Performance Parameters, Measurement Uncertainties, Decision Rules

Measurement Uncertainties

How is the term *measurement uncertainty* defined?	*Measurement uncertainty*: Non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used (ILAC-G17:01/2021, terms and definitions). *Expanded measurement uncertainty*: Product of a combined standard measurement uncertainty and a factor larger than the number one (ILAC-G17:01/2021, terms and definitions). In food analysis, the range “a ± 2u” or “a ± U” represents a 95% level of confidence in which the true value would be found, where “a” is the best estimate of the true value of the concentration of the measurand and “u” is the standard uncertainty to 68% level of confidence and “U“ (equal to 2u) is the *expanded measurement uncertainty* to 95% level of confidence.
Does the *measurement uncertainty* arise from both sampling and analysis?	Measurement uncertainty applies to the whole measurement process which also includes the sampling. However, as the laboratory often has no control over the sampling process, the herein stated values only consider uncertainties arising from the sample preparation and the analytical measurement.
How is the *measurement uncertainty* commonly estimated?	There are several approaches available for estimating the measurement uncertainty of a result, for example using data derived from method validation studies, quality control charts (QCCs), or proficiency testing.
How is the *measurement uncertainty* of different methods estimated at Intertek Food Services?	Measurement uncertainties are determined, where applicable, from a combination of reproducibility data as well as method and laboratory bias data. All measurement uncertainties are expressed as standard deviations, and their variances are generally combined by addition. The square root of the sum of the total variances yields the combined uncertainty, which, when multiplied by the coverage factor k = 2, results in the *expanded measurement uncertainty* ”U” (95% level of confidence).

Decision Rules

Decision Rule	Rule that describes how measurement uncertainty is accounted for when stating conformity with a specified requirement (DIN EN ISO/IEC 17025:2018, terms and definitions).
How are decision rules handled with Intertek Food Services Bremen?	According to DIN EN ISO/IEC 17025:2018, Clause 7.1.3, when making statements of conformity with a specification or standard, both the basis for the assessment and the corresponding decision rule shall be clearly defined. The decision rule to be applied can be specified by legal or normative requirements or set by the client. In the absence of such requirements, Intertek Food Services GmbH Bremen applies a binary statement based on a simple acceptance rule. Measurement uncertainty is not considered for conformity assessment; therefore, the acceptance limit is identical to the specification (tolerance) limit (see ILAC ILAC-G8:09/2019, Clause 4.2.1).
What risk is associated with the standard decision rule of Intertek Food Services GmbH Bremen?	According to DIN EN ISO/IEC 17025:2018, Clause 7.8.6.1, the risk associated with the decision rule must be taken into account if the rule is not specified by the customer or by normative documents. The risk assessment is based on a normal probability distribution of the estimate of the measurand and an expanded measurement uncertainty (U) at a 95% confidence level for a one-sided limit value. • If the measured value plus the expanded measurement uncertainty (measured value + U) is below the limit value, the probability of making an incorrect conformity assessment is less than 2.5%. • If the measured value is below the limit value, but the measured value plus the expanded measurement uncertainty (measured value + U) is equal to or exceeds the limit value, the probability of making an incorrect conformity assessment is between 2.5% and 50%. • If the measured value minus the expanded measurement uncertainty (measured value − U) exceeds the limit value, the probability of making an incorrect conformity assessment is less than 2.5%. • If the measured value exceeds the limit value, but the measured value minus the expanded measurement uncertainty (measured value − U) is equal to or below the limit value, the probability of making an incorrect conformity assessment is between 2.5% and 50%.

Performance Parameters, Measurement Uncertainties, Decision Rules

Typical measurement uncertainties and other performance parameters of selected tests

Bioanalytical methods

Cultural methods, quantitative

Remarks:
In contrast to typical chemical and physico-chemical test methods cultural methods for the quantitative determination of specific germs show a lognormal distribution of measurement results.
This is due to the exponential growth characteristics of germs. In order to statistically handle this, data are logarithmized and then can be processed in the same way as “usual” data.

