

Analytical Reference Materials International

Certificate of Analysis Certified Reference Material

Grade: **SPC3-ZH**

Part Number (Q.A. NO.): **IARM 196A**

Certification Date: **06/01/1994**

Certificate No.: **196A-06011994-IARM-F**

Revision Date: **05/10/2004**

Interpretation of Data

1. Certified values listed below reflect analysis results submitted by qualified analytical laboratories using a combination of methods and instrumentation that emulate actual methods and instrumental techniques currently utilized in the analytical community.
2. Any data reported and enclosed by a **parentheses ()** is a **"best estimate" and is NOT CERTIFIED**. This data could not be quantified sufficiently for certification. It was however, reported by enough laboratories to be considered as potentially present in the matrix of the material being examined.
3. The "Inter-laboratory Analysis Program" (ILAP) utilized in the establishment of the data are an ongoing program with permanent membership. Certain elements may be selected by a consensus of the members for more extensive testing. Therefore the data in **brackets []** indicates further testing is in process.
4. The "**±Estimated Uncertainty**" is enclosed by a **parentheses ()** below the individual **element's concentration** and is based on a Confidence Interval at 95%. Included in this estimated uncertainty, are the combined effects of method imprecision, material inhomogeneity, and any bias between methods.

Important: A "User Registration Card" accompanies all shipments. This card should be completed immediately upon receipt of materials with the appropriate user information. This is the only way in which ARMI can guarantee customer updates or possible data modifications!

<u>Aluminum</u>	<u>Antimony</u>	<u>Arsenic</u>	<u>Boron</u>	<u>Calcium</u>	<u>Carbon</u>	<u>Chromium</u>	<u>Cobalt</u>
0.015	0.006	0.025	0.0017	0.0002	1.08	2.35	0.013
(0.001)	(0.002)	(0.001)	(0.0001)	(0.0001)	(0.01)	(0.01)	(0.001)
<u>Copper</u>	<u>Lead</u>	<u>Manganese</u>	<u>Molybdenum</u>	<u>Nickel</u>	<u>Niobium</u>	<u>Nitrogen</u>	<u>Oxygen</u>
0.25	0.001	2.40	0.129	0.61	0.087	0.0084	0.0021
(0.01)	(0.0005)	(0.03)	(0.002)	(0.01)	(0.002)	(0.0001)	(0.0003)
<u>Phosphorus</u>	<u>Sulfur</u>	<u>Silicon</u>	<u>Tin</u>	<u>Titanium</u>	<u>Tungsten</u>	<u>Vanadium</u>	<u>Zirconium</u>
0.040	0.014	0.35	0.033	0.014	0.189	0.157	0.006
(0.001)	(0.001)	(0.01)	(0.001)	(0.001)	(0.004)	(0.002)	(0.001)

The laboratories participating in the "Inter-Laboratory Analysis Program" (ILAP) and certification of this material are as follows:

AK Steel, Butler Works - Butler, PA	Algoma Steel Corp. - Sault Ste. Marie, Ontario, Canada	Anderson Laboratories, Inc. - Greendale, WI
Armco Advanced Materials Co. - Butler, PA	Armco Research & Technology - Middletown, OH	CKD Technical Laboratories - Prague, Czech Republic
Dofasco Inc. - Hamilton, Ontario, Canada	Fisons / ARL-Deerborn, MI	Fisons / ARL-Ecublens, Switzerland
International Steel Group - East Chicago, IN	Laboratory Testing, Inc. - Hatfield, PA	Lone Star Steel - Lone Star, TX
LTV Steel Corp. - Chicago, IN	MMA Laboratories - Huntington Beach, CA	National Steel Corporation-R&D Center - Trenton, MI
Republic Engineered Products - Canton, OH	Staveley Services Materials Testing - Gary, IN	The Timken Company - Canton, OH
USS - Great Lakes Works - Ecorse, MI	USX-Fairfield Works - Fairfield, AL	Wheeling Pittsburgh Steel Corp. - Mingo Junction, OH

