



Supplement of

UK greenhouse gas measurements at two new tall towers for aiding emissions verification

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1 Supplementary

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Figure S1: The minute mean water observations for (a) Bilsdale and (b) Heathfield. Blue, green and purple data points represent the Bilsdale 42m, 108m and 248m intakes and the red and yellow data points represent the Heathfield 50m and 100m intakes, respectively. The black data points are the 20min mean of the daily standards. The dashed grey line indicates when the TOC system

at the Bilsdale site was repaired. The solid grey line indicates when the Nafion® drying systems were removed from the sites.



Figure S2: Seasonal and diurnal patterns in minute mean water observations. Blue, green and purple represent the Bilsdale 42m, 108m and 248m intakes and red and yellow represent the Heathfield 50m and 100m intakes, respectively. Figure (a) and (c) show a full year's worth of data at Bilsdale, with and without the Nafion® drying system, respectively. Similarly, Figures (e) and (g) show a full year's worth of data at Heathfield, with and without the Nafion® drying system. Figures (b) and (d) show week-long periods of data in summer (dashed lines) and winter (solid lines) at Bilsdale with and without the Nafion®, respectively. Similarly, Figures (f) and (h) show week-long periods of data in summer (dashed lines) and winter (solid lines) and winter (solid lines) at Heathfield with and without the Nafion®, respectively.



Figure S3: (a) CO₂, (b) CH₄, (c) CO and (d) H₂O mole fractions of the gas generator used to supply the Nafion® counter purge flow. Note the HFD gas generator was powered up just before to analysis in contrast to the other sites where the TOCs had been running for at least 12 hours prior to analysis.







Figure S5: The (a) CO_2 , (b), CH_4 and (c) H_2O minute mean data obtained during the Nafion® counter purge experiments for cylinder UoB-16 at a dewpoint of 10C. Error bars are ± 1 standard deviation of each minute mean. Purple and grey data points are the sample without and with the H_2O trap, respectively, while blue and red data points are the Nafion® counter purge before and after the Nafion®, respectively.



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Figure S6: The change in the moisture content of standards measured at Heathfield during August 2014. Each colour represents a different standard run. The date of each run is given in the legend.



Figure S7: The (a) CO₂, (b), CH₄ and (c) H₂O minute mean data for 24 hours starting 16:00 11/3/2016 at Bilsdale. Blue, green and purple data points represent the 42m, 108m and 248m intakes, respectively.



Figure S8: Droplet test residual, wet corrected data less dry mean, plots for Bilsdale (a) 2015, (b) 2016 and (c) 2017, Heathfield (d) 2015 and (e) 2016 and University of Bristol (f) 2015, (g) 2016 and (h) 2017. The instrument specific CO₂ residual values (red) are shown in the upper plots. CH₄ (blue) in the middle plots. And CO (orange) in the lower plots. The residuals of the factory determined water correction are also shown in grey. The mean $\pm 1\sigma^2$ of the residuals are given for each plot for both the instrument specific

5 (black) and the factory (grey) corrections.



Figure S9: Droplet test residual, wet corrected data less dry mean, plots for (a) below ambient cylinder and (b) the above ambient cylinder at the University of Bristol. The instrument specific CO₂ residual values (red) are shown in the upper plots and CH₄ (blue) in the middle plots. The residuals of the factory determined water correction are also shown in grey. The mean $\pm 1\sigma^2$ of the residuals are given for each plot for both the instrument specific (black) and the factory (grey) corrections.