The stated expanded measurement uncertainty was estimated as a combination of the in-house reproducibility standard deviation in accordance with DIN EN ISO 19036:2020-05 and the method and laboratory bias obtained from Proficiency Testing. An expansion factor of k = 2 is used, corresponding to a confidence level of approximately 95%.

For parameters for which no internal laboratory reproducibility standard deviation is available, the measurement uncertainty is estimated based on experience using a ± half power of 10 for cultural microbiological methods in accordance with the Swiss Confederation's Guidelines for the Validation of Microbiological Test Methods and for the Estimation of Measurement Uncertainty in the Field of Food and Environmental Microbiology.

Calculation Example:
Result: 100 cfu
$\log_{10}(100) = 2$
Combined standard deviation: 0.20 $\log_{10}$ cfu
Coverage factor k = 2 (95% confidence interval)
Expanded measurement uncertainty U: ± 0.40 $\log_{10}$ cfu
Expanded measurement uncertainty U (range): 1.60 – 2.40 $\log_{10}$ cfu
Expanded measurement uncertainty U (range): 40 – 251 cfu

Performance Parameters, Measurement Uncertainties, Decision Rules

Microbiology, colony counting method

Parameter (group)	Uncertainty parameter	Value
Aerobic mesophilic total plate count DIN EN ISO 4833-2	Expanded measurement uncertainty U	± 0.27 LOG_{10}
Aerobic mesophilic total plate count Petrifilm AC	Expanded measurement uncertainty U	± 0.20 LOG_{10}
Aerobic mesophilic spores PM DE01.172	Expanded measurement uncertainty U	± 0.50 LOG_{10}
Anaerobic mesophilic total plate count PM DE01.160	Expanded measurement uncertainty U	± 0.50 LOG_{10}
Anaerobic sulfite-reducing bacteria DIN EN ISO 15213-1	Expanded measurement uncertainty U	± 0.31 LOG_{10}
Anaerobic sulfite-reducing bacterial spores DIN EN ISO 15213-1	Expanded measurement uncertainty U	± 0.42 LOG_{10}
Presumptive Bacillus cereus BACARA 2	Expanded measurement uncertainty U	± 0.19 LOG_{10}
Clostridium perfringens PM DE01.293	Expanded measurement uncertainty U	± 0.50 LOG_{10}
Coliform bacteria Petrifilm REC	Expanded measurement uncertainty U	± 0.35 LOG_{10}
E. coli DIN ISO 16649-2	Expanded measurement uncertainty U	± 0.24 LOG_{10}
E. coli Petrifilm REC	Expanded measurement uncertainty U	± 0.27 LOG_{10}
Enterobacteriaceae DIN EN ISO 21528-2	Expanded measurement uncertainty U	± 0.36 LOG_{10}
Enterobacteriaceae Petrifilm EB	Expanded measurement uncertainty U	± 0.38 LOG_{10}
Enterococci PM DE01.178	Expanded measurement uncertainty U	± 0.50 LOG_{10}
Yeasts ISO 21527-1	Expanded measurement uncertainty U	± 0.29 LOG_{10}
Yeasts ISO 21527-2	Expanded measurement uncertainty U	± 0.25 LOG_{10}
Yeasts & moulds Petrifilm RYM	Expanded measurement uncertainty U	± 0.35 LOG_{10}
Coagulase-positive staphylococci DIN EN ISO 6888-1	Expanded measurement uncertainty U	± 0.18 LOG_{10}
Listeria monocytogenes DIN EN ISO 11290-2	Expanded measurement uncertainty U	± 0.17 LOG_{10}
Listeria spp. DIN EN ISO 11290-2	Expanded measurement uncertainty U	± 0.15 LOG_{10}

