WAGENINGEN EVALUATING PROGRAMS FOR
ANALYTICAL LABORATORIES

PROF. TESTING
RvA R 002

International Biomass Exchange Program

BiMEP

Quarterly Report 2009.1 January - March 2009

WAGENINGEN UNIVERSITY
ENVIRONMENTAL SCIENCES

INTRODUCTION

Dear WEPAL-participants,

In this report for the first ringtest in 2009 WEPAL introduces a new method of statistical evaluation. There was no problem with the old statistical method to calculate the concensus value. The calculated mean was (and still is) reliable. The removal of outliers however had too much influence on the calculation of the standard deviation. In a number of datasets the standard deviation is underestimated by the old method.
We have tested several other statistical routines which should give a better estimate of the variation of the data. The aim of our study was to find a method which is not influenced by the presence or removal of outliers.
The new statistical model (Cofino NDA) that is chosen to calculate the mean and standard deviation uses probability functions. It calculates a best fit based on the observed values. The model is tested on simulated data sets and datasets of several interlaboratory studies. It is demonstrated that the model is robust and insensitive to outliers. It can cope with asymmetric, strongly tailing and multimodal distributions. A publication describing the procedure in more detail with the results of the tests is in preparation.
This year we will report both new and old statistics. So you can see what the differences are between the two methods. In general you will see that the new NDA mean and old median and mean are similar. The differences betrween the two methods can be observed in the standard deviation. In the NDA method they are not influenced by the presence or removal of outliers. Marking of outliers (**) and stragglers (*) is based on the old statistics. All results, including marked values, are used in the new NDA method.
The Z-scores are now calculated with the NDA standard deviation. Because in a number of cases the NDA standard deviation is higher than the 'old' standard deviation the Z-scores will be lower than in the past.

Early May we will move to our new building. Our telephone numbers, email and postal address will remain unchanged. Only our visiting address will change. Please note that if you send your mail by courier you must change the address.

WEPAL has a webpage where you can check if we have received and processed your data. We have also added the number of results. This way you can also see if all your results were processed correctly. Because you can see the status of the results that you sent us yourself it is no longer necessary to ask for a confirmation of receipt. You can also spare yourself and us the extra work for sending and processing extra copies. This information is published on "log received" page of the WEPAL website www.wepal.nl. Please note that we use your client number in this table, not your labnumber (or code number).

The WEPAL programs are organised to help you to improve the quality of your results. When you have ideas or remarks on the programs that can help us to improve them please feel free to contact us. We are always looking forward to hear from you,

Yours sincerely,

Bram Eijgenraam
Manager WEPAL

Calculated 07-04-2009 (15:14)

IMPORTANT INFORMATION

The results of the April - June 2009 period will be processed in the beginning of July 2009. Participants are kindly requested to take care that the results of this series are in Wageningen **before the first of July 2009.** All results, which are received later, will not be reported.

The 2009.3 samples will be mailed at the end of May 2009.

GENERAL INFORMATION

Accreditation

Accreditation

The Wageningen Evaluating Programmes for Analytical Laboratories organisation is accredited for the organisation of Interlaboratory Studies by the Dutch Accreditation Council RvA since April 26, 2000. The accreditation is based on the ILAC-requirements (Guidelines for the requirements for the competence of providers of proficiency testing schemes, ILAC-G13: 2000). In the following table the scope is given for all WEPAL programs.

Table 1 *Scope of the WEPAL programs.*
IPE, International Plant-analytical Exchange Program
(Parameters in bold are in the scope of the accreditation)

Group	**Parameter**
Inorganic Chemical Composition	Ag, **As**, **B**, **Ba**, Be, Bi, Br, **Ca**, **Cd**, **Cl**, **Co**, **Cr**, Cs, **Cu**, F, **Fe**, Ga, **Hg**, I, **K**, Li, **Mg**, **Mn**, **Mo**, **N - Kjeldahl**, N - NH_4, **N - NO_3**, **Na**, **Ni**, **P**, **Pb**, Pd, Pt, Rb, Rh, **S**, Sb, **Se**, Sn, SO_4, **Sr**, Ti, **V**, **Zn**
Real totals	**Al**, **C - elementary**, **N - elementary**, Si
Acid extractable (So-called totals)	**Al**, Si
Other determinations	13C, 15N, delta 13C, delta 15N
Nutritional values	ADF-ash-containing, ADF-ash-free, Crude fibre, NDF-ash-containing, NDF-ash-free, Polysaccharides (starch), TDF, TDF-non-soluble, TDF-soluble, **Total ash**, Total Disaccharides, Total fat, Total monosaccharides

ISE, International Soil-analytical Exchange Program
(Parameters in bold are in the scope of the accreditation)

Group	**Parameter**
Real totals	Ag, **Al**, **As**, B, **Ba**, **Be**, Bi, **Br**, C - elementary, **Ca**, **Cd**, **Ce**, **Co**, **Cr**, Cs, **Cu**, F, **Fe**, **Ga**, Ge, **Hg**, I, **K**, **La**, **Li**, **Mg**, **Mn**, **Mo**, **N - elementary**, **Na**, **Nb**, **Nd**, **Ni**, **P**, **Pb**, Pd, Pt, **Rb**, Rh, **S**, **Sb**, **Sc**, Se, **Si**, **Sn**, **Sr**, Te, **Th**, **Ti**, Tl, **U**, **V**, W, **Y**, **Zn**, **Zr**
Acid extractable (So-called totals)	Ag, **Al**, **As**, **B**, **Ba**, **Be**, Bi, Br, **Ca**, **Cd**, Ce, **Co**, **Cr**, **Cu**, F, **Fe**, Ga, **Hg**, I, **K**, La, **Li**, **Mg**, **Mn**, **Mo**, **N**, **Na**, Nb, Nd, **Ni**, **P**, **Pb**, Pt, Rb, **S**, **Sb**, Sc, **Se**, Si, **Sn**, **Sr**, Te, Th, **Ti**, **Tl**, U, **V**, Y, **Zn**, Zr
Aqua Regia (ISO 11466)	Ag, **Al**, **As**, B, Ba, **Be**, Bi, Br, **Ca**, **Cd**, Ce, **Co**, **Cr**, **Cu**, F, **Fe**, Ga, **Hg**, I, **K**, La, Li, **Mg**, **Mn**, **Mo**, N, **Na**, Nb, Nd, **Ni**, **P**, **Pb**, Pt, Rb, **S**, Sb, Sc, Se, Si, Sn, Sr, Te, Th, Ti, Tl, U, **V**, Y, **Zn**, Zr
Extraction with boiling 2M HNO_3	**Cd**, **Co**, **Cr**, **Cu**, **Hg**, **Mo**, **Ni**, **Pb**, Tl, **Zn**
Extraction with 0.1M $NaNO_3$	**Cd**, **Cu**, **Ni**, Pb, **Zn**
Extraction with 0.01M $CaCl_2$ 1:10	Al, B, Cd, CN, Co, Cr, Cu, Fe, **K**, **Mg**, Mn, **N - NH_4**, **N - NO_3**, N total soluble, Na, Ni, P, Pb, SO_4, Zn
Extraction with 1M NH_4NO_3 1:2.5 (w/v) (DIN 19730)	As, Cd, Cr, Cu, Hg, Ni, Pb, Tl, Zn
Soil characteristics	**C - org others (W&B a.o.)**, **EC-SC (ISO 11265)**, **Fraction < 16 µm**, **Fraction < 2 µm**, **Fraction < 63 µm**, **Fraction > 63 µm**, **Org.matter (L.O.I.)**, **pH - $CaCl_2$**, **pH - H_2O**, **pH - KCl**, **TC=Total C (org.+inorg.)**, **TIC=Tot.Inorg, C($CaCO_3$)**, **TOC=Total Org. C**
Other determinations	C^{13}, N^{15}, B - Hot water, CN - Free, CN - Total, delta 13C, delta 15N, K - HCl, Mg - NaCl, Moisture-content

