



Certificate of Analysis 0892

Date: 05-10-2021

Version: 01

CRM ITAK-859 Certified Reference Material Copper Concentrate

Table 1 – ITAK-859 – Certified Values

Element/Unit	Certified Value ^[1]	s ^[2]	s _r ^[3]	s _L ^[4]	U ^[5]
Cu (%) ^{c,b,d,m,q,x}	36.39	0.54	0.38	0.39	± 0.13
Fe (%) ^{b, c, d, q}	18.32	0.35	0.27	0.23	± 0.069
S (%) ^{b, d, i, t}	13.72	0.30	0.12	0.27	± 0.093
Ag (g/t) ^{b, q}	73.4	2.2	1.6	1.6	± 0.60
Au (g/t) ^{e, f, g, h}	23.87	0.85	0.61	0.60	± 0.23
Ni (g/t) ^{b, q}	55.8	9.1	2.1	8.9	± 3.0
F (g/t) ^{n, w}	2623	164	51	155	± 55
Al (%) ^{b, c, d}	1.262	0.043	0.022	0.037	± 0.013
As (g/t) ^{b, r}	138	22	6.2	21	± 6.7
Ba (g/t) ^{b, c}	41.2	2.3	2.2	0.48	± 0.38
Bi (g/t) ^b	10.33	0.59	0.27	0.53	± 0.24
C (%) ⁱ	4.033	0.076	0.030	0.070	± 0.023
Ca (%) ^{b, d}	0.484	0.016	0.0077	0.014	± 0.0054
Co (g/t) ^{b, c}	137.2	6.3	3.8	5.1	± 2.1
Cr (g/t) ^b	32.3	3.5	0.78	3.4	± 1.5
K (%) ^{b, c, d}	0.3122	0.0057	0.0057	0.00010	± 0.00063
Mg (%) ^{b, c, d}	0.393	0.020	0.011	0.017	± 0.0060
Mn (%) ^{b, c, d}	0.281	0.016	0.0050	0.015	± 0.0055
Mo (%) ^{b, c}	0.1274	0.0077	0.0027	0.0073	± 0.0026
Na (%) ^{b, d}	0.0441	0.0043	0.0041	0.0012	± 0.00078
P (%) ^{b, d}	0.0403	0.0019	0.00085	0.0017	± 0.00087

Table 1 – ITAK-859 – Certified Values (cont.)

Element/Unit	Certified Value ^[1]	s ^[2]	s _r ^[3]	s _L ^[4]	U ^[5]
Pb (g/t) ^{b, q}	76	11	3.7	11	± 4.3
Pd (g/t) ^e	0.0912	0.0076	0.0073	0.0019	± 0.0013
Pt (g/t) ^e	0.0215	0.0068	0.0056	0.0038	± 0.0017
Sb (g/t) ^{b, r}	0.140	0.031	0.025	0.018	± 0.010
Se (g/t) ^b	52.2	4.0	1.2	3.8	± 1.9
Si (%) ^{b, c, d, t}	6.82	0.14	0.091	0.10	± 0.039
Sn (g/t) ^b	8.65	0.64	0.45	0.46	± 0.20
Te (g/t) ^b	16.8	1.3	0.32	1.3	± 0.63
Th (g/t) ^b	3.64	0.30	0.15	0.26	± 0.12
Ti (%) ^{b, d}	0.0952	0.0074	0.0025	0.0069	± 0.0026
U (g/t) ^b	58.9	3.5	2.2	2.7	± 1.1
V (g/t) ^{a, b}	22.0	2.7	0.57	2.6	± 1.0
Zn (g/t) ^{a, b}	23.8	4.3	1.8	3.9	± 1.8

^[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

^[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis ($n=1$).

^[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

^[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

^[5] The combined standard uncertainty of the certified value was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

Table 2 – ITAK-859 – Informative Values

Element/Unit	Reference Value ^[6]
Cl (g/t) ^{j, k, l, p, u, w}	1120
Cd (g/t) ^b	1.6
Soluble Cu (%) ^v	2.7
Hg (g/t) ^{b, o, r}	< 0.01
Tl (g/t) ^b	0.18

^[6] These values are informative. They were calculated according to ISO Guide 35 and ISO 5725-2 from ten to fifty results from a varying number of laboratories.

DESCRIPTION

ITAK-859 was prepared from a sample of Copper Concentrate donated by a Copper Mining Company from the North of Brazil in 2020.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-859 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-859.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-859 was analyzed by twenty specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-012/2021 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.

Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-859 are mentioned as follows:

- **a**: Acid digestion Method (HCl, HNO₃, HF) and determination by Atomic Emission Spectrometry (ICP).
- **b**: Acid digestion Method (HCl, HNO₃, HF, HClO₄) and determination by Atomic Emission Spectrometry (ICP).
- **c**: Fusion Method and determination by Atomic Emission Spectrometry (ICP).
- **d**: Fusion Method and determination by X-Ray Fluorescence.
- **e**: Fire Assay Method and determination by Atomic Emission Spectrometry (ICP).
- **f**: Fire Assay Method and determination by Atomic Absorption Spectrometry (AAS).
- **g**: Extraction by DIBK and determination by Atomic Absorption Spectrometry (AAS).
- **h**: Fire Assay Method and determination by Gravimetry.
- **i**: Infrared Analyzer (LECO).
- **j**: Fusion Method and determination by Titration.
- **k**: Fusion Method and determination by Ion Chromatography.
- **l**: Acid digestion Method (HNO₃) and determination by Titration.
- **m**: Acid digestion Method (HNO₃, HClO₄) and determination by Titration.
- **n**: Fusion Method and determination by Ion specific electrode.
- **o**: Acid digestion Method (HCl, HNO₃, HF, HClO₄) and determination by Atomic Emission Spectrometry (ICPMS).
- **p**: Acid digestion Method (HCl) and determination by Atomic Absorption Spectrometry (AAS).
- **q**: Acid digestion Method (HCl, HNO₃, HF, HClO₄) and determination by Atomic Absorption Spectrometry (AAS).
- **r**: Aqua Regia digestion Method (HCl, HNO₃) and determination by Atomic Emission Spectrometry (ICP).
- **s**: Aqua Regia digestion Method (HCl, HNO₃) and determination by Atomic Absorption Spectrometry (AAS).
- **t**: Gravimetric Method (GRAV).
- **u**: Colorimetric Method (COLOR).
- **v**: Acetic Acid leaching Method and determination by Atomic Absorption Spectrometry (LIX-AAS).
- **w**: Fusion Method and determination by Potentiometric.
- **x**: Acid digestion Method (HCl, HNO₃, HF, HClO₄) and determination by Titration (DIG4AC-TIT).

PERIOD OF VALIDITY

This CRM certification is valid until: **May 14, 2031**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.



Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director