Performance Parameters, Measurement Uncertainties, Decision Rules

Parameter (group)	Uncertainty parameter	Value
Lactic acid bacteria PM DE01.169	Expanded measurement uncertainty U	± 0.50 LOG_{10}
Moulds ISO 21527-1	Expanded measurement uncertainty U	± 0.40 LOG_{10}
Moulds ISO 21527-2	Expanded measurement uncertainty U	± 0.26 LOG_{10}
Osmotolerant yeasts ISO 21527-2	Expanded measurement uncertainty U	± 0.25 LOG_{10}
Osmotolerant moulds ISO 21527-2	Expanded measurement uncertainty U	± 0.36 LOG_{10}
Pseudomonas spp. PM DE01.179	Expanded measurement uncertainty U	± 0.50 LOG_{10}
Sulfite-reducing Clostridium spp. DIN EN ISO 15213-1	Expanded measurement uncertainty U	± 0.34 LOG_{10}
Sulfite-reducing Clostridium spp. Spores DIN EN ISO 15213-1	Expanded measurement uncertainty U	± 0.42 LOG_{10}

Microbiology, detection method

Parameter (group)	Parameter	Value
E. coli (detection) DIN EN ISO 16649-3	Limit of detection	<2 cfu after enrichment (depending on the matrix)
Enterobacteriaceae (detection) DIN EN ISO 21528-1	Limit of detection	appr. 1 cfu after enrichment (depending on the matrix)

PCR methods, Bacteria

Parameter (group)	Parameter	Value
BoNT producing Clostridia (detection) DIN CEN ISO/TS 17919	Limit of detection	appr. 1 cfu after enrichment (depending on the matrix)
Clostridium perfringens (detection) SureFast Clostridium perfringens PLUS F5123	Limit of detection	≤ 5 DNA copies
Salmonella species (detection) SureTect Salmonella species A56841	Limit of detection	3-5 cfu after enrichment (depending on the matrix)
Listeria monocytogenes (detection) SureTect Listeria monocytogenes A56843	Limit of detection	3-5 cfu after enrichment (depending on the matrix)
Listeria species (detection) SureTect Listeria species A56842	Limit of detection	3-5 KbE after enrichment (depending on the matrix)

Performance Parameters, Measurement Uncertainties, Decision Rules

PCR methods, Plants, GMO

Parameter (group)	Parameter	Value
Rice (detection) GEN-IAL First-Rice GN217-50	Limit of detection	0.01% Rice DNA in sample DNA
Bt11 Maize (detection) GEN-IAL genControl Bt11 Maize GN500-50	Limit of detection	0.01 % genetically modified DNA in sample DNA
MIR604 Maize (detection) GEN-IAL genControl MIR604 Maize GN507-50	Limit of detection	0.01 % genetically modified DNA in sample DNA
RT73 Canola (detection) GEN-IAL genControl RT73 Canola GN603-50	Limit of detection	0.01 % genetically modified DNA in sample DNA
RR1 Soya (detection) GEN-IAL genControl RR-Soya GN400-50	Limit of detection	0.01 % genetically modified DNA in sample DNA
RR2 Soya (detection) GEN-IAL genControl RR2-Soya GN401-50	Limit of detection	0.01 % genetically modified DNA in sample DNA
CaMV/FMV Virus (detection) GEN-IAL genControl Duplex Virus GN601-50	Limit of detection	0.01 % Virus DNA in sample DNA
Cry1Ab/AC and P-nos (detection) GEN.IAL genControl Duplex Cry1Ab/AC and P-nos GN304-50	Limit of detection	0.1 % genetically modified DNA in sample DNA
35S/Tnos and pFMV (detection) GEN-IAL genControl Triplex 4 GN308-50/-100	Limit of detection	0.01 % genetically modified DNA in sample DNA
A2704-12/A5547-127/DP356043-5 Soya (detection) GEN-IAL genControl Triplex Soya GN405-50	Limit of detection	0.01 % genetically modified DNA in sample DNA
MS8/T45/Rf3 Canola (detection) GEN-IAL genControl Triplex Canola GN604-50	Limit of detection	0.01 % genetically modified DNA in sample DNA
Maize/Canola/Soya (detection) GEN-IAL genControl GN224-50	Limit of detection	0.01 % plant DNA in sample DNA

