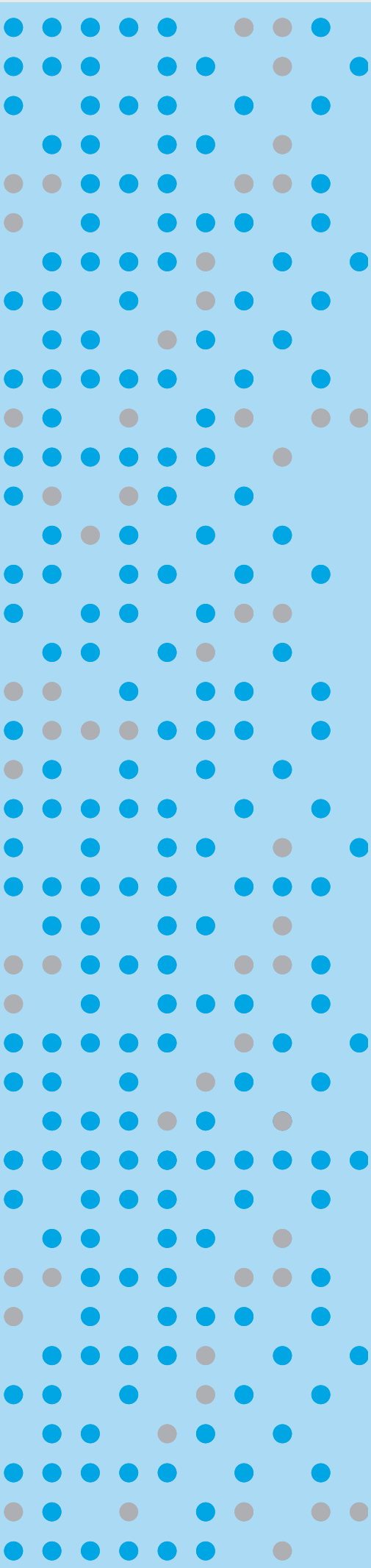


lach:ner

Laboratory standards
and chemicals 2007

LABORATORY STANDARDS

Lach-Ner Ltd., in a close cooperation with our partner company Analytika Ltd. Presents its portfolio of calibration standard solutions (trade mark ASTASOL®) for spectroscopy and chromatography, ultrapure subboiled – distilled mineral acids (trade mark ANALPURE®), pH buffers and conductivity standards, high-purity chemicals and reagents, certified reference materials and quality control materials. In 2001, the Certifying Body for Reference Materials at the Czech Metrology Institute authorized ANALYTIKA® Ltd. for the consecutive production of the CRM „Aqueous Calibration Solution" (Certificate No.: 017/CR/070). The production strictly follows the ISO requirements (ISO Guides 34 and 35) and an extensive documentation to each product is available. At present, ISO 9001:2000 quality management system is implemented.

Lach-Ner, s. r. o.

builds upon a tradition of sixty years. In the past it has been part of Saponia, Spolana, and Lachema. In 2002, the Neratovice plant became a separate legal entity under the current business name of Lach-Ner, s. r. o.

The production range of Lach-Ner, s. r. o. is wide, and the company is also involved in trading.

Our production range includes the following products:

- Laboratory chemicals and standards,
- Products for laboratories (reference normanals, ORS solutions, reagent and indicator papers),
- Medical products (sensitivity disks, Unguentum Simplex),
- Custom production according to customers' requirements.

We deliver our products together with specialized support and consulting services. We deliver chemically tested chemicals in large- and small-size packaging in the following quality grades:

- Pure,
- For analysis,
- Chemically pure,
- Pharmaceutical,
- Special.

The range of chemicals we sell includes more than 3,000 inorganic and organic substances that are used for applications in laboratories, the health-care sector, various industrial sectors, agriculture, research etc. The quality of these chemicals complies with analytical indicators as stated in a reference catalogue of chemicals, or to specific purities verified in our own laboratories using classic analytical methods as well as modern equipment in line with the applicable technical standards, drug formulas, and recipes.

Lach-Ner, s. r. o.

- Since 1997 we have maintained a quality management system certified according to ISO 9000; the certificate was issued by RWTUV Prague. In 2006 the system was re-certified according to CSN EN ISO 9001:2001,
- Since the early 1990s we have had a Proper Production Practice in place, approved by the State Institute for Drug Control,
- We have a certified laboratory complying with the requirements of Proper Production Practice for physical, physical and chemical, chemical, and microbiological tests of drugs (Identification Code 522).

Preface

■ Our offer presented in this catalogue is directed to analytical laboratories which perform an element and ion analysis in various matrices (water, soil, waste and waste leaches, biological materials, foodstuffs, etc.) by spectroscopic techniques (ICP-OES, ICP-MS, AAS, AFS, UV-VIS) and by ion chromatography as well as to chromatographic laboratories involved in analysing organic analytes by GC, GC-MS and HPLC methods. A specially tailored range of standards, reagents and chemicals of high purity should satisfy most of our potential customers from scientific, commercial and industrial laboratories. A rapid production of custom standards is also offered and our clients very often use this service.

■ Our standards and reagents are produced by highly qualified employees following a rigorous internal quality management system. All starting materials and products are (where possible) traceable to certified reference materials supplied for instance by NIST, IRMM or LGC-Promochem. All balances, thermometers, laboratory instruments and volumetric glassware are calibrated and traceable to a corresponding primary standard. All products are labelled with a specific batch number and assigned an expiry date. They are delivered with a Certificate of quality and with a Material Safety Data Sheet.

1. CALIBRATION SOLUTIONS ASTASOL® OF ELEMENTS AND IONS

1.1 Certified reference material – Aqueous Calibration Solution

The Certifying Body for Reference Materials at the Czech Metrology Institute authorized ANALYTIKA® Ltd. for the consecutive production of the certified reference material Aqueous Calibration Solution (Certificate No. 017/CR/070, set of calibration solutions Nos. CZ9001-9200). This set is an open system. At present, 82 calibration solutions of individual elements and ions and 24 multielement calibration solutions are certified. New solutions will be added continuously, especially multielement calibration solutions relevant to particular analytical requirements.

All details concerning the production, certification and use of the CRM´s – Aqueous Calibration Solution are described in the Certificate (see further in this catalogue). The Certificate has two parts: the Certificate itself (a 4 pages general document common for all analytes) and so called "Identification Sheet" of a specific CRM of a particular batch which characterizes in detail the analyte(s). The Identification Sheet is an integral part of the Certificate as a legal-metrological document.

All calibration solutions which are now available are listed in the following tables. Besides a wide range of certified calibration solutions, 40 calibration solutions of the most frequently used elements and ions are also available as a cheap uncertified "daily calibrant". These solutions are directly traceable to the corresponding CRM´s.

Two new groups of calibration solutions have been added recently: calibration solutions especially designed for ion chromatography (with a suffix IC) and for the determination of organic and inorganic carbon.

We do believe that our CRM´s – Aqueous Calibration Solution (due to their wide range of analytes and concentrations, high quality and very competitive prices) will be well accepted by the world analytical community and that they will become – similarly as the calibration solutions certified by other national certifying bodies (e.g. NIST, BAM, LGC, EMPA) – an important mean for the quality assurance and traceability to SI unit in inorganic elemental analysis.

CZECH METROLOGY INSTITUTE
REFERENCE MATERIALS CERTIFYING BODY, PRAGUE
V Botanice 4, CZ-150 72 Praha 5, tel: +420 2 5732 4096, fax: +420 2 57324982

CERTIFICATE

Certified Reference Material - Aqueous Calibration Solution

CZ 9001 ÷ CZ 9200

Aqueous calibration solutions of individual elements and ions with certified concentrations at the 1 g/l and 10 g/l levels and aqueous calibration solutions of combinations of elements and/or ions with certified concentrations at various levels relevant to particular analytical requirements.

The Certified Reference Materials are designed for calibration of instruments and providing traceability to SI unit. They can be used by analytical techniques analyzing aqueous solutions such as atomic spectrometry (AAS, AFS, ICP-AES, ICP-MS), molecular absorption spectrophotometry, ion chromatography, and some selected electroanalytical methods.

The attached Identification Sheet of a specific CRM of a particular batch is an integral part of the Certificate as a legal metrological document.

Producer:

ANALYTIKA® LTD
Ke Klíčovu 816, CZ - 190 00 Prague 9
Czech Republic
Project-in-Charge: Václav Sychra

Phone/Fax: 00420-2-86589616
E-mail: sales@analytika.net

Authorization for consecutive production
Issued on: 15. 6. 2001 Valid until: 15. 6. 2010 Certificate No: 017/CR/070

František Jelínek
ČMI Deputy Director

ČESKÝ METROLOGICKÝ INSTITUT
BRNO
-2-

Preparation procedure.
The mass of the starting primary substance (pure metal or compound) calculated with respect to an assay of the certified constituent and the target volume of the batch, is weighed on an analytical balance and transferred quantitatively to a tall 600÷800 ml beaker and dissolved completely in appropriate media (e.g. water, acid, acid mixture). The resulting solution is then transferred into a volumetric flask (with volume corresponding to the target volume of the batch – usually 5 or 10 l), containing reagents ultimately forming the designed matrix. After adding demineralized water up to 90÷95% of the final volume the solution is tempered to 20.0±0.1 °C , filled up to the mark with similarly tempered water and thoroughly mixed. A sample is taken of the prepared solution and impurities determined. The solution, divided with a measuring cylinder into ultimate unit portions, is then filled into dry leached bottles which are closed with a polypropylene screw cap, provided with protective parafilm, labelled and stored. All data relevant to the particular CRM batch (e.g. source and declared assay of the primary substance, weighing, volume and temperature measurement, determination of impurities, codes, dates of the preparation steps and personnel involved, etc.) are duly recorded and filed in both written and electronic form at least until the certification expires. One unit of each batch is stored for a period of at least 5 years.

Starting primary substances and other applied materials.
High purity metals with a declared assay of minimum 99.99% are preferred, and compounds of a defined and constant stoichiometry and declared assay and/or impurities content are used when a suitable metal is not available.
The supplier of primary substances must comply with ISO Guide 34 [2], namely to employ a certified Quality Management System. Each supply of the primary substance must be accompanied with complete documentation, including an identification of sources and treatment, assay and impurity contents. As required by this Guide, the supplier´s data are verified by the CRM producer and by other subcontracted accredited laboratories (e.g. trace metal impurities by spectroscopic methods such as ICP-AES, ICP-MS, AAS, the assay by primary gravimetric or volumetric methods). Subboil distilled acids (prepared by the CRM producer), other ultrapure chemicals (ammonium hydroxide, hydrogen peroxide, etc.) and demineralized water with a specific conductivity below 0.5 µS/cm are further applied in the CRM preparation. Their impurity contents are regularly monitored. They are generally negligible compared with the concentration of the certified constituent.

Weighing, volume and temperature measurement.
A Class 1 electromechanical analytical balance with a valid verification (type Sartorius 2004 MP) is used to weigh the primary substances. All volumetric vessels used (flasks, pipettes, burettes) are of Accuracy Class 1, calibrated by their producers. They are accompanied with certificates with an uncertainty of volume at 20.0 °C statement. Two mercury thermometers 0–30 °C (with a scale division by 0.1 °C), regularly calibrated by authorised institutions are used for the temperature measurement.

Coding and packing.
A four-digit code – CRM CZ 9001 through 9200 – identifies the certified constituent (constituents), whereas the alternative certified concentration level and matrix is differentiated in both the Identification Sheet and the label by an alphanumeric code (in parentheses). The certified concentrations 1.000 g/l and 10.00 g/l are marked 1 and 10, respectively. The letter following denotes the matrix: C stands for a diluted HCl, N for a diluted HNO_3, S a diluted H_2SO_4, F a diluted HF, H a H_2O matrix, a combination of letters, e.g. C, N specifies a diluted HCl + HNO_3, etc.
A basic packing unit is 500 ml (with options of 250 and 100 ml) in an amber HDPE bottle or an amber glass bottle whenever an interaction of the certified constituent with HDPE may be suspected (e.g. mercury, precious metals). Prior to filling, the bottles and caps are leached by HCl (5 % v/v) for a longer period, washed repeatedly with demineralized water and thoroughly dried. After filling with CRM, the remaining volume above the liquid is purged by nitrogen, the bottle closed hermetically with a polypropylene screw cap and sealed with parafilm. The bottle is labelled with a resistant plastic label containing all data as required by CRM standards, i.e. CRM and batch codes, producer identification and contact data, expiry term and further data and warning symbols when required by specific regulations.

Homogeneity and stability.
The CRMs are considered homogeneous due to their physico-chemical character (diluted solutions) and thus homogeneity testing is not required.
An assumption of stability and the consequent expiration period is based on both over ten years experience with the preparation of similar RMs and a test of possible instability factors. These factors are of general (e.g. water evaporation by regular weighing of the filled bottle) and specific character (e.g. adsorption and desorption of the particular certified constituent on the walls of the bottle, precipitation, etc.) Along with these tests the content of the certified constituent in the bottle is compared (at least twice during the validity period) with that of a newly prepared batch and/or a corresponding CRM from other producers.

Certification, certified values and their uncertainties.
Certification of concentration values is based on the CRM preparation by ISO Guide 35 [3], i.e. on weighing and volume measurement. They are calculated from an assay of the certified constituent in the primary substance, declared by its supplier and duly verified by the CRM producer. The certified concentration (m/v) and its uncertainty are expressed in g/l at a temperature of 20 ± 0.1 °C.
The uncertainty of a certified value is estimated in compliance with ISO and EURACHEM methodologies [4, 5]. It combines the calculated standard uncertainties of the individual CRM preparation steps with an expert estimate of the standard uncertainty of the assay of the certified constituent in the primary substance, usually a dominant contribution. The expanded combined uncertainty calculated with a coverage factor K = 2 is expressed as a two-sided half-interval by one significant figure, with the certified value given by the same number of digits.
The particular certified values and uncertainties, mostly at a level of 0.2 % (rel.), are specified in the Identification Sheets together with the expiry terms and other relevant information.

Traceability and quality assurance.
Traceability to SI unit (mol) is secured by using a primary substance with a verified content of the certified constituent and by the method of the CRM preparation – weighing and volume measurement.
The CRM producer has a standard Quality Management System in force. The appropriateness of the certification and uncertainty estimate methodology was further confirmed by the Metrological Laboratory of the Prague Institute of Chemical Technology.

Instructions for use.
The selection of the concentration of a certified constituent and a matrix adequate to the particular analytical method, as well as the correct preparation of diluted calibration solutions and their proper application is entirely within the user´s responsibility.
CRMs should be stored in their original packing (in an upright position) at temperatures between 10 to 30 °C, away from any strong light source (e.g. sunshine, UV lamp). It is advised to record the first opening of the bottle, to close it immediately after every use and to discard the contents of the bottle when less than 10 percent of the original volume of the solution is left.
The expiry term is valid provided the CRM is properly stored and handled in compliance with these instructions. The certification ceases to be valid if the CRM is damaged, contaminated or modified. (Please note the difference between the validity period of the authorization of the producer and the expiry term of a particular batch of CRM given in its Identification Sheet).
The user is responsible for an update of his contact data with the CRM producer to facilitate immediate relay of information on possible expiry terms and other essential data changes.
Safety regulations for transportation, storage and use of CRM are specified in the Safety Data Sheet enclosed with each supply.

References

1. J. R. Moody, R. R. Greenberg, K. W. Pratt, T. C. Rains (NIST U.S.A.): Analytical Chemistry, Vol. 60, No. 21, 1203A (1988). Recommended Inorganic Chemicals for Calibration.

2. ISO Guide 34: 2000, General Requirements for the Competence of Reference Material Producers.

3. ISO Guide 35: 1989 (E), Certification of Reference Materials – General and Statistical Principles.

4. Document EURACHEM: 1999, Quantifying Uncertainty in Analytical Measurement.

5. ISO Guide to the Expression of Uncertainty in Measurement, ISBN 92-67-10188-9, Geneva 1993.

6. ISO/IEC Guide 25: 1990 General Requirement for the Competence of Calibration and Testing Laboratories.

7. ISO Guide 30: 1992, Terms and Definitions Used in Connection with Reference Materials.

8. ISO Guide 31: 1998, Reference Materials – Contents of Certificates and Labels.

9. ISO Guide 33: 1989, Uses of Certified Reference Materials.

10. Document BCR/01/97: 1997, Guidelines for the Production and Certification of BCR Reference Materials.

11. Reference Materials for Environmental Analysis, ed. by R. E. Clement, L. H. Keith and K. W. Michael Siu, CRC Press Inc., 1997, Chapter 3: Preparation and Verification of ICP and AA Reference Standards.

CERTIFICATE - IDENTIFICATION SHEET

Certified Reference Material - Aqueous Calibration Solution

CZ 9001 (1N) Silver

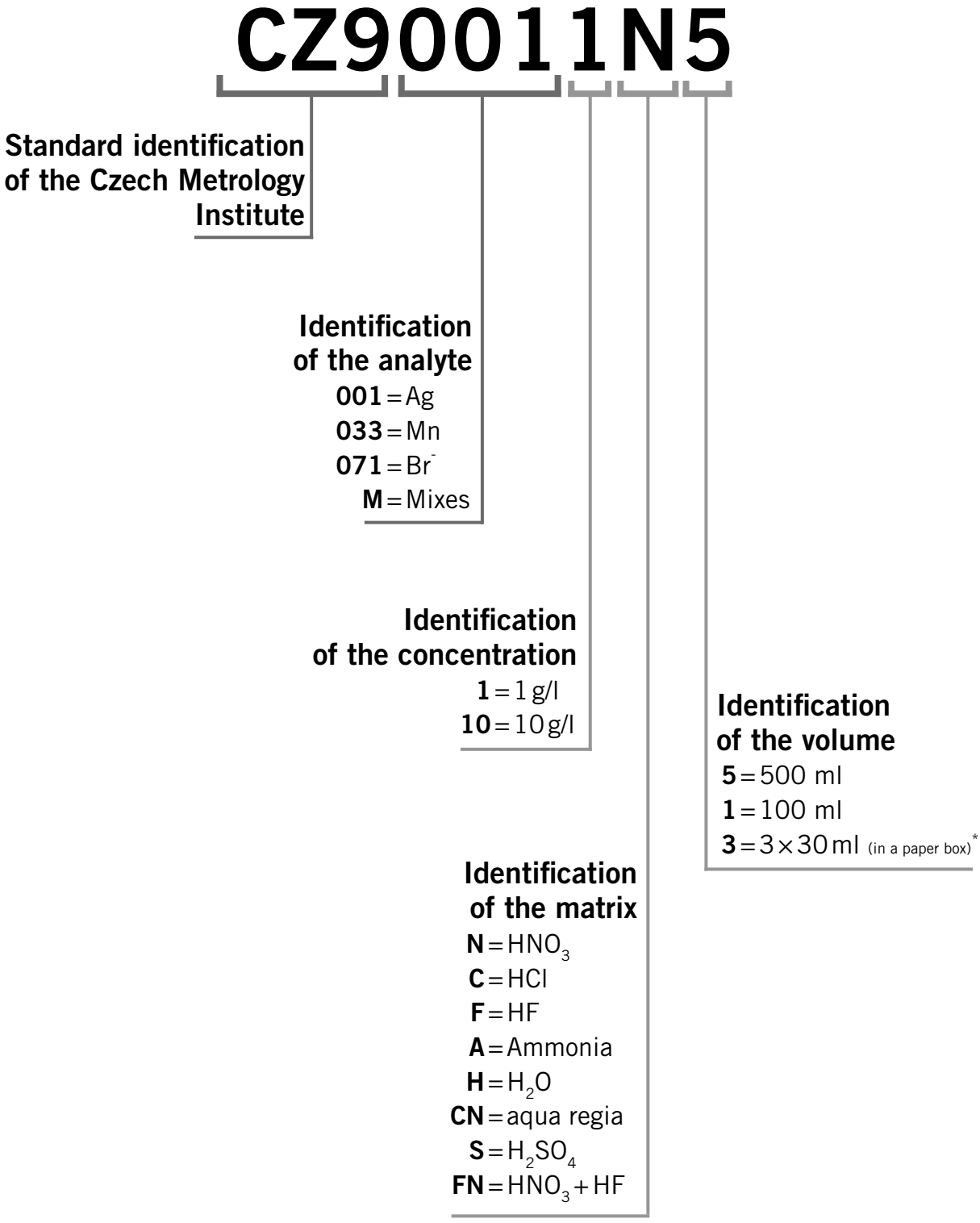
Certified Value and Uncertainty:	**1.000 ± 0.002 g/l Ag at 20°C**
Starting Primary Substance:	Ag metal, assay 99.999%
Matrix:	HNO_3, 2% (v/v) HNO_3 subboil distilled H_2O demineralized, conductivity ≤ 0.5 µS/cm
Impurities ≥ 0.0001g/l:	None Impurities determined by ICP-AES, ICP-MS, AAS and other methods.
Unit Volume, Packing, Code:	100 ml Amber glass bottle sealed and labelled with an original producer's label Trade name ASTASOL® - Ag Order No. CZ90011N1

Batch No.:	***Expiration Term:***	***Date of Issue:***

Producer: ANALYTIKA®, LTD., Ke Klíčovu 816, CZ-190 00 Prague 9
Czech Republic
Phone/fax: 004202-8589616 E-mail: sales@analytika.net
Quality Manager: Ing. Lenka Janečková
Project-in-Charge: Dr. Václav Sychra Ph.D Managing Director
Signed:

This Identification Sheet is an integral part of the Certificate No. 017/CR/070

Identification of new CRM´s – Aqueous Calibration Solution



*) This packing meets the requirements of IATA for transport of dangerous chemicals by air.

All certified solutions (CZ9xxx) may be ordered in this pack size (instead of one 100 ml bottle). The customers will be charged with an additional 3.0 EUR per one pack.

