International Comparison CCQM-K3.2019 Automotive. Support to measurement capabilities

1 Premable

This guidance note is aimed at reviewers of Calibration and Measurement Capabilities (CMCs), supported by the participation in a key comparison. In principle, support to CMCs is limited to those measurement results that are consistent with the key comparison reference value (KCRV). In this key comparison [1], several measurement results were not consistent with the KCRV. For those results, this guidance note provides larger expanded uncertainties, based on the GAWG strategy document [2]. The idea behind these larger uncertainties is that

1. National Metrology Institutes (NMIs) can still use their participation in a key comparison to support their measurement service;
2. The stated uncertainty is large enough to ensure comparability with the KCRV and the results of other NMIs;
3. There is a harmonised way of dealing with discrepant results in relation to CMCs.

Discrepant measurement results can occur for a number of reasons. For a discussion of the measurement results in CCQM-K3.2019, see the final report [1]. In case of incidental discrepant results, the default response would be to investigate the cause of the discrepancy and to resolve it [3, 4]. Hence, the attached tables should not be viewed as

- A substitute for appropriate corrective measures from the side of the NMI to resolve the discrepancy;
- A consent from the CCQM Gas Analysis Working Group (CCQM-GAWG) that the submitted measurement result is acceptable;
- A guarantee that a CMC submitted in accordance with this guidance note will be accepted by reviewers in the review process by the Regional Metrology Organisations;
- Support for the metrological traceability of the measurement result submitted;
- A direction or recommendation to assessors in peer reviews or accreditation visits.

The lower bound (x_{LB}) is calculated as the amount fraction that equals the absolute expanded uncertainty at $10\,\mu\mathrm{mol\,mol}^{-1}$ that is supported by the result submitted in the key comparison. The calculated lower bound may require supporting evidence to demonstrate the detection limit/quantification limit of the equipment and method.

2 Support to CMCs

2.1 General

The support of CMC claims is described in more detail in the “GAWG strategy for comparisons and CMC claims” [2]. The results of this key comparison can be used to support CMC claims for the composition of automotive gas, as well as to support claims under the flexible regime based on the proficiency shown for core competences.

2.2 Support for automotive gases and binary mixtures

The supported CMCs for the amount fraction oxygen in binary and automotive mixtures are shown in table 1. From x_{LB} to x_{tip}, CMC_1 applies as absolute expanded uncertainty. From x_{tip} to x_{UB}, CMC_2 applies as relative expanded uncertainty. x_{LB} does not represent a detection limit.

Table 1: Supported CMCs for the amount fraction oxygen in binary and automotive mixtures

Laboratory	x_{LB} nmol mol^{-1}	CMC_1 nmol mol^{-1}	x_{tip} µmol mol^{-1}	CMC_2 %	x_{UB} cmol mol^{-1}
VSL	8	8	10	0.08	50
CERI	13	13	10	0.13	50
INMETRO	260	260	10	2.60	50
IPQ	44	44	10	0.44	50
KRISS	33	33	10	0.33	50
NIST	16	16	10	0.16	50
NMISA	40	40	10	0.40	50
NPL	14	14	10	0.14	50
VNIIM	32	32	10	0.32	50

The supported CMCs for the amount fraction propane in binary and automotive mixtures are shown in table 2. From x_{LB} to x_{tip}, CMC_1 applies as absolute expanded uncertainty. From x_{tip} to x_{UB}, CMC_2 applies as relative expanded uncertainty. x_{LB} does not represent a detection limit.

Table 2: Supported CMCs for the amount fraction propane in binary and automotive mixtures

Laboratory	x_{LB} nmol mol^{-1}	CMC_1 nmol mol^{-1}	x_{tip} µmol mol^{-1}	CMC_2 %	x_{UB} cmol mol^{-1}
VSL	10	10	10	0.10	50
CERI	20	20	10	0.20	50
INMETRO	152	152	10	1.52	50
IPQ	623	623	10	6.23	50
KRISS	20	20	10	0.20	50
NIST	14	14	10	0.14	50
NMISA	65	65	10	0.65	50
NPL	9	9	10	0.09	50
VNIIM	19	19	10	0.19	50

The supported CMCs for the amount fraction carbon dioxide in binary and automotive mixtures are shown in table 3. From x_{LB} to x_{tip}, CMC_1 applies as absolute expanded uncertainty. From x_{tip} to x_{UB}, CMC_2 applies as relative expanded uncertainty. x_{LB} does not represent a detection limit.