Performance Parameters, Measurement Uncertainties, Decision Rules

PCR methods, Animal Speciation

Parameter (group)	Parameter	Value
Meat (detection) GEN-IAL First-Meat GN109-50	Limit of detection	appr. 0.01% of total animal DNA depending on the examined matrix
Horse (detection) GEN-IAL First-Horse GN108-50	Limit of detection	appr. 0.01% of total animal DNA depending on the examined matrix
Pig (detection) GEN-IAL First-Pig GN109-50	Limit of detection	appr. 0.01% of total animal DNA depending on the examined matrix
Goat (detection) GEN-IAL First-Goat GN107-50	Limit of detection	appr. 0.01% of total animal DNA depending on the examined matrix
Chicken (detection) GEN-IAL First-Chicken GN103-50	Limit of detection	appr. 0.01% of total animal DNA depending on the examined matrix
Turkey (detection) GEN-IAL First-Turkey GN114-50	Limit of detection	appr. 0.01% of total animal DNA depending on the examined matrix
Sheep (detection) GEN-IAL First-Sheep GN114-50	Limit of detection	appr. 0.01% of total animal DNA depending on the examined matrix
Ruminant (detection) GEN-IAL First-Ruminant GN113-50	Limit of detection	< 0.1% of total animal DNA depending on the examined matrix
Beef (detection) GEN-IAL First-Beef GN101-50	Limit of detection	appr. 0.01% of total animal DNA depending on the examined matrix

Performance Parameters, Measurement Uncertainties, Decision Rules

Authenticity **Honey**: Stable Isotope Methods

Parameter (group)	Uncertainty parameter	Value
$\Delta\delta^{13}C$ Protein AOAC 998.12	Expanded measurement uncertainty U	± 0.50 ‰ abs
$\Delta\delta^{13}C$ Honey AOAC 998.12	Expanded measurement uncertainty U	± 0.40 ‰ abs
$\delta^{13}C$ Fructose PM DE01.094	Expanded measurement uncertainty U	± 0.50 ‰ abs
$\delta^{13}C$ Glucose PM DE01.094	Expanded measurement uncertainty U	± 0.40 ‰ abs
$\delta^{13}C$ Disaccharides PM DE01.094	Expanded measurement uncertainty U	± 0.60 ‰ abs
$\delta^{13}C$ Trisaccharides PM DE01.094	Expanded measurement uncertainty U	± 0.80 ‰ abs

Authenticity **Agave** syrup: Stable Isotope Methods

Parameter (group)	Uncertainty parameter	Value
$\delta^{13}C$ agave bulk PM DE01.228	Expanded measurement uncertainty U	± 0.42‰ abs
$\delta^{13}C$ Fructose PM DE01.228	Expanded measurement uncertainty U	± 0.42‰ abs
$\delta^{13}C$ Glucose PM DE01.228	Expanded measurement uncertainty U	± 0.42‰ abs

Authenticity **Maple** syrup: Stable Isotope Methods

Parameter (group)	Uncertainty parameter	Value
$\delta^{13}C$ bulk sample PM 01.355	Expanded measurement uncertainty U	± 0.42‰ abs

Authenticity **Coconut** blossom sugar/syrup: Stable Isotope Methods

Parameter (group)	Uncertainty parameter	Value
$\delta^{13}C$ bulk sample PM 01.356	Expanded measurement uncertainty U	± 0.42‰ abs

Performance Parameters, Measurement Uncertainties, Decision Rules

ELISA

Parameter (group)	Uncertainty parameter	Value
Gliadin/Gluten r-biopharm R7001	Expanded measurement uncertainty U	± 40 % rel
Soy protein r-biopharm R7102	Expanded measurement uncertainty U	± 40 % rel
beta-Lactoglobulin r-biopharm R4912	Expanded measurement uncertainty U	± 60 % rel
Casein r-biopharm R4612	Expanded measurement uncertainty U	± 60 % rel
beta-Lactoglobulin r-biopharm R4901	Expanded measurement uncertainty U	± 60 % rel

Photometry, Titration, etc.

