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Certificate No. Q3993

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

## CERTIFICATE OF ANALYSIS BCS-CRM No. 362 MINE TAILINGS SAMPLE

Prepared under rigorous laboratory conditions and, AFTER CERTIFICATION ANALYSIS IN GREAT BRITAIN,  
issued by the Bureau of Analysed Samples Ltd.

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### ANALYSES

Mean of 4 values – mass content in %, based on the dried (105°C) sample

Analyst No.	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	Mn <sub>3</sub> O <sub>4</sub>	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	PbO	ZnO	SrO	Cd	Total S	LOI (925°C)	BaO
1	9.1365	0.6748	0.0440	0.4613	...	44.2610	0.0693	...	...	...	...	0.0358	0.0193	...	32.5055	...
2	9.0508	0.6518	0.0555	0.4995	0.8290	43.8780	0.0653	0.0995	0.1440	2.6188	2.6738	0.0323	...	1.5790	...	2.0648
3	9.0634	0.6816	0.0493	0.4906	0.8254	44.1802	0.0603	0.0955	0.1536	2.5859	2.5689	0.0293	0.0187	1.4803	32.8077	2.0633
4	...	0.6590	...	...	...	44.5305	0.0693	...	...	...	...	...	...	...	33.0725	...
5	9.0675	0.6900	...	...	0.8325	...	...	...	0.1425	...	2.6825	0.0400	...	...	...	...
6	8.8538	0.6240	...	0.5083	...	...	...	0.0675	...	...	...	...	...	...	32.8820	...
7	...	...	0.0375	0.4575	...	...	...	...	0.1300	...	...	...	...	...	...	1.9325
8	...	...	...	...	0.8305	44.0373	...	0.0800	0.1326	...	...	...	...	1.3958	32.8085	...
9	...	...	...	...	...	...	...	...	...	2.6228	2.4805	...	0.0208	...	...	...
10	8.9839	0.6863	...	0.4818	0.8278	44.3785	0.0765	0.0751	0.1340	2.6953	2.5503	...	0.0222	...	32.7820	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	1.4840	...	...
<i>M<sub>M</sub></i>	<b>9.0260</b>	<b>0.6668</b>	<b>0.0466</b>	<b>0.4832</b>	<b>0.8290</b>	<b>44.2109</b>	<b>0.0681</b>	<b>0.0835</b>	<b>0.1395</b>	<b>2.6307</b>	<b>2.5912</b>	<b>0.0344</b>	<b>0.0203</b>	<b>1.4848</b>	<b>32.8097</b>	...
<i>s<sub>M</sub></i>	0.0973	0.0235	0.0077	0.0205	0.0027	0.2344	0.0060	0.0136	0.0089	0.0461	0.0860	0.0046	0.0016	0.0749	0.1831	...
<i>s<sub>w</sub></i>	0.0447	0.0087	0.0027	0.0072	0.0049	0.1744	0.0028	0.0088	0.0040	0.0290	0.0306	0.0007	0.0004	0.0324	0.0467	...

(Additional information:- Total Carbon 9.9%, CO<sub>2</sub> 35.2%, Sulphide 1.0% as S, As 0.003%, Cr 0.002%, Cu 0.004%, Ni 0.001%, Cl 0.023%, P<sub>2</sub>O<sub>5</sub> 0.014%, combined H<sub>2</sub>O 0.033%)

*M<sub>M</sub>*: Mean of the intralaboratory means. *s<sub>M</sub>*: standard deviation of the intralaboratory means. *s<sub>w</sub>*: Intralaboratory standard deviation.

Values given above in small italic type are for information only

### CERTIFIED VALUES

mass content in %

	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	Mn <sub>3</sub> O <sub>4</sub>	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	PbO	ZnO	SrO	Cd	Total S	LOI (925°C)
<i>M<sub>M</sub></i>	<b>9.03</b>	<b>0.667</b>	<b>0.047</b>	<b>0.483</b>	<b>0.829</b>	<b>44.21</b>	<b>0.068</b>	<b>0.084</b>	<b>0.14</b>	<b>2.63</b>	<b>2.59</b>	<b>0.034</b>	<b>0.020</b>	<b>1.48</b>	<b>32.81</b>
C(95%)	0.10	0.022	0.012	0.022	0.004	0.25	0.008	0.017	0.10	0.08	0.11	0.008	0.003	0.12	0.19

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 35:1989 section 4.

