ECISS

EUROPEAN COMMITTEE FOR IRON AND STEEL STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION DU FER ET DE L'ACIER
EUROPÄISCHES KOMITEE FÜR EISEN-UND STAHLNORMUNG

EUROPEAN CERTIFIED REFERENCE MATERIAL (EURONORM – CRM)
CERTIFICATE OF CHEMICAL ANALYSIS

EURONORM – CRM No. 882-1 INDUSTRIAL FLY ASH

LABORATORY MEANS (4 values) - Mass content in %

Line No	Fe	Ca	Al	Na	K	Zn	Pb	Cd	Cr	Ni	Cu	V	As	Bi
1	------	------	0.3274	0.6416	0.8996	------	1.2644	0.0150	0.4318	0.0238	------	0.0076	0.0042	0.0019
2	21.897	9.871	0.3435	0.6700	0.9137	27.981	1.2670	0.0166	0.4616	0.0241	0.1988	0.0080	0.0043	0.0022
3	21.925	9.947	0.3575	0.6725	0.9163	28.275	1.2700	0.0167	0.4661	0.0245	0.2076	0.0081	------	0.0022
4	22.060	9.958	0.3642	0.6750	0.9180	28.315	1.2725	0.0169	0.4668	0.0254	0.2097	0.0083	0.0044	0.0024
5	22.078	10.020	0.3660	0.6803	0.9285	28.344	1.2837	0.0171	0.4730	0.0254	0.2107	0.0084	0.0046	0.0024
6	22.113	10.020	0.3660	0.6808	0.9375	28.350	1.3010	0.0171	0.4750	0.0258	0.2107	0.0085	0.0048	0.0024
7	22.125	10.045	0.3675	0.6863	0.9548	28.373	1.3014	0.0174	0.4750	0.0258	0.2108	0.0087	0.0049	0.0025
8	22.135	10.093	0.3678	0.6950	0.9575	28.375	1.3035	0.0175	0.4803	------	0.2109	0.0092	0.0050	0.0026
9	22.228	10.100	0.3686	0.6967	0.9625	28.403	1.3061	0.0179	0.4910	0.0262	0.2134	0.0092	0.0050	0.0026
10	22.235	10.105	0.3700	0.7060	0.9638	28.410	1.3172	0.0182	0.4913	0.0263	0.2155	0.0093	0.0050	0.0027
11	22.247	10.134	0.3726	0.7179	0.9656	28.450	1.3175	0.0182	0.4925	0.0264	0.2158	0.0095	0.0052	0.0029
12	22.248	10.155	0.3761	0.7245	0.9770	28.460	1.3225	------	0.4940	0.0265	0.2182	0.0099	0.0054	0.0032
13	22.262	10.215	0.3805	0.7285	0.9880	28.463	1.3320	0.0191	0.4940	0.0266	0.2188	0.0104	0.0054	0.0035
14	22.275	10.218	0.3879	0.7295	1.0078	28.535	1.3340	0.0192	0.4965	0.0267	0.2208	0.0113	0.0056	0.0035
15	22.295	10.224	0.3893	0.7531	1.0150	28.558	1.3378	0.0192	0.4965	0.0267	0.2213	------	0.0057	
16	22.327	10.225	0.3943	------	1.0575	28.583	1.3435	0.0192	0.5062	0.0271	0.2217		0.0063	
17	22.450	10.278	0.3943			28.590	1.3500	0.0193	0.5120	0.0272	0.2273		0.0064	
18	22.464	10.285	0.4054			28.625	1.3607	0.0193	0.5125	0.0279	------		0.0065	
19		------	0.4164			28.657	1.3643	0.0193	0.5167	0.0285	0.2328		0.0065	
20						28.743	1.3732	0.0195	0.5292	0.0292	0.2340		0.0066	
21						28.813	1.3897	0.0195	0.5308		0.2348		0.0070	
22						28.892	1.4050	0.0196						
23								0.0205						
M_M	**22.198**	**10.111**	**0.3745**	**0.6972**	**0.9602**	**28.485**	**1.3235**	**0.0183**	**0.4901**	**0.0263**	**0.2176**	**0.0090**	**0.0054**	**0.0026**
s_M	0.157	0.122	0.0209	0.0293	0.0424	0.203	0.0400	0.0014	0.0240	0.0014	0.0097	0.0011	0.0009	0.0005
s_W	0.116	0.121	0.0105	0.0108	0.0211	0.140	0.0169	0.0005	0.0071	0.0009	0.0036	0.0005	0.0003	0.0002

Line No	Sb	Hg
1	0.0099	0.000040
2	0.0101	0.000055
3	0.0102	0.000073
4	0.0102	0.000073
5	0.0103	0.000077
6	0.0103	0.000078
7	0.0105	0.000083
8	0.0106	0.000093
9	0.0107	< 0.000100
10	0.0111	0.000100
11	0.0113	------
12	0.0119	------
13	0.0122	------
14	0.0123	
15	0.0124	
16	0.0126	
17	0.0130	
18	0.0131	
19	0.0133	
20	0.0133	
21	0.0137	
22		
23		
24		
M_M	**0.0116**	**0.000075**
s_M	0.0013	0.000019
s_W	0.0005	0.000008