Parameter (group)	Uncertainty parameter	Value
Acidity, free (honey) DIN 10756	Expanded measurement uncertainty U	± 18 % rel
Acid number (Fats, oils) DGF C-V 2 (06)	Expanded measurement uncertainty U	± 20 % rel
Acid number Wax DGF M-IV 2	Expanded measurement uncertainty U	± 5.2 % rel
Acid number, free acidity (animal feed) VDLUFA III; 5.4.5 / 5.2.1	Expanded measurement uncertainty U	± 17 % rel
Ash gravimetric DIN 10755, IFU MA 9, etc.	Expanded measurement uncertainty U	± 2.8 % rel
Ash, insoluble in HCl VDLUFA III, 8.2	Expanded measurement uncertainty U	± 20 % rel
Chloride DIN EN ISO 5943	Expanded measurement uncertainty U	± 1.8 % rel
Colour (Hanna) PM DE01.049	Expanded measurement uncertainty U	± 4 mm Pfund
Crude fibre VDLUFA III, 6.1.1 mod.	Expanded measurement uncertainty U	± 10 % rel
Diastase, also for thermoresistant enzymes PM DE01.090	Expanded measurement uncertainty U	± 7.2 % rel
Diastase, Phadebas IHC 6 (2009)	Expanded measurement uncertainty U	± 9 % rel
Diastase, Schade §64 LFGB L 40.00-1 mod.	Expanded measurement uncertainty U	± 7.2 % rel
Dietary Fibre LFGB ASU L 00.00-18 mod.	Expanded measurement uncertainty U	± 35 % rel
Dry soluble residue (Brix) LFGB ASU L 41.00-1, IFU MA 8	Expanded measurement uncertainty U	± 0.8 % rel

Performance Parameters, Measurement Uncertainties, Decision Rules

Parameter (group)	Uncertainty parameter	Value
Dry matter LFGB ASU L 15.00-6 mod., LFGB ASU L 06.00-3 mod., etc.	Expanded measurement uncertainty U	± 2.0 % rel
Electrical Conductivity DIN 10753	Expanded measurement uncertainty U	± 7.0 % rel
Ethanol IFU MA 52	Expanded measurement uncertainty U	Honey: ± 4.2 % rel Fruit: ± 16 % rel
Ferment soluble crude protein VDLUFA III, 4.2.1	Expanded measurement uncertainty U	± 8.0 % rel
Filling quantity DIN 55540-1	Expanded measurement uncertainty U	± 2.8 % rel
Flavonoids (Hyperoside method) PM DE01.255	Expanded measurement uncertainty U	± 9.2 % rel
Fat, total/crude LFGB ASU L 06.00-6 mod., VDLUFA III, 5.1.1 mod.	Expanded measurement uncertainty U	± 6.8 % rel
Glycerin PM DE01.091	Expanded measurement uncertainty U	± 5.2 % rel
Humidity/Moisture (honey, refractometry) LFGB ASU L 40.00-2	Expanded measurement uncertainty U	± 0.8 % rel
Hydroxyproline LFGB ASU L 06.00-8	Expanded measurement uncertainty U	± 25.0 % rel
Invertase activity DIN 10759-1	Expanded measurement uncertainty U	± 3.6 % rel
Iodine number DGF C-V 11d	Expanded measurement uncertainty U	± 5.0 % rel
Melting point LFGB ASU L 13.00-21 mod.; VDLUFA III, 5.4.6 mod.	Expanded measurement uncertainty U	± 2.4 % rel
Optical rotation IHC 11	Expanded measurement uncertainty U	± 0.6 % rel
Peroxide number DGF C-VI 6a, VDLUFA III, 5.4.3	Expanded measurement uncertainty U	± 31 % rel
Peroxide number Wax, Ph. Eur. 01/2016:20505; Method A, mod.	Expanded measurement uncertainty U	± 14 % rel
pH value ASU L 06.00-2, IFU Analysis No. 11, PM DE01.042	Expanded measurement uncertainty U	± 4.5 % rel
Phosphate IFU MA 50	Expanded measurement uncertainty U	± 2.0 % rel
Polyphenols total (Folin Ciocalteu) LFGB ASU L 47.00-10	Expanded measurement uncertainty U	± 14 % rel
Proline LFGB ASU L 40.00-3, IFU MA 49	Expanded measurement uncertainty U	± 25 % rel
Protein Kjeldahl LFGB ASU L 06.00-7	Expanded measurement uncertainty U	± 5.0 % rel