Group	Parameter
Fluoride (Swiss standard procedure)	F - Total
Digestion with conc. HNO_3 + conc. HCl + H_2O_2 (UNEP-UN/EC 91075A)	Al, As, B, Ba, Be, Br, Ca, Cd, Co, Cr, Cu, F, Fe, Ga, Hg, I, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Rb, S, Sb, Se, Si, Sn, Sr, Tl, V, Y, Zn, Zr
Pot. CEC using 1M NH_4-acetate at pH=7	Al, **Ca**, **CEC**, **K**, **Mg**, **Na**
Pot. CEC using 1M or 0.1M $BaCl_2$-TEA at pH=8.1 (ISO 13536 OR BZE)	Al, Ca, **CEC**, K, Mg, Na
Pot. CEC using 1M NH_4Cl (BZE)	Al, Ca, CEC, Fe, H, K, Mg, Mn, Na
Act. CEC using 0.01M $BaCl_2$ (ISO 11260)	Al, Ca, CEC, Fe, H, K, Mg, Mn, Na
Act. CEC using 0.1M $BaCl_2$ (UNEP-UN/EC 91065A)	Al, Ca, CEC, Fe, H, K, Mg, Mn, Na
Act. CEC using cobaltihexamine (AFNOR NFX 31 130)	Al, Ca, CEC, Fe, H, K, Mg, Mn, Na
Mehlich-3	Al, As, B, **Ca**, Cd, Cr, **Cu**, **Fe**, **K**, **Mg**, **Mn**, **Na**, **P**, Pb, **Zn**
Extraction with Ca-lactate (VDLUFA)	K, P
Extraction with double lactate (VDLUFA)	**K**, **P**
Water soluble 1:10 (w/v) (EN-12457-4)	Br, Cl, F, N - NO_3
Extraction with 0.01M $CaCl_2$ + 0.005M DTPA 1:10 (w/v)	Cu, Fe, Mn, Zn
Extraction with 1M KCl 1:10 (w/v)	N - NH_4, N - NO_3
Phosphorus and related analysis	Al - Ox, Fe - Ox, P - Ox, P - AL, **P - Bray**, **P - Olsen**, Pw
Extraction with 1M HCl (Polish standard)	B, Cu, Fe, Mn, Zn
Water soluble 1:10 (w/v) (NL VPR C85-06)	Br, Cl, F, SO_4

SETOC, International Sediment Exchange for Tests on Organic Contaminants

(Parameters in bold are in the scope of the accreditation)

Group	Parameter
Polycyclic aromatic hydrocarbons	**acenaphtene**, **acenaphtylene**, **anthracene**, **benz(a)anthracene**, **benzo(a)pyrene**, **benzo(b)fluoranthene**, **benzo(ghi)perylene**, **benzo(k)fluoranthene**, **chrysene**, **dibenz(ah)anthracene**, **fluoranthene**, **fluorene**, **indeno(1,2,3-cd)pyrene**, **naphtalene**, **phenanthrene**, **pyrene**
Polychlorobiphenyls	**PCB 028**, PCB 031, **PCB 052**, PCB 077, PCB 081, **PCB 101**, **PCB 105**, PCB 114, **PCB 118**, PCB 123, PCB 126, **PCB 128**, **PCB 138**, PCB 149, **PCB 153**, PCB 156, PCB 157, PCB 167, PCB 169, **PCB 180**, PCB 189
Organochlorine pesticides	1,2,3 trichlorobenzene, 1,2,3,4 tetrachlorobenzene, 1,2,3,5 tetrachlorobenzene, 1,2,4 trichlorobenzene, 1,2,4,5 tetrachlorobenzene, 1,3,5 trichlorobenzene, aldrin, alpha-endosulfan, alpha-HCH, beta-endosulfan, beta-HCH, chlordane, cis-chlordane, delta-HCH, dieldrin, endosulfan, endosulfan sulfate, endrin, gamma-HCH, heptachlor, heptachlor epoxide, **hexachlorobenzene**, **hexachlorobutadiene**, isodrin, **o,p`-DDD**, **o,p`-DDE**, **o,p`-DDT**, **p,p`-DDD**, **p,p`-DDE**, **p,p`-DDT**, **pentachlorobenzene**, Sum tetrachlorobenzenes, Sum trichlorobenzenes, telodrin, toxaphene, trans-chlordane
Other parameters	**AOX**, CN - Free, **CN - Total**, **EOX**, Inorganic carbon, **Mineral oil (GC)**, **Mineral oil (IR)**, **Organic carbon**, **Particles < 2 µm**, Particles < 63 µm, Particles > 63 µm

Group	Parameter
Metals (aqua regia)	**As**, Ba, **Cd**, Co, **Cr**, **Cu**, **Hg**, Mo, **Ni**, **Pb**, **Zn**
Dibenzo-P Dioxin	**1,2,3,4,6,7,8 Cl_7DD**, 1,2,3,4,7,8 Cl_6DD, **1,2,3,6,7,8 Cl_6DD**, 1,2,3,7,8 Cl_5DD, **1,2,3,7,8,9 Cl_6DD**, 2,3,7,8 Cl_4DD, **Cl_8DD**
Dibenzofuran	**1,2,3,4,6,7,8 Cl_7DF**, **1,2,3,4,7,8 Cl_6DF**, **1,2,3,4,7,8,9 Cl_7DF**, **1,2,3,6,7,8 Cl_6DF**, **1,2,3,7,8 Cl_5DF**, **1,2,3,7,8,9 Cl_6DF**, **2,3,4,6,7,8 Cl_6DF**, **2,3,4,7,8 Cl_5DF**, **2,3,7,8 Cl_4DF**, **Cl_8DF**
Brominated Flame Retarders	BDE 028, BDE 047, BDE 066, BDE 085, BDE 099, BDE 100, BDE 153, BDE 154, BDE 183, BDE 209
Experimental	DEHP, Tributyl Tin (TBT)

MARSEP, Manure and Refuse Sample Exchange Program

(Parameters in bold are in the scope of the accreditation)

Group	Parameter
Real totals	Ag, Al, As, B, Ba, Be, Bi, Br, C, Ca, Cd, Co, Cr, Cu, F, Fe, Ga, Hg, I, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn
Acid extractable (So-called totals)	Ag, **Al**, **As**, B, Ba, Be, Bi, Br, C, **Ca**, **Cd**, Cl, **Co**, **Cr**, **Cu**, F, **Fe**, Ga, **Hg**, I, **K**, Li, **Mg**, **Mn**, **Mo**, **N**, N - NH_4, N - NO_3, **Na**, **Ni**, **P**, **Pb**, S, SO_4, Sb, Se, Si, Sn, Sr, Ti, Tl, V, **Zn**
Other determinations	**AOX**, **loss-on-ignition**

BIMEP, Biomass Exchange Program

(Parameters in bold are in the scope of the accreditation)

Group	Parameter
General Analysis	**ash, calorific value, moisture**, Volatile Matter
Elementary Analysis	**Carbon (C),** Cl, **Hydrogen (H), Nitrogen (N), S**
Water Soluble Elements	Cl, K, Na
Major Elements	Al, Ca, Fe, K, Mg, Na, P, Si
Minor Elements	As, Ba, Be, Cd, Co, Cr, Cu, F, Hg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Te, Ti, Tl, V, Zn

The selection of parameters included in the scope of accreditation is based on the information that can be given about the homogeneity of the parameters in the samples. This information is based on the relation between the Coefficient of Variation as given in the Annual Reports and the concentration in the different samples used in the WEPAL-programs during the last years. Only in case of a clear and consistent pattern, conclusions can be drawn concerning homogeneity of the material. In the case of a large variation in CV values no distinction can be made between inhomogeneity of the material and the variation in the analytical performance caused by the participating laboratories. These parameters are not (yet) included in the scope of the accreditation.

Some aspects of the proficiency testing scheme may from time to time be subcontracted. When subcontracting occurs it is placed with a competent subcontractor. WEPAL is responsible to the scheme participants for the subcontractor's work.

Homogeneity of the distributed samples

Homogeneity tests

WEPAL has developed special equipment for the production of representative subsamples (Houba, 1993) from a bulk material. The proper functioning of this equipment is tested by a homogeneity test in the final subsamples. To perform this test, samples are collected at regular intervals during the preparation of the the samples. The collected samples, with a minimum of 10, are analysed in duplicate measurements under repeatability conditions. A selection of critical parameters is chosen for the tests. The results of the homogeneity tests are published in the annual reports.

Check of results

Before distribution of the periodic reports to the participants, a final check is made based on the results found by the participants. This check is made for all reported parameters. The Coefficient of Variances and concentrations found in the periodic reports are compared with the patterns as found in the latest Annual Report (part B). The expected pattern is a high CV at a low concentration and a gradually decreasing CV at higher concentrations till a more or less constant level of CV-values is reached (Houba et al., 1986). Deviations from this expected pattern are mentioned in the periodic reports. This might be an indication of inhomogeneity of the material for the certain parameter.

All data of this period are compared with the general patterns as published in the latest year report. No deviating values were found.

The quarterly report

In order to evaluate the accuracy and precision of the analytical procedures used, four proficiency testing programs have been established. At this moment the WEPAL Exchange Programs comprises approximately 600 laboratories in many countries. The participating laboratories receive four air-dried samples every three months and analyse the samples according to their own procedures. The results of the determinations are collected and processed at Wageningen University and published every three months. The participating laboratories are informed of the results in the third week of the next three-month period. Each participant can compare his results with those of all the other members of the exchange program. WEPAL will not comment on results unless asked to do so.

Reporting of data

The analysed components must be reported in ovendry (105 $^{\circ}$C) material. For this purpose the moisture content has to be determined separately and the analytical results have to be recalculated (see the form to report the results). To get reproducible results of these moisture contents we recommend you to dry the material during at least 3 hours at 105 $^{\circ}$C and let cool down in a desiccator before weighing.

