

# National Bureau of Standards

## Certificate of Analysis

### Standard Reference Material C1253

#### Phosphorized Copper - Cu X

Wolverine Tube-NBS-ASTM Cooperative Program

This Standard Reference Material (SRM) is in the form of directionally solidified chill-cast blocks, approximately 32 mm (1 1/4 in) square and 19 mm (3/4 in) thick. \* The SRM is intended for use in trace elemental analysis of copper, and is particularly well suited for calibration with optical emission methods of analysis.

SRM No.	C1253	
Designation	Cu X	
Element	Value <sup>a</sup>	Estimated Uncertainty <sup>b</sup>
<u>Parts per Million by Weight (μg/g)</u>		
Arsenic <sup>c</sup>	244	2
Bismuth <sup>d</sup>	70	5
Gold <sup>e</sup>	74.4	0.5
Lead <sup>f</sup>	244	2
Selenium <sup>g</sup>	140	12
Silver <sup>f</sup>	503	4
Zinc <sup>g</sup>	368	20
<u>Percent by Weight</u>		
Copper, assay <sup>h</sup>	99.42	0.02

\*The chill-cast or test surface is opposite the numbered face. The *certified portion* is that extending upward from the test surface 13 mm (1/2 in), and only this portion was analyzed in the analytical program for certification.

<sup>a</sup>The value listed for an element is the *present best estimate* of the "true" value based on the results of the analytical program for certification.

<sup>b</sup>The estimated uncertainty listed for an element is based on judgment and represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability for samples of 1.0 g or more.

<sup>c</sup>Value for As is based on spectrophotometric analysis at NBS.

<sup>d</sup>Value for Bi is based on photon activation analysis at NBS.

<sup>e</sup>Value for Au is based on agreement of fire assay results from cooperating laboratories.

<sup>f</sup>Values for Pb and Ag are based on isotope dilution mass spectrometric analysis at NBS.

<sup>g</sup>Values for Se and Zn are based on nondestructive neutron activation analysis at NBS.

<sup>h</sup>Value for Cu is based on electrogravimetry (corrected for Ag) at NBS.

The overall coordination of the NBS analytical measurements leading to certification was under the direction of I.L. Barnes.

The technical and support aspects involved in the issuance of this SRM were coordinated through the Office of Standard Reference Materials by R.E. Michaelis.

Washington, D.C. 20234  
 September 16, 1980

George A. Uriano, Chief  
 Office of Standard Reference Materials

(over)

#### PLANNING, PREPARATION, TESTING, ANALYSIS:

This material is one in a series of twelve different composition copper "Benchmark" materials, Cu "O" through Cu XI, that are being prepared in a cooperative Industry-ASTM-NBS program.

The base material for the preparation of Cu X, originally was vacuum melted and cast into a single ingot at Cannon Muskegon Corporation, Muskegon, Michigan, at the request of Wolverine Tube, Decatur, Alabama, R.E. Stanton. About 25 elements were included in the aim composition, covering the concentration range of about 15 to 500 ppm.

The final material for SRM C1253, Cu X, was prepared by remelting and recasting portions of the original ingot sections on the NBS water-cooled, copper-plate mold assembly at the Brass Foundry, American Cast Iron Pipe Company, Birmingham, Ala. The preparation and homogeneity testing plan was similar to that described in NBS Misc. Publ. 260-2, Standard Reference Materials: Preparation of NBS Copper-Base Spectrochemical Standards, Robert E. Michaelis, Leroy L. Wyman, and Richard Flitsch, October 15, 1964.

Extensive homogeneity studies were made at NBS Boulder, by residual resistivity ratio measurements, J.G. Hust, and at NBS Washington, by metallographic studies, C.H. Brady, and by chemical analyses, particularly neutron activation analysis, G.J. Lutz. The results indicated the maximum gross material variability to be less than  $\pm 10\%$ .

Cooperative preliminary analyses and chemical analyses for certification were made in the following analytical laboratories:

Anaconda Company, Primary Metals Division, Raritan Copper Works, Perth Amboy, N.J., P.F. Stryker and A.J. Simon.

Kennecott Copper Corporation, Metal Mining Division, Salt Lake City, Utah, and Utah Copper Division, Magna, Utah, A.P. Langheinrich.

Kennecott Refining Corporation, Baltimore, Md., A.A. Di Leonardi.

Phelps Dodge Refining Corporation, El Paso Works, El Paso, Tex., A.L. Cardinal.

Reading Metals Refining Company, Carteret, N.J., W.P. Darrow.

U.S. Metals Refining Company, AMAX Copper Division, Carteret, N.J., R.M. Kennedy.

Analyses were performed in the NBS Inorganic Analytical Research Division by the following: K.A. Brletic, B.I. Diamondstone, J.D. Fassett, E.L. Garner, J.W. Gramlich, W.R. Kelly, G.J. Lutz, L.A. Machlan, J.R. Moody, and T.C. Rains; and by R.K. Bell, ASTM-NBS Assistant Research Associate.

**ADDITIONAL INFORMATION:**

Elements other than those that are certified are present in these materials as indicated below. These are NOT CERTIFIED, but are given as additional information on the composition:

SRM No.	C1253
Designation	Cu X
<u>Element</u>	<u>Parts by Million by Weight (<math>\mu\text{g/g}</math>)</u>
Aluminum	[~160]
Antimony	(132)
Beryllium	(12)
Boron	[~30]
Cadmium	[~60]
Chromium	(187)
Calcium	(1)
Cobalt	(510)
Iron	(300)
Lithium	(8.6)
Magnesium	(80)
Manganese	[~300]
Nickel	(500)
Oxygen	[~85]
Phosphorus	[~475]
Silicon	[~500]
Sulfur	(50)
Tellurium	(193)
Tin	(489)
Titanium	[~100]
Zirconium	[~100]

NOTE: Figures in brackets [ ] are qualitative estimates only (aim, calculated, or preliminary numbers).

Figures in parentheses ( ) are based on quantitative determinations, but the reliability for certification has not yet been established.

C1253