Sn	*Si*	*Mn*	*Mg*	*Cl*	*C*	*S*	*F*
0.0168	*1.000*	*1.925*	*0.4650*	------	*0.783*	*0.420*	*0.0707*
0.0174	*1.003*	*1.925*	*0.4728*	*2.307*	*0.903*	*0.440*	*0.0715*
0.0183	*1.055*	*2.020*	*0.4925*	*2.313*	*1.226*	*0.475*	*0.0750*
0.0190	*1.155*			*2.345*	*1.360*	*0.478*	*0.0805*
0.0193				*2.415*		*0.503*	
0.0195						*0.508*	
0.0200							
0.0203							
0.0203							
0.0210							
0.0211							
0.0216							
0.0218							
0.0220							
0.0221							
0.0222							
0.0235							
0.0238							
0.0238							
0.0242							

0.0244							
0.0248							
0.0248							

Additional information from laboratories:
Co: 0.0023 % and 0.0028 %; H_20: 0.185 % and 0.22 %; Br: < 0.05 %

M_M: Mean of the intralaboratory means
s_M: Standard deviation of the intralaboratory means
s_W: Intralaboratory standard deviation

The laboratory mean values have been examined statistically to eliminate outlying values.
Where a "------" appears in the table it indicates that an outlying value has been eliminated by either the Cochran or Grubbs Test.

Values given in italics are for information only.

CERTIFIED VALUES - Mass content in %

	Fe	Ca	Al	Na	K	Zn	Pb	Cd
M_M	**22.20**	**10.11**	**0.375**	**0.697**	**0.960**	**28.49**	**1.324**	**0.0183**
C (95 %)	**0.09**	**0.07**	**0.011**	**0.017**	**0.023**	**0.10**	**0.018**	**0.0006**

	Cr	Ni	Cu	V	As	Bi	Sb	Hg
M_M	**0.490**	**0.0263**	**0.218**	**0.0090**	**0.0054**	**0.0026**	**0.0116**	**0.000075**
C (95 %)	**0.011**	**0.0007**	**0.005**	**0.0006**	**0.0004**	**0.0003**	**0.0006**	**0.000014**

The half-width confidence interval C(95%) = $\frac{t \times s_M}{\sqrt{n}}$ where "t" is the appropriate Student's t value and "n" is the number of acceptable mean values

For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 sections 6.1 and 10.5.2

This reference material was prepared in accordance with the recommendations set out in ISO Guides 30 – 35 and issued by:

swerea KIMAB
P.O. Box 55970, SE 102 16, Stockholm, Sweden

ISO 9001 Certifierad

Certified Institute

On behalf of: The Iron and Steel Nomenclature Co-ordinating Committee (COCOR) of the ECISS, after approval by all the participating laboratories and all the producing organisations.
(France-IRSID/CTIF; Germany-Iron and Steel CRM Working Group: VDEh, BAM & MPI für Eisenforschung; UK-BAS Ltd; Nordic Countries-Nordic CRM Working Group (NCRMWG))

JERN • CONTOIRETS • SIGILL

June 2009

EURONORM – CRM No. 882-1
METHODS USED

Element	Line number	Analytical methods
Fe	2.5.15	FAAS
	3.6.9.13.14.17	ICP-OES
	4	ICP-MS
	7	Titration with Cr (VI) after reduction with Sn (II)
	8	Titration with Mn (VII) after reduction with Sn (II)
	10.11.12.16.18	XRF
Ca	2.14.15.17.18	XRF
	3.4.7.13	FAAS
	5.6.8.9.10.11.12.16	ICP-OES
Al	1.2.3.4.7.9.11.12.14.15.17.18	ICP-OES
	5.13.19	XRF
	6.8.16	FAAS
	10	ICP-MS
Na	1.3.8.10.11.12.14.15	ICP-OES
	2	ICP-MS
	4.5.7.13	FAAS
	6	FES
	9	PAA
K	1.2.3.7.9.10.12.15.16	ICP-OES
	4.5.6.14	FAAS
	8	ICP-MS
	11	FES
	13	XRF
Zn	2.6.11.12.19.20.22	ICP-OES
	3.7.9.10.15	Complexometric titration, visual end point
	4	ICP-MS
	5.8	FAAS
	13	Titration with ferrocyanide, potentiometric end point
	14.16.17.18.21	XRF
Pb	1.3.8.13.14.16	FAAS
	2.10.18	XRF
	4.5.6.7.9.11.12.15.19.20.22	ICP-OES
	17	ICP-MS
	21	PAA
Cd	1.3.6.7.8.10.11.13.14.20.22.23	ICP-OES
	2.5.16.18.19	FAAS
	4.9.15.17.21	ICP-MS
Cr	1.2.3.5.6.10.11.12.13.15.20.21	ICP-OES
	4.14	XRF
	7.8.9.17	FAAS
	16.18	ICP-MS
	19	PAA
Ni	1.5.7.10.12.13.14.15.17.20	ICP-OES
	2.3.9.11.18	FAAS
	4.16.19	ICP-MS
	6	XRF
Cu	2.6.7.8.10.11.12.14.17.19.21	ICP-OES
	3.4.5.9.15.20	FAAS
	13	ICP-MS
	16	XRF
V	1	FAAS
	2.3.4.7.9.11.12.13.14	ICP-OES
	5.6.8.10	ICP-MS
As	1.4.8.11.21	ICP-OES
	2.10.12.14.20	AAS, evolution as arsine
	5.13.16	ETAAS
	6	MAS, diethyldithiocarbamate, separation as arsine
	7	ICP-OES, evolution as arsine
	9.15.18.19	ICP-MS
	17	PAA
Bi	1.9	FAAS
	2.4.5.8	ICP-MS
	3.10.11.13.14	ICP-OES
	6.12	AAS, hydride generation
	7	ETAAS
Sb	1.5.13.20	ICP-MS
	2.12.16.18	ICP-OES
	3.6.11	FAAS
	4.21	AAS, hydride generation
	7.8.14.15.19	ETAAS
	9	ICP-OES, hydride generation
	10	AFS
	17	PAA
Hg	1.3.4.5.7.8.9.10	AAS, cold vapour
	2	ICP-MS
	6	AFS

