

## Supplementary Materials

### Indoor Emissions of Carbonaceous Aerosol and Other Air Pollutants from Household Fuel Burning in Southwest China

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## Experimental procedure description

### Dilution Sampling System.

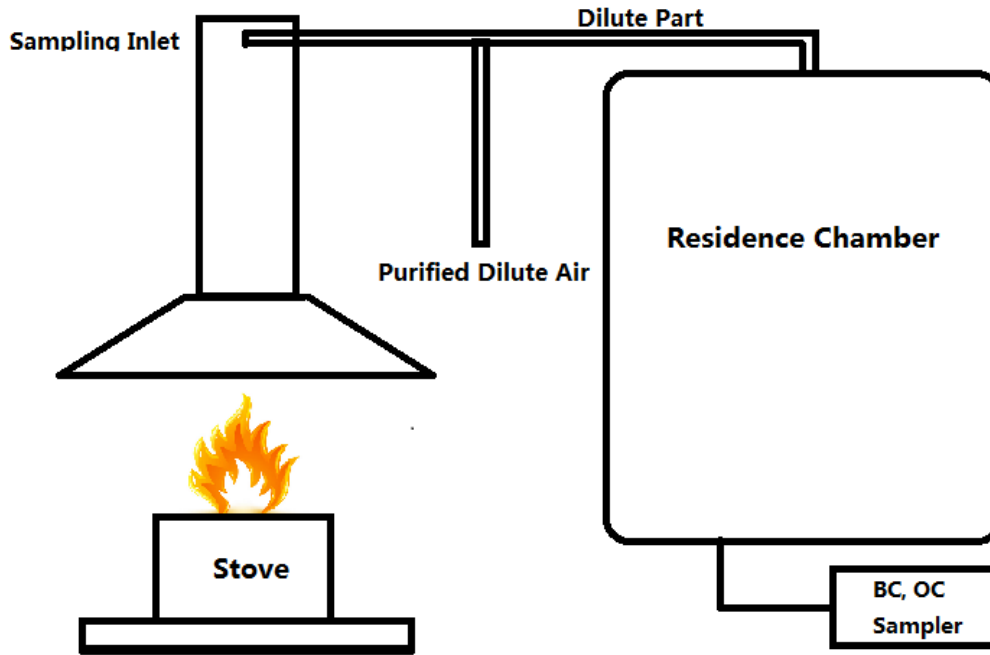
The dilution sampling system simulates the cooling and dilution processes after combustion and is widely used to achieve postcombustion quenching and gas/particle partitioning, which would occur in actual indoor environments, for characterizing emissions from stationary combustion sources (Fig. S1). A compact dilution sampling system consists of four main parts: sampling inlet, dilute part, residence chamber, and sampler. Smoke were entrained into a hood, through the sampling inlet, to the dilution part and residence chamber, and finally, to the particle sampling instruments.

Smoke were diluted by the purified air and cooled close to ambient temperature. The dilution ratios for all tests in our measurements are in the range of from 15 to 30, smoke were cooled to less than 40°C, and the relative humidity was between 30 and 70%, the aging time of particles before being collected was about 80s, enough time for vapors condensing onto particles.

The flue gas temperature and concentrations of CO<sub>2</sub>, CO and O<sub>2</sub> were continuously monitored by the flue gas analyzer (model KM 9106, Kane). The instrument was calibrated before each test and the data were recorded every 10 s.

Particles were collected on pre-baked quartz-fiber filters (QFF) during the measurements using a cyclone inlet particle sampler. A separator inlet of aluminum triplex cyclone (BGI Inc., Waltham, MA), used in recent source sampling studies (1, 2), was operated at 1.5 L/min to allow flow-through of particles with aerodynamic diameters smaller than 2.5 μm for collection on the filters.

Before sampling, the quartz-fiber filters (QFF) were baked at 550°C for 4 h to reduce blank carbon levels. QFF samples were analyzed for black carbon (BC) and organic carbon (OC) masses using a Thermal/Optical Carbon Analyzer (DRI, Model 2001) with the IMPROVE protocol (3, 4). The emission factors were determined using the carbon balance method (5). The detailed calculation process are described as following:



**Fig. S1.** Schematic graph of dilute sampler system.

### **The calculation of using carbon balance approach to determine emission factors**

The carbon balance method was used to determine BC and OC emission factors. The carbon balance method assumes the total mass of carbon combusted (carbon in fuel less carbon remaining in ash) equals the total mass of carbon emitted as carbonaceous aerosols and carbonaceous gases such as CO<sub>2</sub>, CO, CH<sub>4</sub>, and NMHCs. The following equation describes the approach:

$$C_f - C_a = C_{CO_2} + C_{CO} + C_{CH_4} + C_{NMHCs} + C_{PM} \quad (1)$$

where:

$C_f$  and  $C_a$  denote the carbon mass in the fuel and ash, respectively.

$C_{CO_2}$ ,  $C_{CO}$ ,  $C_{CH_4}$ ,  $C_{NMHCs}$  and  $C_{PM}$  are the carbon mass in CO<sub>2</sub>, CO, CH<sub>4</sub>, non-methane hydrocarbons (NMHCs) and particles, respectively.

Sum of OC and BC in PM<sub>2.5</sub> are regarded as carbon mass in particles in the calculation.

The carbon content of the fuel and ash were analyzed using a CHN elemental analyzer (Model CE-440, Exeter Analytical Inc.). The average concentrations of CO<sub>2</sub>

and CO over the whole burning cycle were calculated using the data from the flue gas analyzer. CH<sub>4</sub> and NMHCs were not measured in this study. However, this omission should not have a significant impact on the results. It was reported that omitting CH<sub>4</sub> and NMHCs only results in less than 5% error (6).

BC and OC in PM<sub>2.5</sub> were determined by a Thermal/Optical Carbon Analyzer. The following equation was used to calculate the average concentration of carbon particles:

$$C_{PM} = M_{QF} \times DR / Q_{\text{sampling}} \quad (2)$$

where: M<sub>QF</sub> is carbon mass (BC and OC) in the quartz-fiber filter. Q<sub>sampling</sub> is sampling volume. DR is dilution ratio.

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