



RÉPUBLIQUE
FRANÇAISE

*Liberté
Égalité
Fraternité*



*maîtriser le risque
pour un développement durable*

REAL-LIFE EMISSIONS PROJECT – ACTION A4

Intercomparison of methods on a test bench,
feedback and preliminary results



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Presentation plan

- Principle and objectives of the intercomparison
- Design of the test bench
- Feasibility study: Emission levels and homogeneity of solid Particles and OGCs generated using dry and fresh wood chips (previously demonstrated with pellets in 2014 and 2017)
- Intercomparison Campaign performed in september 2023

Principle and objectives of the intercomparison

Objective of inter-comparison studies:

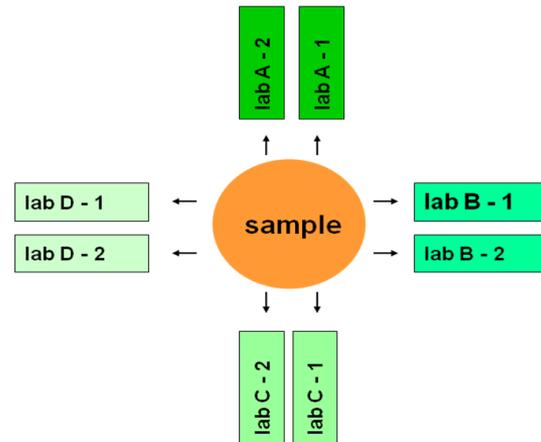
- To evaluate the uncertainty of measurement methods and detect major sources of uncertainty .
- takes part to the standardisation process of measurement methods.
- useful to disseminate good practices to evaluate the capabilities of different laboratories to apply standard measurement methods.

Principle:

- One homogeneous sample provided to several laboratories and results obtained compared.
- When possible (at least 8 participant/method tested with 2 lines per participant/method: Calculation of the global uncertainty (U) of the method (ISO5725-2)

Real life emissions project:

Test of the new EN PME –PT method (4 prototype sampling lines), OGC and Black carbon measurement



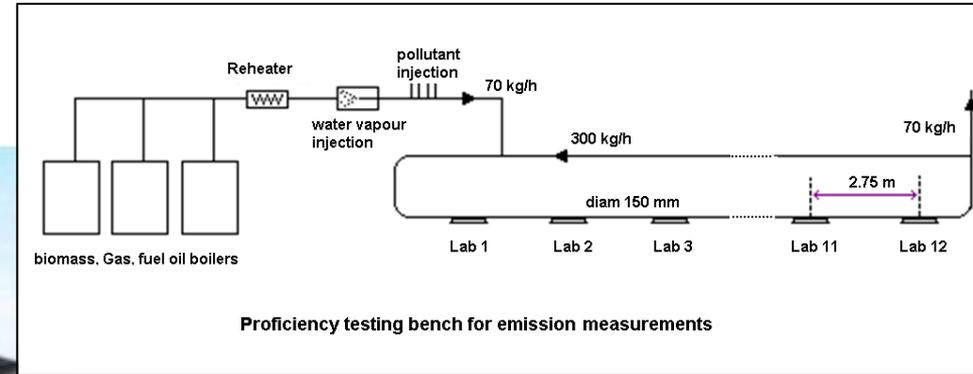
(s_r) intra-laboratory dispersion : scattering of the results within each laboratory

(s_L) inter-laboratory dispersion scattering of the results between laboratories

$$S_{Rj}^2 = S_{rj}^2 + S_{Lj}^2$$

$$\rightarrow U(y) = k \cdot \sqrt{S_{Rj}^2}$$

Design of the test bench



➤ Gas temperature: 120 to 140 °C

➤ Static pressure: > 7 Pa

The bench:

- consists of a titanium loop in order to prevent any reaction and losses or transformations of the generated compounds.
- is designed to generate gaseous effluents of identical composition for each of the **12 sampling ports** ⇒ **12 "stack teams" can participate simultaneously to ILCs**

Feasibility study using dry and fresh wood chips

Experimental Set-Up: OGCs homogeneity



Biomass Boiler (40kw)

Fuel types tested:

- Dry wood chips
- Fresh wood chips



Combustion tests:

- One day by fuel type
- Operated continuously
- Dry wood chips n=8
- Fresh wood chips n=14

3 x FID (109A) EN 16192 method connected to sampling ports 1, 5 and 12



Ineris Emission Bench

Feasibility study study using dry and fresh wood chips

Experimental Set-Up: For the solid particles homogeneity

6 x Stainless steel probes (In-stack) EN 13284 method connected to sampling ports : 1, 3, 5, 7, 10 and 12



Fuel types tested:

- Dry wood chips
- Fresh wood chips



Combustion tests:

- One day by fuel type
- 30 min per run
- n = 4 for Dry wood
- n = 5 for Fresh wood



Biomasse Boiler (40kw)