Performance Parameters, Measurement Uncertainties, Decision Rules

Parameter (group)	Uncertainty parameter	Value
Salt content VDLUFA III, 10.5.2	Expanded measurement uncertainty U	± 1.6 % rel
Saponification number (Fats, oils) DGF C-V 3	Expanded measurement uncertainty U	± 4.0 % rel
Acid number Wax DGF M-IV 2	Expanded measurement uncertainty U	± 7.4 % rel
Sediment DIN 10743 mod.	Expanded measurement uncertainty U	± 39 % rel
Starch polarimetric EU VO 152/2009, meth. L	Expanded measurement uncertainty U	± 1.8 % rel
Sulfite DIN EN 1988-1	Expanded measurement uncertainty U	± 30 % rel
Sugars (Luff-Schoorl) EU VO 152/2009, method J	Expanded measurement uncertainty U	± 7.3 % rel
TVB-N LFGB L 10.00-3 mod.	Expanded measurement uncertainty U	± 20 % rel
Unsaponifiable matter DGF C-III 1	Expanded measurement uncertainty U	± 7.8 % rel
Water activity Proprietary method (labmaster AW)	Expanded measurement uncertainty U	± 2.5 % rel
Water content LFGB ASU L 13.00-39	Expanded measurement uncertainty U	± 5.0 % rel

HPLC methods

Parameter (group)	Uncertainty parameter	Value
Aflatoxins LFGB ASU L 15.00-2 mod, VDLUFA III, 16.1.4 mod.	Expanded measurement uncertainty U	± 30 % rel
Antioxidants PM DE01.302	Expanded measurement uncertainty U	± 10 % rel
Beta-/gamma-amylase activity PM DE01.115	Expanded measurement uncertainty U	± 4 U/kg (range 2 to 10 U/kg)
Beta-fructofuranosidase activity PM DE01.102	Expanded measurement uncertainty U	± 11 % (at 20 U/kg) ± 10 % (at 100 U/kg)
DHA, PM DE01.273	Expanded measurement uncertainty U	± 15 % rel
MGO PM DE01.123	Expanded measurement uncertainty U	± 15 % rel
10-HDA (royal jelly) ISO 12824	Expanded measurement uncertainty U	± 10 % (fresh RJ)
HMF (honey) DIN 10751-3	Expanded measurement uncertainty U	± 5 % rel
Methyl anthranilate PM DE01.028	Expanded measurement uncertainty U	± 10 %
Naphthalene PM DE01.027	Expanded measurement uncertainty U	± 12 % rel

Performance Parameters, Measurement Uncertainties, Decision Rules

Parameter (group)	Uncertainty parameter	Value
Na-Cyclamate LFGB ASU L 00.00-29	Expanded measurement uncertainty U	± 20 % rel
Non-honey oligosaccharides PM DE01.191	Expanded measurement uncertainty U	± 0.22 % at 0.56 %
Ochratoxin PM DE01.039	Expanded measurement uncertainty U	± 30 % rel
Patulin LFGB ASU L 31.00-20 mod.	Expanded measurement uncertainty U	± 30 % rel
Phenol, Thymol PM DE01.055	Expanded measurement uncertainty U	± 20 % rel
Polyphenols PM DE01.249	Expanded measurement uncertainty U	± 20 % rel
Preservatives LFGB ASU L 00.00-9 mod.	Expanded measurement uncertainty U	± 15 % rel
Sugar spectrum (honey) DIN 10758	Expanded measurement uncertainty U	Glucose: ± 4.7 % rel Fructose: ± 3.4 % rel
Sweeteners LFGB ASU L 00.00-28	Expanded measurement uncertainty U	± 10 % rel
Theobromine, Caffeine PM DE01.192	Expanded measurement uncertainty U	± 15 % rel
Vitamin C PM DE01.303	Expanded measurement uncertainty U	± 10 % rel