1.2 Single element (ion) aqueous calibration solutions ASTASOL®

Element	Concentration (g/l)	Order number	Starting material and its purity (%)	Matrix (%, v/v)	Volume (ml)
Ag	1.000 ± 0.002	CZ 90011N1	Ag 99.999	2% HNO_3	100 G
	1.000 ± 0.002	CZ 90011N5	Ag 99.999	2% HNO_3	500 G
	10.00 ± 0.02	CZ 900110N1	Ag 99.999	2% HNO_3	100 G
	1.000 ± 0.005	S 001	Ag 99.99	2% HNO_3	500 G
Al	1.000 ± 0.002	CZ 90021C1	Al 99.999	5% HCl	100 H
	1.000 ± 0.002	CZ 90021C5	Al 99.999	5% HCl	500 H
	10.00 ± 0.02	CZ 900210C1	Al 99.999	5% HCl	100 H
	1.000 ± 0.002	CZ 90021N1	Al 99.999	5% HNO_3	100 H
	1.000 ± 0.002	CZ 90021N5	Al 99.999	5% HNO_3	500 H
	10.00 ± 0.02	CZ 900210N1	Al 99.999	5% HNO_3	100 H
	1.000 ± 0.005	S 002	Al 99.995	5% HCl	500 H
As	1.000 ± 0.002	CZ 90031N1	As 99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90031N5	As 99.999	2% HNO_3	500 H
	10.00 ± 0.02	CZ 900310N1	As 99.999	2% HNO_3	100 H
	1.000 ± 0.005	S 003	As 99.999	2% HNO_3	500 H
Au	1.000 ± 0.002	CZ 90041C1	Au 99.998	5% HCl	100 G
	10.00 ± 0.02	CZ 900410C1	Au 99.998	5% HCl	100 G
B	1.000 ± 0.002	CZ 90051H1	H_3BO_3 99.99	H_2O	100 H
	1.000 ± 0.002	CZ 90051H5	H_3BO_3 99.99	H_2O	500 H
	10.00 ± 0.02	CZ 900510H1	H_3BO_3 99.99	H_2O	100 H
	1.000 ± 0.005	S 005	H_3BO_3 99.99	H_2O	500 H
Ba	1.000 ± 0.002	CZ 90061N1	$BaCO_3$ 99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90061N5	$BaCO_3$ 99.999	2% HNO_3	500 H
	10.00 ± 0.02	CZ 900610N1	$BaCO_3$ 99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90061C1	$BaCO_3$ 99.999	2% HCl	100 H
	1.000 ± 0.002	CZ 90061C5	$BaCO_3$ 99.999	2% HCl	500 H
	10.00 ± 0.02	CZ 900610C1	$BaCO_3$ 99.999	5% HCl	100 H
	1.000 ± 0.005	S 006	$BaCO_3$ 99.99	2% HNO_3	500 H
Be	1.000 ± 0.002	CZ 90071N1	BeO 99.99	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90071S1	BeO 99.99	2% H_2SO_4	100 H
	10.00 ± 0.02	CZ 900710N1	BeO 99.99	2% HNO_3	100 H
Bi	1.000 ± 0.002	CZ 90081N1	Bi 99.999	5% HNO_3	100 H
	1.000 ± 0.002	CZ 90081N5	Bi 99.999	5% HNO_3	500 H
	10.00 ± 0.02	CZ 900810N1	Bi 99.999	5% HNO_3	100 H
	1.000 ± 0.005	S 008	Bi 99.999	5% HNO_3	500 H
Ca	1.000 ± 0.002	CZ 90091N1	$CaCO_3$ 99.995	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90091N5	$CaCO_3$ 99.995	2% HNO_3	500 H
	10.00 ± 0.02	CZ 900910N1	$CaCO_3$ 99.995	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90091C1	$CaCO_3$ 99.995	2% HCl	100 H
	1.000 ± 0.002	CZ 90091C5	$CaCO_3$ 99.995	2% HCl	500 H
	10.00 ± 0.02	CZ 900910C1	$CaCO_3$ 99.995	5% HCl	100 H
	1.000 ± 0.005	S 009	$CaCO_3$ 99.99	2% HNO_3	500 H

The table continues on the next page →

Element	Concentration (g/l)	Order number	Starting material and its purity (%)	Matrix (%, v/v)	Volume (ml)
Cd	1.000 ± 0.002	CZ 90101N1	Cd 99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90101N5	Cd 99.999	2% HNO_3	500 H
	10.00 ± 0.02	CZ 901010N1	Cd 99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90101C1	Cd 99.999	2% HCl	100 H
	1.000 ± 0.002	CZ 90101C5	Cd 99.999	2% HCl	500 H
	10.00 ± 0.02	CZ 901010C1	Cd 99.999	5% HCl	100 H
	1.000 ± 0.005	S 010	Cd 99.999	2% HNO_3	500 H
Ce	1.000 ± 0.002	CZ 90111N1	CeO_2 99.99	5% HNO_3	100 H
	10.00 ± 0.02	CZ 901110N1	CeO_2 99.99	5% HNO_3	100 H
Co	1.000 ± 0.002	CZ 90121N1	Co 99.995	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90121N5	Co 99.995	2% HNO_3	500 H
	10.00 ± 0.02	CZ 901210N1	Co 99.995	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90121C1	Co 99.995	2% HCl	100 H
	1.000 ± 0.002	CZ 90121C5	Co 99.995	2% HCl	500 H
	10.00 ± 0.02	CZ 901210C1	Co 99.995	5% HCl	100 H
	1.000 ± 0.005	S 012	Co 99.99	2% HNO_3	500 H
Cr	1.000 ± 0.002	CZ 90131C1	Cr 99.995	2% HCl	100 H
	1.000 ± 0.002	CZ 90131C5	Cr 99.995	2% HCl	500 H
	10.00 ± 0.02	CZ 901310C1	Cr 99.995	5% HCl	100 H
	1.000 ± 0.002	CZ 90131N1	$Cr(NO_3)_3 \cdot 9H_2O$ 99.99+	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90131N5	$Cr(NO_3)_3 \cdot 9H_2O$ 99.99+	2% HNO_3	500 H
	10.00 ± 0.02	CZ 901310N1	$Cr(NO_3)_3 \cdot 9H_2O$ 99.99+	2% HNO_3	100 H
	1.000 ± 0.005	S 013	$Cr(NO_3)_3 \cdot 9H_2O$ 99.99+	2% HNO_3	500 H
Cs	1.000 ± 0.002	CZ 90141H1	CsCl 99.999	H_2O	100 H
	10.00 ± 0.02	CZ 901410H1	CsCl 99.999	H_2O	100 H
	1.000 ± 0.002	CZ 90141N1	$CsNO_3$ 99.999	2% HNO_3	100 H
	10.00 ± 0.02	CZ 901410N1	$CsNO_3$ 99.999	2% HNO_3	100 H
Cu	1.000 ± 0.002	CZ 90151N1	Cu 99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90151N5	Cu 99.999	2% HNO_3	500 H
	10.00 ± 0.02	CZ 901510N1	Cu 99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90151C1	Cu 99.999	2% HCl	100 H
	1.000 ± 0.002	CZ 90151C5	Cu 99.999	2% HCl	500 H
	10.00 ± 0.02	CZ 901510C1	Cu 99.999	2% HCl	100 H
	1.000 ± 0.005	S 015	Cu 99.999	2% HNO_3	500 H
Dy	1.000 ± 0.002	CZ 90161N1	Dy_2O_3 99.99+	2% HNO_3	100 H
	10.00 ± 0.02	CZ 901610N1	Dy_2O_3 99.99+	2% HNO_3	100 H
Er	1.000 ± 0.002	CZ 90171N1	Er_2O_3 99.99+	2% HNO_3	100 H
	10.00 ± 0.02	CZ 901710N1	Er_2O_3 99.99+	2% HNO_3	100 H
Eu	1.000 ± 0.002	CZ 90181N1	Eu_2O_3 99.999	2% HNO_3	100 H
	10.00 ± 0.02	CZ 901810N1	Eu_2O_3 99.999	2% HNO_3	100 H
Fe	1.000 ± 0.002	CZ 90191N1	Fe 99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90191N5	Fe 99.999	2% HNO_3	500 H
	10.00 ± 0.02	CZ 901910N1	Fe 99.999	5% HNO_3	100 H
	1.000 ± 0.002	CZ 90191C1	Fe 99.999	5% HCl	100 H
	1.000 ± 0.002	CZ 90191C5	Fe 99.999	5% HCl	500 H

The table continues on the next page →

Element	Concentration (g/l)	Order number	Starting material and its purity (%)	Matrix (%, v/v)	Volume (ml)
Fe (continued)	10.00 ±0.02	CZ 901910C1	Fe 99.999	5% HCl	100 H
	1.000±0.005	S 019	Fe 99.995	2% HNO_3	500 H
Ga	1.000±0.002	CZ 90201N1	Ga 99.999	2% HNO_3	100 H
	10.00 ±0.02	CZ 902010N1	Ga 99.999	2% HNO_3	100 H
Gd	1.000±0.002	CZ 90211N1	Gd_2O_3 99.995	2% HNO_3	100 H
	10.00 ±0.02	CZ 902110N1	Gd_2O_3 99.995	2% HNO_3	100 H
Ge	1.000±0.002	CZ 90221FN1	Ge 99.999	1% HF + 5% HNO_3	100 H
	10.00 ±0.02	CZ 902210FN1	Ge 99.999	1% HF + 5% HNO_3	100 H
Hf	1.000±0.002	CZ 90231FN1	Hf 99.9	1% HF + 5% HNO_3	100 H
	10.00 ±0.02	CZ 902310FN1	Hf 99.9	1% HF + 5% HNO_3	100 H
Hg	1.000±0.002	CZ 90241N1	Hg 99.999+	2% HNO_3	100 G
	1.000±0.002	CZ 90241N5	Hg 99.999+	2% HNO_3	500 G
	10.00 ±0.02	CZ 902410N1	Hg 99.999+	2% HNO_3	100 G
	1.000±0.005	S 024	Hg 99.999+	2% HNO_3	500 G
Ho	1.000±0.002	CZ 90251N1	Ho_2O_3 99.999	2% HNO_3	100 H
	10.00 ±0.02	CZ 902510N1	Ho_2O_3 99.999	2% HNO_3	100 H
In	1.000±0.002	CZ 90261N1	In 99.999	2% HNO_3	100 H
	10.00 ±0.02	CZ 902610N1	In 99.999	2% HNO_3	100 H
Ir	1.000±0.002	CZ 90271C1	$(NH_4)_2IrCl_6$ 99.998	5% HCl	100 G
	10.00 ±0.02	CZ 902710C1	$(NH_4)_2IrCl_6$ 99.998	5% HCl	100 G
K	1.000±0.002	CZ 90281H1	KCl 99.999	H_2O	100 H
	1.000±0.002	CZ 90281H5	KCl 99.999	H_2O	500 H
	10.00 ±0.02	CZ 902810H1	KCl 99.999	H_2O	100 H
	1.000±0.002	CZ 90281N1	KNO_3 99.99	2% HNO_3	100 H
	1.000±0.002	CZ 90281N5	KNO_3 99.99	2% HNO_3	500 H
	10.00 ±0.02	CZ 902810N1	KNO_3 99.99	2% HNO_3	100 H
	1.000±0.005	S 028	KNO_3 99.99	H_2O	500 H
La	1.000±0.002	CZ 90291N1	La_2O_3 99.999	2% HNO_3	100 H
	10.00 ±0.02	CZ 902910N1	La_2O_3 99.999	2% HNO_3	100 H
Li	1.000±0.002	CZ 90301C1	Li_2CO_3 99.997	2% HCl	100 H
	1.000±0.002	CZ 90301C5	Li_2CO_3 99.997	2% HCl	500 H
	10.00 ±0.02	CZ 903010C1	Li_2CO_3 99.997	5% HCl	100 H
	1.000±0.002	CZ 90301N1	Li_2CO_3 99.997	2% HNO_3	100 H
	1.000±0.002	CZ 90301N5	Li_2CO_3 99.997	2% HNO_3	500 H
	10.00 ±0.02	CZ 903010N1	Li_2CO_3 99.997	2% HNO_3	100 H
	1.000±0.005	S 030	Li_2CO_3 99.99	2% HNO_3	500 H
Lu	1.000±0.002	CZ 90311N1	Lu_2O_3 99.99	2% HNO_3	100 H
	10.00 ±0.02	CZ 903110N1	Lu_2O_3 99.99	2% HNO_3	100 H
Mg	1.000±0.002	CZ 90321N1	Mg 99.99	2% HNO_3	100 H
	1.000±0.002	CZ 90321N5	Mg 99.99	2% HNO_3	500 H
	10.00 ±0.02	CZ 903210N1	Mg 99.99	2% HNO_3	100 H
	1.000±0.002	CZ 90321C1	Mg 99.99	2% HCl	100 H
	1.000±0.002	CZ 90321C5	Mg 99.99	2% HCl	500 H
	10.00 ±0.02	CZ 903210C1	Mg 99.99	5% HCl	100 H
	1.000±0.005	S 032	Mg 99.99	2% HNO_3	500 H

The table continues on the next page →

Element	Concentration (g/l)	Order number	Starting material and its purity (%)		Matrix (%, v/v)	Volume (ml)
Mn	1.000 ± 0.002	CZ 90331N1	Mn	99.98	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90331N5	Mn	99.98	2% HNO_3	500 H
	10.00 ± 0.02	CZ 903310N1	Mn	99.98	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90331C1	Mn	99.98	2% HCl	100 H
	1.000 ± 0.002	CZ 90331C5	Mn	99.98	2% HCl	500 H
	10.00 ± 0.02	CZ 903310C1	Mn	99.98	5% HCl	100 H
	1.000 ± 0.005	S 033	Mn	99.98	2% HNO_3	500 H
Mo	1.000 ± 0.002	CZ 90341A1	Mo	99.999	2% NH_4OH	100 H
	1.000 ± 0.002	CZ 90341A5	Mo	99.999	2% NH_4OH	500 H
	10.00 ± 0.02	CZ 903410A1	Mo	99.999	2% NH_4OH	100 H
	1.000 ± 0.005	S 034	Mo	99.99	2% NH_4OH	500 H
Na	1.000 ± 0.002	CZ 90351H1	NaCl	99.995	H_2O	100 H
	1.000 ± 0.002	CZ 90351H5	NaCl	99.995	H_2O	500 H
	10.00 ± 0.02	CZ 903510H1	NaCl	99.995	H_2O	100 H
	1.000 ± 0.002	CZ 90351N1	$NaNO_3$	99.99	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90351N5	$NaNO_3$	99.99	2% HNO_3	500 H
	10.00 ± 0.02	CZ 903510N1	$NaNO_3$	99.99	2% HNO_3	100 H
	1.000 ± 0.005	S 035	$NaNO_3$	99.99	H_2O	500 H
Nb	1.000 ± 0.002	CZ 90361FN1	Nb	99.9+	1% HF + 5% HNO_3	100 H
	10.00 ± 0.02	CZ 903610FN1	Nb	99.9+	1% HF + 5% HNO_3	100 H
Nd	1.000 ± 0.002	CZ 90371N1	Nd_2O_3	99.99	2% HNO_3	100 H
	10.00 ± 0.02	CZ 903710N1	Nd_2O_3	99.99	2% HNO_3	100 H
Ni	1.000 ± 0.002	CZ 90381N1	Ni	99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90381N5	Ni	99.999	2% HNO_3	500 H
	10.00 ± 0.02	CZ 903810N1	Ni	99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90381C1	Ni	99.999	2% HCl	100 H
	1.000 ± 0.002	CZ 90381C5	Ni	99.999	2% HCl	500 H
	10.00 ± 0.02	CZ 903810C1	Ni	99.999	5% HCl	100 H
	1.000 ± 0.005	S 038	Ni	99.99	2% HNO_3	500 H
Os	1.000 ± 0.002	CZ 90391C1	$(NH_4)_2OsCl_6$	99.998	5% HCl	100 G
	10.00 ± 0.02	CZ 903910C1	$(NH_4)_2OsCl_6$	99.998	5% HCl	100 G
P	1.000 ± 0.002	CZ 90401S1	$NH_4H_2PO_4$	99.999	0.05% H_2SO_4	100 H
	1.000 ± 0.002	CZ 90401S5	$NH_4H_2PO_4$	99.999	0.05% H_2SO_4	500 H
	10.00 ± 0.02	CZ 904010S1	$NH_4H_2PO_4$	99.999	0.05% H_2SO_4	100 H
	1.000 ± 0.005	S 040	$NH_4H_2PO_4$	99.999	0.05% H_2SO_4	500 H
Pb	1.000 ± 0.002	CZ 90411N1	Pb	99.999	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90411N5	Pb	99.999	2% HNO_3	500 H
	10.00 ± 0.02	CZ 904110N1	Pb	99.999	2% HNO_3	100 H
	1.000 ± 0.005	S 041	Pb	99.999	2% HNO_3	500 H
Pd	1.000 ± 0.002	CZ 90421C1	Pd	99.999	5% HCl	100 G
	10.00 ± 0.02	CZ 904210C1	Pd	99.999	5% HCl	100 G
Pr	1.000 ± 0.002	CZ 90431N1	Pr_6O_{11}	99.999	2% HNO_3	100 H
	10.00 ± 0.02	CZ 904310N1	Pr_6O_{11}	99.999	2% HNO_3	100 H
Pt	1.000 ± 0.002	CZ 90441C1	Pt	99.995	5% HCl	100 G
	10.00 ± 0.02	CZ 904410C1	Pt	99.995	5% HCl	100 G

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Element	Concentration (g/l)	Order number	Starting material and its purity (%)	Matrix (%, v/v)	Volume (ml)
Rb	1.000 ± 0.002	CZ 90451H1	RbCl 99.98	H_2O	100 H
	10.00 ± 0.02	CZ 904510H1	RbCl 99.98	H_2O	100 H
	1.000 ± 0.002	CZ 90451N1	$RbNO_3$ 99.99	2% HNO_3	100 H
	10.00 ± 0.02	CZ 904510N1	$RbNO_3$ 99.99	2% HNO_3	100 H
Re	1.000 ± 0.002	CZ 90461H1	NH_4ReO_4 99.999	H_2O	100 H
	10.00 ± 0.02	CZ 904610H1	NH_4ReO_4 99.999	H_2O	100 H
Rh	1.000 ± 0.002	CZ 90471C1	$(NH_4)_3RhCl_6$ 99.99	5% HCl	100 G
	10.00 ± 0.02	CZ 904710C1	$(NH_4)_3RhCl_6$ 99.99	5% HCl	100 G
Ru	1.000 ± 0.002	CZ 90481C1	$(NH_4)_2RuCl_6$ 99.95	5% HCl	100 G
	10.00 ± 0.02	CZ 904810C1	$(NH_4)_2RuCl_6$ 99.95	5% HCl	100 G
S	1.000 ± 0.002	CZ 90491H1	$(NH_4)_2SO_4$ 99.999	H_2O	100 H
	10.00 ± 0.02	CZ 904910H1	$(NH_4)_2SO_4$ 99.999	H_2O	100 H
Sb	1.000 ± 0.002	CZ 90501C1	Sb 99.999	10% HCl	100 H
	1.000 ± 0.002	CZ 90501C5	Sb 99.999	10% HCl	500 H
	10.00 ± 0.02	CZ 905010C1	Sb 99.999	10% HCl	100 H
	1.000 ± 0.002	CZ 90501FN1	Sb 99.999	1% HF + 5% HNO_3	100 H
	1.000 ± 0.002	CZ 90501FN5	Sb 99.999	1% HF + 5% HNO_3	500 H
	10.00 ± 0.02	CZ 905010FN1	Sb 99.999	1% HF + 5% HNO_3	100 H
	1.000 ± 0.005	S 050	Sb 99.999	10% HCl	500 H
Se	1.000 ± 0.002	CZ 90511N1	Se 99.999	2% HNO_3	100 H
	10.00 ± 0.02	CZ 905110N1	Se 99.999	2% HNO_3	100 H
	1.000 ± 0.005	S 051	Se 99.999	2% HNO_3	500 H
Sc	1.000 ± 0.002	CZ 90521N1	Sc_2O_3 99.999	2% HNO_3	100 H
	10.00 ± 0.02	CZ 905210N1	Sc_2O_3 99.999	2% HNO_3	100 H
Si	1.000 ± 0.002	CZ 90531H1	Na_2SiO_3 99.9	H_2O	100 H
	1.000 ± 0.002	CZ 90531H5	Na_2SiO_3 99.9	H_2O	500 H
	10.00 ± 0.02	CZ 905310H1	Na_2SiO_3 99.9	H_2O	100 H
	1.000 ± 0.002	CZ 90531F1	$(NH_4)_2SiF_6$ 99.99	0.05% HF	100 H
	1.000 ± 0.002	CZ 90531F5	$(NH_4)_2SiF_6$ 99.99	0.05% HF	500 H
	10.00 ± 0.02	CZ 905310F1	$(NH_4)_2SiF_6$ 99.99	0.05% HF	100 H
	1.000 ± 0.005	S 053	Na_2SiO_3 99.9	H_2O	500 H
Sm	1.000 ± 0.002	CZ 90541N1	Sm_2O_3 99.99	2% HNO_3	100 H
	10.00 ± 0.02	CZ 905410N1	Sm_2O_3 99.99	2% HNO_3	100 H
Sn	1.000 ± 0.002	CZ 90551C1	Sn 99.999	10% HCl	100 H
	1.000 ± 0.002	CZ 90551C5	Sn 99.999	10% HCl	500 H
	10.00 ± 0.02	CZ 905510C1	Sn 99.999	20% HCl	100 H
	1.000 ± 0.002	CZ 90551FN1	Sn 99.999	1% HF + 5% HNO_3	100 H
	1.000 ± 0.002	CZ 90551FN5	Sn 99.999	1% HF + 5% HNO_3	500 H
	10.00 ± 0.02	CZ 905510FN1	Sn 99.999	1% HF + 5% HNO_3	100 H
	1.000 ± 0.005	S 055	Sn 99.999	10% HCl	500 H
Sr	1.000 ± 0.002	CZ 90561N1	$SrCO_3$ 99.995	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90561N5	$SrCO_3$ 99.995	2% HNO_3	500 H
	10.00 ± 0.02	CZ 905610N1	$SrCO_3$ 99.995	2% HNO_3	100 H
	1.000 ± 0.002	CZ 90561C1	$SrCO_3$ 99.995	2% HCl	100 H
	1.000 ± 0.002	CZ 90561C5	$SrCO_3$ 99.995	2% HCl	500 H