New statistics: normal distribution approximation (NDA)

Interlaboratory studies like the WEPAL proficiency testing ringtests frequently give rise to datasets that have complex distributions including excessive tailing and multiple modes. Consequently, sophisticated statistical methods are required to obtain meaningful assessments. The strategy that was used until now makes use of an outlier test followed by straightforward statistics. Problem with this strategy is that removal of outliers causes an underestimation of variance of the dataset. Therefore a methodology is needed that does not rely on arbitrary outlier removal or subjective manual interpretations. Ideally the new methodology must provide the characteristics of the highest mode of the dataset.
A new model is chosen to calculate population characteristics (mean and standard deviation) from experimental datasets (Cofino 2000). The model uses an estimate for the probability density function (pdf) of the measurement process and calculates a best fit based on all observed values. The implementation of the model that is used does not require uncertainty estimates for all data points. Instead it uses a normal distribution approximation (NDA) for the pdf of the individual data points. In essence, the pdf's of the individual datapoints are superposed on each other to create a continuous pdf representing the entire distribution (all datapoints).
With the mathematical model coefficients can be obtained by looking for the combination of data points that has the highest probability in the basis set. This maximization amounts to the identification of the first mode

of the dataset. The coefficients can be used to calculate the weighted mean and standard deviation. Subsequent calculations give additional modes of the distribution and for each mode the expectation value (mean), the standard deviation and a percentage indicating the fraction of observations encompassed. In this report only mean and standard deviation for the first mode (combination with the highest probability in the dataset) are given.

Table 2. The model summarised

- Each observation is attributed an ' Observation measurement function' (OMF, φ_i)
- An OMF is defined as the square root of the probability density function appropriate for the observation. If normal distributions are used: $\varphi_i=\sqrt{N(\mu_i,\sigma_i^2)}$
- The set of φ_i 's constitutes a basisset in which the population measurement function Ψ is constructed: $\Psi_i=\sum c_{ik}\,\varphi_k$
- The coefficients are obtained by finding the combination which renders highest probability density (maximise $\int\Psi^2dx$, x being concentration). Mathematically this amounts to solving the eigenvector-eigenvalue equation $Sc=\lambda c$, S_{ij} being an overlap integral defined as $\int \varphi_i\,\varphi_j dx$, $0\leq S_{ij} \leq 1$
- Mean and standard deviation of Ψ_i are calculated from the first and second moment of the probability density function Ψ_i^2

$$\overline{m}_i = \frac{\int x\Psi_i^2 dx}{\int \Psi_i^2 dx},$$

$$s_i^2 = \frac{\int x^2\Psi_i^2 dx}{\int \Psi_i^2 dx} - \overline{m}_i^{\,2}$$

- The variance calculated by the model represents the sum of the estimates for the within-laboratory and between-laboratory variances, i.e. $s_i^2 = s_{between\,labs,i}^2 + s_{within\,labs,i}^2$
- When the NDA approximation is used, s_i^2 estimates the between-laboratory variance

The model is tested on simulated data sets and datasets of several interlaboratory studies. It is demonstrated that the model is robust and insensitive to outliers. It can cope with asymmetric, strongly tailing and multimodal distributions. Publications describing the procedure in more detail and results of the tests are in preparation.
With the NDA model mean and standard deviation are calculated using all reported data when at least 8 results are left after removal of reported 'lower than' (<) and 0 (= zero) values. No outliers are removed.

Old statistics: Calculation of median and MAD.

Starting with the first proficiency tests in 2009 a new statical method was chosen. For reasons of continuity the statistical results of the old method will be reported in 2009. The old statistical method was preferred because strange values had less influence on the estimated central value (location) and the spread of this value (scale). Therefore estimators for location and scale were used which give less weight to observations in the tails (van Montfort, 1996). For each element a median value (μ_1) and a median of absolute deviations (MAD, σ_1) are calculated using all reported data except the reported '<' and 0 (= zero) values. The median is the middle observation of the sorted array of observations in the case of an odd sample size. Otherwise it is the mean of the two middle observations. Using the median instead of mean, extreme data are of less influence. MAD is the median of the absolute values of the observations minus their median. In case more than 7 data are reported, the values with $|(x - \mu_1)| / (f*\sigma_1) > 2$ are marked with a double asterisk (**). The factor f, aiming at 5% (singly or doubly) asterisked data in a sample of size n (n > 7) from a Gaussian distribution, is approximated by (0.7722 + 1.604 / n) * t, where t is the 2½ percent point of Student's t with (n - 1) degrees of freedom. A second median (μ_2) and a second MAD (σ_2) are computed then leaving out the items labelled **; included values with $|(x - \mu_2)| / (f*\sigma_2) > 2$ are marked with a single asterisk (*). Finally a third median and MAD are calculated, discarding both * and **.

In the case of small results which are heavily rounded the MAD often becomes 0 (= zero). This is very unsatisfactory because all results other than the median are marked as outlier. Therefore no results are marked as outlier in cases where MAD = 0. Mean and standard deviation are only calculated when at least 8 results are left after removal of outliers (**) and stragglers (*).

Rounding of results

Rounding interval is based on the first decimal value lower than sd / 2 (standard deviation divided by 2). If no standard deviation is available (less than 8 results) the MAD is used. At least three significant digits are shown as a minimum. If no standard deviation and MAD are available rounding is also based on three (most) significant digits. For the statistical results (mean, standard deviation, median and MAD) one extra digit is shown.
Note that larger results are also rounded (e.g. 1809 may be rounded as 1810).

Z-score

For all analytical data a Z-score is calculated according to the formula:

$$\text{Z-score} = \frac{\text{X-}\,\text{X}_{\text{mean}}}{\text{S}_{\text{d}}}$$

in which:
X = the reported value
X_{mean} = the mean of all values calculated with the NDA model
S_d = standard deviation calculated with the NDA model

METHOD INDICATING CODE (MIC)

In order to evaluate the analytical results for each reported element (see **Fout! Verwijzingsbron niet gevonden.** for the different element groups), a Method Indicating Code (MIC) is used in the other WEPAL programs. Details of the analytical procedures used by the individual participants are indicated by four characters, added at the end of each row with results. With this information all participants can compare the results of their analytical procedures more specifically with the results of other participants. This could be a further valuable tool in judgement of the individual results.

The BIMEP program is still in development therefore the MIC codes are not available yet. After each group of analytes a summary is given of the method details of the participating laboratories. Because this is important information send us your changes or corrections together with the results for the next period.

References and related literature

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MATERIALS ANALYSED

Table 3 Materials analysed in this period.

Sample	Sample ID	Type	Country
1	417	Compost	Switzerland
2	402	Barley (straw)	Netherlands
3	416	Grass (gr94) / Poaceae	Leeuwarden / Netherlands
4	418	Sewage sludge	Fac Liebefeld / Switzerland

NEW MEMBERS

Secil S.A. FSQP, Setubal, Portugal

Used abbrevations and symbols

Table 4 *Used abbreviations and symbols*

Where	Abbreviation	Explanation
General Information	CV	coefficient of variation
General Information	MIC	method indicating code
General Information	MAD	median absolute deviation
General Information	Sd	standard deviation
General Information	f	f factor
General Information	μ_1	first median
General Information	μ_2	second median leaving out **
General Information	μ_3	third median leaving out * and **
General Information	σ_1	first MAD
General Information	σ_2	second MAD leaving out **
General Information	σ_3	third MAD leaving out * and **
General Information	<	value smaller than
General Information	*	straggler
General Information	**	outlier
Results	median "result" (0)	no median available
Results	median "result" (1)	first median (all results)
Results	median "result" (2)	second median leaving out **
Results	median "result" (3)	third median leaving out * and **
Results	-	no result was submitted
Results	x	zero (0) was submitted as result, not taken into account
Results	-	statistical values: not calculated
Z-scores	#	less than 8 values, no mean and Sd calculated
Z-scores	<	a smaller than value was reported
Z-scores	-	no result (or zero) was submitted
Errors	C	Correction participant
Errors	D	Results received after deadline (before publication date)
Errors	E	Error WEPAL
Errors	M	Modified results
Errors	N	New results
Errors	R	Results removed