IC methods

Nitrate, Nitrite PM DE01.278	Expanded measurement uncertainty U	Nitrate: ± 5.8 % rel Nitrite: ± 14.8 % rel
Organic Acids PM DE01.276	Expanded measurement uncertainty U	Citrate: ± 10.4 % rel
Sugars PM DE01.275	Expanded measurement uncertainty U	Glucose: ± 20 % rel Fructose: ± 20 % rel Sucrose: ± 20 % rel Mannose: ± 23 % rel
Sugar alcohols (Alditoles) PM DE01.277	Expanded measurement uncertainty U	Sorbitol: ± 23.0 % rel

ICP-MS methods

Parameter (group)	Uncertainty parameter	Value
Arsenic species PM DE01.198	Expanded measurement uncertainty U	± 20%
Elements DIN EN 15763, VDLUFA Methodenbuch Band III, 11.7.1	Expanded measurement uncertainty U	± 20% (general) ± 30% (Iod)
TM-R PM DE01.205	Expanded measurement uncertainty U	± 10%

Performance Parameters, Measurement Uncertainties, Decision Rules

LC-MS/MS, GC-MS/MS methods

Remark: Variation depends on matrix (honey, royal jelly, pollen etc.) as well as the detected analyte (antibiotic) and can only be estimated within a broad range.

Parameter (group)	Uncertainty parameter	Value
Aminoglycosides PM DE01.147	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Amphenicols PM DE01.022	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Beta-Lactam Antibiotics PM DE01.132	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Fluoroquinolones PM DE01.125	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Macrolides PM DE01.059	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Nitrofuran metabolites PM DE01.031	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Nitroimidazoles PM DE01.101	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Polycyclic aromatic hydrocarbons (PAHs) PM DE01.128 PM DE01.206	Expanded measurement uncertainty U	± 10.0 % (min) – 50.0 % (max)
Polychlorinated biphenyls (PCB) LFGB ASU L00.00-115:2014-02	Expanded measurement uncertainty U	± 7.0 % (min) – 50.0 % (max)
Pyrrolizidine alkaloids PM DE01.118	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Streptomycin PM DE01.104 PM DE01.105 PM DE01.131	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Sulfonamides PM DE01.046	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Tetracyclines PM DE01.060	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
SM-R PM DE01.190	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Tropane alkaloids PM DE01.282	Expanded measurement uncertainty U	± 7 % (min) – 50.0 % (max)
Pesticides (LC-MS/MS and GC-MS/MS) LFGB L 00.00-115, EURL-SRM QuPPe, etc.	Expanded measurement uncertainty U	± 50.0 % rel

Performance Parameters, Measurement Uncertainties, Decision Rules

NMR methods

Parameter (group)	Uncertainty parameter	Value
16-O-Methylcafestol PM DE01.299	Expanded measurement uncertainty U	± 25 % rel
Purity determination PM DE01.309	Expanded measurement uncertainty U	± 0,7 % rel
Paraffin PM DE01.330	Expanded measurement uncertainty U	± 26 % rel
Fatty acids PM DE01.330	Expanded measurement uncertainty U	± 30 % rel
Sebum PM DE01.330	Expanded measurement uncertainty U	± 10 % rel

Pollen Analysis (Microscopy, etc.)

Parameter (group)	Uncertainty parameter	Value
relative pollen frequency DIN 10760	Expanded measurement uncertainty U	± 35 % rel

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