

## Reply on RC2

Tatiana Macé et al.

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Author comment on "Air pollution monitoring: development of ammonia (NH<sub>3</sub>) dynamic reference gas mixtures at nanomoles per mole levels to improve the lack of traceability of measurements" by Tatiana Macé et al., Atmos. Meas. Tech. Discuss.,  
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We would like to thank the referee for reading our paper and for its comments.

Major concerns:

This study did not indicate the reasons to select the measurement range of 1-400 nmol/mol in this study (e.g., Line 454). The readers may wonder if it is representative of ambient ammonia concentrations worldwide, and thus the reference gas mixtures can be widely used.

- Because this amount fraction range covers the NH<sub>3</sub> amount fractions measured in ambient air (immissions) by the monitoring networks
- The draft has been modified in this way

Line 83: Could you please change the unit of nmol/mol in the whole text to ppb or ug/m<sup>3</sup>, which are more common in literature reporting ammonia concentrations?

- The unit for amount fractions according to the SI units is nmol/mol. As this manuscript is related to gas metrology, we are following the units of the International System of Units (cf. International vocabulary of metrology – Basic and general concepts and associated terms (VIM) and works made in the framework of BIPM)
- Nevertheless we have modified the introduction by adding precisions as follows: "The method is based on gas permeation and further dynamic dilution to obtain an amount fraction range between 1 and 400 nmol/mol (also well known as ppb; 1 ppb (NH<sub>3</sub>) » to 0.7 µg/m<sup>3</sup>) to cover the NH<sub>3</sub> amount fractions measured in ambient air (immissions) by the monitoring networks."

Why Picarro G2103 analyzer was selected as a reference in this study (e.g., Line 360)?

- We planed a bilateral comparison with METAS to validate the calibration method and it was the analyser that they have available. It's not a reference analyser, but an analyser used to compare LNE's and METAS's reference
- We have modified the second sentence of the § 7 as follows: "In March 2020, METAS calibrated their PICARRO G2103 gas analyzer using a NH<sub>3</sub> permeation tube (99.98 % purity; Fine Metrology S.r.l.s., Italy) to use it as a transfer standard at LNE."
- We have modified the second sentence of the second paragraph of the § 9 as follows: "The bilateral comparison organized by LNE and METAS used a PICARRO G2103 gas

analyzer as transfer standard based on a robust spectroscopic method and set up in a lot of AASQA monitoring stations. Both institutes generated reference gas mixtures dynamically by two different reference generators and used the above-mentioned PICARRO as comparator.

It will be more interesting to give an example by applying this dynamic reference gas in the real course of ammonia measurements (e.g., show the time series in the field measurements by overlapping the calibration process on the ambient ammonia concentrations, based on figure 6).

- The objective of this study was to improve the LNE's and METAS's references and to validate them before using them for the monitoring stations. It is a new procedure and it has not been yet introduced in the routine of the monitoring stations. Therefore, it is not possible to show an example of measurement time series in the field by overlapping the calibration process on the ambient ammonia.

Technical corrections:

Lines 26-29: Some words or logic here looks not scientific sound, e.g., "raised great interest", "requests shows the interest" and "to guarantee".

- We have modified the draft as follows: "The results highlighted the good agreement between the NH<sub>3</sub> reference generators developed by the two institutes and allowed to validate both LNE's reference generator and calibration procedure. Since the end of 2020, LNE calibrated several NH<sub>3</sub> analyzers from the French air quality monitoring networks (AASQA) using the newly developed SI-traceable RGMs. The enhanced number of calibrations provided, may promote and increase the comparability, accuracy and traceability of the NH<sub>3</sub> measurements carried out on the French territory."

Line 45: Some recent nitrogen isotopic study also suggested nonagricultural emissions of ammonia in urban regions, e.g., <https://pubs.acs.org/doi/10.1021/acs.est.1c05884>. Such findings signify the requirements in observing ammonia to reduce air pollution.

- This sentence was added in the draft

Line 127: Be consistent in the text and change sulfur dioxide, nitrogen dioxide to SO<sub>2</sub>, NO<sub>x</sub>.

- The draft has been modified

Lines 508-509: The last sentence in the conclusion is not scientific sound.

- We have modified the draft as follows: " The application of these findings, together with the use of the newly developed NH<sub>3</sub> SI-traceable RGMs by the French air quality monitoring stations within AASQA, may promote the accuracy, comparability and traceability of NH<sub>3</sub> measurements carried out in France."
- And the sentence "Since the end of 2020, several French air quality monitoring networks have requested LNE to calibrate their NH<sub>3</sub> analyzers, enabling them to guarantee the traceability and accuracy of measurements performed in France." was deleted.