

## ***Interactive comment on “Gravimetrically-Prepared Carbon Dioxide Standards in Support of Atmospheric Research” by Bradley D. Hall et al.***

**Anonymous Referee #1**

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General comments:

The manuscript “Gravimetrically Prepared Carbon Dioxide Standards in Support of Atmospheric Research” is well written and reports a method using a one stage dilution to produce gravimetric reference standards of carbon dioxide in air. A correction is applied to account for adsorption of carbon dioxide to the walls of the cylinder and internal surfaces during transfer. The method results in reference standards with excellent consistency. This work is an important development towards maintaining the World Meteorological Organisation Global Atmosphere Watch Programme’s scale for CO<sub>2</sub> amount fraction and a valuable contribution to the atmospheric monitoring community.

I recommend publication subject to the following minor suggestions for revision:

C1

The second paragraph of the introduction refers to a requirement for a relative standard uncertainty of  $\sim 0.01\%$  to assess the drift in CO<sub>2</sub> amount fraction in cylinders over many years. How is this uncertainty target determined?

The experimental methods section describes the transfer of an aliquot of CO<sub>2</sub> to a cylinder from a 5 ml stainless steel container. Considerable experimental effort is employed (heating and re-pressurising the transfer vessel) to ensure that the CO<sub>2</sub> is transferred with negligible losses. Would it be possible to simplify the experimental procedure by weighing the transfer vessel before and after to determine the mass transferred?

Equation (1) defines the transfer efficiency ( $f$ ), although a value is not provided. In the results and discussion section, a statement is made that the transfer efficiency is assumed to be 100%. Further text is required to accompany equation (1).

The paragraph which precedes equation (1) and the first sentence after refers to the unit when the quantity is implied (e.g. “number of moles” and “moles of”). In each case this should be replaced with the quantity “amount”.

In equation (1), in order to accurately determine the amount fraction of the mixture,  $X_{CO_2,ad}$  and  $X_{CO_2,dil}$  should be changed to amount of CO<sub>2</sub> adsorbed and amount of CO<sub>2</sub> in the dilution gas and be added to the numerator and denominator in the first term of the equation (rather than added as separate terms). Also  $n_{air}$  should be split up into its components ( $n_{Ar}$ ,  $n_{N_2}$  and  $n_{O_2}$ ).

On page 7, amount is missing from the sentence “The amount of CO<sub>2</sub> adsorbed to the walls, expressed as a fraction of total amount of CO<sub>2</sub> in the cylinder”.

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