The table continues on the next page →

Element	Concentration (g/l)	Order number	Starting material and its purity (%)	Matrix (%, v/v)	Volume (ml)
Sr (continued)	10.00 ±0.02	CZ 905610C1	$SrCO_3$ 99.995	5% HCl	100 H
	1.000±0.005	S 056	$SrCO_3$ 99.99	2% HNO_3	500 H
Ta	1.000±0.002	CZ 90571FN1	Ta 99.98	1% HF + 5% HNO_3	100 H
	10.00 ±0.02	CZ 905710FN1	Ta 99.98	1% HF + 5% HNO_3	100 H
Tb	1.000±0.002	CZ 90581N1	Tb_4O_7 99.999	2% HNO_3	100 H
	10.00 ±0.02	CZ 905810N1	Tb_4O_7 99.999	2% HNO_3	100 H
Te	1.000±0.002	CZ 90591C1	Te 99.999	20% HCl	100 H
	1.000±0.002	CZ 90591C5	Te 99.999	20% HCl	100 H
	10.00 ±0.02	CZ 905910C1	Te 99.999	20% HCl	100 H
Th	1.000±0.002	CZ 90601N1	ThO_2 99.95	5% HNO_3	100 H
	10.00 ±0.02	CZ 906010N1	ThO_2 99.95	5% HNO_3	100 H
Ti	1.000±0.002	CZ 90611FN1	Ti 99.98	1% HF + 5% HNO_3	100 H
	1.000±0.002	CZ 90611FN5	Ti 99.98	1% HF + 5% HNO_3	500 H
	10.00 ±0.02	CZ 906110FN1	Ti 99.98	1% HF + 5% HNO_3	100 H
	1.000±0.005	S 061	Ti 99.98	1% HF + 5% HNO_3	500 H
Tl	1.000±0.002	CZ 90621N1	$TlNO_3$ 99.9995	2% HNO_3	100 H
	1.000±0.002	CZ 90621N5	$TlNO_3$ 99.9995	2% HNO_3	500 H
	10.00 ±0.02	CZ 906210N1	$TlNO_3$ 99.9995	2% HNO_3	100 H
	1.000±0.005	S 062	$TlNO_3$ 99.995	2% HNO_3	500 H
Tm	1.000±0.002	CZ 90631N1	Tm_2O_3 99.99	2% HNO_3	100 H
	10.00 ±0.02	CZ 906310N1	Tm_2O_3 99.99	2% HNO_3	100 H
U	1.000±0.002	CZ 90641N1	U_3O_8 99.95	2% HNO_3	100 H
	10.00 ±0.02	CZ 906410N1	U_3O_8 99.95	2% HNO_3	100 H
V	1.000±0.002	CZ 90651N1	NH_4VO_3 99.95+	2% HNO_3	100 H
	1.000±0.002	CZ 90651N5	NH_4VO_3 99.95+	2% HNO_3	500 H
	10.00 ±0.02	CZ 906510N1	NH_4VO_3 99.95+	2% HNO_3	100 H
	1.000±0.005	S 065	NH_4VO_3 99.95+	2% HNO_3	500 H
W	1.000±0.002	CZ 90661A1	W 99.99+	2% NH_4OH	100 H
	1.000±0.002	CZ 90661A5	W 99.99+	2% NH_4OH	500 H
	10.00 ±0.02	CZ 906610A1	W 99.99+	2% NH_4OH	100 H
	1.000±0.005	S 066	W 99.99+	2% NH_4OH	500 H
Y	1.000±0.002	CZ 90671N1	Y_2O_3 99.999	2% HNO_3	100 H
	10.00 ±0.02	CZ 906710N1	Y_2O_3 99.999	2% HNO_3	100 H
Yb	1.000±0.002	CZ 90681N1	Yb_2O_3 99.99	2% HNO_3	100 H
	10.00 ±0.02	CZ 906810N1	Yb_2O_3 99.99	2% HNO_3	100 H
Zn	1.000±0.002	CZ 90691N1	Zn 99.999	2% HNO_3	100 H
	1.000±0.002	CZ 90691N5	Zn 99.999	2% HNO_3	500 H
	10.00 ±0.02	CZ 906910N1	Zn 99.999	2% HNO_3	100 H
	1.000±0.002	CZ 90691C1	Zn 99.999	2% HCl	100 H
	1.000±0.002	CZ 90691C5	Zn 99.999	2% HCl	500 H
	10.00 ±0.02	CZ 906910C1	Zn 99.999	5% HCl	100 H
	1.000±0.005	S 069	Zn 99.995	2% HNO_3	500 H
Zr	1.000±0.002	CZ 90701FN1	Zr 99.98	1% HF + 5% HNO_3	100 H
	10.00 ±0.02	CZ 907010FN1	Zr 99.98	1% HF + 5% HNO_3	100 H

The table continues on the next page →

Element	Concentration (g/l)	Order number	Starting material and its purity (%)	Matrix (%, v/v)	Volume (ml)
Br^-	1.000 ± 0.002	CZ 90711H1	KBr 99.99	H_2O	100 H
	10.00 ± 0.02	CZ 907110H1	KBr 99.99	H_2O	100 H
Cl^-	1.000 ± 0.002	CZ 90721H1	KCl 99.99	H_2O	100 H
	1.000 ± 0.002	CZ 90721H5	KCl 99.99	H_2O	500 H
	10.00 ± 0.02	CZ 907210H1	KCl 99.99	H_2O	100 H
	1.000 ± 0.005	A 002	KCl 99.99	H_2O	500 H
F^-	1.000 ± 0.002	CZ 90731H1	NaF 99.98	H_2O	100 H
	1.000 ± 0.002	CZ 90731H5	NaF 99.98	H_2O	500 H
	10.00 ± 0.02	CZ 907310H1	NaF 99.98	H_2O	100 H
	1.000 ± 0.005	A 005	NaF 99.98	H_2O	500 H
I^-	1.000 ± 0.002	CZ 90741H1	KI 99.997	H_2O	100 H
	10.00 ± 0.02	CZ 907410H1	KI 99.997	H_2O	100 H
NO_2^-	1.000 ± 0.002	CZ 90751H1	$NaNO_2$ 99.99	H_2O	100 H
	1.000 ± 0.002	CZ 90751H5	$NaNO_2$ 99.99	H_2O	500 H
	10.00 ± 0.02	CZ 907510H1	$NaNO_2$ 99.99	H_2O	100 H
	1.000 ± 0.005	A 007	$NaNO_2$ 99.99	H_2O	500 H
NO_3^-	1.000 ± 0.002	CZ 90761H1	NH_4NO_3 99.999	H_2O	100 H
	1.000 ± 0.002	CZ 90761H5	NH_4NO_3 99.999	H_2O	500 H
	10.00 ± 0.02	CZ 907610H1	NH_4NO_3 99.999	H_2O	100 H
	1.000 ± 0.005	A 008	NH_4NO_3 99.999	H_2O	500 H
PO_4^{3-}	1.000 ± 0.002	CZ 90771H1	$NH_4H_2PO_4$ 99.999	H_2O	100 H
	1.000 ± 0.002	CZ 90771H5	$NH_4H_2PO_4$ 99.999	H_2O	500 H
	10.00 ± 0.02	CZ 907710H1	$NH_4H_2PO_4$ 99.999	H_2O	100 H
	1.000 ± 0.005	A 009	$NH_4H_2PO_4$ 99.999	H_2O	500 H
SO_4^{2-}	1.000 ± 0.002	CZ 90781H1	$(NH_4)_2SO_4$ 99.999	H_2O	100 H
	1.000 ± 0.002	CZ 90781H5	$(NH_4)_2SO_4$ 99.999	H_2O	500 H
	10.00 ± 0.02	CZ 907810H1	$(NH_4)_2SO_4$ 99.999	H_2O	100 H
	1.000 ± 0.005	A 011	$(NH_4)_2SO_4$ 99.999	H_2O	500 H
Cr^{6+}	1.000 ± 0.002	CZ 90791H1	$K_2Cr_2O_7$ 99.997	H_2O	100 H
	1.000 ± 0.002	CZ 90791H5	$K_2Cr_2O_7$ 99.997	H_2O	500 H
	10.00 ± 0.02	CZ 907910H1	$K_2Cr_2O_7$ 99.997	H_2O	100 H
	1.000 ± 0.005	C 001	$K_2Cr_2O_7$ 99.997	H_2O	500 H
NH_4^+	1.000 ± 0.002	CZ 90801H1	NH_4Cl 99.998	H_2O	100 H
	1.000 ± 0.002	CZ 90801H5	NH_4Cl 99.998	H_2O	500 H
	10.00 ± 0.02	CZ 908010H1	NH_4Cl 99.998	H_2O	100 H
	1.000 ± 0.005	C 002	NH_4Cl 99.998	H_2O	500 H

H – amber HDPE bottle
G – amber glass bottle

1.3 Multielement (ion) aqueous calibration solutions ASTASOL® - MIX

Volume: 100 ml

Elements	Concentrations and their uncertainties (mg/l)	Order number	Matrix (%, v/v)	Packing material
K, Li, Na	1000±2 (each)	CZ 9081MC1	2% HCl	HDPE
Ba, Ca, Mg, Sr	1000±2 (each)	CZ 9082MN1	2% HNO_3	HDPE
Ca, K, Mg, Na	Ca 100±0.2, K 150±0.3, Mg 20±0.04, Na 3300±6.6	CZ 9083MC1[a]	1% HCl	HDPE
Co, Cr, Cu, Fe, Mn, Ni, V	500±1 (each)	CZ 9084MN1	5% HNO_3	HDPE
As, Be, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, V, Zn	As 25±0.05, Be 10±0.02, Cd 2±0.004, Co 50±0.1, Cr 100±0.2, Cu 50±0.1, Hg 2±0.004, Mo 10±0.02, Ni 100±0.2, Pb 200±0.4, V 200±0.4, Zn 100±0.2	CZ 9085MCN1[b]	5% aqua regia	glass
Al, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Se, Tl, V, Zn	Al 100±0.2, B 20±0.04, Ba 5±0.01, Be 2±0.004, Cd 20±0.04, Co 50±0.1, Cr 20±0.04, Cu 20±0.04, Fe 20±0.04, Mn 10±0.02, Ni 50±0.1, Pb 200±0.4, Se 5±0.01, Tl 100±0.2, V 50±0.1, Zn 50±0.1	CZ 9086MN1[c,d]	10% HNO_3	HDPE
Au, Ir, Os, Pd, Pt, Rh, Ru	100±0.2 (each)	CZ 9087MC1[d]	20% HCl	glass
Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sc, Sm, Tb, Tm, Y, Yb	Ce 100±0.2, Dy 20±0.04, Er 20±0.04, Eu 20±0.04, Gd 20±0.04, Ho 20±0.04, La 100±0.2, Lu 20±0.04, Nd 100±0.2, Pr 100±0.2, Sc 20±0.04, Sm 20±0.04, Tb 20±0.04, Tm 20±0.04, Y 20±0.04, Yb 20±0.04	CZ 9088MN1	5% HNO_3	HDPE
Cd, Co, Cu, Cr, Mn, Ni, Pb, V, Zn	100±0.2 (each)	CZ 9089MN1	5% HNO_3	HDPE
Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Se, Sr, Ti, Tl, V, Zn	100±0.2 (each)	CZ 9090MN1	5% HNO_3	HDPE
Ca, K, Mg, Na	1000±2 (each)	CZ 9091MN1	2% HNO_3	HDPE
Al, B, Ba, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Zn	1000±2 (each)	CZ9092MN1	10% HNO_3	HDPE
Al, Ba, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Na, Ni, Pb, Ti, Zn	100±0.2 (each)	CZ 9093MN1	5% HNO_3	HDPE
As, Be, Ca, Cd, Co, Cr, Cu, Fe, Li, Mg, Mn, Mo, Ni, P, Pb, Sb, Se, Sn, Sr, Ti, Tl, V, Zn	100±0.2 (each)	CZ 9094MFN1	5% HNO_3 0.2% HF	HDPE

The table continues on the next page →

Elements	Concentrations and their uncertainties (mg/l)	Order number	Matrix (%, v/v)	Packing material
Al, Be, Bi, Cd, Co, Cu, Fe, Li, Mn, Mo, Ni, Pb, Si, Sr, V, W, Zn, Zr	100±0.2 (each)	CZ 9095MN1[e]	5% HNO_3	HDPE
As, Sb, Se, Sn	100±0.2 (each)	CZ 9096MN1[e]	5% HNO_3	HDPE
Ca, K, Mg, Na, P, S	100±0.2 (each)	CZ 9097MN1[e]	1% HNO_3	HDPE
As, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Ti, Tl, V, Zn	100±0.2 (each)	CZ 9098MN1[f]	5% HNO_3	HDPE
Ag, Hg	100±0.2 (each)	CZ 9099MN1[e]	5% HNO_3	glass
Br^-, Cl^-, F^-	1000±2 (each)	CZ 9100MH1	H_2O	HDPE
NO_3^-, PO_4^{3-}, SO_4^{2-}	1000±2 (each)	CZ 9101MH1	H_2O	HDPE
Br^-, Cl^-, F^-, NO_3^-, PO_4^{3-}, SO_4^{2-}	100±0.2 (each)	CZ 9102MH1	H_2O	HDPE
Ba, Ca, K, Li, Mg, Na, NH_4^+, Sr	100±0.2 (each)	CZ 9103MH1	H_2O	HDPE

a) Blood serum matrix
b) Recommended for the determination of toxic elements in soils
c) Recommended for the evaluation of the waste leaches
d) Shelf-life 12 months
e) Recommended for use in water analysis according to EN ISO 11885: 1997 (the concentrate to be diluted 10x)
f) Recommended for EPA method No. 200.7 and 600/482-055

1.4 Tuning, verification and internal standard solutions for ICP-MS

Volume: 100 ml

Elements	Concentrations and their uncertainties (mg/l)	Order number	Matrix (%, v/v)	Packing material
Ba, Be, Bi, Ce, Co, In, Li, Ni, Pb, U	10.0±0.1 (each)	TUNE 1	5% HNO_3	HDPE
Ca, Fe, K, Li, Na	10.0±0.1 (each)	TUNE 2	5% HNO_3	HDPE
Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, In, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Se, Tl, V, U, Zn	10.0±0.1 (each)	TUNE 3	5% HNO_3	HDPE
As, In, Pb, Se, V	10.0±0.1 (each)	TUNE 4	5% HNO_3	HDPE
Bi, In, Sc, Tb, Y	10.0±0.1 (each)	INT-MIX 1	5% HNO_3	HDPE
Au, Rh	10.0±0.1 (each)	INT-MIX 2	5% HCl	glass

1.5. Auxiliary reagents: deionizers, releasing agents, matrix modifiers

The offer covers the most popular support reagents such as deionizers and releasing agents (for flame AAS) and matrix modifiers (for electrothermal AAS). All these reagents are prepared from starting materials of the highest available purity.

Order number	Agent and its concentration (g/l)		Starting material and its purity(%)		Matrix (%, v/v)	Volume (ml)[d]
V001	CsCl	25	CsCl	99.997	H_2O	500 H
V002	KCl	25	KCl	99.999	H_2O	500 H
V003	$LaCl_3$	25	La_2O_3	99.999	2% HCl	500 H
V004	$AlCl_3$	25	Al	99.999	2% HCl	500 H
V0041[a]	CsCl + $Al(NO_3)_2 \cdot 9H_2O$	5 250	CsCl Al	99.997 99.999	H_2O	250 H
V0042[b]	CsCl + $La(LaCl_3)$	10 100	CsCl La_2O_3	99.997 99.999	2% HCl	250 H
V005	Pd	2	Pd	99.999	5% HNO_3	50 G
V0051	Pd	10	Pd	99.999	5% HNO_3	25 G
V006	Mg	2	Mg $(NO_3)_2 \cdot 6H_2O$	99.998	0, 2% HNO_3	50 H
V0061	Mg	10	Mg $(NO_3)_2 \cdot 6H_2O$	99.998	0, 2% HNO_3	25 H
V007[c]	$NH_4H_2PO_4$	200	$NH_4H_2PO_4$	99.999	H_2O	50 H
V008[c]	Ascorbic acid	10	Ascorbic acid	99+	H_2O	50 H
V009	$Ni(NO_3)_2$	10	$Ni(NO_3)_2 \cdot 6H_2O$	99.998	1% HNO_3	50 H
V0091	$Ni(NO_3)_2$	50	$Ni(NO_3)_2 \cdot 6H_2O$	99.998	1% HNO_3	25 H
V010	NH_4NO_3	50	NH_4NO_3	99.999	1% HNO_3	50 H
V011	$Ca(NO_3)_2$	20	$Ca(NO_3)_2 \cdot 4H_2O$	99.999	1% HNO_3	25 H

a) Spectroscopic buffer by Schuhknecht and Schinkel
b) Spectroscopic buffer by Schinkel
c) Solid material ready to use after dilution to 50 ml with deionized water
d) H – amber HDPE bottle, G – amber glass bottle

1.6 Calibration solutions ASTASOL® - IC for ion chromatography

These certified reference materials are prepared from the highest purity starting primary substances (typically better than 99.99%) and ultrapure demineralized water (conductivity ≤0.5µS/cm). They are filtered through membrane ultrafiltres (0.45µm) to prevent clogging of chromatographic columns. Some of these solutions are practically identical with those listed for the particular analyte in previous tables. A suffix "IC" added to their catalogue number shows that they are filtered and recommended for use in ion chromatography. The solutions are prepared in water or 0.005% (v/v) HNO_3 matrix with a fungicide additive to ensure their long-term stability. Packing size is 100 ml.

1.6.1 Certified single element (ion) calibration solutions

Element (analyte)	Concentration and its uncertainty(g/l)	Order number	Starting material and its purity (%)		Matrix (%, v/v)	Packing material
Ba	1.000±0.002	CZ90061H1IC	$Ba(NO_3)_2$	99.995	H_2O	HDPE
Ca	1.000±0.002	CZ90091H1IC	$Ca(NO_3)_2$	99.99	H_2O	HDPE
Cs	1.000±0.002	CZ90141H1IC	$CsNO_3$	99.999	H_2O	HDPE

The table continues on the next page →

Element (analyte)	Concentration and its uncertainty(g/l)	Order number	Starting material and its purity (%)	Matrix (%, v/v)	Packing material
K	1.000±0.002	CZ90281N1IC	KNO_3 99.995	0.005% HNO_3	HDPE
Li	1.000±0.002	CZ90301N1IC	$LiNO_3$ 99.997	0.005% HNO_3	HDPE
Mg	1.000±0.002	CZ90321H1IC	$Mg(NO_3)_2$ 99.995	H_2O	HDPE
Na	1.000±0.002	CZ90351N1IC	$NaNO_3$ 99.999	0.005% HNO_3	HDPE
Rb	1.000±0.002	CZ90451N1IC	$RbNO_3$ 99.995	0.005% HNO_3	HDPE
Sr	1.000±0.002	CZ90561N1IC	$Sr(NO_3)_2$ 99.995	0.005% HNO_3	HDPE
Br^-	1.000±0.002	CZ90711H1IC	KBr 99.99	H_2O	HDPE
Cl^-	1.000±0.002	CZ9072141IC	KCl 99.999	H_2O	HDPE
F^-	1.000±0.002	CZ90731H1IC	NaF 99.99	H_2O	HDPE
NO_2^-	1.000±0.002	CZ90751H1IC	$NaNO_2$ 99.99	H_2O	HDPE
NO_3^-	1.000±0.002	CZ90761H1IC	NH_4NO_3 99.999	H_2O	HDPE
PO_4^{3-}	1.000±0.002	CZ90771H1IC	$NH_4H_2PO_4$ 99.999	H_2O	HDPE
SO_4^{2-}	1.000±0.002	CZ90781H1IC	$(NH_4)_2SO_4$ 99.999	H_2O	HDPE
NH_4^+	1.000±0.002	CZ90801H1IC	NH_4Cl 99.998	H_2O	HDPE

1.6.2 Certified multielement (ion) calibration solutions

Element (analyte)	Concentration and its uncertainty (mg/l)	Order number	Matrix (%, v/v)	Packing material
Br^-, Cl^-, F^-	1000±2 (each)	CZ9100MH1IC	H_2O	HDPE
NO_3^-, PO_4^{3-}, SO_4^{2-}	1000±2 (each)	CZ9101MH1IC	H_2O	HDPE
Br^-, Cl^-, F^-, NO_3^-, PO_4^{3-}, SO_4^{2-}	100±0.2 (each)	CZ9102MH1IC	H_2O	HDPE
Ba, Ca, K, Li, Mg, Na, NH_4^+, Sr	100±0.2 (each)	CZ9103MH1IC	H_2O	HDPE
NH_4^+ – N, NO_3^- – N, PO_4^{3-} – P, SO_4^{2-} – S	100±0.2 (each)	CZ9107MH1IC*	H_2O	HDPE

*) Concentrations are 100 mg/l as the element

1.6.3 Uncertified calibration solutions

Volume: 100 ml

Analyte	Starting material and its purity (%)	Concentration and its uncertainty (g/l)	Order number	Matrix (%, v/v)	Packing material
Formate, $HCOO^-$	$HCOONH_4$ 99.0	1.000±0.01	OIC001	H_2O	HDPE
Acetate, CH_3COO^-	CH_3COONH_4 99.99	1.000±0.005	OIC002	H_2O	HDPE
Oxalate, $(COO)_2^{2-}$	$(COO)_2(NH_4)_2 \cdot H_2O$ 99.99	1.000±0.005	OIC003	H_2O	HDPE
Tartrate, $(CHOH)_2(COO)_2^{2-}$	$(CHOH)_2(COO)_2(NH_4)_2$ 99.0	1.000±0.01	OIC004	H_2O	HDPE