Analysis BIMEP 2009.1

BIMEP 2009.1 - General Analysis

Sample		417		402		416		418		MIC
ash (g/kg)										
ATVC	(7)	716		76.2		106		724		
IFPO	(145)	716		78.4		101		734		
NGGBUG	(755)	700		73.9		102		736		
INCOLAB	(821)	709		76.1		101		726		
TLR	(900)	694		75.3		102		723		
CSL	(916)	7	**	0.8	**	1	**	7	**	
BSPLZE	(917)	687		69.0	*	94		679		
INETI	(919)	714		76.5		104		714		
EON	(921)	657		65.8	**	84	**	674	*	
SECIL	(985)	683		77.2		98		694		
NDA mean		700.4		76.15		101.4		716.1		
NDA st dev		21.7		2.23		4.0		24.5		
NDA N		10		10		10		10		
	Old statistics									
Median		699.9	(3)	76.20	(3)	101.4	(3)	723.4	(3)	
MAD		14.1		0.90		1.8		10.0		
Mean		697.2		-		101.0		716.2		
St Dev		19.8		-		3.6		19.9		
N		9		7		8		8		
calorific value (MJ/kg)										
ATVC	(7)	5.85		17.8		18.7		5.26		
IFPO	(145)	5.63		17.8		18.3		5.05		
NGGBUG	(755)	5.65		17.8		18.5		5.25		
INCOLAB	(821)	5.88		18.1		18.6		5.38		
TLR	(900)	5.92		18.3		18.7		5.92	**	
CSL	(916)	6.56		17.9		18.5		5.44		
BSPLZE	(917)	4.25	**	18.1		18.0		5.08		
INETI	(919)	5.33		17.0		18.4		4.94		
EON	(921)	4.44	*	17.1		18.2		5.11		
SECIL	(985)	5.20		16.1	**	16.2	**	4.30	**	
NDA mean		5.662		17.86		18.48		5.193		
NDA st dev		0.454		0.47		0.23		0.236		
NDA N		10		10		10		10		
	Old statistics									
Median		5.752	(3)	17.80	(3)	18.46	(3)	5.184	(3)	
MAD		0.150		0.31		0.12		0.120		
Mean		5.753		17.77		18.44		5.190		
St Dev		0.418		0.45		0.22		0.172		
N		8		9		9		8		
moisture (g/kg)										
ATVC	(7)	34.2		73.1		99.7	**	61.8		
IFPO	(145)	34.4		73.6		81.7		57.8		
NGGBUG	(755)	36.6		74.6		66.3		62.9		
INCOLAB	(821)	29.0		65.8		65.2		52.4		
TLR	(900)	37.0		78.9		72.4		62.7		
CSL	(916)	0.4	**	0.7	**	0.7	**	0.6	**	
BSPLZE	(917)	53.4	**	71.0		68.5		46.8		
INETI	(919)	36.0		73.6		76.5		61.2		
EON	(921)	38.1		77.2		70.1		59.0		
SECIL	(985)	28.4		64.2		71.3		53.1		
NDA mean		35.19		73.34		70.90		58.48		
NDA st dev		3.42		4.54		6.70		6.19		
NDA N		10		10		10		10		
	Old statistics									
Median		35.20	(3)	73.60	(3)	70.68	(3)	59.02	(3)	
MAD		1.61		2.60		3.28		3.68		
Mean		34.21		72.44		71.50		57.52		
St Dev		3.64		4.82		5.45		5.60		
N		8		9		8		9		

BIMEP 2009.1 - General Analysis

Sample		417	402	416	418	MIC
Volatile Matter (g/kg)						
INCOLAB	(821)	269	740	723	257	
TLR	(900)	256	739	727	263	
CSL	(916)	3	7	7	3	
BSPLZE	(917)	279	777	734	283	
INETI	(919)	273	747	733	281	
EON	(921)	257	739	726	289	
SECIL	(985)	284	750	741	284	
Median		268.6 (1)	739.9 (1)	726.9 (1)	281.4 (1)	
MAD		11.4	6.7	6.0	7.5	
N		7	7	7	7	

Method information :

Analyte	temperature	time	Labnumber	ref method
Moisture	105	3h	7, 900	
	105	3h	817, 919	CEN 14774-3
	105	4h	145	
	110	16 h	460	
	105		916	
	105	constant weight	821, 917	ISO 589
	105	3 h, under nitrogen	921	ISO 11722

	temperature	time	Labnumber	ref method
Ash	550	250 1h, up 550 1h, 550 2h	7, 817, 821, 900, 919	CEN 14775
	550	3h	145	
	550	16h	460	
	550		916	
	815	constant weight	917	ISO 1171
	815	500 1h, 815 1h	921	ISO 1171

	method	detail	Labnumber	ref method
Calorific Value	Oxygen Bomb calorimeter	constant volume	7	
	Bombcalorimeter		145	DIN 51900
	Bombcalorimeter		916	
	Bombcalorimeter	adiabatic	460, 821	
	Bombcalorimeter		917, 921	ISO 1928
	elemental analyser	calculated (from C, H, S)	817	CEN/TS 15296
			919	CEN/TS 14918
Volatile Matter			919	CEN/TS 15148

BIMEP 2009.1 - Elementary Analysis

Sample		417		402		416		418		MIC
Carbon (C) (g/kg)										
ATVC	(7)	184		458		464		175		
IFPO	(145)	175		457		452		159		
NGGBUG	(755)	167		457		452		177		
INCOLAB	(821)	177		461		459		171		
TLR	(900)	-		466		425	*	151		
CSL	(916)	2	**	5	**	5	**	2	**	
BSPLZE	(917)	154		462		448		168		
INETI	(919)	172		460		456		161		
EON	(921)	173		458		450		9	**	
SECIL	(985)	160		427	**	438		162		
NDA mean		172.4		459.3		452.2		165.8		
NDA st dev		7.9		3.5		9.5		12.9		
NDA N		9		10		10		10		
	Old statistics									
Median		172.7	(3)	459.1	(3)	452.0	(3)	165.2	(3)	
MAD		5.0		2.1		4.2		6.2		
Mean		170.4		459.8		452.3		165.6		
St Dev		9.7		3.1		7.8		8.9		
N		8		8		8		8		
Hydrogen (H) (g/kg)										
IFPO	(145)	21.3		65.4		68.4	**	20.4		
NGGBUG	(755)	16.6		57.4		58.7		17.9		
INCOLAB	(821)	16.3		53.6		57.6		14.7		
TLR	(900)	16.1		54.0		61.9		10.2		
CSL	(916)	0.2	**	0.6	**	0.6	**	0.2	**	
BSPLZE	(917)	14.0		54.0		58.0		16.0		
INETI	(919)	19.1		62.8		65.4	**	21.9		
EON	(921)	17.2		56.0		58.1		155.2	**	
SECIL	(985)	18.5		59.7		59.4		18.5		
NDA mean		17.25		56.58		58.57		17.41		
NDA st dev		2.56		3.80		1.55		4.55		
NDA N		9		9		9		9		
	Old statistics									
Median		16.92	(3)	56.70	(3)	58.42	(2)	17.94	(2)	
MAD		1.20		2.85		0.62		2.46		
Mean		17.39		57.86		-		-		
St Dev		2.21		4.41		-		-		
N		8		8		6		7		
Nitrogen (N) (g/kg)										
ATVC	(7)	15.0		4.49		32.1		10.4		
IFPO	(145)	14.9		4.75		31.1		10.0		
NGGBUG	(755)	14.7		7.46	**	31.8		12.1	**	
INCOLAB	(821)	14.4		2.50		29.2		10.4		
TLR	(900)	-		4.30		30.7		9.8		
CSL	(916)	0.1	**	0.02	<	0.0	**	0.1	**	
BSPLZE	(917)	10.0	*	3.00		31.0		10.0		
INETI	(919)	13.6		5.75		31.7		10.3		
EON	(921)	13.8		3.80		31.3		14.5	**	
SECIL	(985)	13.6		4.20		30.5		10.3		
NDA mean		14.27		4.192		31.21		10.18		
NDA st dev		1.20		0.801		0.81		0.43		
NDA N		9		9		10		10		
	Old statistics									
Median		14.40	(3)	4.250	(3)	31.10	(3)	10.30	(2)	
MAD		0.60		0.475		0.56		0.10		
Mean		-		4.099		31.04		-		
St Dev		-		1.016		0.87		-		
N		7		8		9		7		

BIMEP 2009.1 - Elementary Analysis

Method information C, H, N :

Analyte	method	detail	Labnumber	ref method
C, H, N	C, H, N, S elemental analyser	950	7	
	C, H, N, S elemental analyser		817, 919	CEN 15104
	elemental analyser		145, 821, 900, 916, 921	
	elemental analyser	2 - 5 mg	460	
	elemental analyser	GC TCD	917	ISO 12902