EURONORM – CRM No. 882-1
METHODS USED

Element	*Line number*	*Analytical methods*
Sn	*1.2.10.11*	*FAAS*
	3.5.9.13.14.15.18.20.24	*ICP-OES*
	4.6.7.16.19.22	*ICP-MS*
	8	*XRF*
	12.17	*ETAAS*
	23	*PAA*
Si	*1*	*Gravimetry, dehydration with perchloric acid*
	2.4	*ICP-OES*
	3	*XRF*
Mn	*1.2*	*ICP-OES*
	3	*XRF*
Mg	*1.3*	*ICP-OES*
	2	*XRF*
Cl	*2*	*Ion chromatography*
	3.4.5	*Titration with Ag^+, potentiometric end point*
C	*1.2.3*	*Combustion: Infrared absorption*
S	*1*	*Gravimetry as $BaSO_4$ without separation*
	2	*Ion chromatography*
	3.5	*Combustion: Infrared absorption*
	4.6	*ICP-OES after dissolution in nitric and hydrochloric acid in presence of potassium nitrate*
F	*1*	*Ion chromatography*
	2	*Direct potentiometry after steam distillation*
	3	*Ion chromatography after alkaline fusion*
	4	*Specific ion electrode, alkaline fusion, separation of hydroxides*

Abbreviations:

AAS	Atomic Absorption Spectrometry
AFS	Atomic Fluorescence Spectrometry
ETAAS	Electrothermal Atomic Absorption Spectrometry
FAAS	Flame Atomic Absorption Spectrometry
FES	Flame Emission Spectrometry
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectrometry
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
MAS	Molecular Absorption Spectrometry
PAA	Photon Activation Analysis
XRF	X-ray Fluorescence Spectrometry

DESCRIPTION OF THE SAMPLE

The ECRM 882-1 is available in the form of ash powder in bottles containing 100 g.

INTENDED USE & STABILITY

The ash, ECRM 882-1, is intended for the verification of analytical methods, such as those used by the participating laboratories, for the calibration of analytical instruments in cases where the calibration with primary substances (pure stoichiometric metals or compounds) is not possible and for establishing values for secondary reference materials.
It will remain stable provided that the bottle remains sealed and is stored in a cool, dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. If the contents should become discoloured (eg oxidised) due to atmospheric contamination they should be discarded.

TRACEABILITY

The traceability of ECRM 882-1 has been established in accordance with principles of ISO Guides 30 – 35 and the International vocabulary of basic and general terms in metrology.
The characterisation of this material has been achieved by inter-laboratory study, each laboratory using the method of their choice, details of which are given above. These methods are either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds. Most methods used were either international or national standard methods or methods which are technically equivalent.

FURTHER INFORMATION

For information regarding the preparation, certification and supply of these European Certified Reference Materials (EURONORM-CRMs) and the use of the statistical information given on this certificate, please refer either to the producer of this Certified Reference Material or to CEN Report CR 10317 and ECISS Information Circular No. 5, both of which are available from the national standards body in your country or from CEN in Brussels. (In the UK this is the BSI, 389 Chiswick High Road, London W4 4AL).
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Pour disposer d'informations sur la fabrication, la certification et la distribution des Matériaux de Référence Certifiés Européens (EURONORM-MRC) ainsi que sur l'utilisation des informations statistiques données sur ce certificat se reporter soit au producteur de ce Matériau de Référence Certifié, à l'adresse figurant sur ce Certificat soit au Rapport CEN CR 10317 et à la circulaire d'information No.5 (ECISS). On peut se procurer ces deux documents auprès des organismes nationaux de normalisation ou auprès du CEN, Bruxelles. (Pour la France: AFNOR, 11 Av. F. de Pressensé, 93571 - Saint-Denis La Plaine Cedex).
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