

Comment on amt-2021-45

Stefan Persijn (Referee)

Referee comment on "Characterisation of gas reference materials for underpinning atmospheric measurements of stable isotopes of nitrous oxide" by Ruth E. Hill-Pearce et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-45-RC1>, 2021

The authors describe N₂O gas standards prepared by gravimetric methods at ambient levels and with low uncertainty and they provide data on the isotopic ratios and the long-term stability. Such N₂O gas standards are of key importance for atmospheric research and in particular the provided data on the isotopic ratios makes the paper a good contribution to existing literature. Therefore, I suggest that the paper is accepted. Some minor points:

- The introduction section can be improved. There are quite some equations and definitions and their need is not always clear (e.g. site-specific distribution expressed by SP in equation 4).
- A table with an uncertainty budget for the developed standards can help the reader get a quick overview of the main uncertainty contributions. From the current text this is more difficult to grasp.
- line 115 'to inhibit adsorption of target components' Is there any evidence in literature that N₂O at these amount fractions adsorbs on aluminium? Regarding the other components in the mixtures (except for CO₂ for which adsorption has been demonstrated) is there some evidence that they adsorb?
- 'Figure 5: For some symbols only a cap but no error bar is shown.
- Line 125: '± 0.3 mg' and Line 129: '± 3 mg' Please give some explanation.
- line 262 'providing independence' Rephrase as within one lab often parent mixtures do have some dependencies (e.g. prepared using the same instruments, or purity analysis of the pure gases using the same analytical instruments and reference gases)
- Line 27 '(WMO, 2020)' seems to be missing from the list of references.
- A few typos, e.g. line 366 'vales', line 395 'measured of 10 minutes', figure 3 'of Certified amount'
- In equation 8, where does 'c' refers to?
- In figure 8, there seems to be a clear trend in the assigned values of NPL - Empa as a function of the Empa assigned amount fraction. Please comment on this.
- Lines 250-254: Mismatch between the number of significant digits for the mass uncertainty ('0.3 mg', '3 mg') and the contributions to the percentage of the combined uncertainty ('73.07 %' '17.87 %').
- Correct the author list of reference 'BIPM et al., 2008'.

- Line 148-150. It is mentioned that N₂O was determined in the matrix gas but no data are presented. Please provide these data including the corresponding uncertainty.