Traceability: All members of the "Inter-Laboratory Analysis Program" (ILAP) listed above validate test methods and instrument performance utilizing SRMs produced by the National Institute of Standards and Technology, (NIST) as well as other CRMs and RMs produced by recognized Certifying Bodies from around the world. The specific SRMs, CRMs and RMs applicable to the material covered by this certificate are: NIST 1760, 1761, 1762, 1763, 1764, 1765, 1766, 1767, 1090, 153A, 11H, 12H, NIST 1761, 1762, 1763, 1764, 1765, 1766, 1767, 1160, 1161, 1162, 1163, 1164, 16F, 1754, BAS 401/1-410/2, JSS STD1-STD6, 168-4,-175-4, BS CA-1, CA-2, CA-3, CA-4, CA-1A, CA-2A, CA-3A, XCCV, XAAS, XCCS, LECO 501-645, 502-280, NIST 73c, 341, 32e, 125b, 179, 1261A, 1262A, 1263, 1264, 1285, 1761, 1762, 1763, 1767, LECO 501-550, SS 457, 458, 459, 460, BS 11A, 14A, 33A, 34A, 35A, 35B, 36B, 37A, NIST 1361, 1762, 133A, 109A, 106B, NIST 1761, 1762, 1765, 1261A, 1262A, 1263A, 1269A, 821, BS 46, LECO 501-644, BS 2942, NIST 1134, 1261, 1262, 1263, 1762, 1763, 1764, 1765, 1766, 1767, LECO 501-504, NIST 1261, 1262, 1263, 1264, NIST1761, 1762, 1763, 1764, 1765, 1766, 1767, AR 882, 883, 885, 626, 668, NIST 1763, 1766, 100B, SUS C8, C2, D8, D5, H1, BAS B3, H1, BS CSN4, CSN3, AR871, 873, NIST 337A, BS CCS-1, LECO 501-643

A specific line of traceability is established to NIST and other Certifying Bodies for those elements that are noted as "Certified Values" on the Certificates of Analyses referenced above.

See Reverse Side for Statistical Data and Additional Information Regarding this Material.

The following data and accompanying statements represent all pertinent information reported in the ILAP as it applies to the chemical characterization of this material as of 05/10/2004.

