

# National Bureau of Standards

## Certificate of Analysis

### Standard Reference Material C2424a

#### Ductile Iron

(In Cooperation With the American Society for Testing & Materials)

This SRM is in the form of a disk, approximately 32 mm (1 1/4 in) in diameter and 19 mm (3/4 in) thick, intended for use in optical emission and x-ray spectrometric methods of analysis.

Constituent	Certified Value <sup>1</sup> Percent by Weight	Estimated <sup>2</sup> Uncertainty
Carbon	2.76	0.05
Manganese	0.207	.003
Phosphorus	.034	.002
Sulfur	.016	.002
Silicon	3.30	.05
Copper	0.099	.003
Nickel	.045	.001
Chromium	.15	.01
Vanadium	.081	.004
Molybdenum	.019	.002
Magnesium	.014	.002
Cerium	.0053	.0007
Lanthanum	.0010	.0002
Titanium	.045	.003

<sup>1</sup>The certified value listed for a constituent is the present best estimate of the "true" value based on the results of the cooperative program for certification.

<sup>2</sup>The estimated uncertainty listed for a constituent is based on judgment and represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability. (No attempt was made to derive exact statistical measures of imprecision because several methods were involved in the determination of most constituents.)

**METALLURGICAL CONDITION:** The specimens were chill cast by a rapid unidirectional solidification technique.

**CERTIFIED PORTION:** The certified portion for each specimen is that extending upward 16 mm (5/8 in) from the chill cast or test surface (the largest surface opposite the numbered surface). Only this portion was analyzed in the cooperative program for certification.

The overall coordination of the technical measurements leading to certification was performed under the direction of J.I. Shultz, Research Associate, ASTM-NBS Research Associate Program.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by W.P. Reed.

Gaithersburg, MD 20899  
July 15, 1985

Stanley D. Rasberry, Chief  
Office of Standard Reference Materials

(Over)

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

The material for this standard was provided and prepared by the American Cast Iron Pipe Company, Birmingham, Ala. A water-cooled, copper plate mold assembly was used in the preparation of the chill castings.

Extensive homogeneity testing was performed at the National Bureau of Standards by optical emission analysis, J.A. Norris, Inorganic Analytical Research Division and by R.K. Bell, ASTM/NBS Research Associate Program.

Cooperative analyses for certification were performed in the following laboratories:

American Cast Iron Pipe Co., Birmingham, Ala., R.N. Smith, J.B. Hobby, L.J. Moore, D.R. Denney and R.G. Moffett

Allegheny Ludlum Steel Corp., Research Center, Brackenridge, Pa., W.D. Heavner

Armco Inc., Research and Technology, Middletown, Ohio, C.C. Borland

General Motors Research Laboratories, Warren, Mich., N. Potter

Inland Steel Co., Indiana Harbor Works, East Chicago, Ind., D.E. Smith

Interlake, Inc., Globe Metallurgical Division, Beverly, Ohio, J.C. Cline and R. Pontello

Interlake, Inc., Riverdale Plant, Riverdale, Ill, R.E. Nelson

University of Gent, Belgium, R. Dams and C. Vandecasteele

Wagner Castings Co., Decatur, Ill., T.L. Ross

#### CAUTIONS:

1. Determinations made on other than the chill-cast or test surface are not recommended because of the unidirectional solidification structure.
2. This chill-cast SRM is designed for calibration in the analysis of samples prepared in the same general manner; samples prepared by other casting techniques, or having different metallurgical condition, may exhibit a bias in the results.

Additional elements were determined in the cooperative analytical program. Although NOT CERTIFIED, the approximate values are given below:

<u>Element</u>	<u>Percent by Weight</u>
Aluminum	(<0.01)
Boron	(0.001)
Cobalt	(0.05)