Table 3: Supported CMCs for the amount fraction carbon dioxide in binary and automotive mixtures

Laboratory	x_{LB} nmol mol^{-1}	CMC_1 nmol mol^{-1}	x_{tip} µmol mol^{-1}	CMC_2 %	x_{UB} cmol mol^{-1}
VSL	10	10	10	0.10	50
CERI	25	25	10	0.25	50
INMETRO	50	50	10	0.50	50
IPQ	20	20	10	0.20	50
KRISS	24	24	10	0.24	50
NIST	18	18	10	0.18	50
NMISA	43	43	10	0.43	50
NPL	16	16	10	0.16	50
VNIIM	10	10	10	0.10	50

The supported CMCs for the amount fraction carbon monoxide in binary and automotive mixtures are shown in table 4. From x_{LB} to x_{tip}, CMC_1 applies as absolute expanded uncertainty. From x_{tip} to x_{UB}, CMC_2 applies as relative expanded uncertainty. x_{LB} does not represent a detection limit.

Table 4: Supported CMCs for the amount fraction carbon monoxide in binary and automotive mixtures

Laboratory	x_{LB} nmol mol^{-1}	CMC_1 nmol mol^{-1}	x_{tip} µmol mol^{-1}	CMC_2 %	x_{UB} cmol mol^{-1}
VSL	12	12	10	0.12	50
CERI	29	29	10	0.29	50
INMETRO	130	130	10	1.30	50
IPQ	38	38	10	0.38	50
KRISS	32	32	10	0.32	50
NIST	40	40	10	0.40	50
NMISA	29	29	10	0.29	50
NPL	19	19	10	0.19	50
VNIIM	16	16	10	0.16	50

2.3 Support for flexible scheme (Track A support)

The support to CMCs under the track A flexible regime requires a single contribution from this key comparison. The CMC that can be used for the track A scheme is obtained by pooling the CMCs shown in the previous section, i.e.,

$$u_{\mathrm{CMC,K3}} = \sqrt{\frac{1}{4}\sum_{i=1}^{4} u^2_{\mathrm{CMC},i}} \tag{1}$$

where $u_{\mathrm{CMC,K3}}$ denotes the pooled relative standard uncertainty from the performance in this key comparison, and $u_{\mathrm{CMC},i}$ the relative standard uncertainty of the amount fraction of component i that is supported by the performance demonstrated in this key comparison.

Table 5 lists the CMC support under the track A scheme, expressed as relative expanded uncertainty. These CMCs should be combined with those from the preceding two track A key comparisons.

Table 5: Supported CMCs for the amount fraction of components under the track A regime (%).

Laboratory	CMC
VSL	0.10
CERI	0.23
INMETRO	1.66
IPQ	3.13
KRISS	0.28
NIST	0.24
NMISA	0.46
NPL	0.15
VNIIM	0.21

References

[1] Adriaan M H van der Veen, Ewelina T Zalewska, Janneke I T van Wijk, Midori Kobayashi, Dai Akima, Shinji Uehara, Andreia L Fioravante, Cristiane R Augusto, Claudia C Ribeiro, Viviane Silva, Florbela Dias, Alda Botas, Carlos Costa, Joengsoon Lee, Jinbok Lee, Jeongsik Lim, Hyun-Kil Bae, Namgoo Kang, Christina E Cecelski, Kimberly J Harris, Walter R Miller Jr, Jennifer Carney, James Tshilongo, Napo G Ntsasa, Mudalo I Jozela, Nompumelelo Leshabane, Prelly Mohweledi Marebane, David R Worton, Eric B Mussell Webber,

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[2] P. Brewer and A. M. H. van der Veen. GAWG strategy for comparisons and CMC claims. GAWG 19/41, Gas Analysis Working Group, Sèvres, France, October 2019.

[3] ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories. ISO, International Organization for Standardization, Geneva, Switzerland, 2017. Third edition.

[4] ISO 17034 General requirements for the competence of reference material producers. ISO, International Organization for Standardization, Geneva, Switzerland, 2016. First edition.