196A	Al	B	C	Co	Cr	Cu	Mn	Mo	N	Nb	Ni	O	P	Pb	S	Si	Sn	Ti	V	W	As	Ca	Ce	Sb	Ta	Zn	Zr	
1	0.015	0.0020	1.06	0.010	2.32	0.24	2.32	0.130	0.0085	0.084	0.59	0.00196	0.041	0.002	0.014	0.34	0.034	0.012	0.160	0.195	0.026	0.0005	0.0060	0.002	0.0010	0.0025	0.005	
2	0.016	0.0023	1.07	0.013	2.34	0.23	2.37	0.135	0.0083	0.099	0.62	0.0020	0.040	0.002	0.0145	0.36	0.038	0.015	0.160	0.205	0.020	0.0002	<0.002	0.005	<0.00001	0.0047	0.006	
3	0.015	0.0019	1.06	0.015	2.31	0.232	2.43	0.130	0.0085	0.084	0.593	0.0022	0.038	0.001	0.014	0.376	0.028	0.016	0.155	0.184	0.0296	0.0001		0.006	0.0030	0.0027	0.005	
4	0.019	0.0018	1.09	0.014	2.35	0.25	2.37	0.129	0.00837	0.093	0.64	0.0023	0.042	0.0011	0.013	0.37	0.039	0.016	0.158	0.193	0.0257	0.0001		0.0002			0.0065	
5	0.018	0.0016	1.065	0.015	2.308	0.232	2.30	0.130	0.0081	0.095	0.609	0.0027	0.041	0.00109	0.015	0.359	0.0345	0.014	0.157	0.1869	0.0259	0.0001		0.0029			0.007	
6	0.018	0.0012	1.081	0.0130	2.3336	0.276	2.528	0.1281	0.0084	0.0964	0.610	0.00202	0.042	0.0007	0.019	0.351	0.036	0.014	0.1661	0.1866	0.029	0.0001		0.011			0.0052	
7	0.0177	0.0013	1.1105	0.0122	2.351	0.2668	2.3870	0.124	0.0085	0.0823	0.5977	0.0018	0.0414	0.002	0.0176	0.3637	0.0282	0.0123	0.1612	0.196	0.026	0.0001		0.008			0.0036	
8	0.013	0.0016	1.095	0.009	2.32	0.2374	2.387	0.130	0.00791	0.0874	0.606		0.0383	0.0018	0.0186	0.3307	0.0386	0.0141	0.1538	0.176	0.023			0.012			0.0057	
9	0.0151	0.0018	1.0606	0.010	2.333	0.2727	2.480	0.128	0.00858	0.082	0.5813		0.0382		0.0140	0.3281	0.0319	0.0139	0.155	0.190	0.0231			0.0039			0.006	
10	0.018	0.0020	1.076	0.012	2.40	0.233	2.31	0.120	0.0078	0.085	0.608		0.038		0.0093	0.325	0.033	0.011	0.160	0.1895	0.0275			0.0045			0.009	
11	0.012	0.0018	1.11	0.0096	2.394	0.24	2.381	0.125	0.0081	0.077	0.63		0.040		0.012	0.35	0.035	0.013	0.152	0.186	0.02328			0.0108			0.007	
12	0.010	0.0020	1.11	0.0126	2.353	0.231	2.47	0.125	0.0088	0.09	0.583		0.038		0.018	0.333	0.033	0.010	0.150	0.1986	0.025			0.0093			0.0030	
13	0.016	0.0015	1.08	0.0122	2.353	0.25	2.377	0.130	0.0078	0.087	0.63		0.044		0.013	0.37	0.030	0.019	0.161	0.185	0.023			0.003			0.0060	
14	0.016	0.0017	1.072	0.015	2.389	0.24	2.44	0.1257	0.0087	0.0882	0.59		0.040		0.0142	0.34	0.031	0.012	0.1553	0.193	0.026			0.0006			0.0045	
15	0.0158	0.00174	1.066	0.013	2.335	0.263	2.445	0.126	0.0085	0.0859	0.617		0.036		0.0124	0.347	0.034	0.013	0.160	0.1831	0.022			0.0095			0.0038	
16	0.0148	0.0019	1.084	0.0139	2.414	0.240	2.421	0.120	0.0087	0.084	0.608		0.0410		0.0097	0.348	0.0346	0.0127	0.1606	0.181	0.027			0.010			0.0066	
17	0.0128	0.0020	1.068	0.014	2.32	0.245	2.44	0.130	0.0084	0.0843	0.616		0.042		0.0131	0.32	0.031	0.0132	0.160		0.025			0.004			0.0036	
18	0.015	0.0018	1.049	0.012	2.388	0.2430	2.34	0.134	0.0085	0.087	0.619		0.0418		0.016	0.322	0.0359	0.0140	0.157		0.02850						0.0059	
19	0.015	0.0015	1.035	0.015	2.36	0.260	2.29	0.128	0.0086125	0.090	0.600		0.040		0.014	0.338	0.032	0.014	0.150		0.027						0.0056	
20	0.013	0.0020	1.075		2.370	0.234	2.45	0.1359	0.00791	0.085	0.621		0.037		0.0142	0.335	0.031	0.015	0.156								0.008	
21	0.014	0.0018	1.09			0.266	2.362	0.130	0.0087	0.082	0.63		0.042		0.015	0.36	0.034	0.017	0.155								0.00515	
22	0.013	0.0014	1.08			0.237	2.4038	0.12858		0.089	0.612		0.037		0.012	0.328	0.032	0.015	0.1557								0.005	
23	0.0138	0.00182	1.092			0.2355	2.463	0.135		0.088	0.601		0.0410		0.0142	0.347	0.034	0.016	0.154									
24	0.014	0.0015	1.0665			0.232				0.085	0.589		0.0407		0.0150	0.3368	0.0341	0.0149	0.151515									
25	0.015065	0.00174	1.088			0.258645				0.08546	0.598		0.039		0.014785	0.349	0.031	0.016	0.158									
26	0.017		1.066			0.280				0.086	0.617115		0.03849		0.014	0.345435	0.033005	0.016225										
27										0.608			0.036		0.012	0.351	0.034	0.015										
Mean	0.0151	0.0017	1.0769	0.0127	2.3521	0.2471	2.3985	0.1286	0.0084	0.0870	0.6083	0.0021	0.0398	0.0015	0.0142	0.3453	0.0334	0.0142	0.1569	0.1893	0.0254	0.0002	0.0060	0.0060	0.0020	0.0033	0.0056	
STDV.	0.0021	0.0003	0.0184	0.0019	0.0315	0.0156	0.0623	0.0042	0.0003	0.0048	0.0153	0.0003	0.0021	0.0005	0.0023	0.0153	0.0028	0.0019	0.0039	0.0073	0.0025	0.0001	#DIV/0!	0.0038	0.0014	0.0012	0.0015	
Certified	0.015	0.0017	1.08	0.013	2.35	0.25	2.40	0.129	0.0084	0.087	0.61	0.0021	0.040	0.001	0.014	0.35	0.033	0.014	0.157	0.189	0.025	0.0002		0.006			0.006	
95% C.I.	0.001	0.0001	0.01	0.001	0.01	0.01	0.03	0.002	0.0001	0.002	0.01	0.0003	0.001	0.0005	0.001	0.01	0.001	0.001	0.002	0.004	0.001	0.0001		0.002			0.001	
Methods	O	O	C,O	X,A,I,O	X,W,A,O	X,A,I,O	X,A,I,O	X,I,O	F,O	X,O	X,A,I,O	F	X,I,O	X,A,I,O	C,O	X,W,O	X,O	X,O	X,O	X,I,O	A,I,O	O		X,O			X,O	