Sample		**417**	**402**	**416**	**418**	**MIC**
Cl (g/kg)						
ATVC	(7)	0.58	6.34	8.14	0.500 <	
IFPO	(145)	1.25	6.12	7.97	0.260	
NGGBUG	(755)	0.70	7.03	8.34	0.132	
INCOLAB	(821)	1.24	6.25	7.81	0.204	
TLR	(900)	1.65	7.50	9.72 **	0.170	
CSL	(916)	0.01	0.05 **	0.06 **	0.001	
INETI	(919)	0.73	6.50	7.83	0.121	
EON	(921)	1.65	6.48	8.39	0.274	
SECIL	(985)	3.00	42.10 **	36.10 **	0.700 **	
NDA mean		1.050	6.494	8.081	0.1765	
NDA st dev		0.743	0.501	0.404	0.0987	
NDA N		9	9	9	8	
	Old statistics					
Median		1.243 (3)	6.480 (2)	8.055 (2)	0.1700 (2)	
MAD		0.517	0.226	0.235	0.0490	
Mean		1.202	-	-	-	
St Dev		0.860	-	-	-	
N		9	7	6	7	
S (g/kg)						
ATVC	(7)	1.20	1.46	3.64	0.95	
IFPO	(145)	2.31	1.33	3.08	1.98	
NGGBUG	(755)	3.21	10.57 **	3.81	3.47	
INCOLAB	(821)	1.90	1.70	3.10	1.70	
TLR	(900)	2.00	2.00	3.20	0.50 <	
CSL	(916)	0.01	0.02 **	0.04 **	0.00	
BSPLZE	(917)	0.50	0.80	1.70	0.50	
INETI	(919)	1.55	2.07	3.71	1.44	
EON	(921)	3.43	1.64	3.68	3.20	
SECIL	(985)	1.50	1.30	3.20	1.20	
NDA mean		1.733	1.539	3.397	1.337	
NDA st dev		0.895	0.501	0.600	0.879	
NDA N		10	10	10	9	
	Old statistics					
Median		1.723 (3)	1.548 (3)	3.200 (3)	1.438 (3)	
MAD		0.555	0.233	0.440	0.542	
Mean		1.760	1.537	3.236	1.605	
St Dev		1.073	0.412	0.645	1.150	
N		10	8	9	9	

BIMEP 2009.1 - Elementary Analysis

Method information Cl, S :

Analyte	destruction details	detection	Labnumber	ref method
S, Cl total	combustion oxygen bomb, absorption in water	ion chromatograph	7	
S, Cl total	presstablet	WD-RFA	145	
S, Cl total	presstablet	XRF	921	
Cl	combustion oxygen bomb	ion chromatograph	460	
Cl		Capil. Electrophoresis	919	CEN 15289/15408
S	Berghoff bomb acid mixture HCLO4 HNO3 HF 9h 190	ICP OES	460	
S	Dumas combustion (oxygen)	gas analysis TCD	817, 919	CEN 15289
S	elemental analyser	IR	821	
S	C, H, N, S elemental analyser		900	
Cl	tube furnace	ion chromatograph	821, 900	
S	combustion 1350	gas analysis IR	916	
S, F, Cl	bomb combustion	ion selection ?	917	

BIMEP 2009.1 - Water Soluble Elements

Sample		417	402	416	418	MIC
Cl (g/kg)						
ATVC	(7)	0.93	6.29	8.3	0.50 <	
INETI	(919)	5.32	10.05	18.7	1.12	
Median		3.125 (1)	8.170 (1)	13.49 (1)	1.120 (1)	
MAD		2.195	1.880	5.23	-	
N		2	2	2	1	
K (g/kg)						
ATVC	(7)	6.80	12.10	13.8	1.030	
INETI	(919)	0.99	5.94	7.8	0.102	
Median		3.897 (1)	9.020 (1)	10.80 (1)	0.5661 (1)	
MAD		2.903	3.080	3.00	0.4640	
N		2	2	2	2	
Na (g/kg)						
ATVC	(7)	0.340	0.160	2.47	0.0500 <	
INETI	(919)	0.015	0.080	2.36	0.0376	
Median		0.1774 (1)	0.1201 (1)	2.415 (1)	0.03760 (1)	
MAD		0.1627	0.0400	0.055	-	
N		2	2	2	1	

Method information WaterSoluble Elements :

Analyte	method	detail	Labnumber	ref method
K, Na	AAS		919	CEN 15105
Cl	Capil. Electrophoresis		919	CEN 15105

BIMEP 2009.1 - Major Elements

Sample		417	402	416	418	MIC
Al (g/kg)						
IFPO	(145)	24.9	0.146	0.688	26.4	
INCOLAB	(821)	26.3	0.160	0.900	2.8	
BSPLZE	(917)	27.3	0.100	0.300	30.5	
INETI	(919)	20.2	0.200 <	0.670	21.1	
EON	(921)	32.0	0.137	0.787	34.7	
SECIL	(985)	35.8	0.300	0.900	39.8	
Median		26.80 (1)	0.1459 (1)	0.7374 (1)	28.44 (1)	
MAD		3.58	0.0141	0.1153	6.83	
N		6	5	6	6	
Ca (g/kg)						
IFPO	(145)	37.9	3.05	5.40	45.9	
INCOLAB	(821)	46.3	2.70	5.40	52.9	
BSPLZE	(917)	91.8	5.30	12.30	108.2	
INETI	(919)	47.5	2.71	5.99	57.3	
EON	(921)	53.9	3.29	6.20	66.3	
SECIL	(985)	86.8	67.30	76.00	109.9	
Median		50.68 (1)	3.170 (1)	6.097 (1)	61.82 (1)	
MAD		8.56	0.465	0.697	12.44	
N		6	6	6	6	
Fe (g/kg)						
IFPO	(145)	12.9	0.104	0.500	10.8	
INCOLAB	(821)	25.9	0.140	0.600	14.4	
BSPLZE	(917)	41.8	0.200	1.400	35.6	
INETI	(919)	16.4	0.139	0.569	13.4	
EON	(921)	18.0	0.119	0.531	16.0	
SECIL	(985)	37.1	4.300	10.100	33.9	
Median		21.95 (1)	0.1396 (1)	0.5844 (1)	15.20 (1)	
MAD		7.29	0.0281	0.0690	3.12	
N		6	6	6	6	
K (g/kg)						
IFPO	(145)	15.1	14.6	25.6	7.6	
INCOLAB	(821)	14.9	15.3	28.0	12.3	
BSPLZE	(917)	32.5	19.6	35.4	17.5	
INETI	(919)	16.5	14.3	26.1	10.5	
EON	(921)	23.4	16.1	29.7	11.9	
SECIL	(985)	29.7	155.1	178.3	15.5	
Median		19.95 (1)	15.70 (1)	28.85 (1)	12.10 (1)	
MAD		4.97	1.25	3.03	2.51	
N		6	6	6	6	
Mg (g/kg)						
IFPO	(145)	7.29	0.440	1.90	5.07	
INCOLAB	(821)	8.70	0.370	2.10	4.90	
BSPLZE	(917)	8.50	0.200	0.90	6.30	
INETI	(919)	8.72	0.351	2.04	4.88	
EON	(921)	9.70	0.441	2.11	7.14	
SECIL	(985)	11.20	0.400	1.00	7.30	
Median		8.710 (1)	0.3850 (1)	1.970 (1)	5.685 (1)	
MAD		0.600	0.0445	0.135	0.793	
N		6	6	6	6	
Na (g/kg)						
IFPO	(145)	2.90	0.123	3.15	3.67	
INCOLAB	(821)	4.80	0.410	3.80	8.00	
Median		4.390 (1)	0.2311 (1)	3.316 (1)	5.765 (1)	
MAD		0.273	0.1081	0.654	1.048	
N		6	3	6	6	

BIMEP 2009.1 - Major Elements

Sample		417	402	416	418	MIC
Na (g/kg)	(cont.)					
BSPLZE	(917)	3.10	-	1.30	4.00	
INETI	(919)	4.53	0.231	3.48	6.10	
EON	(921)	4.38	-	4.14	5.53	
SECIL	(985)	4.40	-	0.40	6.00	
Median		4.390 (1)	0.2311 (1)	3.316 (1)	5.765 (1)	
MAD		0.273	0.1081	0.654	1.048	
N		6	3	6	6	
P (g/kg)						
IFPO	(145)	3.74	1.00	3.67	2.68	
INCOLAB	(821)	3.30	0.94	3.90	2.20	
BSPLZE	(917)	6.30	0.70	2.50	4.70	
INETI	(919)	3.83	2.35	5.79	2.58	
EON	(921)	5.48	1.08	4.29	4.00	
SECIL	(985)	8.10	9.50	13.00	5.90	
Median		4.653 (1)	1.040 (1)	4.095 (1)	3.340 (1)	
MAD		1.133	0.220	1.010	0.951	
N		6	6	6	6	
Si (g/kg)						
IFPO	(145)	119	22.3	8.9	113	
INCOLAB	(821)	235	20.7	13.3	236	
BSPLZE	(917)	165	13.0	4.9	166	
INETI	(919)	209	19.4	12.5	212	
EON	(921)	168	24.1	10.1	158	
SECIL	(985)	217	64.7	17.0	215	
Median		188.6 (1)	21.50 (1)	11.30 (1)	188.7 (1)	
MAD		25.8	2.35	2.18	28.5	
N		6	6	6	6	

Method information Major Elements :

Analyte	destruction details	detection	Labnumber	ref method
Major elements	presstablet	XRF	917, 921	
	presstablet	WD-RFA	145	
	Berghoff bomb acid mixture HCLO4 HNO3 HF 9h 190	ICP OES	460	
	ash 550 + fusion $LiCO_3$	ICP OES	821	
	microwave	AAS	900	
	ash 500 + acid	ICP OES	916	
	?	AAS	919	ASTM D 3682
P	?	UV/VIS	919	EN 13656

