TECHNICAL REPORT ON INTERCOMPARISON CAMPAIGN OF THE NEW EXTENDED ENPME METHOD AND OGC MEASUREMENT

SUMMARY OF ACTION A4 REPORT

12/2024

PROJECT: HARMONIZING RELIABLE TEST PROCEDURES REPRESENTING REAL-LIFE AIR POLLUTION FROM SOLID FUEL HEATING APPLIANCES

Real-LIFE emissions, Life preparatory project 2020
Project Number: LIFE20 PRE/FI/000006

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This action was led by INERIS with the involvement of all project partners. The main objective was to evaluate the implementation of the extended ENPME method (ENPME method with PM sampling at 180 °C followed by porous tube dilution at a dilution ratio of about 1:8 and PM sampling below 40 °C). One of the largest uncertainties in combustion emission tests arises from the lack of comparable data on method performance, which compromises the scientific reliability of these methods. To address this, a measurement campaign was conducted at INERIS using a horizontal flue gas simulator, a titanium loop capable of generating gaseous effluents of similar composition from various combustion sources such as biomass, gas, or fuel oil using boilers. This simulator can accommodate up to 12 beneficiaries (12 sampling ports), allowing for the collection of large amounts of emission data simultaneously around the same chimney.

Feasibility tests were performed prior to the measurement campaign to evaluate the concentration levels of OGCs and solid PM generated by a pellet boiler (40 kW) connected to the loop using three types of fuel (dry wood chips, fresh wood chips, and pellets) and to assess the homogeneity of OGC and solid PM concentrations across the flue gas simulator. It was observed that OGC concentrations were homogeneous across the entire simulator, whereas solid PM concentrations were homogeneous from sampling ports 7 to 12 only.

Following the feasibility study, a measurement campaign took place in September 2023 and included three consecutive days of measurements, with the three fuel types mentioned earlier. One experimental day was allocated to each fuel type, with a minimum of four parallel measurements conducted per day. A total of 16 trials were conducted at varying concentrations of OGCs and PM (solid and condensable fractions): 5 trials at 0-50 mgC/Nm^3 for OGCs and 0-50 mg/Nm^3 for PM emission, and 11 trials at 50-650 mgC/Nm^3 for OGCs and 50-300 mg/Nm^3 for PM emission.

The comparison involved comprehensive assessments among partners, including the measurement of PM (solid and condensable fractions) using four prototype sampling lines of the extended ENPME method, the evaluation of sampling probe cleaning techniques (blowing and rinsing), and the comparison of OGC measurements using three FID instruments. During the campaign, two sampling configurations for the condensable fraction using the extended ENPME method were tested: the full flow configuration (all sampled gas passed through the first ENPME filter and is diluted with a porous tube diluter) and the partial flow configuration (all sampled gas passed through the first ENPME filter and only half of this flow passed through the porous tube diluter).

Results showed that solid particle measurements were consistent overall (with an average daily coefficient of variation of 18%). Condensable levels varied depending on the method configuration, with the two laboratories using the full flow configuration reporting concentrations of the same order of magnitude (with an average daily coefficient of variation of 19%) being higher compared to the partial flow configuration. The evaluation of rinsing with acetone after blowing revealed residual particle deposition, indicating that regular cleaning is necessary, as required by the EN 16510-1:2022 standard. Furthermore, OGC measurements showed good agreement between the three laboratories using the FID technique (with average daily coefficient of variation of 22%).

Future work should focus on enhancing the capability to generate higher concentrations of condensables with the simulator. Additionally, further investigations are needed on the full flow configuration of the extended ENPME method to evaluate its performance at different concentrations, including tests on stoves. Finally, a more comprehensive comparison with other methods should be performed to validate these findings.

UNIVERSITY OF EASTERN FINLAND

Harmonizing reliable test procedures representing real-LIFE air pollution from solid fuel heating appliances - **Real-LIFE Emissions** project.

Project Partners

- University of Eastern Finland (UEF)
- Technical University in Ostrava (VSB)
- The French National Institute for Industrial Environment and Risks (INERIS)
- Technology and Support Centre in the Centre of Excellence for Renewable Resources (TFZ)

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