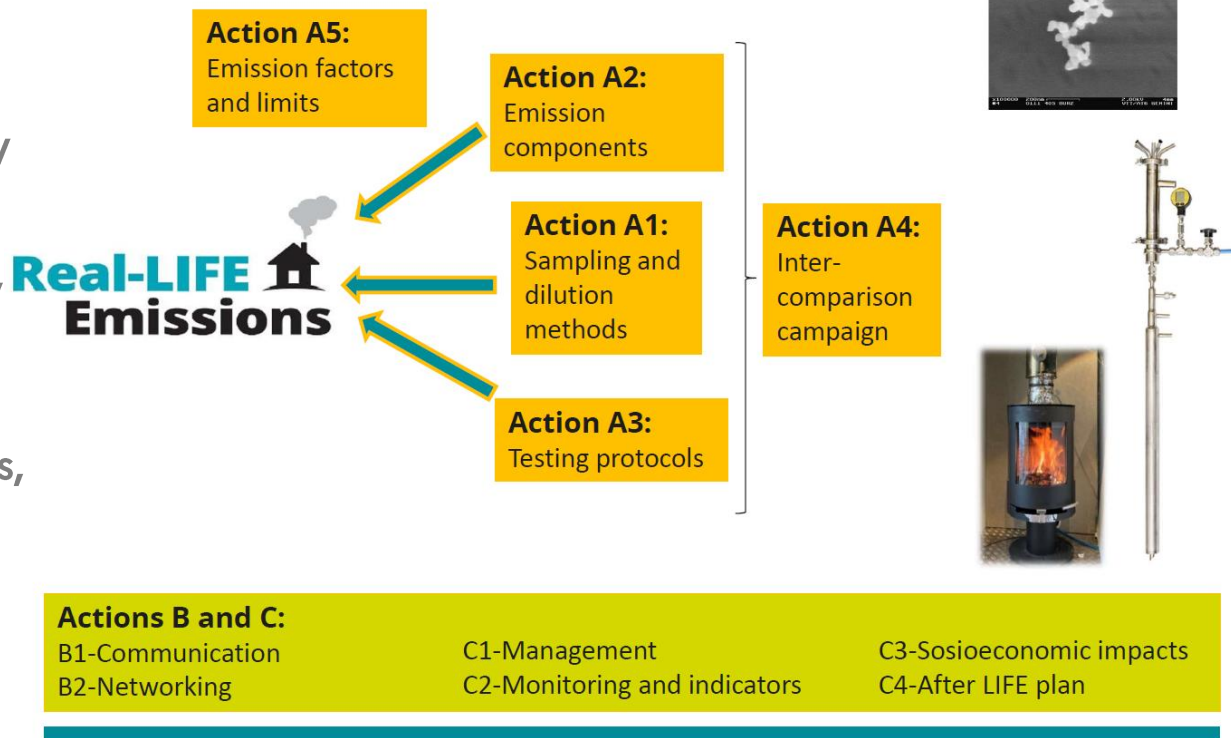


- Residential wood combustion (RWC) is a major contributor to atmospheric emissions of PM in many countries, case of France 62 % of PM<sub>2.5</sub> emissions in 2020
- Aerosols emitted by wood combustion include solid and condensable particles

**Condensables:** class of organic compounds vapour phase at stack conditions, which undergo both condensation and evaporation processes as the stack air is cooled and diluted upon discharge into ambient air

- Significant implications for the modelling of organic aerosol and therefore PM levels in the European atmosphere (EMEP Technical Report MSC-W 4/2020), inconsistent inclusion of condensables into national emission inventories leads to gaps in emissions between countries (*Denier Van Der Gon et al. 2015*)
  - Different testing protocols (appliance operation) in use lead to variation in measured emissions causing difficulty in the comparison of emissions,
  - **EFs used by different countries to report emissions differ in terms of condensables inclusion, and use of real-life or near to real life protocol**
  - **Used test protocols in existing test standards (EN 16510/Ecodesign directive) do not reflect the real life or near to real life emissions from RWC and do not include condensables.**
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- LIFE preparatory project 2020 call, duration may 2021-december 2024
- Coordinated by the University of Eastern Finland (UEF), with the participation of TFZ Germany, Technical university of Ostrava (VSB), Czech Republic, and Ineris France
- To propose testing procedures, which better reflects quality and quantity of the real-life emissions from solid fuel heating appliances, as well as the adverse effects to human health and environment.



# Action A1 - Sampling and dilution methods main outcomes

Outcome of this action : evaluation of the existing methods, and suggestion for sampling and dilution methods to be tested within the project.

Dilution is required to measure condensables/organic matter

Various sampling and dilution methods and dilutors available to measure particulate emissions from RWC (some established as standards, all methods have their own advantages and disadvantages)



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## OVERVIEW OF PARTICULATE MATTER SAMPLING AND DILUTION METHODS FOR THE SMALL-SCALE SOLID FUEL COMBUSTION

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Summary of Action A1 Report

# Action A1 - Sampling and dilution methods main outcomes

## Short term option :

ENPME (used in EN 16510) + PTD

## Dual filter extended EN PME method

**First filter hot:** collects the **solid fraction**

**Second filter** at ambient temperature after dilution using a porous tube, collects the **condensables**

## Long term option :

Porous tube diluter +the ejector  
and (PTD+ED) combination  
dilution system

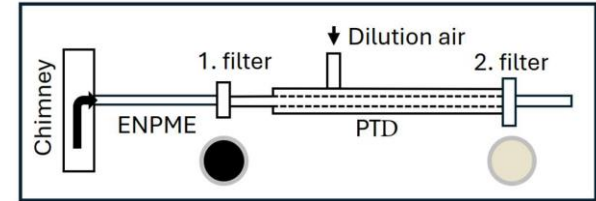


Figure 1. Extended ENPME method consists of an ENPME sond and a porous tube diluter (PTD). Solid and condensed particles are collected on successive filters.