BIMEP 2009.1 - Minor Elements

Sample		417		402		416		418		MIC
As (mg/kg)										
NGGBUG	(755)	16.00		-		7.00		13.00		
INCOLAB	(821)	7.90		0.30	<	0.40		4.90		
TLR	(900)	7.29		0.59		0.36		4.85		
BSPLZE	(917)	10.60		4.00		3.90		8.20		
SECIL	(985)	8.40		1.10		1.00		5.20		
Median		8.400	(1)	1.100	(1)	1.000	(1)	5.200	(1)	
MAD		1.110		0.514		0.640		0.346		
N		5		3		5		5		
Ba (mg/kg)										
NGGBUG	(755)	110		41.0		11.0		87		
INCOLAB	(821)	186		48.0		15.0		214		
TLR	(900)	100		46.1		11.8		97		
BSPLZE	(917)	214		43.0		-		243		
EON	(921)	186		-		-		185		
SECIL	(985)	186		52.9		9.8		213		
Median		185.9	(1)	46.10	(1)	11.40	(1)	199.2	(1)	
MAD		14.1		3.10		1.00		29.4		
N		6		5		4		6		
Be (mg/kg)										
INCOLAB	(821)	0.700		0.3	<	0.3	<	0.600		
Median		0.7000	(1)	-	(0)	-	(0)	0.6000	(1)	
MAD		-		-		-		-		
N		1		-		-		1		
Cd (mg/kg)										
INCOLAB	(821)	0.40		0.400		0.200	<	0.40		
TLR	(900)	0.40		0.457		0.106		0.45		
BSPLZE	(917)	4.00		-		-		3.00		
INETI	(919)	3.00	<	0.320		0.400	<	3.00	<	
SECIL	(985)	3.30		1.600		1.600		4.20		
Median		1.851	(1)	0.4285	(1)	0.8530	(1)	1.725	(1)	
MAD		1.450		0.0685		0.7470		1.300		
N		4		4		2		4		
Co (mg/kg)										
NGGBUG	(755)	6.00		-		-		6.00		
INCOLAB	(821)	7.20		0.300	<	0.300		6.00		
TLR	(900)	5.97		0.100	<	0.170		4.15		
BSPLZE	(917)	23.70		-		1.200		19.40		
SECIL	(985)	6.60		0.800		0.800		6.50		
Median		6.600	(1)	0.8000	(1)	0.5500	(1)	6.000	(1)	
MAD		0.600		-		0.3150		0.500		
N		5		1		4		5		
Cr (mg/kg)										
NGGBUG	(755)	124		-		2.00		26.0		
INCOLAB	(821)	110		4.0		3.50		33.0		
TLR	(900)	42		5.0	<	5.00	<	10.9		
BSPLZE	(917)	150		-		2.00		51.0		
INETI	(919)	102		0.8	<	1.52		28.3		
EON	(921)	170		-		-		59.0		
SECIL	(985)	131		20.1		1.20		63.2		
Median		124.0	(1)	12.05	(1)	2.000	(1)	33.00	(1)	
MAD		22.4		8.05		0.480		18.00		
N		7		2		5		7		

BIMEP 2009.1 - Minor Elements

Sample		417		402		416		418		MIC
Cu (mg/kg)										
IFPO	(145)	35.5		3.22		7.33		29.6		
NGGBUG	(755)	45.0		4.00		8.00		44.0		
INCOLAB	(821)	46.0		4.10		8.10		37.0		
TLR	(900)	41.2		5.00	<	7.68		36.2		
BSPLZE	(917)	43.0		3.00		8.00		36.0		
INETI	(919)	43.3		4.46		8.45		38.1		
EON	(921)	94.0	**	22.00		29.00	**	86.0	**	
SECIL	(985)	49.3		-		4.70	**	42.1		
NDA mean		43.99		-		7.943		37.79		
NDA st dev		3.54		-		0.509		4.46		
NDA N		8		6		8		8		
	Old statistics									
Median		43.30	(2)	4.050	(1)	8.000	(2)	37.00	(2)	
MAD		2.14		0.620		0.210		1.10		
N		7		6		6		7		
F (mg/kg)										
INCOLAB	(821)	232		18.0		9.80		223.0		
TLR	(900)	217		9.6		9.20		222.6		
Median		224.7	(1)	13.80	(1)	9.500	(1)	222.80	(1)	
MAD		7.3		4.20		0.300		0.20		
N		2		2		2		2		
Hg (mg/kg)										
NGGBUG	(755)	-		-		-		0.210		
INCOLAB	(821)	0.110		0.0370		0.0240		0.261		
TLR	(900)	0.125		0.0230		0.0200	<	0.171		
BSPLZE	(917)	0.107		0.0370		0.0120		0.252		
INETI	(919)	0.095		0.0290		0.0108		0.216		
EON	(921)	0.101		0.0264		0.0091		0.226		
SECIL	(985)	0.200		-		-		0.100		
Median		0.1085	(1)	0.02900	(1)	0.01140	(1)	0.2164	(1)	
MAD		0.0106		0.00600		0.00145		0.0356		
N		6		5		4		7		
Mn (mg/kg)										
IFPO	(145)	519		23.1		78.4		424		
NGGBUG	(755)	667		22.0		89.0		581		
INCOLAB	(821)	620		23.0		76.0		464		
TLR	(900)	755		26.4		90.6		605		
BSPLZE	(917)	775		29.0		101.0		662		
INETI	(919)	632		20.7		83.4		515		
EON	(921)	785		21.0		83.0		683		
SECIL	(985)	642		28.5		77.1		548		
NDA mean		677.6		23.63		83.27		562.3		
NDA st dev		98.8		3.40		8.49		105.1		
NDA N		8		8		8		8		
	Old statistics									
Median		654.6	(3)	23.05	(3)	83.19	(3)	564.7	(3)	
MAD		67.5		2.22		5.95		73.6		
Mean		674.3		24.21		84.81		560.2		
St Dev		91.8		3.31		8.42		90.9		
N		8		8		8		8		

BIMEP 2009.1 - Minor Elements

Sample		417		402		416		418		MIC
Mo (mg/kg)										
INCOLAB	(821)	3.90		0.60		2.00		0.90		
TLR	(900)	3.10		5.00	<	2.10		1.40		
BSPLZE	(917)	-		-		0.90		-		
SECIL	(985)	5.10		3.10		2.30		2.50		
Median		3.900	(1)	1.850	(1)	2.050	(1)	1.400	(1)	
MAD		0.800		1.250		0.150		0.500		
N		3		2		4		3		
Ni (mg/kg)										
NGGBUG	(755)	27.0		-		-		17.0		
INCOLAB	(821)	28.0		1.00		1.80		16.0		
TLR	(900)	27.5		3.00	<	3.00	<	23.8		
BSPLZE	(917)	27.0		-		1.00		18.0		
INETI	(919)	20.3		0.70	<	0.98		9.5		
EON	(921)	38.0		-		-		27.0		
SECIL	(985)	26.8		8.80		1.60		19.6		
Median		27.00	(1)	4.900	(1)	1.300	(1)	18.00	(1)	
MAD		0.50		3.900		0.310		2.00		
N		7		2		4		7		
Pb (mg/kg)										
NGGBUG	(755)	31.0		-		-		65.0		
INCOLAB	(821)	46.0		6.00		1.60		79.0		
TLR	(900)	44.1		6.57		0.52		75.8		
BSPLZE	(917)	37.8		4.20		1.40		70.8		
INETI	(919)	33.5		4.60		0.78		74.7		
EON	(921)	41.0		-		-		80.0		
SECIL	(985)	37.4		3.20		-		70.3		
Median		37.80	(1)	4.600	(1)	1.090	(1)	74.67	(1)	
MAD		4.26		1.400		0.410		4.33		
N		7		5		4		7		
Sb (mg/kg)										
INCOLAB	(821)	1.10		0.20	<	0.20		1.30		
TLR	(900)	2.00	<	5.30		5.10		4.50		
BSPLZE	(917)	-		1.30		1.90		1.10		
SECIL	(985)	1.10		-		-		0.80		
Median		1.100	(1)	3.300	(1)	1.900	(1)	1.200	(1)	
MAD		-		2.000		1.700		0.250		
N		2		2		3		4		
Se (mg/kg)										
INCOLAB	(821)	0.300	<	0.30	<	0.30	<	0.300	<	
TLR	(900)	1.000	<	1.00	<	1.00	<	1.000	<	
SECIL	(985)	0.500		-		-		0.500		
Median		0.5000	(1)	-	(0)	-	(0)	0.5000	(1)	
MAD		-		-		-		-		
N		1		-		-		1		
Sn (mg/kg)										
INCOLAB	(821)	4.80		0.40		0.30	<	7.80		
TLR	(900)	0.80		0.30	<	0.30	<	1.00		
BSPLZE	(917)	14.60		4.50		4.70		10.50		
SECIL	(985)	5.90		1.40		0.90		6.70		
Median		5.350	(1)	1.400	(1)	2.800	(1)	7.250	(1)	
MAD		2.550		1.000		1.900		1.900		
N		4		3		2		4		