1.6.4. Eluents (concetrates)

Order number	Eluent	Volume (ml)* Packing
IC-CON 1 ($0.25M\ Na_2CO_3$)	Concentrate to make 5l $0.005M\ Na_2CO_3$	100 HDPE
IC-CON 2 ($0.25M\ NaHCO_{3)}$	Concentrate to make 5l $0.005M\ NaHCO_3$	100 HDPE
IC-CON 3 ($0.125M\ Na_2CO_3 + 0.125M\ NaHCO_3$)	Concentrate to make 5l $0.0025M\ Na_2CO_3 + 0.0025M\ NaHCO_3$	100 HDPE
IC-CON 4 (0.25M HCl)	Concentrate to make 5l 0.005M HCl	100 HDPE

*) Dilute to the volume (100 ml to 5 l) quantitatively with a demineralized water to get 5 l of a fresh mobile phase

1.7 Calibration solutions for the determination of organic and inorganic carbon*

Analyte	Concentration and its uncertainty (g/l)	Order number	Starting material and its purity (%)	Matrix (v/v)	Volume (ml) Packing
C_{inorg} (TIC)	1.000 ± 0.002	TIC1H5	Na_2CO_3 99.999 $NaHCO_3$ 99.99+ 1 : 1	H_2O	500 glass
C_{org} (TOC)	1.000 ± 0.002	TOC1H5	Potassium hydrogenphthalate 99.99+	H_2O	500 glass
$C_{inorg} + C_{org}$ TIC + TOC (1 : 1)	1.000 ± 0.002	TIOCH5		H_2O	500 glass

*) For use with EN 1484-43

1.8 Single element calibration solutions ASTASOL® - OS in oil (1.000 ± 0.005 g/kg)

(Supplied with a Certificate of Analysis)

Order number	Element		Quantity (g)
SOS001	Al	Aluminium	100 H
SOS002	Ba	Barium	100 H
SOS003	Ca	Calcium	100 H
SOS004	Cd	Cadmium	100 H
SOS005	Cr	Chromium	100 H
SOS006	Cu	Copper	100 H
SOS007	Fe	Iron	100 H
SOS008	K	Potassium	100 H
SOS009	Mg	Magnesium	100 H
SOS010	Mn	Manganese	100 H
SOS011	Na	Sodium	100 H
SOS012	Ni	Nickel	100 H
SOS013	P	Phosphorus	100 H
SOS014	Pb	Lead	100 H
SOS015	Si	Silicon	100 H
SOS016	Sn	Tin	100 H

The table continues on the next page →

Order number	Element		Quantity (g)
SOS017	V	Vanadium	100 H
SOS018	Zn	Zinc	100 H
SOS019	Ag	Silver	100 H
SOS020	B	Boron	100 H
SOS021	Be	Beryllium	100 H
SOS022	Mo	Molybdenum	100 H
SOS023	Sb	Antimony	100 H
SOS024	Sc	Scandium	100 H
SOS025	Ti	Titanium	100 H
SOS026	Co	Cobalt	100 H
SOS100	Base oil		500 H

a) Starting material is an organometallic oil concentrate
b) H – amber HDPE bottle

Multielement oil calibration standard solutions ASTASOL® - OS MIX can be made on request.

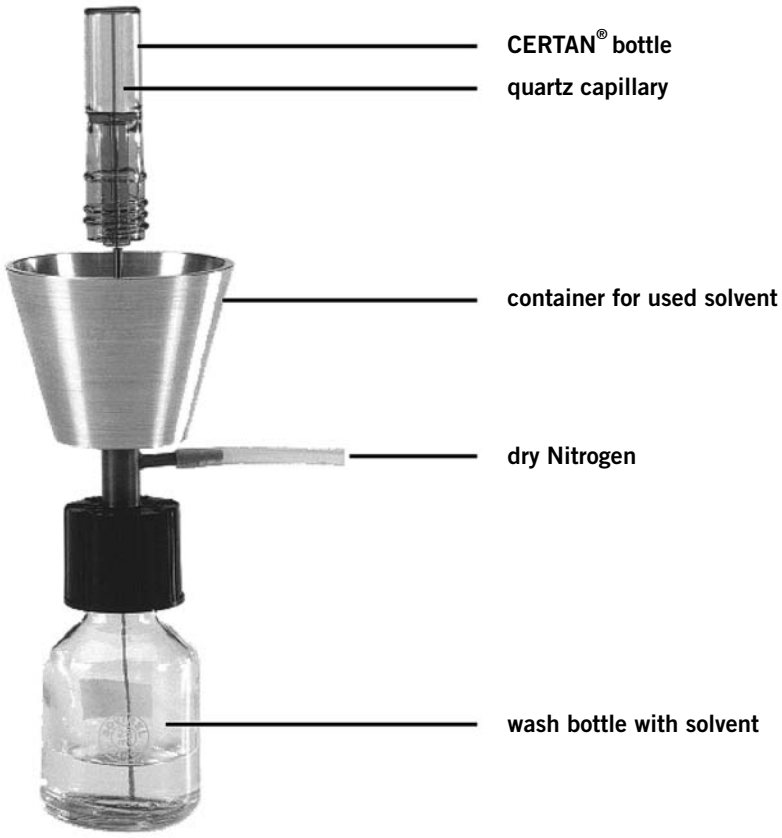
2. ASTASOL® - CH: CALIBRATION STANDARD SOLUTIONS FOR CHROMATOGRAPHY IN CERTAN® CAPILLARY BOTTLES

2.1. Introduction

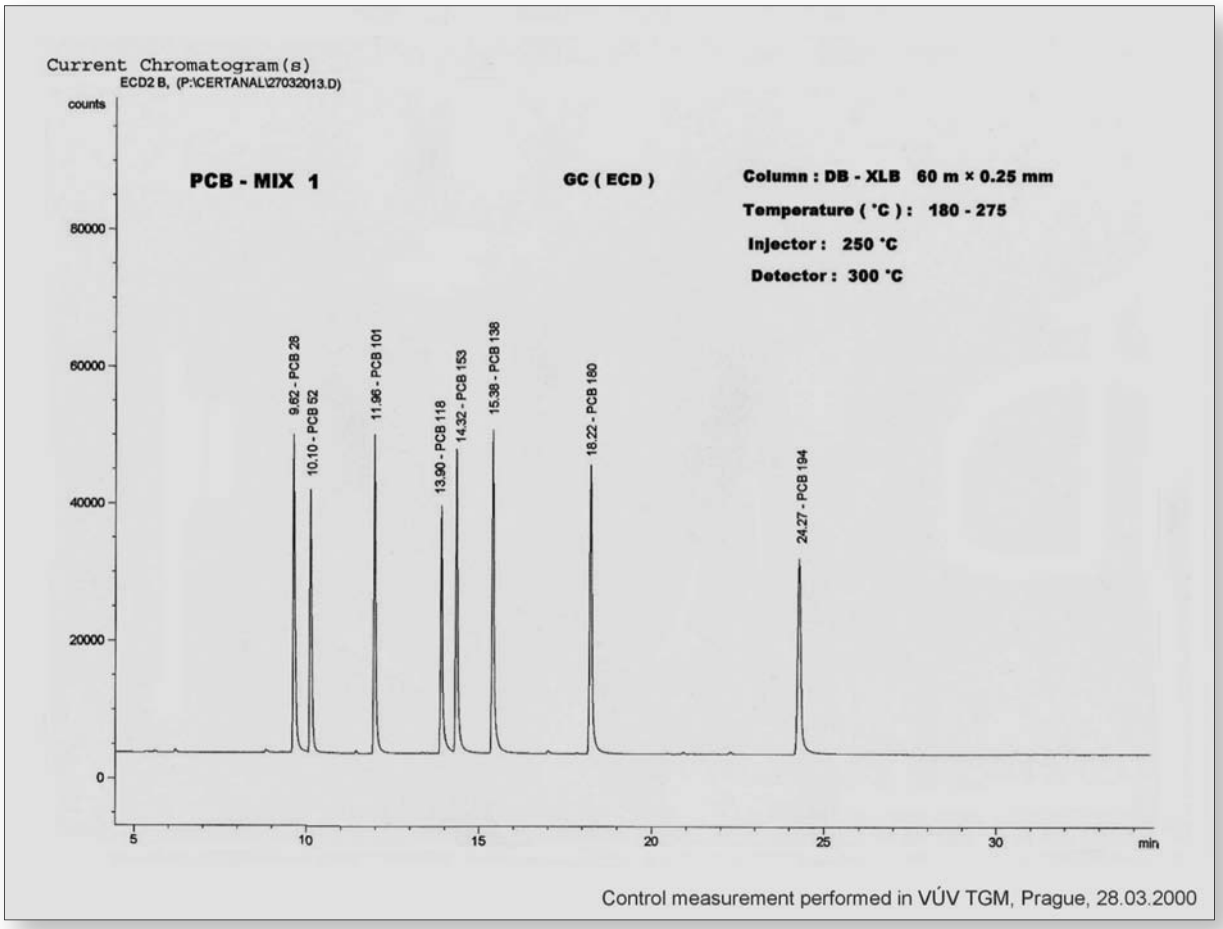
Five years ago, ANALYTIKA® Ltd. introduced on the market a new line of calibration solutions for chromatography in CERTAN® capillary bottles. CERTAN® from Promochem GmbH (Wesel, Germany) combines the advantages of sealed glass ampoules and screw capped bottles. The capillary serves as a recondensation zone for the solvent thus limiting the loss of volatile organic solvent and reducing the sealing surface of the inside of the cap. Together these features ensure a perfect seal and guarantee an unchanging concentration of analytes in the solution for a long time. Another advantage is easy filling and removal of aliquots with a normal „GC“ syringe.

CERTAN® capillary bottles can be cleaned effectively and thus reused many times. A simple washing apparatus is shown at the picture bellow. Pressure from a standard nitrogen (or argon) gas cylinder pumps the solvent (toluene is recommended) through the capillary into the CERTAN® bottle and by spraying from the capillary it washes the bottle (as well as the capillary itself) completely. After all the solvent is used the CERTAN® bottle is first dried by the nitrogen flow. Then the bottle should be heated in a suitable oven at approximately 150 – 200 °C for two hours. Finally, the remaining vapour of the solvent inside the bottle is removed by the dry nitrogen flow.

At present, our offer of chromatographic standards in CERTAN® bottles covers the most frequently used standards (solutions of individual compounds as well as mixes) for the determination of PAH's (Polycyclic Aromatic Hydrocarbons), PCB's (Polychlorinated Biphenyls), VOC´s (Volatile Organic Compounds), pesticides, chlorophenols, nitrosamines and phthalates . Other single – as well as multianalyte solutions are added continuously.



ASTASOL® - CH standards are filled into 1.5, 4.5 and 10 ml CERTAN® bottles. Each bottle is packed in a plastic case (from clear polystyrene). An attached certificate (usually including a control chromatogram) describes in detail the gravimetric preparation and potentional traceability (see examples further in this chapter). Customised calibration solutions can be made on request.



Certificate of quality

ASTASOL® - CH

CALIBRATION STANDARD SOLUTION FOR CHROMATOGRAPHY IN CERTAN® CAPILLARY BOTTLE

Catalogue order number:	**CE 150 10I**
Trade name:	**PCB MIX - 1**
Analytes and concentrations (at 20 °C) :	**PCB No. 28, 52, 101, 118, 138, 153, 180, 194** **10 ± 0.1 µg/ ml (each component)**
Matrix solvent:	iso - Octane (pesticide grade) , Scharlau - Chemie, S.A.
Starting materials:	PCB 28 2, 4, 4´- Trichlorobiphenyl, certified, Promochem PCB 52 2, 2´, 5, 5´- Tetrachlorobiphenyl, certified, Promochem PCB 101 2, 2´, 4, 5, 5´- Pentachlorobiphenyl, certified, Promochem PCB 118 2, 3´, 4, 4´, 5- Pentachlorobiphenyl, certified, Promochem PCB 138 2, 2´, 3, 4, 4´, 5´- Hexachlorobiphenyl, certified, Promochem PCB 153 2, 2´, 4, 4´, 5, 5´- Hexachlorobiphenyl, certified, Promochem PCB 180 2, 2´, 3, 4, 4´, 5, 5´- Heptachlorobiphenyl, certified, Promochem PCB 194 2, 2´, 3, 3´, 4, 4´, 5, 5´- Octachlorobiphenyl, Promochem
Gravimetric preparation and traceability:	The single components are weighed by using an electronic microbalances (Mettler MT 5 capable of weighing to 0.000001g with a built in automatic calibration function) dissolved and transferred into a calibrated volumetric flask (class A glassware).The necessary weight of the neat material to compensate the difference of the purity of the compound to 100% is taken into account. The tolerance of the weighing procedure and the dilution error adds to a maximum of ± 0.5% . Quality control of nominal composition of this solution can be done by comparing the concentrations of this solution with those of an independent internal standard solution traceable to BCR CRM 291, 293, 296, 297, 298, 365 or to NIST SRM 1493 and 2262. A representative chromatogram from the GC analysis of the original solution is shown in the figure enclosed. The control measurement was performed in chromatographic laboratories of the Water Research Institute, Prague.
Packing material:	10 ml amber glass CERTAN® bottle. CERTAN® is a trade-mark of special containers registered by Promochem GmbH, Wesel, Germany.
Storage:	The bottle should be stored in the dark at temperatures 5 - 10 °C . Solution aliquots for analysis should be withdrawn at 20 °C immediately after opening the bottle, the bottle should be again tightly capped within 1-2 minutes.

Certificate valid till: ☐ ***Batch number:*** ☐

ANALYTIKA® Ltd .
Ke Klíčovu 816
190 00 Prague 9
Czech Republic
tel./fax: +420-2-86589616

Signed by .....
Managing Director

2.2 Calibration solutions for the determination of polycyclic aromatic hydrocarbons (PAH)

2.2.1 Single analyte calibration solutions

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
CE055 1.5M	anthracene	100	CERTAN® 1.5 ml
CE054 1.5M	benzo(a)pyrene	100	CERTAN® 1.5 ml
CE053 1.5M	fluoranthene	100	CERTAN® 1.5 ml
CE056 1.5M	chrysene	100	CERTAN® 1.5 ml
CE051 1.5A	2-methylnaphtalene	10	CERTAN® 1.5 ml
CE050 4.5M	naphtalene	1000	CERTAN® 4.5 ml
CE052 1.5M	phenanthrene	100	CERTAN® 1.5 ml
CE057 1.5M	pyrene	100	CERTAN® 1.5 ml
CE058 1.5A	indeno(1,2,3,cd)pyrene	10	CERTAN® 1.5 ml

M – methanol, A – acetonitrile

2.2.2 Multianalyte calibration solutions

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
CE001 1.5A	**PAH MIX–1 (WHO)**		CERTAN® 1.5 ml
CE001 4.5A			CERTAN® 4.5 ml
	benzo(b)fluoranthene	20	
	benzo(k)fluoranthene	20	
	benzo(g, h, I)perylene	20	
	benzo(a)pyrene	20	
	fluoranthene	50	
	indeno(1, 2, 3, c, d)pyrene	50	
CE002 4.5A	**PAH MIX–2 (EPA 610)**		CERTAN® 4.5 ml
CE002 4.5C			CERTAN® 4.5 ml
	acenaphtene acenaphtylene anthracene benzo(a)anthracene benzo(b)fluoranthene benzo(k)fluoranthene benzo(g, h, i)perylene benzo(a)pyrene dibenzo(a, h)anthracene fluoranthene fluorene chrysene indeno(1, 2, 3, c, d)pyrene naphtalene phenanthrene pyrene	10 (each)	

The table continues on the next page →

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
CE003 1.5A	**PAH MIX–3 (EPA 610)**		CERTAN® 1.5 ml
	acenaphtene	500	
	acenaphtylene	800	
	anthracene	100	
	benzo(a)anthracene	100	
	benzo(b)fluoranthene	200	
	benzo(k)fluoranthene	100	
	benzo(g, h, I)perylene	200	
	benzo(a)pyrene	100	
	dibenzo(a, h)anthracene	200	
	fluoranthene	200	
	fluorene	200	
	chrysene	100	
	naphtalene	500	
	indeno(1, 2, 3, c, d)pyrene	100	
	phenanthrene	100	
	pyrene	100	
CE004 1.5A	**PAH MIX–4**		CERTAN® 1.5 ml
	benzo(a)pyrene	100	
	fluoranthene	200	
CE005 4.5T	**PAH MIX–5 (EPA 610)**		CERTAN® 4.5 ml
	acenaphtene acenaphtylene anthracene benzo(a)anthracene benzo(b)fluoranthene benzo(k)fluoranthene benzo(g, h, i)perylene benzo(a)pyrene dibenzo(a, h)anthracene fluoranthene fluorene chrysene indeno(1, 2, 3, c, d)pyrene naphtalene phenanthrene pyrene	100 (each)	
CE006 1.5M	**PAH MIX–6**		CERTAN® 1.5 ml
CE006 4.5M			CERTAN® 4.5 ml
	anthracene	10	
	benzo(k)fluoranthene	5	
	benzo(a)anthracene	10	

The table continues on the next page →

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
	PAH MIX–6 (continued)		
	benzo(a)pyrene	10	
	benzo(b)fluoranthene	20	
	benzo(g, h, i)perylene	20	
	dibenzo(a, h)anthracene	20	
	fluoranthene	20	
	chrysene	10	
	indeno(1, 2, 3, c, d)pyrene	20	
	naphtalene	40	
	pyrene	40	
CE007 4.5A	**PAH MIX–7 (EEC directive)**		CERTAN® 4.5 ml
	indeno(1, 2, 3, c, d)pyrene	10	
	benzo(g, h, i)perylene	10	
	benzo(a)pyrene	10	
	fluoranthene	10	
	benzo(b)fluoranthene	10	
	benzo(k)fluoranthene	10	

I – iso-octane, C – cyclohexane, M – methanol, N – acetone, A – acetonitrile

2.3 Calibration solutions for the determination of polychlorinated biphenyls (PCB)

2.3.1 Single analyte calibration solutions

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
CE100 1.5I	**PCB S028**		CERTAN® 1.5 ml
	PCB, congener No.28	50	
CE106 1.5I	**PCB S031**		CERTAN® 1.5 ml
	PCB, congener No.31	50	
CE101 1.5I	**PCB S052**		CERTAN® 1.5 ml
	PCB, congener No.52	50	
CE107 1.5I	**PCB S077**		CERTAN® 1.5 ml
	PCB, congener No.77	50	
CE115 1.5I	**PCB S081**		CERTAN® 1.5 ml
	PCB, congener No.81	50	
CE102 1.5I	**PCB S101**		CERTAN® 1.5 ml
	PCB, congener No.101	50	
CE108 1.5I	**PCB S110**		CERTAN® 1.5 ml
	PCB, congener No.110	50	
CE109 1.5I	**PCB S118**		CERTAN® 1.5 ml
	PCB, congener No.118	50	

The table continues on the next page →

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
CE116 1.5I	**PCB S126**		CERTAN® 1.5 ml
	PCB, congener No.126	50	
CE103 1.5I	**PCB S138**		CERTAN® 1.5 ml
	PCB, congener No.138	50	
CE110 1.5I	**PCB S149**		CERTAN® 1.5 ml
	PCB, congener No.149	50	
CE104 1.5I	**PCB S153**		CERTAN® 1.5 ml
	PCB, congener No. 153	50	
CE111 1.5I	**PCB S163**		CERTAN® 1.5 ml
	PCB, congener No.163	50	
CE117 1.5I	**PCB S169**		CERTAN® 1.5 ml
	PCB, congener No.169	50	
CE112 1.5I	**PCB S170**		CERTAN® 1.5 ml
	PCB, congener No.170	50	
CE105 1.5I	**PCB S180**		CERTAN® 1.5 ml
	PCB, congener No.180	50	
CE113 1.5I	**PCB S187**		CERTAN® 1.5 ml
	PCB, congener No.187	50	
CE114 1.5I	**PCB S194**		CERTAN® 1.5 ml
	PCB, congener No.194	50	

I – iso-octane

2.3.2 Multianalyte calibration solutions

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
CE150 10I	**PCB MIX–1**		CERTAN® 10 ml
	PCB congeners No.: 28, 52, 101, 118, 138, 153, 180, 194	10 (each)	
CE151 4.5M	**PCB MIX–2**		CERTAN® 4.5 ml
CE151 10M			CERTAN® 10 ml
	PCB congeners No.: 28, 52, 101, 118, 138, 153, 180, 194	1 (each)	
CE152 4.5I	**PCB MIX–3**		CERTAN® 4.5 ml
	PCB congeners No.: 28, 31, 52, 77, 101, 110, 118, 138, 149, 153, 163, 170, 180, 187, 194	10 (each)	
CE153 1.5I	**PCB MIX–4**		CERTAN® 1.5 ml
	PCB congeners No.: 28, 52, 101, 138, 153, 180	20 (each)	
CE154 4.5N	**PCB MIX–5**		CERTAN® 4.5 ml
	PCB congeners No.: 28, 52, 101, 138, 153, 180	2 (each)	
CE155 4.5I	**PCB MIX–6**		CERTAN® 4.5 ml
	Aroclor 1242	100	

The table continues on the next page →

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
CE156 4.5I	**PCB MIX–7**		CERTAN® 4.5 ml
	Aroclor 1260	100	
CE157 10I	**PCB MIX–8**		CERTAN® 10 ml
	Aroclor 1242 Aroclor 1260	100 (each)	
CE158 1.5I	**PCB MIX–9 Non-ortho PCB**		CERTAN® 1.5 ml
	PCB congeners No.: 77, 81, 126, 169	10 (each)	