Methods: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, D = DC Arc, O = OE, X = XRF, G = GDMs

The International Standards Organization (ISO) definitions, expressed in ISO Guide 30-1981-(E) list the following:

Certifying Body: A technically competent body (organization or firm, public or private) that issues a Reference Material Certificate. The only generally accepted certifying body in the United States is the U. S. Department of Commerce, National Institute of Standards & Technology, (NIST), Gaithersburg, MD.

Reference Material (RM): A material or substance with one or more properties which are sufficiently well established to be used for calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Certified Reference Material (CRM): A reference material with one or more properties whose values are certified by a technically valid procedure accompanied by or traceable to a certificate or other documentation, which is issued by a Certifying Body.

Inter-Laboratory Analysis Program (ILAP): Although ASTM Standard E691-87 applies to inter-laboratory studies to "Determine the Precision of a Single Test Method", it is also a well thought out and logical plan for conducting an inter-laboratory program involving multiple techniques. Therefore, the planning, conducting, analyzing, protocol, and treatment of data resulting from this inter-laboratory program were performed utilizing the guidelines established in ASTM E691-87.

Methods of Analysis: In view of the fact, that the "Inter-Laboratory Analysis Program" entails a wide variety of materials, no single analytical method would provide optimum data results. Therefore, the methods utilized were a combination of ASTM Standard Methods for classical wet chemistry, ICP, AA, Optical Emission and X-Ray spectrometric methods. The determinations for Carbon, Sulfur, Nitrogen, and Oxygen are the result of combustion instrument procedures.

Selection of Materials: A "batch" or "series" is defined as a single bar of one continuous length. The majority of materials are in wrought condition. Other methods of manufacture are utilized as a last resort, only in the case of those materials being unavailable in wrought condition. "Batch" samples are taken by removing a one-inch cross section for every thirteen inches of total length from the entire bar. Twenty-five percent of the one inch cross section is converted to chips for analysis by classical wet chemistry, ICP, AA, and combustion procedures and seventy-five percent remains in a solid disk form for OES and X-Ray analysis where applicable. Each member of the ILAP is furnished both a solid sample and the corresponding supply of chips from a specific location on the batch bar. This massive sampling procedure results in the homogeneity being reflected as a product of the overall statistics and certified data.

Certified by: 
 William D. Britt, President & General Manager
 Analytical Reference Materials International Corporation

Certificate No.: 196A-06011994-ARM-F
 Certification Date: 06/01/1994
 Revision Date/No.: 05/10/2004