## Action A2 – Emission components main outcomes

Results of emission testing should reflect the harmfulness of the emissions, for both environmental and human health perspective, and should be suitable to be used as input to emission modeling activities.

The outcome includes suggestions for the new parameters that should be considered in future (long-term) testing procedures

Amongst most important components are: PM2.5, BC or EC, VOCs, PAHs, Particle Number, UltraFineParticles, SOAs



### **REVIEW OF PARTICULATE EMISSIONS PRODUCED FROM THE SMALL SCALE SOLID FUEL COMBUSTION**

Summary and Key messages  
of Action A2 report

**25 NOV 2022**

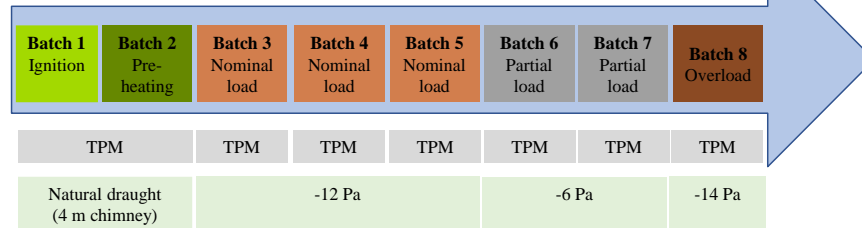
# Action A3 – Test protocols main outcomes

Various national and international test protocols for residential appliances burning solid fuels were reviewed.

Different protocols in use

- lead to variation in measured emissions causing difficulty in the comparison of emissions
- currently used test protocols in existing test standards do not reflect the real life or near to real life emissions from RWC.

Testing protocol for wood stoves was proposed and tested in A5.



**Real Life protocol**



Technical report on an overview of test protocols for residential appliances burning solid fuels

Summary and Key Messages of Action A3 Report

11 March 2024

Contributors:

Kamil Krpec (VSB), Petr Kubesa (VSB), Jiri Horak (VSB), Juho Louhisalmi (UEF), Karna Dahal (UEF), Jarkko Tissari (UEF), Hans Hartmann (TFZ), Claudia Schön (TFZ), Isaline Fraboulet (INERIS) and Benjamin Cea (INERIS)



LIFE20 PRE/FI/000006  
LIFE PREPARATORY PROJECT 2020  
01/05/2021 - 30/04/2024

## Action A4– Intercomparison main outcomes

### Testing of suggested ENPME + PTD method on the same flue gas at Ineris

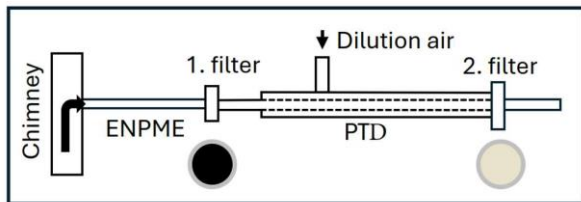
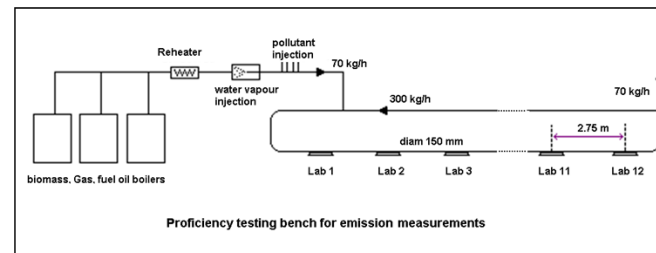


Figure 1. Extended ENPME method consists of an ENPME sond and a porous tube diluter (PTD). Solid and condensed particles are collected on successive filters.



- Different configurations (-> experiences)
- Different emission levels

Solid fraction results correlated well between configurations.

- Condensable fraction was found in all systems.
- Deviation was seen in the condensable fraction obtained between two configurations

-> Preliminary evaluation, needs a dedicated project where the new method is described precisely and its performances evaluated



# Action A5–Emission factors and emission limits main outcomes

- Development, testing and establishment of **extended ENPME method** using ENPME and Porous Tube Diluter (Round-robin campaign and laboratory tests)
- Development, definition and successful validation of **Real-LIFE test protocol for log wood stoves**
- Application of Real-LIFE test protocol to 11 small scale appliances (9x log wood stove and 2x inset) and generation of emission factors for the appliances tested
- Round robin: Emission results were in good agreement for both stoves in each laboratory
- Emissions in different phases varied, which emphasizes the importance of wide (inc. different loads/phases) emission measurements in type testing



Real-LIFE emissions, Life preparatory project 2020

Project Number: LIFE20 PRE/FI/000006

[Action A5: Emission factors and emission limits](#)

**Technical report on emission factors, emission limits,  
round robin with Real-LIFE test protocol - Draft**



To be continued...

- Project terminates at the end of 2024
- Plan to publish results in scientific journals
- Experiments continues after the project –Testing procedures/ ENPME+PTD to be used whenever possible to collect more data
- More information available on : <https://sites.uef.fi/real-life-emissions/materials/>
- ENPME+PTD : A project is needed where the specifications of the new method are described and set-up precisely, and performance evaluated (modeling of nucleation without seed, LOQ, uncertainties, etc.)
- Topics related to RWC emissions would require EU dedicated Research programs



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# Thank you!



# Thank you for your attention

*The contents are purely those of the beneficiaries of the REAL-LIFE EMISSIONS project and may not in any circumstances be regarded as stating an official position of the EUROPEAN COMMISSION.*

UEF // University of Eastern Finland