BIMEP 2009.1 - Minor Elements

Sample		417		402		416		418		MIC
Te (mg/kg)										
INCOLAB	(821)	0.30	<	0.30	<	0.30	<	0.30	<	
TLR	(900)	1.00	<	7.60		4.00		1.00	<	
Median		-	(0)	7.600	(1)	4.000	(1)	-	(0)	
MAD		-		-		-		-		
N		-		1		1		-		
Ti (mg/kg)										
INCOLAB	(821)	1770		23.0		63.0		1400		
BSPLZE	(917)	3710		-		-		3260		
INETI	(919)	940		15.0	<	37.5		680		
EON	(921)	1640		-		43.0		1490		
Median		1704	(1)	23.00	(1)	43.00	(1)	1443	(1)	
MAD		412		-		5.54		406		
N		4		1		3		4		
Tl (mg/kg)										
INCOLAB	(821)	0	<	0.3	<	0.3	<	0	<	
TLR	(900)	0	<	1.0	<	1.0	<	0	<	
Median		-	(0)	-	(0)	-	(0)	-	(0)	
MAD		-		-		-		-		
N		-		-		-		-		
V (mg/kg)										
NGGBUG	(755)	33.0		-		-		22.0		
INCOLAB	(821)	36.0		0.90		1.70		27.0		
TLR	(900)	77.2		1.20		1.90		43.7		
BSPLZE	(917)	52.0		1.00		1.00		44.0		
SECIL	(985)	44.2		-		0.80		38.8		
Median		44.20	(1)	1.000	(1)	1.350	(1)	38.80	(1)	
MAD		8.20		0.100		0.450		5.20		
N		5		3		4		5		
Zn (mg/kg)										
IFPO	(145)	115		12.6		33.5		182		
NGGBUG	(755)	149		13.0		37.0		266		
INCOLAB	(821)	154		12.0		26.0	**	222		
TLR	(900)	151		13.3		34.8		266		
BSPLZE	(917)	140		13.0		35.0		227		
INETI	(919)	129		12.2		33.2		219		
EON	(921)	170		15.0		38.0		292		
SECIL	(985)	143		16.3	**	34.7		261		
NDA mean		146.2		12.77		34.95		244.7		
NDA st dev		11.1		0.85		1.96		34.2		
NDA N		8		8		8		8		
	Old statistics									
Median		146.1	(3)	13.00	(2)	34.80	(2)	244.2	(3)	
MAD		7.0		0.40		1.30		22.0		
Mean		143.8		-		-		241.9		
St Dev		16.7		-		-		35.4		
N		8		7		7		8		

BIMEP 2009.1 - Minor Elements

Method information Minor Elements :

Analyte	destruction details	detection	Labnumber	ref method
Minor elements	presstablet	XRF	917, 921	
	presstablet	WD-RFA	145	
	Berghoff bomb acid mixture HCLO4 HNO3 HF 9h 190	ICP OES Hg : CV AFS	460	
	ash 550 + acid mixture	ICP MS	821	
	?	AAS	919	EN 13656
Hg	tube furnace	CV AAS	821	
	microwave	AAS	900	
	ash 500 + acid	ICP OES	916	
	?	AAS	919	ASTM D 6722

BIMEP 2009.1 Z - Scores

BIMEP 2009.1 Z - Scores - Per Participant

Sample	417	402	416	418
ATVC (7)				
ash (GEN)	0.72	0.02	1.14	0.32
calorific value (GEN)	0.41	-0.12	0.98	0.28
moisture (GEN)	-0.29	-0.05	4.30	0.54
Carbon (C) (ELEM)	1.46	-0.36	1.24	0.71
Cl (ELEM)	-0.63	-0.31	0.15	<
Nitrogen (N) (ELEM)	0.61	0.37	1.10	0.51
S (ELEM)	-0.60	-0.16	0.40	-0.44
Cl (WS)	#	#	#	<
K (WS)	#	#	#	#
Na (WS)	#	#	#	<
IFPO (145)				
ash (GEN)	0.72	1.01	-0.16	0.72
calorific value (GEN)	-0.07	-0.22	-0.57	-0.61
moisture (GEN)	-0.23	0.06	1.61	-0.11
Carbon (C) (ELEM)	0.34	-0.76	-0.05	-0.56
Cl (ELEM)	0.27	-0.75	-0.27	0.85
Hydrogen (H) (ELEM)	1.58	2.32	6.32	0.66
Nitrogen (N) (ELEM)	0.53	0.70	-0.13	-0.50
S (ELEM)	0.64	-0.42	-0.53	0.73
Al (MAJOR)	#	#	#	#
Ca (MAJOR)	#	#	#	#
Fe (MAJOR)	#	#	#	#
K (MAJOR)	#	#	#	#
Mg (MAJOR)	#	#	#	#
Na (MAJOR)	#	#	#	#
P (MAJOR)	#	#	#	#
Si (MAJOR)	#	#	#	#
Cu (MINOR)	-2.39	#	-1.20	-1.83
Mn (MINOR)	-1.61	-0.16	-0.57	-1.32
Zn (MINOR)	-2.85	-0.20	-0.74	-1.83
NGGBUG (755)				
ash (GEN)	-0.02	-1.01	0.23	0.82
calorific value (GEN)	-0.02	-0.12	-0.05	0.26
moisture (GEN)	0.41	0.27	-0.68	0.72
Carbon (C) (ELEM)	-0.64	-0.72	-0.01	0.90
Cl (ELEM)	-0.47	1.07	0.64	-0.45
Hydrogen (H) (ELEM)	-0.24	0.22	0.10	0.12
Nitrogen (N) (ELEM)	0.39	4.08	0.78	4.55
S (ELEM)	1.65	18.02	0.69	2.43
As (MINOR)	#	-	#	#
Ba (MINOR)	#	#	#	#
Co (MINOR)	#	-	-	#
Cr (MINOR)	#	-	#	#
Cu (MINOR)	0.29	#	0.11	1.39
Hg (MINOR)	-	-	-	#
Mn (MINOR)	-0.11	-0.48	0.68	0.18
Ni (MINOR)	#	-	-	#
Pb (MINOR)	#	-	-	#
V (MINOR)	#	-	-	#
Zn (MINOR)	0.25	0.27	1.05	0.62
INCOLAB (821)				
ash (GEN)	0.40	-0.02	-0.11	0.38
calorific value (GEN)	0.48	0.61	0.39	0.81
moisture (GEN)	-1.81	-1.66	-0.85	-0.98
Volatile Matter (GEN)	#	#	#	#
Carbon (C) (ELEM)	0.62	0.49	0.72	0.40
Cl (ELEM)	0.26	-0.48	-0.67	0.28
Hydrogen (H) (ELEM)	-0.37	-0.79	-0.63	-0.60
Nitrogen (N) (ELEM)	0.11	-2.11	-2.47	0.51
S (ELEM)	0.19	0.32	-0.50	0.41
Al (MAJOR)	#	#	#	#
Ca (MAJOR)	#	#	#	#
Fe (MAJOR)	#	#	#	#

(cont)