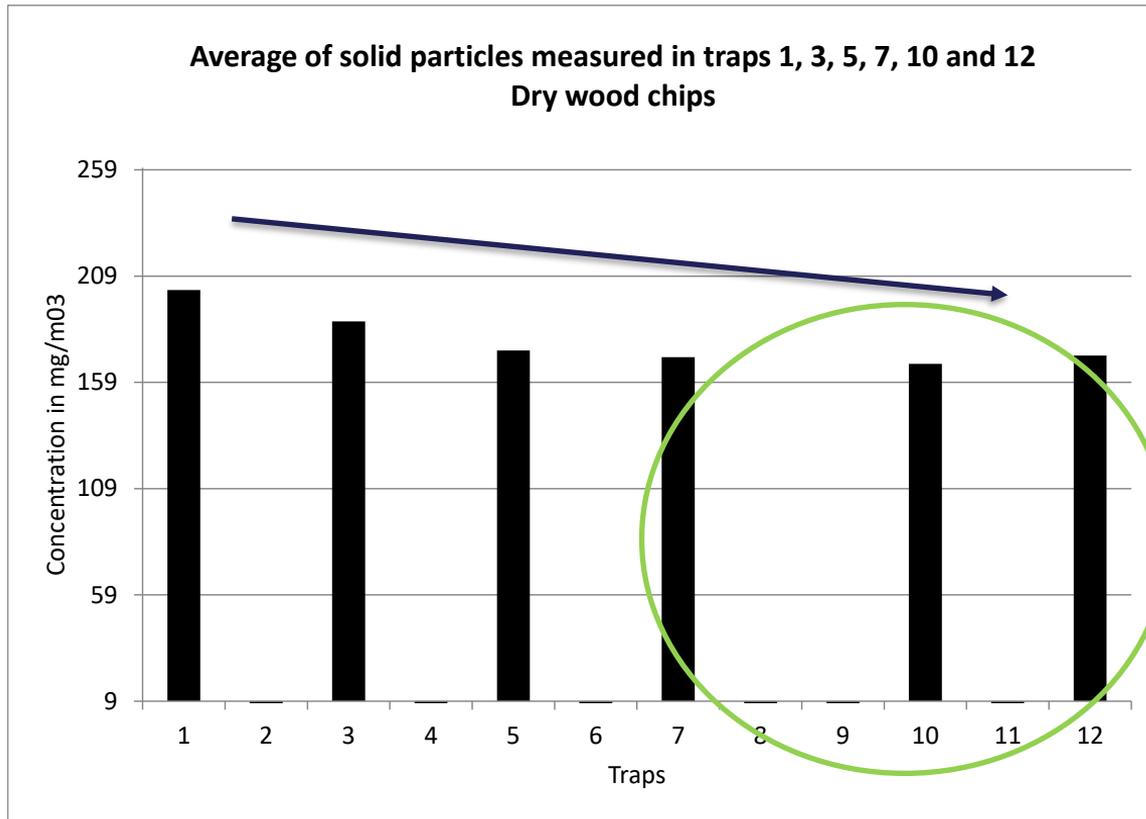
Ineris Emission Bench

Results of feasibility study

*Emission levels of solid particles and OGCs produced by
Ineris emission*

Fuel types	Averages (min – max) of Solid Particles (mg/Nm ³)	Averages (min – max) of OGCs (ppm)
Pellets	27 (26 – 28)*	34 (28 – 40)*
Dry wood chips	180 (133 – 228)	213 (110 – 300)
Fresh wood chips (Mixed with pellets)	95 (59 – 137)	362 (40 – 950)