I – iso-octane, C – cyclohexane, M – methanol, N – acetone, A – acetonitrile

2.4 Calibration solutions for the determination of volatile organic compounds (VOC, BTEX)

2.4.1 Single analyte calibration solutions

Order number	Trade name Analyte(s) and concentration	µg/ml	Volume (ml)
CE200 4.5M	benzene	5000	CERTAN® 4.5 ml
CE235 4.5I	bromodichloromethane	1000	CERTAN® 4.5 ml
CE233 4.5I	dibromochloromethane	1000	CERTAN® 4.5 ml
CE228 4.5M	1,2-dichlorobenzene	1000	CERTAN® 4.5 ml
CE229 4.5M	1,3-dichlorobenzene	1000	CERTAN® 4.5 ml
CE230 4.5M	1,4-dichlorobenzene	1000	CERTAN® 4.5 ml
CE222 4.5M	1,2-dichloroethane	5000	CERTAN® 4.5 ml
CE223 1.5M	1,1-dichloroethylene	1000	CERTAN® 1.5 ml
CE223 4.5M	1,1-dichloroethylene	1000	CERTAN® 4.5 ml
CE224 1.5M	cis 1,2-dichloroethylene	1000	CERTAN® 1.5 ml
CE224 4.5M	cis 1,2-dichloroethylene	1000	CERTAN® 4.5 ml
CE201 4.5M	ethylbenzene	5000	CERTAN® 4.5 ml
CE227 4.5M	chlorobenzene	1000	CERTAN® 4.5 ml
CE206 4.5M	styrene	2000	CERTAN® 4.5 ml
CE221 4.5M	tetrachloromethane	5000	CERTAN® 4.5 ml
CE226 4.5M	1,1,2,2-tetrachloroethylene	5000	CERTAN® 4.5 ml
CE202 4.5M	toluene	5000	CERTAN® 4.5 ml
CE231 4.5I	tribromomethane (bromoform)	1000	CERTAN® 4.5 ml
CE225 4.5M	1,1,2-trichloroethylene	5000	CERTAN® 4.5 ml
CE220 4.5M	trichloromethane (chloroform)	5000	CERTAN® 4.5 ml
CE237 1.5M	vinylchloride	200	CERTAN® 1.5 ml
CE203 4.5M	o-xylene	5000	CERTAN® 4.5 ml
CE204 4.5M	m-xylene	5000	CERTAN® 4.5 ml
CE205 4.5M	p-xylene	5000	CERTAN® 4.5 ml

2.4.2 Multianalyte calibration solutions

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE210 1.5M	**BTEX MIX–1**			CERTAN®1.5 ml
CE210 4.5M				CERTAN®4.5 ml
		benzene, ethylbenzene, toluene, o-xylene, m-xylene, p-xylene	2000 (each)	
CE211 1.5M	**BTEX MIX–2**			CERTAN® 1.5 ml
CE211 4.5M				CERTAN® 4.5 ml
		benzene, ethylbenzene, toluene, o-xylene, m-xylene, p-xylene, styrene	1000 (each)	
CE280 1.5M	**VOC MIX – 1**			CERTAN® 1.5 ml
CE280 4.5M				CERTAN® 4.5 ml
		trichloromethane, tetrachloromethane, 1,2-dichloroethane, 1,1-dichloroethylene, cis 1,2-dichloroethylene, 1,1,2-trichloroethylene, 1,1,2,2-tetrachloroethylene, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene	1000 (each)	
CE281 10l	**VOC MIX–2**			CERTAN® 10 ml
CE281 1.5M				CERTAN® 1.5 ml
		trichloromethane, tetrachloromethane, 1,2-dichloroethane, 1,1,2-trichloroethylene, 1,1,2,2-tetrachloroethylene, tribromomethane, dibromochloromethane, bromodichloromethane	1000 (each)	
CE282 1.5M	**VOC MIX–3**			CERTAN® 1.5 ml
CE282 4.5M				CERTAN® 4.5 ml
		dibromomethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,2-dichloropropane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2,2-tetrachloroethylene, tetrachloromethane, tribromomethane, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloromethane, 1,1,2-trichloroethylene, 1,2,3-trichloropropane	100 (each)	

The table continues on the next page →

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE283 1.5M	**VOC MIX–4**			CERTAN® 1.5 ml
CE283 4.5M				CERTAN® 4.5 ml
		bromobenzene, bromodichloromethane, chlorobenzene, dibromochloromethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, dichloromethane, cis-1,3-dichloropropylene, trans-1,3-dichloropropylene	100 (each)	
CE284 4.5M	**VOC MIX–5**			CERTAN® 4.5 ml
		1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, 1,1,2-trichloroethylene, 1,1,2,2-tetrachloroethylene	1000 (each)	
CE285 4.5M	**VOC MIX–6**			CERTAN® 4.5 ml
		tribromomethane, trichloromethane, bromodichloromethane, dibromochloromethane	1000 (each)	
CE286 4.5M	**VOC MIX–7**			CERTAN® 4.5 ml
		ethylbenzene, benzene, toluene, o-xylene, m-xylene	10 (each)	
		styrene, 1,1,1-trichloroethane	10 (each)	
		cis-1,2-dichloroethylene, 1,1,2-trichloroethylene	20 (each)	
		tribromomethane, 1,1,2,2-tetrachloroethylene	20 (each)	
		dibromochloromethane, bromodichloromethane	20 (each)	
		1,2-dichlorobenzene, 1,3-dichlorobenzene,	4 (each)	
		1,4-dichlorobenzene	4	
		chlorobenzene	5	
		tetrachloromethane	7,50	
		1,2-dichloroethane	25	
		trichloromethane	60	

I – iso-octane, M – methanol

2.5 Calibration solutions for the determination of pesticides (metabolites)

2.5.1 Single analyte calibration solutions (1 mg/ml) in CERTAN® 4.5 ml bottle

Order number	Analyte	Solvent
CE439 4.5A	**aldicarb**	acetonitrile
CE400 4.5A	**aldrin**	acetonitrile
CE400 1.5I	**aldrin**	iso-octane
CE467 4.5M	**ametryn**	methanol
CE440 4.5A	**atrazine**	acetonitrile
CE468 4.5M	**atrazine-desethyl**	methanol
CE428 4.5A	**azinphos-methyl**	acetonitrile
CE428 4.5I	**azinphos-methyl**	iso-octane
CE441 4.5A	**bentazone**	acetonitrile
CE401 4.5C	**chlorpyriphos-ethyl**	cyclohexane
CE402 4.5C	**chlorpyriphos-methyl**	cyclohexane
CE434 4.5C	**cis-chlordane**	cyclohexane
CE435 4.5C	**trans-chlordane**	cyclohexane
CE442 4.5A	**chlortoluron**	acetonitrile
CE443 4.5A	**cyanazine**	acetonitrile
CE445 4.5A	**2,4-D**	acetonitrile
CE403 4.5C	**4,4´-DDA**	cyclohexane
CE404 4.5C	**2,4´-DDD**	cyclohexane
CE405 4.5C	**4,4´-DDD**	cyclohexane
CE444 4.5C	**2,4´-DDE**	cyclohexane
CE406 4.5C	**4,4´-DDE**	cyclohexane
CE407 4.5C	**2,4´-DDT**	cyclohexane
CE408 4.5C	**4,4´-DDT**	cyclohexane
CE470 4.5A	**diazinon**	acetonitrile
CE446 4.5A	**dicamba**	acetonitrile
CE447 4.5A	**dichlorprop**	acetonitrile
CE471 4.5A	**dichlorvos**	acetonitrile
CE409 4.5C	**dieldrin**	cyclohexane
CE429 4.5A	**dimethoat**	acetonitrile
CE429 4.5I	**dimethoat**	iso-octane
CE448 4.5A	**dinoseb**	acetonitrile
CE472 4.5N	**diuron**	acetone
CE410 4.5I	**alfa-endosulfan**	iso-octane
CE411 4.5I	**beta-endosulfan**	iso-octane
CE412 4.5I	**endrin**	iso-octane
CE449 4.5M	**endrin-aldehyde**	methanol
CE430 4.5A	**fenitrothion**	acetonitrile
CE430 4.5I	**fenitrothion**	iso-octane
CE413 4.5M	**alfa-HCH**	methanol
CE414 4.5M	**beta-HCH**	methanol
CE415 4.5M	**gama-HCH (lindane)**	methanol
CE416 4.5M	**delta-HCH**	methanol
CE417 4.5I	**heptachlor**	iso-octane

The table continues on the next page →

Order number	Analyte	Solvent
CE427 1.5I	**heptachlor-epoxide (A+B 1 : 1)**	iso-octane
CE450 4.5M	**heptachlor-epoxide (B)**	methanol
CE418 4.5I	**hexachlorobenzene**	iso-octane
CE473 4.5M	**hexazinon**	methanol
CE419 4.5A	**imazalil**	acetonitrile
CE451 4.5A	**isodrin**	acetonitrile
CE452 4.5A	**isoproturon**	acetonitrile
CE474 4.5N	**linuron**	acetone
CE420 4.5A	**malathion**	acetonitrile
CE453 4.5A	**MCPA**	acetonitrile
CE454 4.5A	**mecoprop (MCPP)**	acetonitrile
CE475 4.5N	**methabenzthiazuron**	acetone
CE455 4.5A	**metazachlor**	acetonitrile
CE456 4.5A	**methiocarb**	acetonitrile
CE457 4.5A	**metobromuron**	acetonitrile
CE477 4.5M	**metolachlor**	methanol
CE458 4.5A	**metoxuron**	acetonitrile
CE421 4.5M	**2,4´-metoxychlor**	methanol
CE476 4.5M	**4,4´-metoxychlor**	methanol
CE459 4.5M	**mirex**	methanol
CE478 4.5N	**monolinuron**	acetone
CE460 4.5A	**parathion-ethyl**	acetonitrile
CE461 4.5A	**parathion-methyl**	acetonitrile
CE422 4.5M	**pentachlorobenzene**	methanol
CE431 4.5A	**phosalon**	acetonitrile
CE431 4.5I	**phosalon**	iso-octane
CE432 4.5A	**phosmet**	acetonitrile
CE432 4.5I	**phosmet**	iso-octane
CE423 4.5C	**pirimiphos- methyl**	cyclohexane
CE469 4.5A	**prometryn**	acetonitrile
CE479 4.5A	**propazin**	acetonirile
CE462 4.5A	**propoxur**	acetonitrile
CE433 4.5A	**quinalphos**	acetonitrile
CE433 4.5I	**quinalphos**	iso-octane
CE424 4.5C	**quintozene**	cyclohexane
CE463 4.5A	**sebuthylazine**	acetonitrile
CE464 4.5M	**simazine**	methanol
CE465 4.5M	**2,4,5-T**	methanol
CE466 4.5A	**terbuthylazine**	acetonitrile
CE480 4.5M	**terbutryn**	methanol
CE425 4.5C	**tetradifon**	cyclohexane
CE436 4.5I	**1,2,3-trichlorobenzene**	iso-octane
CE437 4.5I	**1,2,4-trichlorobenzene**	iso-octane
CE438 4.5I	**1,3,5-trichlorobenzene**	iso-octane
CE481 4.5N	**trietazin**	acetone
CE426 4.5C	**trifluralin**	cyclohexane

2.5.2 Multianalyte calibration solutions

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE500 4.5l	**OCP MIX–1**			CERTAN® 4.5 ml
		gamma-HCH (lindane), 4,4´-DDT, heptachlor, 4,4´-methoxychlor, hexachlorobenzene	10 (each)	
CE501 4.5l	**OCP MIX–2**			CERTAN® 4.5 ml
		alpha-HCH, beta-HCH, gamma-HCH (lindane), delta-HCH, 4,4´-DDD, 4,4´-DDE, 4,4´-DDT, heptachlor, 4,4´-methoxychlor, hexachlorobenzene	10 (each)	
CE502 10M	**OCP MIX–3**			CERTAN® 1.0 ml
		alpha-HCH, beta-HCH, gamma-HCH (lindane), delta-HCH, 4,4´-DDD, 4,4´-DDE, 4,4´-DDT, heptachlor, 4,4´-methoxychlor, hexachlorobenzene	1 (each)	
CE503 1.5l	**OCP MIX–4**			CERTAN® 1.5 ml
		aldrin, dieldrin, endrin, alpha-endosulfan, beta-endosulfan, gamma-HCH (lindane), trifluralin, hexachlorobenzene, heptachlor, 4,4´-methoxychlor, 4,4´-DDD, 4,4´-DDE, 4,4´-DDT	10 (each)	
CE504 10l	**OCP MIX–5**			CERTAN® 10 ml
		1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene, pentachlorobenzene, hexachlorobenzene	10 (each)	
CE506 4.5l	**OCP MIX–6**			CERTAN® 4.5 ml
		aldrin, dieldrin, gama-HCH (lindane), heptachlor, heptachlorepoxide (A) heptachlorepoxide (B)	10 (each)	

The table continues on the next page →

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE505 1.5C	**OPP MIX–1**			CERTAN® 1.5 ml
		chlorpyriphos (ethyl), chlorpyriphos (methyl), imazalil, malathion, pirimiphos (methyl), quintozene, tetradifon	50 (each)	
CE507 1.5I	**OPP MIX–2**			CERTAN® 1.5 ml
CE507 4.5I				CERTAN® 4.5 ml
CE507 1.5A				CERTAN® 1.5 ml
CE507 4.5A				CERTAN® 4.5 ml
		azinphos-methyl, chlorpyriphos (ethyl), chlorpyriphos (methyl), dimethoate, fenitrothion, malathion, phosalone, phosmet, pirimiphos (methyl), quinalphos	1000 (each)	
CE700 4.5I	**OCP + PCB MIX–1**			CERTAN® 4, 5 ml
		alpha-HCH, beta-HCH, gamma-HCH (lindane), delta-HCH, 4,4´-DDD, 4,4´-DDE, 4,4´-DDT, heptachlor, 4,4´-methoxychlor, hexachlorobenzene, PCB-28, PCB-118, PCB-52, PCB-138, PCB-180, PCB-101, PCB-153, PCB-194	10 (each)	
CE508 1.5A	**PEST MIX–1**			CERTAN® 1.5 ml
CE508 4.5A				CERTAN® 4.5 ml
CE508 1.5E				CERTAN® 1.5 ml
CE508 4.5E				CERTAN® 4.5 ml
		aldicarb, chlortoluron, isoproturon, metobromuron, metoxuron	100 (each)	
CE509 1.5A	**PEST MIX–2**			CERTAN® 1.5 ml
CE509 4.5A				CERTAN® 4.5 ml
CE509 1.5E				CERTAN® 1.5 ml
CE509 4.5E				CERTAN® 4.5 ml
		atrazine, cyanazine, metazachlor, sebuthylazine, simazine, terbuthylazine	100 (each)	

The table continues on the next page →

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE510 1.5A	**PEST MIX–3**			CERTAN® 1.5 ml
CE510 4.5A				CERTAN® 4.5 ml
CE510 1.5E				CERTAN® 1.5 ml
CE510 4.5E				CERTAN® 4.5 ml
		bentazone, 2,4 D, dichlorprop, MCPA, mecoprop (MCPP)	100 (each)	
CE511 1.5A	**PEST MIX–4**			CERTAN® 1.5 ml
CE511 4.5A				CERTAN® 4.5 ml
CE511 1.5E				CERTAN® 1.5 ml
CE511 4.5E				CERTAN® 4.5 ml
		hexachlorobenzene, isodrine, mirex	100 (each)	
CE512 10A	**PEST MIX–5**			CERTAN® 10 ml
		atrazine desethyl, hexazinone, simazine, atrazine, terbuthylazine, prometryne	100 (each)	
CE513 4.5A	**PEST MIX–6 (EN ISO 11369)**			CERTAN® 4.5 ml
		atrazine desethyl, metoxuron, hexazinone, simazine, cyanazine, methabenzthiazuron, atrazine, chlorotoluron, monolinuron, isoproturon, diuron, metobromuron, metazachlor, sebuthylazine, terbuthylazine, linuron, metolachlor	100 (each)	

I – iso-octane, C – cyclohexane, M – methanol, N – acetone, A – acetonitrile, E – ethylacetate

2.6 Calibration solutions for the determination of chlorophenols

2.6.1 Single analyte calibration solutions

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE800 1.5M		4-chlorophenol	1000	CERTAN® 1.5 ml
CE801 1.5M		2,4-dichlorophenol	1000	CERTAN® 1.5 ml
CE802 1.5M		2,5-dichlorophenol	1000	CERTAN® 1.5 ml
CE803 1.5M		2,6-dichlorophenol	1000	CERTAN® 1.5 ml
CE804 1.5M		3,4-dichlorophenol	1000	CERTAN® 1.5 ml
CE806 1.5M		3,5-dichlorophenol	1000	CERTAN® 1.5 ml
CE808 1.5M		pentachlorophenol	1000	CERTAN® 1.5 ml
CE807 1.5M		2,4,5-trichlorophenol	1000	CERTAN® 1.5 ml
CE805 1.5M		2,4,6-trichlorophenol	1000	CERTAN® 1.5 ml

2.6.2. Multianalyte calibration solutions

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE820 4.5M	**CHF MIX–1**			CERTAN® 4.5 ml
		4-chlorophenol, 2,4-dichlorophenol, 2,5-dichlorophenol, 2,6-dichlorophenol, 3,4-dichlorophenol, 2,4,6-trichlorophenol	100 (each)	
CE821 4.5M	**CHF MIX–2**			CERTAN® 4.5 ml
		4-chlorophenol, 2,4-dichlorophenol, 2,5-dichlorophenol, 2,6-dichlorophenol, 3,4-dichlorophenol, 3,5-dichlorophenol, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, pentachlorophenol	100 (each)	

M – methanol

2.7 Calibration solutions for the determination of nitrosamines

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE830 1.5M	**NI MIX–1**			CERTAN® 1.5 ml
CE830 4.5M				CERTAN® 4.5 ml
		N-nitrosodi-n-buthylamine, N-nitrosodiethylamine, N-nitrosodimethylamine, N-nitrosodi-n-propylamine, N-nitrosodiphenylamine, N-nitrosomethylethylamine, N-nitrosomorfoline, N-nitrosopiperidine, N-nitrosopyrrolidine	100 (each)	

M – methanol

2.8 Calibration solutions for the determination of phthalates (EPA 8060)

Order number	Trade name	Analyte(s) and concentration	µg/ml	Volume (ml)
CE840 1.5M	**FT MIX–1**			CERTAN® 1.5 ml
CE840 4.5M				CERTAN® 4.5 ml
		bis-2(ethylhexyl)phthalate, buthylbenzylphthalate, diethylphthalate, dimethylphthalate, di-n-butylphthalate, di-n-octylphthalate	100 (each)	

M – methanol

2.9 Empty (new) CERTAN® bottles and recommended accessories

The following products are available for handling standards in CERTAN® bottles e.g. for dilution and storage of diluted working solutions and samples, archiving difficult samples and extracts, storage of standard solutions removed from conventional glass ampoules, etc.

Order number	Product	Quantity (pcs)
CER 01	1.5 ml CERTAN® bottle	10
		100
		500
CER 05	4.5 ml CERTAN® bottle	5
		50
		250
		500
CER 10	10 ml CERTAN® bottle	5
		50
		250
		500
CERPR	Apparatus for cleaning CERTAN® (including rack and capillary)	1

Order number	Product
R 81 430	2.5 ml Hamilton syringe with 50 mm needle (RN 1002)
209 908	5 ml Hamilton syringe with 70 mm needle (RSN 1005)
209 008	10 µl Hamilton syringe with 70 mm needle (RSN 1701)
209 108	25 µl Hamilton syringe with 70 mm needle (RSN 1702)
209 208	50 µl Hamilton syringe with 70 mm needle (RSN 1705)
MIG 13	10 place rack for 1.5 ml CERTAN® bottle
MIG 17	10 place rack for 4.5 ml CERTAN® bottle
MIG 19	10 place rack for 10 ml CERTAN® bottle

3. REFERENCE MATERIALS OF PHYSICAL PROPERTIES

ANALYTIKA® distributes a wide range of primary and secondary reference materials of physical properties, particularly for a realiable calibration and traceability in pH and conductivity measurement. Our own production covers two series of secondary reference materials of the most frequently used calibration solutions for pH measurement (pHanal™´s) and for conductivity measurement (CONDUCTANAL™´s).

3.1 Buffer solutions pHanal™

This series of ready to use buffer solutions includes typical NIST/IUPAC values and pH values of 4, 7, 9, 10. They are traceable to NIST primary reference buffer substances via national primary (secondary) buffer solutions (or secondary reference buffer substances). The particular pH values and uncertainties are specified in an attached Certificate of quality together with temperature dependence data, expiry term, batch number and other relevant information.

NIST/IUPAC values:

Order number	pH value and its uncertainty[a]	Temperature (°C)	Volume (ml)[b]
PH 16805	1.68±0.01	20	500 H
PH 37805	3.79±0.01	20	500 H
PH 40005	4.00±0.01	20	500 H
PH 68805	6.88±0.01	20	500 H
PH 74305	7.43±0.01	20	500 H
PH 92205	9.22±0.01	20	500 H
PH 100605	10.06±0.01	20	500 H

a) Expanded combined uncertainty (k÷2)
b) HDPE bottle

Other ready to use buffer solutions:

Order number	pH value and its uncertainty[a]	Temperature (°C)	Volume (ml)[b]
PH 0405	4.00±0.02	20	500 H
PH 0705	7.00±0.02	20	500 H
PH 0905	9.00±0.02	20	500 H
PH 1005	10.00±0.02	20	500 H

a) Expanded combined uncertainty (k÷2)
b) HDPE bottle

3.2 CONDUCTANAL™ – calibration solutions for conductivity

These solutions are standardised at 25 °C and are directly traceable to NIST standard reference material SRM 999a (KCl) and corresponding national primary conductivity standard solutions such as NIST SRM 3190-3198, CRM F01-F03 (Slovak Metrology Institute) etc. The particular conductivity values and uncertainties are specified in an attached certificate of quality together with temperature dependence data, expiry term, batch number and other relevant information.