### DESCRIPTION OF SAMPLE

100g bottles of finely divided material passing a 150µm (100 mesh) sieve for chemical analysis

XRD analysis indicates that the sample consists mainly of calcite with approximately 8% quartz, 6% baryte, 0.6% galena and some sphalerite. PTO

# BCS-CRM 362 MINE TAILINGS SAMPLE

## NOTES ON METHODS USED

### **SILICA**

Analysts Nos. 1 and 3 determined silica gravimetrically. All other analysts used XRF.

### **ALUMINA**

Analyst No 1 determined alumina by ICP-OES. Nos. 2, 5 and 6 used XRF. Analyst No 3 determined alumina gravimetrically with 8 hydroxyquinoline. Nos. 4 and 10 used FAAS.

### **TITANIA**

Analyst No. 1 determined titanium by ICP-OES, Nos. 2 and 7 determined titanium by XRF. Analyst No 3 determined titanium photometrically with diantipyrylmethane.

### **TOTAL IRON AS FERRIC OXIDE**

Analyst No 1 determined iron by ICP-OES. Analysts Nos. 3 and 10 determined iron photometrically with 1,10-phenanthroline. All other analysts determined iron by XRF.

### **MANGANESE OXIDE**

Analysts Nos. 2 and 5 determined manganese by XRF. Analysts Nos. 3 and 8 used a photometric method following oxidation with periodate. Analyst No. 10 used FAAS.

### **CALCIUM OXIDE**

Analysts Nos. 1, 4, 8 and 10 determined calcium titrimetrically. No 1 precipitated calcium as the oxalate and titrated with potassium permanganate. Nos. 4, 8 and 10 used a visual titration method with EDTA. Analyst No. 2 determined calcium by XRF and Analyst No 3 determined calcium gravimetrically as CaO after precipitation of calcium as oxalate.

### **MAGNESIA**

Analysts Nos. 1 and 3 determined magnesia by ICP. No 2 used XRF and Nos. 4 and 10 used FAAS.

### **SODIUM OXIDE**

Analyst No 2 determined sodium oxide by XRF. Analyst No 3 used FAAS, Analysts Nos. 6 and 8 used AES and No 10 used ICP-OES.

### **POTASSIUM OXIDE**

Analysts Nos. 2, 5 and 7 determined potassium by XRF. Analyst No. 3 used FAAS and Nos. 8 and 10 used AES

### **LEAD OXIDE**

Analyst No 2 determined lead by XRF. Analyst No 3 determined lead electro-gravimetrically following separation as sulphide. Analyst No 9 used ICP-OES and No 10 FAAS.

### **ZINC OXIDE**

Analysts Nos. 2, and 5 determined zinc using XRF. Analyst No 3 determined zinc gravimetrically with oxime after separation as sulphide. Analyst No. 9 used ICP-OES and Analyst No 10 used FAAS.

### **STRONTIUM OXIDE**

Analyst No. 1 determined strontium using ICP-OES, Nos. 2 and 5 used XRF and Analyst No.3 used FAAS

### **CADMIUM**

Analysts Nos. 1, 3 and 9 determined cadmium using ICP-OES, No 10 used FAAS.

### **SULPHUR (TOTAL)**

Analyst Nos. 2 and 11 determined sulphur using high frequency combustion with infrared absorption.. Analysts Nos. 3 and 8 determined sulphur gravimetrically as barium sulphate.

### **LOSS ON IGNITION**

All analysts determined loss gravimetrically after heating at 925 °C.

### **BARIUM OXIDE**

Analysts Nos. 2 and 7 determined barium by XRF. No 3 determined barium gravimetrically as sulphate.

<b>Abbreviations:-</b>	ICP-OES	Inductively Coupled Plasma-Optical Emission Spectrometry
	FAAS	Flame Atomic Absorption Spectrometry
	AES	Atomic Emission Spectrometry

Traceability: The majority of Analysts calibrated using pure metals, metal oxides or primary chemicals.

NEWHAM HALL  
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For BUREAU OF ANALYSED SAMPLES LTD.  
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