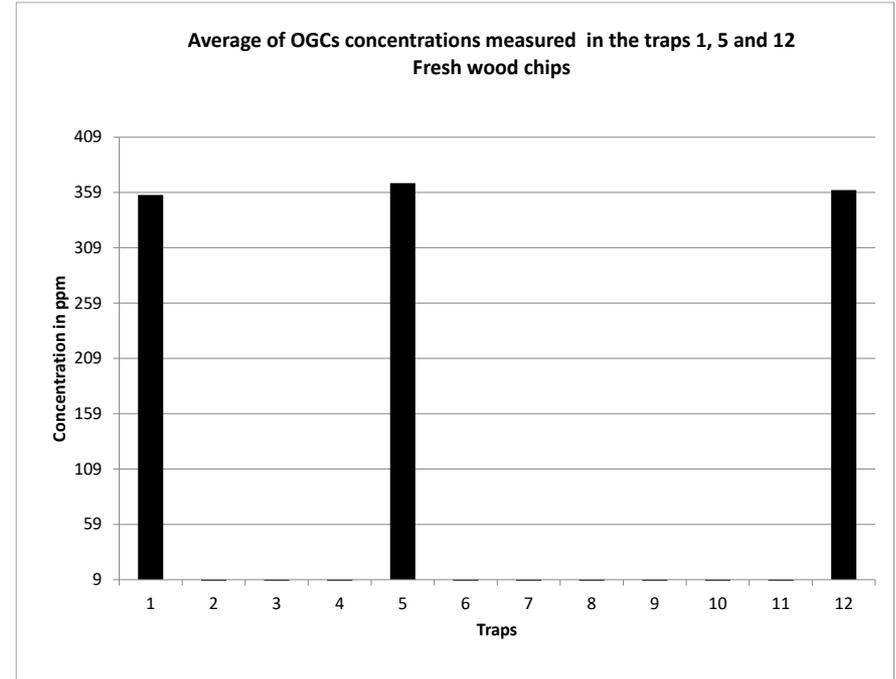
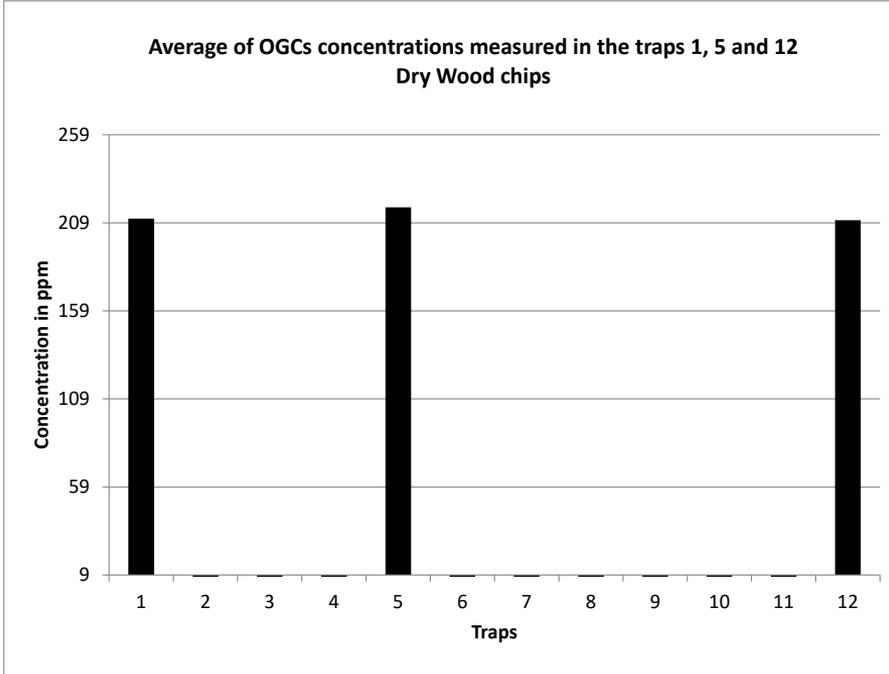
*Values from Ineris emission Bench Validation for the French national ILC



Decrease of concentrations along the bench stable from sampling port 7:

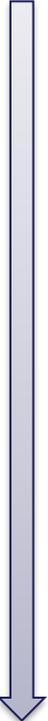
Concentrations of solid PM considered as homogeneous from sampling ports 7 to 11

Homogeneity of OGCs concentration along Ineris emission bench



Concentrations of OGC considered as homogeneous along the full bench

Inter-comparison campaign



18/09:

- Partners arrival, Visit and Briefing (morning).
- Equipment Installation (afternoon)

19th to 21st :

(Pellets, Dry and Fresh wood chips)

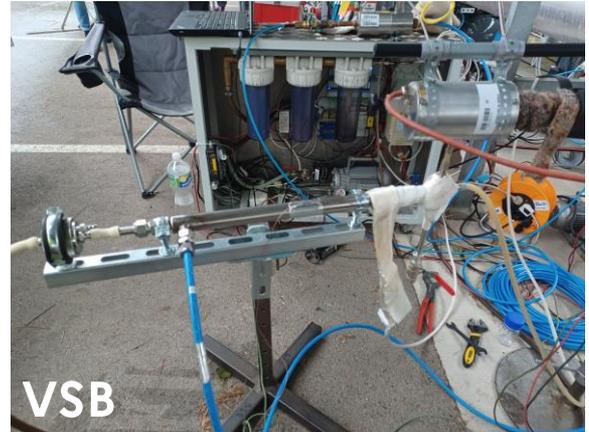
- Minimum four Combustion Tests/day/fuel type between the sampling ports 7, 8, 9, 10 and 11;
- OGCs measured continuously (TPM measured during 30-45 min);
- Other combustion gases measured by Ineris (O₂, CO₂, CO and NO_x);
- Possibility to measure other pollutants on other available sampling ports (BC, EC/OC, number of PM, etc....)

22/09:

- Debriefing, equipment storage, partners departure

- **4 participants: TFZ, UEF, VSB and Ineris**
- **Methods tested:**
 - Particulate Matter (solid+condensable) : 4 prototype sampling lines of EN_PME +PT method
 - OGC: 3 FID and 1 FTIR
 - Black carbon : 2 aethalometers
- **16 trials performed within the 3 days of measurement**
- **Levels of concentrations generated:**
 - OGC :
 - 5 trials between 0 and 50 mg Ceq/Nm³
 - 11 trials between 50 and 650 mg Ceq/Nm³
 - Total particles (Solid + Condensables) :
 - 5 trials between 0 and 50 mg//Nm³
 - 11 trials between 50 and 300 mg/Nm³

Inter-comparison campaign, some pictures



Inter-comparison campaign

Data processing on going....thank you for your attention!