Order number	Conductivity value and its uncertainty (µS/cm)[a]	Temperature (°C)	Volume (ml)[b]
CON 01	147±1.5	25	500 H
CON 02	1015±10	25	500 H
CON 03	1413±14	25	500 H
CON 04	12880±35	25	500 H
CON 05	111300±200	25	500 H

a) Expanded combined uncertainty (k÷2)
b) HDPE bottle

4. MINERAL ACIDS AND OTHER REAGENTS OF HIGH PURITY

The most frequently used mineral acids produced by subboiling distillation of a very pure starting material are offered (trade name ANALPURE™). This purification results in most metallic impurities being reduced to (or bellow) ppb ranges. All acids are accompanied with a certificate of quality based on the results from ultratrace analytical laboratory where more than 60 trace elements are determined by ICP – OES and ICP – MS techniques. The acids are delivered in special bottles (long-term leached borosilicate glass or modified HDPE) which ensure minimum contamination of the acid from the material of the bottle. Specification and lists of impurities are shown in Table 4.1 and Tables 4.2.

Table 4.1

Order number	Acid (reagent) and its concentration	Trade name	Volume (ml)*
SAc 0031b	**HCl, min. 36%**	Analpure™	1000 G
SAc 0061b	**HNO_3, min. 67%**	Analpure™	1000 G
SAc 0091b	**HF, min. 48%**	Analpure™	1000 H
SAc 0012b	**H_2SO_4, min. 95%**	Analpure™	1000 G
SAc11002**	**$HClO_4$, min. 68%**	Analpure™	1000 G
SAc 0017b**	**CH_3COOH, min. 99.5%**	Analpure™	1000 G
SCH 0170**	**NH_4OH, min. 21%**	Analpure™	1000 G

*) H – HDPE bottle, G – Glass bottle

**) On request, delivery time can be longer

Tables 4.2

SAc 0031b	Hydrochloric Acid min. 36% Analpure™							
Contents min.	36	%	Cd (Cadmium)	<0.1	ppb	Na (Sodium)	<0.5	ppb
Br^-	<50	ppm	Co (Cobalt)	<0.1	ppb	Ni (Nickel)	<0.1	ppb
PO_4^{3-}	<0.05	ppm	Cr (Chromium)	<0.1	ppb	Pb (Lead)	<0.1	ppb
SO_4^{2-}	<0.5	ppm	Cu (Copper)	<0.1	ppb	Se (Selenium)	<0.1	ppb
Ag (Silver)	<0.1	ppb	Fe (Iron)	<1	ppb	Sn (Tin)	<0.1	ppb
Al (Aluminium)	<0.5	ppb	Hg (Mercury)	<0.2	ppb	Sr (Strontium)	<0.1	ppb
As (Arsenic)	<0.1	ppb	K (Potassium)	<0.1	ppb	Th (Thorium)	<0.1	ppb
Ba (Barium)	<0.1	ppb	Li (Lithium)	<0.1	ppb	Ti (Titanium)	<0.1	ppb
Be (Beryllium)	<0.1	ppb	Mg (Magnesium)	<0.5	ppb	V (Vanadium)	<0.1	ppb
Bi (Bismuth)	<0.1	ppb	Mn (Manganese)	<0.1	ppb	Zn (Zinc)	<0.5	ppb
Ca (Calcium)	<0.5	ppb	Mo (Molybdenum)	<0.1	ppb			

SAc 0061b	Nitric Acid min. 67% Analpure™							
Contents min.	67	%	Cd (Cadmium)	<0.1	ppb	Ni (Nickel)	<0.1	ppb
Cl^-	<0.08	ppm	Co (Cobalt)	<0.1	ppb	Mo (Molybdenum)	<0.1	ppb
PO_4^{3-}	<0.1	ppm	Cr (Chromium)	<0.2	ppb	Pb (Lead)	<0.1	ppb
SO_4^{2-}	<0.5	ppm	Cu (Copper)	<0.1	ppb	Se (Selenium)	<0.1	ppb
Ag (Silver)	<0.1	ppb	Fe (Iron)	<0.5	ppb	Sn (Tin)	<0.1	ppb
Al (Aluminium)	<0.5	ppb	Hg (Mercury)	<0.2	ppb	Sr (Strontium)	<0.1	ppb
As (Arsenic)	<0.1	ppb	K (Potassium)	<0.2	ppb	Th (Thorium)	<0.1	ppb
Ba (Barium)	<0.1	ppb	Li (Lithium)	<0.1	ppb	Ti (Titanium)	<0.1	ppb
Be (Beryllium)	<0.1	ppb	Mg (Magnesium)	<0.5	ppb	V (Vanadium)	<0.1	ppb
Bi (Bismuth)	<0.1	ppb	Mn (Manganese)	<0.1	ppb	Zn (Zinc)	<0.5	ppb
Ca (Calcium)	<0.5	ppb	Na (Sodium)	<0.5	ppb			

SAc 0091b	Hydrofluoric Acid min. 48% Analpure™							
Contents min.	48	%	Cd (Cadmium)	<1	ppb	Na (Sodium)	<5	ppb
Cl^-	<1	ppm	Co (Cobalt)	<1	ppb	Ni (Nickel)	<5	ppb
PO_4^{3-}	<0.1	ppm	Cr (Chromium)	<1	ppb	Pb (Lead)	<1	ppb
SO_4^{2-}	<0.5	ppm	Cu (Copper)	<1	ppb	Se (Selenium)	<1	ppb
Ag (Silver)	<1	ppb	Fe (Iron)	<10	ppb	Si (Silicon)	<50	ppb
Al (Aluminium)	<5	ppb	Hg (Mercury)	<1	ppb	Sn (Tin)	<5	ppb
As (Arsenic)	<10	ppb	K (Potassium)	<5	ppb	Sr (Strontium)	<1	ppb
Ba (Barium)	<1	ppb	Li (Lithium)	<1	ppb	Ti (Titanium)	<5	ppb
Be (Beryllium)	<1	ppb	Mg (Magnesium)	<10	ppb	V (Vanadium)	<1	ppb
Bi (Bismuth)	<1	ppb	Mn (Manganese)	<1	ppb	Zn (Zinc)	<5	ppb
Ca (Calcium)	<50	ppb	Mo (Molybdenum)	<1	ppb			

SAc 0012b	Sulphuric Acid min. 95% Analpure™							
Contents min.	95	%	Cd (Cadmium)	<0.1	ppb	Na (Sodium)	<0.5	ppb
Cl^-	<0.1	ppm	Co (Cobalt)	<0.1	ppb	Ni (Nickel)	<0.1	ppb
NO_3^-	<0.07	ppm	Cr (Chromium)	<0.1	ppb	Pb (Lead)	<0.1	ppb
PO_4^{3-}	<0.5	ppm	Cu (Copper)	<0.1	ppb	Se (Selenium)	<5	ppb
Ag (Silver)	<0.1	ppb	Fe (Iron)	<0.5	ppb	Sn (Tin)	<0.1	ppb
Al (Aluminium)	<0.5	ppb	Hg (Mercury)	<1	ppb	Sr (Strontium)	<0.1	ppb
As (Arsenic)	<1	ppb	K (Potassium)	<0.5	ppb	Th (Thorium)	<0.1	ppb
Ba (Barium)	<0.1	ppb	Li (Lithium)	<0.1	ppb	Ti (Titanium)	<1	ppb
Be (Beryllium)	<0.1	ppb	Mg (Magnesium)	<0.5	ppb	V (Vanadium)	<0.1	ppb
Bi (Bismuth)	<0.1	ppb	Mn (Manganese)	<0.1	ppb	Zn (Zinc)	<0.1	ppb
Ca (Calcium)	<0.5	ppb	Mo (Molybdenum)	<0.1	ppb			

SAc 11002	Perchloric Acid min. 68% Analpure™							
Contents min.	68	%	Cd (Cadmium)	<0.1	ppb	Ni (Nickel)	<0.1	ppb
PO_4^{3-}	<0.1	ppm	Co (Cobalt)	<0.1	ppb	Pb (Lead)	<0.1	ppb
SO_4^{2-}	<5	ppm	Cu (Copper)	<0.1	ppb	Sn (Tin)	<0.1	ppb
Total N	<10	ppm	Fe (Iron)	<0.5	ppb	Sr (Strontium)	<0.1	ppb
Ag (Silver)	<0.1	ppb	K (Potassium)	<0.5	ppb	Th (Thorium)	<0.1	ppb
Al (Aluminium)	<0.5	ppb	Li (Lithium)	<0.1	ppb	Ti (Titanium)	<0.1	ppb
Ba (Barium)	<0.1	ppb	Mg (Magnesium)	<0.5	ppb	V (Vanadium)	<0.5	ppb
Be (Beryllium)	<0.1	ppb	Mn (Manganese)	<0.1	ppb	Zn (Zinc)	<0.5	ppb
Bi (Bismuth)	<0.1	ppb	Mo (Molybdenum)	<0.1	ppb			
Ca (Calcium)	<0.5	ppb	Na (Sodium)	<0.5	ppb			

SAc 0017b	Acetic Acid min. 99.5% Analpure™							
Contents min.	99.5	%	Cr (Chromium)	<0.1	ppb	Pb (Lead)	<0.1	ppb
Ag (Silver)	<0.1	ppb	Cu (Copper)	<0.1	ppb	Se (Selenium)	<0.5	ppb
Al (Aluminium)	<0.1	ppb	Fe (Iron)	<0.5	ppb	Sn (Tin)	<0.1	ppb
As (Arsenic)	<0.1	ppb	K (Potassium)	<0.1	ppb	Sr (Strontium)	<0.1	ppb
Ba (Barium)	<0.1	ppb	Li (Lithium)	<0.1	ppb	Th (Thorium)	<0.1	ppb
Be (Beryllium)	<0.1	ppb	Mg (Magnesium)	<0.1	ppb	Ti (Titanium)	<0.1	ppb
Bi (Bismuth)	<0.1	ppb	Mn (Manganese)	<0.1	ppb	V (Vanadium)	<0.1	ppb
Ca (Calcium)	<0.5	ppb	Mo (Molybdenum)	<0.1	ppb	Zn (Zinc)	<0.5	ppb
Cd (Cadmium)	<0.1	ppb	Na (Sodium)	<0.5	ppb			
Co (Cobalt)	<0.1	ppb	Ni (Nickel)	<0.1	ppb			

SCH 0170 Ammonia Solution min. 21% Analpure™								
Contents min.	21	%	Cr (Chromium)	<0.1	ppb	Pb (Lead)	<0.1	ppb
Ag (Silver)	<0.1	ppb	Cu (Copper)	<0.5	ppb	Se (Selenium)	<0.1	ppb
Al (Aluminium)	<0.5	ppb	Fe (Iron)	<0.5	ppb	Sn (Tin)	<0.1	ppb
As (Arsenic)	<0.1	ppb	K (Potassium)	<0.2	ppb	Sr (Strontium)	<0.1	ppb
Ba (Barium)	<0.1	ppb	Li (Lithium)	<0.1	ppb	Th (Thorium)	<0.1	ppb
Be (Beryllium)	<0.1	ppb	Mg (Magnesium)	<0.2	ppb	Ti (Titanium)	<0.1	ppb
Bi (Bismuth)	<0.1	ppb	Mn (Manganese)	<0.1	ppb	V (Vanadium)	<0.1	ppb
Ca (Calcium)	<0.5	ppb	Mo (Molybdenum)	<0.1	ppb	Zn (Zinc)	<0.2	ppb
Cd (Cadmium)	<0.1	ppb	Na (Sodium)	<0.5	ppb			
Co (Cobalt)	<0.1	ppb	Ni (Nickel)	<0.1	ppb			

5. PURE METALS

The following very pure metals (4N5–6N) are available in different forms in „bulk“ (1–10 kg) as well as in laboratory packings (50–100 g). Concerning the „bulk“ the price and the delivery delay depend on the quantity ordered and the actual situation on the market. Laboratory packings are delivered from the stock. Each supply is accompanied with a certificate of analysis (list of impurities determined by different spectroscopic techniques).

Metal	Purity*		Form
Aluminium	99.995 %	Al4N5	ingots, pieces, wires, foils
Aluminium	99.999 %	Al5N	ingots, pieces, wires, foils
Aluminium	99.9995 %	Al5N5	ingots, pieces, wires, foils
Antimony	99.995 %	Sb4N5	ingots, shots
Antimony	99.999 %	Sb5N	ingots, shots
Antimony	99.9999 %	Sb6N	ingots, shots
Bismuth	99.999 %	Bi5N	ingots, shots
Bismuth	99.9999 %	Bi6N	ingots, shots
Cadmium	99.999 %	Cd5N	ingots, shots, wires, foils
Cadmium	99.9995 %	Cd5N5	ingots, shots, wires, foils
Cadmium	99.9999 %	Cd6N	ingots, shots, wires, foils
Copper	99.999 %	Cu5N	ingots, shots, wires, foils
Copper	99.9999 %	Cu6N	ingots, shots, wires, foils
Indium	99.999 %	In5N	ingots, shots, wires, foils
Indium	99.9999 %	In6N	ingots, shots, wires, foils
Lead	99.999 %	Pb5N	ingots, shots, wires, foils, shot
Lead	99.9999 %	Pb6N	ingots, shots, wires, foils
Silver	99.999 %	Ag5N	ingots, cryst. pieces, wires, foils
Silver	99.9999 %	Ag6N	ingots, cryst. pieces, wires, foils
Tellurium	99.999 %	Te5N	ingots, shots
Tellurium	99.9999 %	Te6N	ingots, shots
Tin	99.999 %	Sn5N	ingots, shots, wires, foils
Zinc	99.995 %	Zn4N5	ingots, shots, wires, foils
Zinc	99.999 %	Zn5N	ingots, shots, wires, foils
Zinc	99.9999 %	Zn6N	ingots, shots, wires, foils

*) Metal basis

Laboratory packing:

Order number	Metal and its purity*		Form	Quantity (g)
Me 001a	Aluminium, Al	99.995 %	pieces 3–7 mm	50
				100
Me 001b	Aluminium, Al	99.999 %	pieces 3–7 mm	50
				100
Me 001c	Aluminium, Al	99.9995 %	pieces 3–7 mm	50
				100
Me 002a	Antimony, Sb	99.995 %	shots	50
				100
Me 002b	Antimony, Sb	99.999 %	shots	50
				100
Me 002c	Antimony, Sb	99.9999 %	shots	25
				50
Me 003a	Bismuth, Bi	99.999 %	shots	50
				100
Me 003b	Bismuth, Bi	99.9999 %	shots	25
				50
Me 004a	Cadmium, Cd	99.999 %	shots, pieces	50
				100
Me 004b	Cadmium, Cd	99.9995 %	shots, pieces	50
				100
Me 004c	Cadmium, Cd	99.9999 %	shots, pieces	25
				50
Me 005a	Copper, Cu	99.999 %	pieces	50
				100
Me 005b	Copper, Cu	99.9999 %	pieces	25
				50
Me 006a	Indium, In	99.999 %	shots	25
				50
Me 006b	Indium, In	99.9999 %	shots	25
				50
Me 007a	Lead, Pb	99.999 %	shots	50
				100
Me 007b	Lead, Pb	99.9999 %	shots	25
				50
Me 008a	Silver, Ag	99.999 %	cryst. pieces	25
				50
Me 008b	Silver, Ag	99.9999 %	cryst. pieces	25
				50
Me 009a	Tellurium, Te	99.999 %	shots	50
				100
Me 009b	Tellurium, Te	99.9999 %	shots	25
				50
Me 010a	Tin, Sn	99.999 %	shots	50
				100
Me 011a	Zinc, Zn	99.995 %	shots	50
				100
Me 011b	Zinc, Zn	99.999 %	shots	50
				100
Me 011c	Zinc, Zn	99.9999 %	shots	25
				50

*) Metal basis

6. MATRIX REFERENCE MATERIALS AND QUALITY CONTROL MATERIALS

A production of matrix certified reference materials (CRM) and quality control materials (QCM) is one of our the most rapidly developing activities during last several years. We cooperate with several recognised Europian manufacturers and distributors as well as with several experienced local subcontractors and laboratories accreditated according to ISO 9001 and EN ISO 17025, respectively. The production meets relevant ISO requirements postulated in ISO Guides 25, 30-35, and other documents. In 1995, we introduced on the market a set of four CRMs of soils certified for total element contents and for contents of element extractable fractions in aqua regia, cold 2M nitric acid and boiling 2M nitric acid (see further in this catalogue). These CRMs have become very desirable and the set was recertified in 2004.

In 2006, a new reference material was released, cerifying PCDD, PCDF and some PCB in a sewage sludge of mixed origin. This project was supported and partly funded by the Czech government and several recognized laboratories took part in the interlaboratory comparisons.

A great attention is paid to the rapid development of QCMs, i.e. low-cost quality check samples to be used by routine analytical laboratories for regular checking of their analytical equipment (e.g. for setting-up control charts), for proficiency testing as interlaboratory test samples and other applications. We have on stock (in bulk) a wide range of fully processed, homogenized and radiationally sterilized materials (including homogeneity and stability testing), such as e.g. river and lake sediments, sewage sludges, soils, biological materials (strawberry leaves, orange peel, green algae), food materials (milled onion) etc. These materials can be rapidly finalized, bottled and packed according to the customer's requirements. Realized materials are offered under the trade name METRANAL™ (refer to paragraph 6.3).

6.1 Certified reference materials of soils

Order number	Trade name	Quantity
CRM 7001	Light Sandy Soil (normal analyte levels)	80 g
CRM 7002	Light Sandy Soil (elevated analyte levels)	80 g
CRM 7003	Clay Loam Soil (normal analyte levels)	80 g
CRM 7004	Loam (elevated analyte levels)	80 g
CRM 7001-7004	Set	4 × 80 g

CZECH METROLOGY INSTITUTE
CERTIFYING BODY FOR REFERENCE MATERIALS
Radiová 3
102 00 Praha 10

CERTIFICATE No. 0217-CM-7001-04

Set of certified reference materials 7001, 7002, 7003, 7004

TOTAL ELEMENT CONTENTS AND CONTENTS OF ELEMENT EXTRACTABLE FRACTION IN SOIL

The set of soil comprises four natural agricultural soils differing in elemental composition:

7001 Light Sandy Soil with normal analyte levels
7002 Light Sandy Soil with elevated analyte levels
7003 Silty Clay Loam with normal analyte levels
7004 Loam with elevated analyte levels

Use: This set of certified reference materials is intended primarily for use in validation of analytical methods, for determination of total element contents and contents of element fraction extractable by the below described conventional procedures in soil and materials of similar matrix.

Packing: 80 g of powder of the respective soil with a particles size of les than 100 μm in polyethylene bottles.

Producer: ANALYTIKA Ltd., Ke Klíčovu 2a/816, 190 00 Prague 9

Project leader: Dr. Václav Sychra, Ph.D.

