ALPHA RESOURCES LLC Value Beyond Measure

Certificate of Analysis

AR-747

GREEN PETROLEUM COKE CRM

LOT # 747919 LID # 747919

ALL ANALYSIS REPORTED ON A DRIED BASIS VALUE	MEAN	Exp. Unc.	n=	k=	METHODS USED
MASS FRACTION PERCENT SULFUR	3.66	± 0.12	31	2.04	ASTM D4239, D1552
MASS FRACTION PERCENT ASH	0.41	± 0.04	6	2.57	ASTM D3174, D4422
MASS FRACTION PERCENT VOLATILE MATTER	10.97	± 0.45	6	2.57	ASTM D3175, D7582
MEAN BTU/POUND	14,919	± 98	6	2.57	ASTM D5865
FIXED CARBON (CALCULATED)	(88.62)	-----			ASTM D3172
MASS FRACTION PERCENT CARBON	88.46	± 1.97	6	2.57	ASTM D5373
MASS FRACTION PERCENT HYDROGEN	3.11	± 0.15	6	2.57	ASTM D5373
MASS FRACTION PERCENT NITROGEN	1.45	± 0.2	6	2.57	ASTM D5373
PPM- ug/g NICKEL	203	± 17	6	2.57	ASTM D5056, D6357, D5600
PPM- ug/g IRON	492	± 60	6	2.57	ASTM D5056, D6357, D5600
PPM- ug/g VANADIUM	794	± 72	6	2.57	ASTM D5056, D6357, D5600
PPM- ug/g CALCIUM	241	± 10	6	2.57	ASTM D5056, D6357, D5600
PPM- ug/g SILICON	418	± 61	6	2.57	ASTM D5056, D6357, D5600
PPM- ug/g ALUMINUM	146	± 68	6	2.57	ASTM D5056, D6357, D5600
PPM- ug/g PHOSPHOROUS	19	± 9	6	2.57	ASTM D5056, D6357, D5600
PPM- ug/g SODIUM	51	± 18	6	2.57	ASTM D5056, D6357, D5600
PPM- ug/g ZINC	(7)	-----			ASTM D6357, D5600
PPM- ug/g CHLORINE	(31)	-----			ASTM D6721, D4208
PPM- ug/g FLUORINE	(26)	-----			ASTM D5987, D3761

Numbers in brackets are given for reference information only.

This Certified Reference Material is traced to NIST SRM 2718a, 1633c, 2693, 2682b, 1632d, SARM 18; High purity materials: Phenylalanine, EDTA. The BTU is traceable to Benzoic Acid NIST 39j

The intended use of this material is for the verification of test analysis by the above listed or other valid methods. The precision value represents the expanded degree of uncertainty based on errors from analytical assay by a consensus of approved labs, at a 95% confidence level utilizing ANOVA, ISO Guide 35, and the Guide to Uncertainty Measurement. Metrological traceability is to the SI derived unit of mass fraction expressed as mass fraction percent, ug/g, or BTU/lb. When necessary, professional judgment is applied toward consideration of data and statistical information. The statistical analysis and the overall direction and coordination of the analytical measurements leading to certification were performed by K.E. Dyer Chief Chemist at Alpha Resources. Normal testing procedures should be employed when using this standard; this includes using the *reproducibility* and *repeatability* factors based upon your test method. Refer to your test method or instrument manufacturer for typical and minimum sample size.

The material used for the production of this CRM was identified in accordance to ARI 041. The samples for round robin testing were selected in accordance with ARI 031. The above values relate only to the material used to produce this standard. The analytical samples are recommended to be dried per the test method used. This bottle contains 50g, fine -60 mesh (250u) green petroleum coke powder. Keep bottle sealed immediately after use and store under normal laboratory conditions. While unable to determine a definite shelf life this reference should be reviewed 20 years from date of certification. Once opened this certificate is valid for 2 years. Remedies for any claimed defect in this product will be limited to product replacement or refund of the purchase price. In no event shall Alpha Resources be liable for incidental or consequential damages. This certificate cannot be reproduced except in full.

This is a Certified Reference Material (CRM), and is traceable to the above-mentioned standards and or gravimetric methods. For good laboratory practice it is recommended that all reference standards be verified as fit for purpose prior to use. This standard was produced in accordance to ISO 17034 (RMP) accreditation issued by ANSI-ASQ/ANAB. Refer to certificate and scope of accreditation AR1920.

EXPIRATION DATE

THIS CRM IS VALID FOR TWO YEARS FROM THE DATE OF OPENING

Certified January 28, 2020

Kent Dyer

P.O. BOX 199, 3090 Johnson Rd. • Stevensville, MI 49127-0199 • Phone (269) 465-5559 • Fax (269) 465-3629 • alpharesources.com