BIMEP 2009.1 Z - Scores - Per Participant

Sample	417	402	416	418	
INCOLAB (821) (cont.)					
K (MAJOR)	#	#	#	#	
Mg (MAJOR)	#	#	#	#	
Na (MAJOR)	#	#	#	#	
P (MAJOR)	#	#	#	#	
Si (MAJOR)	#	#	#	#	
As (MINOR)	#	<	#	#	
Ba (MINOR)	#	#	#	#	
Be (MINOR)	#	<	<	#	
Cd (MINOR)	#	#	<	#	
Co (MINOR)	#	<	#	#	
Cr (MINOR)	#	#	#	#	
Cu (MINOR)	0.57	#	0.31	-0.18	
F (MINOR)	#	#	#	#	
Hg (MINOR)	#	#	#	#	
Mn (MINOR)	-0.58	-0.19	-0.86	-0.94	
Mo (MINOR)	#	#	#	#	
Ni (MINOR)	#	#	#	#	
Pb (MINOR)	#	#	#	#	
Sb (MINOR)	#	<	#	#	
Se (MINOR)	<	<	<	<	
Sn (MINOR)	#	#	<	#	
Te (MINOR)	<	<	<	<	
Ti (MINOR)	#	#	#	#	
Tl (MINOR)	<	<	<	<	
V (MINOR)	#	#	#	#	
Zn (MINOR)	0.70	-0.91	-4.56	-0.66	
TLR (900)					
ash (GEN)	-0.31	-0.38	0.07	0.27	
calorific value (GEN)	0.57	0.97	0.94	3.07	
moisture (GEN)	0.53	1.23	0.22	0.68	
Volatile Matter (GEN)	#	#	#	#	
Carbon (C) (ELEM)	-	1.89	-2.83	-1.13	
Cl (ELEM)	0.81	2.01	4.06	-0.07	
Hydrogen (H) (ELEM)	-0.45	-0.68	2.14	-1.58	
Nitrogen (N) (ELEM)	-	0.13	-0.62	-0.90	
S (ELEM)	0.30	0.92	-0.33	<	
As (MINOR)	#	#	#	#	
Ba (MINOR)	#	#	#	#	
Cd (MINOR)	#	#	#	#	
Co (MINOR)	#	<	#	#	
Cr (MINOR)	#	<	<	#	
Cu (MINOR)	-0.80	<	-0.52	-0.37	
F (MINOR)	#	#	#	#	
Hg (MINOR)	#	#	<	#	
Mn (MINOR)	0.78	0.82	0.86	0.40	
Mo (MINOR)	#	<	#	#	
Ni (MINOR)	#	<	<	#	
Pb (MINOR)	#	#	#	#	
Sb (MINOR)	<	#	#	#	
Se (MINOR)	<	<	<	<	
Sn (MINOR)	#	<	<	#	
Te (MINOR)	<	#	#	<	
Tl (MINOR)	<	<	<	<	
V (MINOR)	#	#	#	#	
Zn (MINOR)	0.41	0.62	-0.08	0.62	
CSL (916)					
ash (GEN)	-31.90	-33.84	-25.04	-28.90	
calorific value (GEN)	1.98	0.18	0.30	1.03	
moisture (GEN)	-10.19	-16.01	-10.47	-9.35	
Volatile Matter (GEN)	#	#	#	#	
Carbon (C) (ELEM)	-21.51	-130.00	-47.14	-12.70	
Cl (ELEM)	-1.40	-12.85	-19.86	-1.78	
Hydrogen (H) (ELEM)	-6.68	-14.75	-37.30	-3.78	
Nitrogen (N) (ELEM)	-11.76	<	-38.37	-23.64	(cont)

BIMEP 2009.1 Z - Scores - Per Participant

Sample	417	402	416	418
CSL (916) (cont.)				
S (ELEM)	-1.93	-3.04	-5.61	-1.52
BSPLZE (917)				
ash (GEN)	-0.62	-3.21	-1.85	-1.51
calorific value (GEN)	-3.12	0.53	-2.06	-0.49
moisture (GEN)	5.33	-0.52	-0.36	-1.89
Volatile Matter (GEN)	#	#	#	#
Carbon (C) (ELEM)	-2.36	0.69	-0.48	0.20
Hydrogen (H) (ELEM)	-1.27	-0.68	-0.37	-0.31
Nitrogen (N) (ELEM)	-3.55	-1.49	-0.25	-0.43
S (ELEM)	-1.38	-1.47	-2.83	-0.95
Al (MAJOR)	#	#	#	#
Ca (MAJOR)	#	#	#	#
Fe (MAJOR)	#	#	#	#
K (MAJOR)	#	#	#	#
Mg (MAJOR)	#	#	#	#
Na (MAJOR)	#	-	#	#
P (MAJOR)	#	#	#	#
Si (MAJOR)	#	#	#	#
As (MINOR)	#	#	#	#
Ba (MINOR)	#	#	-	#
Cd (MINOR)	#	-	-	#
Co (MINOR)	#	-	#	#
Cr (MINOR)	#	-	#	#
Cu (MINOR)	-0.28	#	0.11	-0.40
Hg (MINOR)	#	#	#	#
Mn (MINOR)	0.99	1.58	2.09	0.95
Mo (MINOR)	-	-	#	-
Ni (MINOR)	#	-	#	#
Pb (MINOR)	#	#	#	#
Sb (MINOR)	-	#	#	#
Sn (MINOR)	#	#	#	#
Ti (MINOR)	#	-	-	#
V (MINOR)	#	#	#	#
Zn (MINOR)	-0.56	0.27	0.03	-0.52
INETI (919)				
ash (GEN)	0.62	0.15	0.64	-0.09
calorific value (GEN)	-0.74	-1.79	-0.22	-1.06
moisture (GEN)	0.24	0.06	0.84	0.43
Volatile Matter (GEN)	#	#	#	#
Carbon (C) (ELEM)	0.00	0.24	0.40	-0.34
Cl (ELEM)	-0.44	0.02	-0.62	-0.56
Hydrogen (H) (ELEM)	0.71	1.63	4.41	0.98
Nitrogen (N) (ELEM)	-0.55	1.95	0.56	0.37
S (ELEM)	-0.21	1.07	0.53	0.12
Cl (WS)	#	#	#	#
K (WS)	#	#	#	#
Na (WS)	#	#	#	#
Al (MAJOR)	#	<	#	#
Ca (MAJOR)	#	#	#	#
Fe (MAJOR)	#	#	#	#
K (MAJOR)	#	#	#	#
Mg (MAJOR)	#	#	#	#
Na (MAJOR)	#	#	#	#
P (MAJOR)	#	#	#	#
Si (MAJOR)	#	#	#	#
Cd (MINOR)	<	#	<	<
Cr (MINOR)	#	<	#	#
Cu (MINOR)	-0.19	#	1.00	0.07
Hg (MINOR)	#	#	#	#
Mn (MINOR)	-0.46	-0.87	0.01	-0.45
Ni (MINOR)	#	<	#	#
Pb (MINOR)	#	#	#	#
Ti (MINOR)	#	<	#	#
Zn (MINOR)	-1.57	-0.68	-0.88	-0.76

BIMEP 2009.1 Z - Scores - Per Participant

Sample	417	402	416	418
EON (921)				
ash (GEN)	-2.02	-4.64	-4.40	-1.72
calorific value (GEN)	-2.69	-1.68	-1.02	-0.34
moisture (GEN)	0.84	0.84	-0.13	0.09
Volatile Matter (GEN)	#	#	#	#
Carbon (C) (ELEM)	0.08	-0.36	-0.24	-12.16
Cl (ELEM)	0.81	-0.03	0.76	0.99
Hydrogen (H) (ELEM)	-0.02	-0.15	-0.30	30.27
Nitrogen (N) (ELEM)	-0.39	-0.49	0.12	10.14
S (ELEM)	1.90	0.19	0.47	2.12
Al (MAJOR)	#	#	#	#
Ca (MAJOR)	#	#	#	#
Fe (MAJOR)	#	#	#	#
K (MAJOR)	#	#	#	#
Mg (MAJOR)	#	#	#	#
Na (MAJOR)	#	-	#	#
P (MAJOR)	#	#	#	#
Si (MAJOR)	#	#	#	#
Ba (MINOR)	#	-	-	#
Cr (MINOR)	#	-	-	#
Cu (MINOR)	14.11	#	41.35	10.81
Hg (MINOR)	#	#	#	#
Mn (MINOR)	1.09	-0.77	-0.03	1.15
Ni (MINOR)	#	-	-	#
Pb (MINOR)	#	-	-	#
Ti (MINOR)	#	-	#	#
Zn (MINOR)	2.14	2.63	1.56	1.38
SECIL (985)				
ash (GEN)	-0.83	0.47	-0.81	-0.89
calorific value (GEN)	-1.02	-3.75	-9.96	-3.78
moisture (GEN)	-1.99	-2.02	0.06	-0.87
Volatile Matter (GEN)	#	#	#	#
Carbon (C) (ELEM)	-1.56	-9.23	-1.50	-0.29
Cl (ELEM)	2.63	71.01	69.36	5.30
Hydrogen (H) (ELEM)	0.49	0.82	0.53	0.24
Nitrogen (N) (ELEM)	-0.56	0.01	-0.87	0.28
S (ELEM)	-0.26	-0.48	-0.33	-0.16
Al (MAJOR)	#	#	#	#
Ca (MAJOR)	#	#	#	#
Fe (MAJOR)	#	#	#	#
K (MAJOR)	#	#	#	#
Mg (MAJOR)	#	#	#	#
Na (MAJOR)	#	-	#	#
P (MAJOR)	#	#	#	#
Si (MAJOR)	#	#	#	#
As (MINOR)	#	#	#	#
Ba (MINOR)	#	#	#	#
Cd (MINOR)	#	#	#	#
Co (MINOR)	#	#	#	#
Cr (MINOR)	#	#	#	#
Cu (MINOR)	1.50	-	-6.37	0.97
Hg (MINOR)	#	-	-	#
Mn (MINOR)	-0.36	1.43	-0.73	-0.13
Mo (MINOR)	#	#	#	#
Ni (MINOR)	#	#	#	#
Pb (MINOR)	#	#	-	#
Sb (MINOR)	#	-	-	#
Se (MINOR)	#	-	-	#
Sn (MINOR)	#	#	#	#
V (MINOR)	#	-	#	#
Zn (MINOR)	-0.28	4.16	-0.13	0.49

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