Certifying body responsible person: Ing. Jan Tichý

Revised: 30.6.2004 **Expiry date:** 31.12.2010

.....
Dr. František Jelínek,
Deputy director of CMI

ČESKÝ METROLOGICKÝ INSTITUT BRNO -2-

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Certified and non-certified values of total element contents in CRM No. 7001–7004 (µg/g dry weight)

CRM	No. 7001		No. 7002		No. 7003		No. 7004	
Element	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**
As	12.3	5/7	**32.4 ± 1.9**	8/11	16.7	12/16	**49.6 ± 3.0**	9/12
Ba	970	4/6	987	3/4	495	4/ 6	568	4/6
Be	**3.32 ± 0.26**	13/17	**8.77 ± 0.32**	13/17	**2.18 ± 0.16**	14/17	**4.17 ± 0.18**	10/14
Cd	**0.32 ± 0.05**	15/16	**0.31 ± 0.04**	13/16	**0.32 ± 0.04**	10/14	**1.52 ± 0.15**	15/19
Co	**9.66 ± 0.61**	14/17	**12.6 ± 0.9**	17/20	**11.5 ± 0.7**	15/20	**20.0 ± 1.25**	14/18
Cr	**89.6 ± 4.2**	18/23	**179 ± 8**	17/22	**79.8 ± 6.7**	17/23	**82.2 ± 6.3**	18/22
Cu	**30.8 ± 0.9**	17/21	**29.3 ± 0.6**	7/20	**29.1 ± 0.8**	18/21	**183 ± 5**	16/2
Hg	**0.087 ± 0.006**	11/14	**0.090 ± 0.012**	12/14	**0.096 ± 0.014**	10/14	**0.223 ± 0.016**	10/13
Mn	**540 ± 20**	10/14	**587 ± 37**	14/16	**600 ± 37**	13/16	**869 ± 34**	9/12
Ni	**31.9 ± 1.6**	18/21	**42.0 ± 1.7**	19/21	**31.3 ± 1.5**	18/21	**33.3 ± 1.1**	17/21
Pb	**43.8 ± 3.7**	19/21	**58.9 ± 4.9**	18/21	**33.5 ± 2.4**	17/21	**93.4 ± 3.4**	17/20
V	**58.7 ± 6.3**	13/18	**54.9 ± 6.8**	13/18	**76.2 ± 6.4**	13/18	**126 ± 7**	16/18
Zn	**120 ± 7**	19/21	**69.0 ± 7.7**	13/18	**81.0 ± 7.6**	17/21	**227 ± 7**	19/21

*) Mean ± Uncertainty of certified and information values are given in bold and normal figures, respectively;
**) Number of accepted laboratory sets/number of reported sets (after elimination of outliers from technical reasons)

Certified and non-certified values of contents of conventionally defined element fractions extractable by aqua regia in CRM No. 7001–7004 (µg/g dry weight)

CRM	No. 7001		No. 7002		No. 7003		No. 7004	
Element	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**
As	**10.4 ± 1.0**	15/20	**26.1 ± 1.0**	11/15	**11.6 ± 0.7**	12/16	**42.4 ± 2.2**	13/17
Ba	108	6/6	99.1	5/6	146	5/6	217	5/6
Be	**1.02 ± 0.10**	18/19	**2.83 ± 0.15**	16/20	**1.29 ± 0.13**	16/19	**2.69 ± 0.21**	20/20
Cd	**0.29 ± 0.04**	12/16	**0.28 ± 0.03**	11/15	**0.32 ± 0.03**	11/15	**1.44 ± 0.07**	17/25
Co	**9.15 ± 0.47**	23/25	**11.1 ± 0.5**	23/25	**10.3 ± 0.5**	25/25	**17.5 ± 0.9**	25/25
Cr	**71.9 ± 5.9**	26/26	**147 ± 8**	20/26	**42.4 ± 3.6**	26/26	**46.3 ± 3.8**	25/26
Cu	**28.9 ± 0.8**	24/26	**27.3 ± 0.7**	23/26	**25.4 ± 0.9**	24/26	**167 ± 1**	16/20
Hg	0.085	8/10	0.080	6/8	0.093	5/6	0.21	8/10
Mn	**479 ± 18**	18/19	**531 ± 19**	16/19	**529 ± 19**	17/19	**741 ± 36**	17/19
Ni	**31.8 ± 1.2**	24/26	**40.1 ± 1.2**	24/26	**28.8 ± 1.2**	25/26	**30.4 ± 1.2**	24/26
Pb	**24.1 ± 1.7**	26/26	**35.5 ± 0.9**	20/26	**25.2 ± 1.1**	20/26	**83.1 ± 2.3**	25/26
V	**52.0 ± 3.4**	18/19	**44.6 ± 3.4**	16/19	**52.9 ± 2.7**	18/19	**95.1 ± 4.9**	19/20
Zn	**108 ± 3.5**	26/26	**64.0 ± 1.5**	23/26	**69.4 ± 1.8**	23/26	**198 ± 6**	25/26

Certified and non-certified values of contents of conventionally defined element fractions extractable by boiling 2 mol/l HNO_3 in CRM No. 7001–7004 (µg/g dry weight)

CRM	No. 7001		No. 7002		No. 7003		No. 7004	
Element	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**
As	**5.92 ± 0.67**	8/11	**15.1 ± 2.1**	10/13	**3.58 ± 0.75**	11/13	**27.1 ± 2.9**	12/14
Ba	76.0	5/5	– – –		101	5/5	– – –	
Be	**0.71 ± 0.04**	15/17	**1.94 ± 0.09**	15/17	**0.95 ± 0.02**	14/17	**2.17 ± 0.06**	13/17
Cd	0.22	18/19	**0.26 ± 0.03**	14/19	**0.27 ± 0.04**	17/19	**1.44 ± 0.07**	17/25
Co	**8.44 ± 0.65**	19/19	**10.2 ± 0.6**	16/19	**8.31 ± 0.46**	18/19	**12.5 ± 0.6**	18/19
Cr	**48.5 ± 4.5**	19/19	**121 ± 11**	18/19	**23.8 ± 2.3**	19/19	**27.3 ± 2.0**	18/19
Cu	**24.1 ± 1.05**	19/19	**23.8 ± 1.1**	19/19	**20.6 ± 1.2**	19/19	**159 ± 5**	16/19
Hg	0.059	8/10	**0.046 ± 0.005**	10/9	**0.054 ± 0.008**	7/10	0.16	10/10
Mn	**438 ± 26**	12/14	**481 ± 31**	12/14	**476 ± 28**	12/14	**572 ± 35**	12/14
Ni	**18.7 ± 1.2**	19/19	**33.7 ± 2.0**	19/19	**22.2 ± 1.1**	19/19	**21.4 ± 0.9**	18/19
Pb	**23.7 ± 1.4**	19/19	**34.1 ± 1.8**	19/19	**22.7 ± 1.3**	19/19	**82.6 ± 1.9**	14/19
V	**42.7 ± 4.2**	16/16	**37.7 ± 3.1**	15/16	**25.3 ± 2.8**	17/17	**48.9 ± 4.3**	15/17
Zn	**97.1 ± 2.9**	18/19	**58.1 ± 2.2**	18/19	**54.2 ± 2.3**	17/19	**169 ± 8**	18/19

Certified and non-certified values of contents of conventionally defined element fractions extractable by cold 2 mol/l HNO_3 in CRM No. 7001–7004 (µg/g dry weight)

CRM	No. 7001		No. 7002		No. 7003		No. 7004	
Element	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**	Mean ± Unc.	N/n**
As	**2.32 ± 0.36**	14/18	**6.12 ± 0.83**	15/18	**1.30 ± 0.19**	13/18	**16.4 ± 1.8**	16/18
Ba	68.0	5/5	67.3	5/5	93.6	5/5	142	5/5
Be	**0.52 ± 0.05**	18/19	**1.40 ± 0.11**	17/20	**0.69 ± 0.05**	18/20	**1.84 ± 0.08**	16/20
Cd	**0.18 ± 0.02**	19/23	**0.21 ± 0.02**	18/23	**0.23 ± 0.01**	17/23	**1.36 ± 0.01**	10/14
Co	**5.19 ± 0.21**	21/24	**6.64 ± 0.30**	21/24	**5.90 ± 0.25**	22/24	**9.42 ± 0.38**	22/24
Cr	**23.6 ± 2.1**	21/24	**62.9 ± 6.1**	25/25	**9.06 ± 0.67**	24/25	**14.6 ± 1.1**	25/25
Cu	**18.1 ± 0.5**	25/25	**19.8 ± 0.5**	25/25	**15.8 ± 0.3**	24/25	**137 ± 4**	24/25
Hg	0.052	15/15	0.041	12/15	0.040	13/15	**0.094 ± 0.014**	14/16
Mn	**357 ± 21**	14/16	**425 ± 22**	13/16	**435 ± 19**	14/16	**527 ± 24**	14/16
Ni	**10.0 ± 0.6**	24/25	**16.0 ± 1.4**	25/25	**11.9 ± 0.6**	25/25	**13.0 ± 0.7**	24/25
Pb	**20.7 ± 0.6**	23/25	**30.6 ± 1.1**	24/25	**19.3 ± 0.4**	19/25	**71.7 ± 2.5**	25/25
V	**21.0 ± 1.5**	16/19	**21.3 ± 1.7**	17/19	**11.4 ± 0.7**	16/20	**29.9 ± 2.3**	19/20
Zn	**58.0 ± 3.0**	23/25	**34.2 ± 2.0**	24/25	**24.4 ± 0.9**	21/25	**119 ± 5**	24/25

6.2 Certified reference material of a sewage sludge for PCDD, PCDF and some toxic PCB.

Order number	Trade name	Quantity
CRM CZ 7006	PCDD, PCDF and toxic PCB in sewage sludge of mixed origin	60 g

The characterization of this material and analytical data are seen from the next three pages of the Certificate.

Czech Metrology Institute
Certifying Body for Reference Materials
V botanice 4
150 72 Praha 5

CERTIFICATE

No. 0217-CM-7006-06

POLYCHLORODIBENZO-p-DIOXINS, POLYCHLORODIBENZO FURANS AND TOXIC POLYCHLORO BIPHENYLS IN SEWAGE SLUDGE OF MIXED ORIGIN

Use:

The material is intended for use in verification of analytical procedures and validation of analytical methods and for ensuring traceability. It is not intended for use as a calibrant.

Description of the material:

The sample consists of 60±0.5g of dried sewage sludge powder (a particle size of less than 100 μm) in amber glass bottles with a polypropylene insert and screw cap. The total I-TEQ value is approximately 150 ng/kg. The material is radiationally sterilised by ^{60}Co at a dose of 25 kGy.

Leader Subcontractor: ANALYTIKA® spol. s r.o., Ke Klíčovu 2a/816, 190 00 Prague 9
Czech Republic

Project leader: Dr. Václav Sychra, Ph. D.

Certifying body responsible person: Ing. Pavel Nováček

Production, testing and certification of this material followed strictly ISO REMCO Guide 34.

Date of issue: 20.12.2006 Expiry date: 20.12.2011

Date of certification: 7.12.2006

.....
Dr. Jiří Tesař, PhD.
Deputy director of CMI

ČESKÝ METROLOGICKÝ INSTITUT BRNO -2-

Certified values and their uncertainties

Analyte		Mass fraction		Number of accepted sets of data
		Certified value (ng/kg)[1) 3)]	Uncertainty (ng/kg)[2)]	
2,3,7,8 TeCDD	(D48)	4.5	0.3	7
1,2,3,7,8 PeCDD	(D54)	2.1	0.3	7
1,2,3,4,7,8 HxCDD	(D66)	2.6	0.5	7
1,2,3,6,7,8 HxCDD	(D67)	5.0	0.9	9
1,2,3,7,8,9 HxCDD	(D70)	3.7	0.6	9
1,2,3,4,6,7,8 HpCDD	(D73)	65	10	7
OCDD	(D75)	519	74	7
2,3,7,8 TeCDF	(F83)	110	17	8
1,2,3,7,8 PeCDF	(F94)	157	21	8
2,3,4,7,8 PeCDF	(F114)	87	11	6
1,2,3,4,7,8 HxCDF	(F118)	376	63	9
1,2,3,6,7,8 HxCDF	(F121)	102	13	8
1,2,3,7,8,9 HxCDF	(F124)	11.0	2.2	7
2,3,4,6,7,8 HxCDF	(F130)	19.8	2.8	6
1,2,3,4,6,7,8 HpCDF	(F131)	256	41	9
1,2,3,4,7,8,9 HpCDF	(F134)	110	17	8
OCDF	(F135)	1590	290	9
PCB 77		2380	370	10
PCB 81		108	16	6
PCB 126		169	32	9
PCB 169		25	4	8
PCB 105		3430	495	10
PCB 114		169	36	6
PCB 118		15800	2300	10
PCB 123		121	30	6
PCB 156		9140	1300	8
PCB 157		802	130	10
PCB 167		4130	670	10
PCB 189		1860	260	8

1) This value is the unweighed mean of the means of accepted sets of results
2) Uncertainties are combined uncertainties multiplied by a coverage factor k=2
3) Corrected for dry mass at 105 °C

Non-certified values of contents of some other analytes present in CZ 7006*

Metals	
Analyte	**Mass fraction[a)] mg/kg[c)]**
Ag	6.75
As	17.3
Be	0.82
Cd	1.47
Co	16.8
Cr	498
Cu	318
Hg	1.48
Mn	1410
Mo	4.15
Ni	41.2
Pb	174
Se	1.41
Sn	15.2
Tl	0.17
V	39.5
Zn	782
Al	(19800)[d)]
Ca	(98200)
Fe	(21500)
K	(5650)
Mg	(4940)
Na	(5470)

Polycyclic AromaticHydrocarbons (PAHs)	
Analyte	**Mass fraction[a)] mg/kg**
acenaphtene	0.53
anthracene	0.20
benzo(a)anthracene	0.61
benzo(b)fluoranthene	0.33
benzo(k)fluoranthene	0.21
benzo(g,h,i)perylene	0.21
benzo(a)pyrene	0.23
chrysene	0.53
dibenzo(a,h)anthracene	0.04
fluoranthene	3.84
fluorene	0.51
indeno(1,2,3-c,d)pyrene	0.23
naphtalene	1.32
phenanthrene	1.92
pyrene	2.27

Some other organic analytes	
Analyte	**Mass fraction[b)], µg/kg**
$\sum$ HCH,α,β,γ,δ	(52)[d)]
2,4´-DDD	(670)
4,4´-DDD	(1650)
2,4´-DDT	(190)
4,4´-DDT	(850)
1,2,3-trichlorobenzene	(280)
pentachlorobenzene	(200)
hexachlorobenzene	(6000)

Other PCBs („markers“)	
Analyte	**Mass fraction[a)], µg/kg**
PCB-28	26.3
PCB-52	14.6
PCB-101	49.3
PCB-138	115
PCB-153	153
PCB-170	64.8
PCB-180	123

Brominated Flame Retardants (BFRs)	
Analyte	**Mass fraction[a)], µg/kg**
PBDE-28	0.77
PBDE-47	62.2
PBDE-49	2.23
PBDE-66	1.33
PBDE-85	3.50
PBDE-99	59.8
PBDE-100	14.0
PBDE-153	4.05
PBDE-154	4.60
PBDE-183	6.25
PBDE-209	55.6
HBCD	79.2

*) Analyte contents were derived (unless otherwise stated) from a minimum of 3 data sets
a) Corrected for dry mass at 105 °C
b) Corrected for dry mass at 40 °C
c) Aqua regia extraction according to ISO-11885
d) Informative analyses only from 2 labs

6.3 Quality control materials METRANAL™

METRANALS™ is a series of quality control materials (QCM) designed primarily for internal and external quality control purposes (quality control charts, inter-laboratory comparisons, estimation of bias etc.). They are not intended for use as calibrants or for realizing traceability.

Quality control material	Packing (g)
METRANAL™ 1 – River sediment 1 (metals)	80
METRANAL™ 2 – River sediment 2 (PAH, PCB, OCP)	40
METRANAL™ 3 – Strawberry leaf (metals)	25
METRANAL™ 6 – Sewage sludge 1 (metals)	60
METRANAL™ 7 – Sewage sludge 2 (PAH, PCB, OCP)	40
METRANAL™ 8 – Green algae (metals)	20
METRANAL™ 9 – Industrial sandy-loam soil (PAH, PCB, OCP)	50
METRANAL™ 10 – Industrial clay soil (metals, PCB, OCP)	60
METRANAL™ 11 – Pond sediment-blank (PAH, PCB, OCP)	50
METRANAL™ 12 – Sewage sludge SS-06 (PCDD, PCDF, PCB)	40
METRANAL™ 13 – Sewage sludge SS-01 (metals, PAH, PCB, OCP)	50
METRANAL™ 14 – River sediment RS-01-2 (metals, PCB, OCP)	60
METRANAL™ 15 – Sewage sludge SS-04 (PCDD, PCDF, PCB)	30
METRANAL™ 16 – River sediment (OCP)	25
METRANAL™ 17 – Set of three environmental samples for the determination of mercury from solid samples	3 × 15
METRANAL™ 18 – Pond sediment RS-02 (metals, PAH)	40
METRANAL™ 19 – Agricultural sandy-clay soil (metals, PAH)	40
METRANAL™ 20 – Sewage sludge SS-02 (PAH, PCB, metals)	40
METRANAL™ 21 – Industrial land, contaminated (PAH, PCB, metals)	40

METRANAL™ 1: River sediment 1

Analyte	Total sample decomposition		Aqua regia extraction*	
	Concentration (mg/kg)**	Uncertainty (mg/kg)***	Concentration (mg/kg)**	Uncertainty (mg/kg)***
Ag	3.10	0.38	2.50	0.32
As	29.0	2.0	24.1	3.2
Ba	522	104	275	22
Be	2.65	0.80	1.58	0.32
Bi	0.72	0.14	0.69	0.14
Cd	3.10	0.68	2.66	0.54
Co	15.6	1.4	12.5	1.5
Cr	118	12	93.0	14.0
Cu	97.0	10.0	91.2	8.0
Fe	28500	3800	25500	2700
Hg	1.55	0.14	1.38	0.20
Mn	1370	140	1330	106
Mo	1.13	0.12	0.97	0.02
Ni	45.0	8.2	35.4	5.0
Pb	93.2	10.0	82.4	16.4
Sb	2.52	0.50	1.73	0.34
Se	1.02	0.20	0.74	0.14
Sn	8.75	1.74	7.37	1.48
V	73.0	10.2	43.2	5.6
Zn	520	68	465	64

*) According to ISO 11466 (1995)
**) Dry mass at 105 °C
***) Expanded combined uncertainty (k=2)

METRANAL™ 2: River sediment 2
METRANAL™ 7: Sewage sludge 2

Analyte	METRANAL™ 2		METRANAL™ 7	
	Concentration (µg/kg)*	Uncertainty (µg/kg)**	Concentration (µg/kg)*	Uncertainty (µg/kg)**
Anthracene	393	128	91	44
Benzo(a)anthracene	998	260	716	196
Benzo(b)fluoranthene	829	228	747	234
Benzo(k)fluoranthene	423	116	351	88
Benzo(g,h,i)perylene	546	156	627	176
Benzo(a)pyrene	742	222	588	160
Dibenzo(a,h)anthracene	89	34	83	21
Fluoranthene	1995	572	1615	548
Chrysene	831	234	815	134
Indeno(1,2,3-cd)pyrene	585	166	582	212
Phenathrene	982	274	1000	348

The table continues on the next page →

METRANAL™ 2 and METRANAL™ 7 (continued)

Analyte	METRANAL™ 2		METRANAL™ 7	
	Concentration (µg/kg)*	Uncertainty (µg/kg)**	Concentration (µg/kg)*	Uncertainty (µg/kg)**
Pyrene	1677	424	1542	480
PCB-28	23.3	6.8	20	6
PCB-31	16.3	5.0	15	6
PCB-52	29.2	9.0	12	2
PCB-77	–	–	2.0	0.4
PCB-101	28.1	7.6	32	4
PCB-110	17.4	5.4	21	4
PCB-118	12.2	3.2	17	6
PCB-138	61.3	15.4	67	20
PCB-149	50.6	12.6	52	10
PCB-153	70.2	19.8	74	10
PCB-163	20.1	6.2	18	6
PCB-170	33.4	8.8	27	6
PCB-180	63.6	15.4	64	20
PCB-187	30.8	7.8	27	10
PCB-194	14.2	4.0	10	4
Pentachlorobenzene	–	–	4.3	2.0
Hexachlorobenzene	45.1	11.2	28	6
2,4´-DDE	–	–	1.5	1.0
4,4´-DDE	19.0	5.6	52	10
4,4´-DDD	28.9	7.0	26	12
4,4´-DDT	45.8	12.4	14	8

*) Dry mass at 40 °C
**) Expanded combined uncertainty (k=2)

METRANAL™ 3: Strawberry leaf, METRANAL™ 8: Green algae

Analyte	METRANAL™ 3		METRANAL™ 8	
	Concentration (mg/kg)*	Uncertainty (mg/kg)***	Concentration (mg/kg)*	Uncertainty (mg/kg)***
Al	1120	110	–	–
As	0.26	0.06	41	3
Ba	124	24	–	–
Ca	15500	1540	1380	80
Cd	0.18	0.01	0.023	0.004
Co	–	–	18.0	1.6
Cr	1.70	0.34	–	–
Cu	8.68	0.76	34.0	1.6
Fe	912	90	290	20
Hg	0.038	0.008	0.017	0.010
K	21200	2100	–	–

The table continues on the next page →

METRANAL™ 3 and METRANAL™ 8 (continued)

Analyte	METRANAL™ 3		METRANAL™ 8	
	Concentration (mg/kg)*	Uncertainty (mg/kg)***	Concentration (mg/kg)*	Uncertainty (mg/kg)***
Li	0.69	0.14	–	–
Mg	4210	420	1580	120
Mn	187	18	43.0	3.4
Ni	2.68	0.16	0.8	0.1
Pb	1.88	0.22	0.21	0.01
Sr	77	16	–	–
Zn	27.1	1.8	38	3

*) Dry mass at 105 °C
**) Expanded combined uncertainty (k=2)

METRANAL™ 6: Sewage sludge 1

Analyte	Total sample decomposition		Aqua regia extraction*	
	Concentration (mg/kg)**	Uncertainty (mg/kg)***	Concentration (mg/kg)**	Uncertainty (mg/kg)***
Ag	55	4	52	4
As	9.0	1	8.6	1
Be	0.90	0.2	0.55	0.1
Cd	6.1	0.4	6.3	0.4
Co	15	2	8.2	1.4
Cr	106	12	90	12
Cu	340	18	376	30
Hg	6.0	0.6	5.5	0.8
Mn	550	30	530	40
Ni	60	8	49	8
Pb	104	6	100	12
Sn	29	2	25	2
V	38	4	22	2
Zn	1220	60	1125	60

*) According to ISO 11466 (1995)
**) Dry mass at 105 °C
***) Expanded combined uncertainty (k=2)

METRANAL™ 9: Industrial sandy-loam soil (PAH, PCB, metals)

Analyte	Concentration (mg/kg)**	Uncertainty (mg/kg)***
Acenaphtene	21.5	1.7
Antracene	5.15	0.43
Benzo(a)anthracene	65.0	4.0
Benzo(b)fluoranthene	4.87	0.29

Analyte	Concentration (mg/kg)*a	Uncertainty (mg/kg)***
As	16.0	1.6
Ba	174	14
Be	2.01	0.20
Ca	5561	450

The table continues on the next page →

METRANAL™ 9 (continued)

Analyte	Concentration (mg/kg)**	Uncertainty (mg/kg)***
Benzo(k)fluoranthene	2.44	0.12
Benzo(g,h,i)perylene	0.34	0.03
Benzo(a)pyrene	0.60	0.05
Chrysene	16.1	0.8
Dibenzo(a,h)anthracene	0.06	0.01
Fluoranthene	262	14
Fluorene	97.5	6.6
Indeno(1,2,3-d)pyrene	0.39	0.11
Naphtalene	4.05	0.56
Phenantrene	147	9
Pyrene	135	7

Analyte	Concentration (mg/kg)*a	Uncertainty (mg/kg)***
Cd	1.30	0.10
Co	12.3	0.12
Cr	106	7
Cu	26.0	1.8
Hg	0.16	0.02
Mn	511	45
Mo	1.40	0.10
Ni	40.0	2.5
Pb	33.3	2.9
Sn	<5	–
V	49.9	3.8
Zn	114	5

Analyte	Concentration (µg/kg)*	Uncertainty (µg/kg)**
PCB-28	653	27
PCB-52	309	12
PCB-101	95.0	4.6
PCB-118	135	9
PCB-138	22.9	1.5
PCB-153	24.7	1.5
PCB-180	11.5	1.0
PCB194	2.1	0.2

*) Dry mass at 105 °C
**) Dry mass at 40 °C
***) Expanded combined uncertainty (k=2)
a) Aqua regia extractable content according to ISO 11466 (1995)

METRANAL™ 10: Industrial clay soil (metals, pesticides and PCB)

Analyte	Concentration (mg/kg)* a	Uncertainty (mg/kg)**
As	3.9	0.4
Ba	133	14
Be	1.17	0.10
Ca	3 663	210
Cd	0.33	0.03
Co	10.0	0.6
Cr	30.6	1.9
Cu	17.0	0.8
Hg	0.33	0.03
Mn	566	35
Mo	0.80	0.08
Ni	22.3	1.6
Pb	28.0	1.2
Sn	3.0	0.5

Analyte	Concentration (µg/kg) b	Uncertainty (µg/kg)**
2,4´-DDE	10.5	0.8
4,4´-DDE	405	24
2,4´-DDD	37.5	5.0
4,4´-DDD	70.5	10.0
2,4´-DDT	110	6
4,4´-DDT	278	25
Hexachlorobenzene	53.4	3.4
alpha-HCH	1.7	0.2
beta-HCH	4.8	0.5
gamma-HCH	2.1	0.4
delta-HCH	<0.2	–
PCB-28	0.6	0.1
PCB-52	0.8	0.2
PCB-101	1.1	0.2

The table continues on the next page →

METRANAL™ 10 (continued)

Analyte	Concentration (mg/kg)* [a]	Uncertainty (mg/kg)**
V	36.6	3.2
Zn	84.9	3.5

[a]) Dry mass at 105 °C
[b]) Dry mass at 40 °C
*) Aqua regia extractable content according to ISO 11466 (1995)
**) Expanded combined uncertainty (k=2)

Analyte	Concentration (µg/kg) [b]	Uncertainty (µg/kg)**
PCB-118	0.7	0.1
PCB-138	2.3	0.2
PCB-153	3.3	0.4
PCB-180	2.4	0.3
PCB-187	2.1	0.2

METRANAL™ 11: Pond sediment (low organic analyte levels – blank)

Analyte	Concentration (µg/kg)*	Uncertainty (µg/kg)**
PCB-28	0.35	0.1
PCB-31	<0.2	–
PCB-52	0.42	0.1
PCB-77	<0.2	–
PCB-101	0.85	0.2
PCB-110	0.40	0.1
PCB-118	<0.2	–
PCB-138	0.72	0.1
PCB-149	0.70	0.2
PCB-153	0.85	0.2
PCB-163	<0.2	–
PCB-170	<0.2	–
PCB-180	0.58	0.1
PCB-187	0.35	0.1
PCB-194	<0.2	–
PAHs (sum)	<1000	–

*) Dry mass at 40 °C
**) Expanded combined uncertainty (k=2)

Analyte	Concentration (µg/kg)*	Uncertainty (µg/kg)**
2,4´-DDE	<0.2	–
4,4´-DDE	3.9	0.2
2,4´-DDD	1.0	0.1
4,4´-DDD	3.6	0.2
2,4´-DDT	<0.2	–
4,4´-DDT	0.9	0.1
alpha-HCH	2.2	0.2
beta-HCH	3.7	0.3
gamma-HCH	<0.2	–
delta-HCH	<0.2	–
1,2,3-trichlorobenzene	4.5	0.4
1,2,4-trichlorobenzene	<0.2	–
1,3,5-trichlorobenzene	<0.2	–
1,2,3,5-tetrachlorobenzene	<0.2	–
1,2,4,5-tetrachlorobenzene	<0.2	–
1,2,3,4-tetrachlorobenzene	<0.2	–
Pentachlorobenzene	<0.2	–
Hexachlorobenzene	2.7	0.3

METRANAL™ 12: Sewage sludge SS-06 (PCDD, PCDF, PCB)

Analyte	Concentration (ng/kg)*	Uncertainty (ng/kg)**
2,3,7,8 TeCDD	2.9	1.3
1,2,3,7,8 PeCDD	8.3	4.0
1,2,3,4,7,8 HxCDD	10.6	2.2
1,2,3,6,7,8 HxCDD	25.2	5.2
1,2,3,7,8,9 HxCDD	18.2	4.0
1,2,3,4,6,7,8 HpCDD	290	58
OCDD	1800	400
2,3,7,8 TeCDF	26.0	4.8
1,2,3,7,8 PeCDF	19.8	4.0
2,3,4,7,8 PeCDF	44.4	8.9
1,2,3,4,7,8 HxCDF	49.7	10.0
1,2,3,6,7,8 HxCDF	43.5	9.0
1,2,3,7,8,9 HxCDF	<2	–
2,3,4,6,7,8 HxCDF	ND***	–
1,2,3,4,6,7,8 HpCDF	230	46
1,2,3,4,7,8,9 HpCDF	93	19
OCDF	950	200

Analyte	Concentration (µg/kg)*	Uncertainty (µg/kg)**
PCB-77	2.2	0.4
PCB-81	0.08	0.02
PCB-126	0.25	0.05
PCB-169	0.03	0.01
PCB-105	3.5	0.7
PCB-114	0.3	0.1
PCB-118	14.0	2.7
PCB-123	<0.02	–
PCB-156	5.4	1.1
PCB-157	0.6	0.1
PCB-167	9.1	1.8
PCB-189	0.8	0.2

*) Dry mass at 105°C
**) Expanded combined uncertainty (k=2)
***) Not detected

METRANAL™ 13: Sewage sludge SS-01 (metals, PAH, PCB, pesticides)

Analyte	Concentration (mg/kg)* [a] [b]	Uncertainty (mg/kg)**
Ag	8.0	0.5
As	9.7	1.0
Ba	500	38
Be	1.0	0.1
Ca	24 410	1200
Cd	7.7	0.5
Co	29.0	2.0
Cr	66.6	6.7
Cu	216	10
Hg	2.8	0.3
Mn	1049	85
Mo	6.0	0.6
Ni	63.3	3.8
Pb	63.4	2.5
Sn	16.4	1.6
V	30.3	3.5
Zn	699	29

Analyte	Concentration (µg/kg) [b]	Uncertainty (µg/kg)**
PCB-28	12.0	0.6
PCB-31	9.5	3.0
PCB-52	9.1	1.0
PCB-77	5.3	0.8
PCB-101	9.2	1.3
PCB-110	13.9	1.9
PCB-118	5.6	1.0
PCB-138	30.0	5.6
PCB-149	26.6	4.9
PCB-153	31.8	3.9
PCB-163	7.7	1.2
PCB-170	13.4	2.0
PCB-180	31.0	6.1
PCB-187	14.3	2.7
PCB-194	4.1	0.6
2,4´-DDE	<0.2	–
4,4´-DDE	24.1	2.8
2,4´-DDD	21.6	3.0
4,4´-DDD	14.4	1.8

The table continues on the next page →

METRANAL™ 13 (continued)

Analyte	Concentration (mg/kg)* a b	Uncertainty (mg/kg)**
Acenaphtene	0.28	0.06
Anthracene	0.39	0.08
Benzo(a)anthracene	1.98	0.40
Benzo(b)fluoranthene	2.64	0.40
Benzo(k)fluoranthene	1.01	0.20
Benzo(g,h,i)perylene	1.73	0.35
Benzo(a)pyrene	2.16	0.44
Chrysene	1.75	0.35
Dibenzo(a,h)anthracene	<0.01	–
Fluoranthene	6.17	0.94
Fluorene	1.24	0.28
Indeno(1,2,3-cd)pyrene	1.40	0.28
Naphtalene	0.51	0.11
Phenathrene	3.56	0.74
Pyrene	4.44	0.70

Analyte	Concentration (µg/kg) b	Uncertainty (µg/kg)**
2,4´-DDT	<0.5	–
4,4´-DDT	10.1	1.7
gamma-HCH	0.9	0.2
Pentachlorobenzene	1.0	0.5
Hexachlorobenzene	22.5	2.5

a) Dry mass at 105 °C (metals)
b) Dry mass at 40 °C (organics)
*) Aqua regia extractable content according to ISO 11466 (1995)
**) Expanded combined uncertainty (k=2)

METRANAL™ 14: River sediment RS-01-2 (metals, PCB, pesticides, PAH, dioxines)

Analyte	Concentration (mg/kg)* a	Uncertainty (mg/kg)**
Ag	2.0	0.12
As	27.6	1.5
Ba	221	26
Be	0.63	0.05
Ca	6325	430
Cd	1.49	0.08
Co	6.00	0.42
Cr	36.6	1.5
Cu	127	4
Hg	8.67	0.26
Mn	400	32
Mo	2.30	0.28
Ni	24.9	0.7
Pb	93.2	2.8
Sb	5.31	0.55
Se	0.94	0.10
Sn	5.30	0.26
V	21.3	1.9
Zn	600	21

a) Dry mass at 105 °C
b) Dry mass at 40 °C
*) Aqua regia extractable content according to ISO 11466 (1995)
**) Expanded combined uncertainty (k=2)

Analyte	Concentration (µg/kg) b	Uncertainty (µg/kg)**
PCB-28	94.0	12.5
PCB-31	45.1	4.6
PCB-52	73.6	6.8
PCB-77	12.2	0.9
PCB-101	115	12
PCB-110	94.9	14.2
PCB-118	50.4	5.6
PCB-138	338	44
PCB-149	244	40
PCB-153	375	75
PCB-163	90.4	14.3
PCB-170	157	18
PCB-180	344	38
PCB-187	158	23
PCB-194	59.0	5.2
alpha-HCH	38.8	4.8
beta-HCH	105	21
gamma-HCH	25.3	5.0
delta-HCH	29.0	5.6
2,4´-DDE	28.1	4.8
4,4´-DDE	574	61
2,4´-DDD	1190	98
4,4´-DDD	2750	235
2,4´-DDT	250	63
4,4´-DDT	1620	315
Hexachlorobenzene	140	21

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METRANAL™ 14 (continued)

Analyte[a)]	Concentration (ng/kg)*	Uncertainty (ng/kg)**
2,3,7,8 TeCDD	31.2	6.0
1,2,3,7,8 PeCDD	7.2	1.0
1,2,3,4,7,8 HxCDD	12.3	2.0
1,2,3,6,7,8 HxCDD	10.5	2.0
1,2,3,7,8,9 HxCDD	7.6	2.0
1,2,3,4,6,7,8 HpCDD	110	22
OCDD	980	200
2,3,7,8 TeCDF	160	32
1,2,3,7,8 PeCDF	120	32
2,3,4,7,8 PeCDF	120	24
1,2,3,4,7,8 HxCDF	410	82
1,2,3,6,7,8 HxCDF	120	24
1,2,3,7,8,9 HxCDF	<20	-
2,3,4,6,7,8 HxCDF	19.2	4.0
1,2,3,4,6,7,8 HpCDF	270	54
1,2,3,4,7,8,9 HpCDF	230	46
OCDF	1400	300
Total I – TEQ[b)]	~187	

Analyte [a)]	Concentration (µg/kg)*	Uncertainty (µg/kg)**
PCB-77	12.0	2.3
PCB-81	0.48	0.10
PCB-126	0.42	0.08
PCB-169	0.044	0.010
PCB-105	14.0	2.7
PCB-114	3.0	0.3
PCB-118	53.0	10.6
PCB-123	<0.2	–
PCB-156	25.0	4.8
PCB-157	2.5	0.5
PCB-167	37.0	7.4
PCB-170	149	18
PCB-180	330	38
PCB-189	5.0	1.0
Total I-TEQ[b)]	~66	

*) Corrected to dry mass at 40 °C
**) Expanded combined uncertainty (k=2)
a) GC–HRMS
b) Toxicity equivalent (EN-1948-3)

Analyte	Concentration (mg/kg)*	Uncertainty[a] (mg/kg)*
Anthracene	0.144	0.009
Benzo(a)anthracene	0.207	0.040
Benzo(b)fluoranthene	0.195	0.028
Benzo(k)fluoranthene	0.081	0.012
Benzo(g,h,i)perylene	0.098	0.005
Benzo(a)pyrene	0.122	0.007
Chrysene	0.200	0.025
Fluorathene	0.899	0.043
Indeno(1,2,3-cd)pyrene	0.082	0.004
Phenathrene	0.753	0.066
Pyrene	0.692	0.016

*) Dry mass at 40 °C
a) Half width of the 95% confidence interval

METRANAL™ 15: Sewage sludge (SS-04) of mixed origin (PCDD, PCDF, PCB)

Analyte	Concentration (ng/kg)*	Uncertainty (ng/kg)**
2,3,7,8 TeCDD	5.3	0.6
1,2,3,7,8 PeCDD	2.8	0.6
1,2,3,4,7,8 HxCDD	3.3	0.8
1,2,3,6,7,8 HxCDD	4.2	0.6
1,2,3,7,8,9 HxCDD	3.4	0.6
1,2,3,4,6,7,8 HpCDD	58.0	7.5
OCDD	404	50
2,3,7,8 TeCDF	107	15
1,2,3,7,8 PeCDF	107	15
2,3,4,7,8 PeCDF	99	24
1,2,3,4,7,8 HxCDF	426	60
1,2,3,6,7,8 HxCDF	74	12
1,2,3,7,8,9 HxCDF	10.0	3.0
2,3,4,6,7,8 HxCDF	22.9	4.5
1,2,3,4,6,7,8 HpCDF	187	29
1,2,3,4,7,8,9 HpCDF	158	34
OCDF	2330	500

*) Dry mass at 105 °C
**) Expanded combined uncertainty (k=2)

Analyte	Concentration (µg/kg)*	Uncertainty (µg/kg)**
PCB-77	2.470	0.250
PCB-81	0.066	0.007
PCB-126	0.137	0.014
PCB-169	0.020	0.002
PCB-105	2.9	0.3
PCB-114	0.10	0.02
PCB-118	13.3	1.2
PCB-123	<0.1	-
PCB-156	9.2	0.9
PCB-157	0.60	0.06
PCB-167	3.8	0.4
PCB-189	1.8	0.2
PCB-28	29.6	7.2
PCB-52	12.8	1.8
PCB-101	38.0	5.5
PCB-138	102	15
PCB-153	127	19
PCB-180	128	18

METRANAL™ 16: River sediment (OCP)

Analyte	Concentration (mg/kg)*	Uncertainty (mg/kg)**
alpha-HCH	16.4	3.2
beta-HCH	20.1	4.0
gamma-HCH	44.4	8.0
4,4´-DDE	38.5	7.5
4,4´-DDD	38.7	7.5
4,4´-DDT	82.9	16.0
dieldrin	45.0	9.0
endrin	19.1	3.8

*) Dry mass at 40 °C
**) Expanded combined uncertainty (k=2)

METRANAL™ 17: Set of three environmental samples (soil, sewage sludge, fly ash) for the determination of mercury from solid samples.

Designed especially for Advanced Mercury Analyser AMA-254 (Altec Ltd., Czech Republic)

Matrix	Hg-Concentration (mg/kg)*a	Uncertainty (mg/kg)**
Sandy soil	0.060	0.002
Sewage sludge	5.65	0.17
Fly ash	1.54	0.04

*) Dry mass at 40 °C
**) Expanded combined uncertainty (k=2)
a) Total element content

METRANAL™ 18: Pond sediment RS-02 (metals, PAH)

Analyte	Concentration (mg/kg)*a	Uncertainty (mg/kg)**
Acenaphtene	0.02	0.01
Antracene	0.20	0.05
Benzo(a)anthracene	1.52	0.17
Benzo(b)fluoranthene	2.28	0.25
Benzo(k)fluoranthene	0.74	0.08
Benzo(g,h,i)perylene	1.36	0.35
Benzo(a)pyrene	1.83	0.35
Chrysene	1.41	0.40
Dibenzo(a,h)anthracene	<0.01	-
Fluoranthene	3.91	0.85
Fluorene	0.15	0.05
Indeno(1,2,3-cd)pyrene	1.14	0.35
Naphtalene	0.23	0.06
Phenantrene	0.95	0.20
Pyrene	3.16	0.85

Analyte	Concentration (mg/kg)b	Uncertainty (mg/kg)**
Ag	2.90	0.14
As	35.0	2.9
Ba	64.9	12.0
Be	1.7	0.1
Ca	57276	335
Cd	2.2	0.1
Co	11.8	1.0
Cr	48.3	2.5
Cu	98.2	3.1
Mg	0.98	0.05
Mn	375	12
Ni	32.6	3.9
Pb	170	4
Sn	13.7	0.3
V	56.6	7.0
Zn	920	30
sulphate (water soluble)	4100	88
chloride (water soluble)	280	5

a) Dry mass at 40 °C
b) Dry mass at 105 °C
*) Aqua regia extractable content according to ISO 11466 (1995)
**) Expanded combined uncertainty (k=2)

METRANAL™ 19: Agricultural sandy-clay soil (metals, PAH)

Analyte	Concentration (mg/kg)[ab]	Uncertainty (mg/kg)[c]
Acenapthylene	< 2	–
Acenapthene	< 0.02	–
Antracene	15.3	0.6
Benzo(a)anthracene	75.3	3.5
Benzo(b)fluoranthene	15.3	0.6
Benzo(k)fluoranthene	7.0	0.4
Benzo(g,h,i)perylene	0.76	0.12
Benzo(a)pyrene	<0.05	–
Chrysene	39.7	1.5
Dibenzo(a,h)anthracene	0.38	0.03
Fluoranthene	677	31
Fluorene	233	15
Indeno(1,2,3-cd)pyrene	1.6	0.1
Naphtalene	12.3	0.6
Phenantrene	390	20
Pyrene	237	15

Analyte	Concentration (mg/kg)[ab]	Uncertainty (mg/kg)[c]
Al	21690	1020
As	31.1	0.4
Ba	123	14
Be	4.58	0.06
Ca	2540	50
Cd	0.76	0.14
Co	16.2	0.2
Cr	50.7	1.0
Cu	66.8	3.5
Fe	29530	706
Hg	0.21	0.02
K	7550	190
Mg	7076	34
Mn	358	12
Mo	6.1	0.1
Ni	38.5	3.1
Pb	49.4	0.7
Se	1.8	0.1
Sn	3.2	0.1
Sr	69.7	1.8
Te	<0.03	–
Ti	0.85	0.06
V	53.4	0.7
Zn	147	4
S-total	12300	450
cyanide, total	430	20
sulphate (water soluble)	10260	90
chloride (water soluble)	250	10

a) Dry mass at 105 °C
b) Aqua regia extractable content according to ISO 11466 (1995)
c) Expanded combined uncertainty (k=2)

METRANAL™ 20: Sewage sludge SS-02 (PAH, PCB, metals)

Analyte	Concentration (mg/kg)*	Uncertainty[a] (mg/kg)*
Anthracene	0.25	0.06
Benzo(a)anthracene	0.58	0.05
Benzo(b)fluoranthene	0.37	0.02
Benzo(k)fluoranthene	0.18	0.01
Benzo(g,h,i)perylene	0.29	0.10
Benzo(a)pyrene	0.27	0.03
Chrysene	0.59	0.10
Fluoranthene	2.86	0.34
Fluorene	0.50	0.07
Indeno(1,2,3-cd)pyrene	0.21	0.01
Phenanthrene	1.71	0.12
Pyrene	1.89	0.21

Analyte	Concentration (µg/kg)*	Uncertainty[a] (µg/kg)*
PCB-28	17.8	1.4
PCB-52	9.08	1.76
PCB-101	28.5	7.5
PCB-118	14.4	0.7
PCB-138	102	3
PCB-153	97.8	11.8
PCB-180	86.7	18.4
PCB-194	10.5	0.4

Analyte	Concentration (mg/kg)*[b]	Uncertainty (mg/kg)*[a]
Ag	9.45	0.13
As	18.3	0.5
Be	0.91	0.03
Cd	1.45	0.04
Co	24.2	1.6
Cr	645	14
Cu	348	7
Hg	53.6	1.1
Mn	1580	110
Mo	4.47	0.51
Ni	48.3	1.1
Pb	221	6
Sn	14.4	0.3
V	49.2	0.3
Zn	937	16
sulphate (water soluble)	11520	152
chloride (water soluble)	2230	57
fluoride (water soluble)	32.2	1.0

Analyte	Concentration (%)	Uncertainty (%)
N_{total} (Kjeldahl)	2.16	0.12
Loss on ignition, LOI (440 °C)	42.44	0.14
Dry residue (40 °C)	96.61	0.29
Dry residue (105 °C)	91.57	0.08

*) Dry mass at 105 °C
a) Half widht of the 95% confidence interval
b) Aqua regia extractable content according to ISO 11466 (1995)

METRANAL™ 21: Industrial poluted land (PAH, PCB, metals)

Analyte	Concentration (mg/kg) *	Uncertainty (mg/kg) *a
Acenaphtene	11.4	1.4
Anthracene	2.55	0.16
Benzo(a)anthracene	33.5	3.4
Benzo(b)fluoranthene	2.49	0.05
Benzo(k)fluoranthene	1.3	0.18
Benzo(g,h,i)perylene	0.18	0.01
Benzo(a)pyrene	0.30	0.08
Chrysene	8.27	0.44
Fluoranthene	135	12
Fluorene	49.5	3.6
Indeno(1,2,3-cd)pyrene	0.22	0.05
Naphtalene	2.19	0.31
Phenanthrene	74.0	5.1
Pyrene	69.0	5.0

Analyte	Concentration (mg/kg) ** b	Uncertainty (mg/kg) ** a
As	19.5	0.7
Ba	137	11
Be	1.66	0.12
Ca	5760	125
Cd	1.01	0.07
Co	11.8	0.3
Cr	120	4
Cu	21.4	0.6
Hg	0.175	0.005
Mn	514	27
Ni	32.4	4.0
Pb	30.0	2.3
Sn	6.50	0.43
V	41.0	2.1
Zn	79.7	1.6

Analyte	Concentration (µg/kg)*	Uncertainty[a] (µg/kg)*
PCB-28	329	5
PCB-52	149	7
PCB-101	48.6	1.3
PCB-118	68.4	2.7
PCB-138	11.3	0.7
PCB-153	12.2	1.4
PCB-180	5.9	0.19
PCB-194	1.03	0.14

*) Dry mass at 40 °C
**) Dry mass at 105 °C
a) Half width of the 95% confidence interval
b) Aqua regia extractable content according to ISO 11466 (1995)

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