

## Residual Fuel Oil Certified Reference Material

**Product No: AR1622**

**Lot No: 240730**

### Material and Intended Use

AR1622 is a residual oil certified reference material (CRM). The intended use of this CRM is for the verification and calibration of x-ray fluorescence, combustion, and other appropriate analysis methods for the determination of sulfur, carbon, hydrogen, and nitrogen. This CRM can also be used to validate value assignment of in-house reference materials. A unit consists of one bottle containing 100 mL of reference material as a liquid. All reference materials should be verified as fit for purpose prior to use.

### Instructions for Use

The minimum sample size for analysis is dependent upon the test method and instrumentation used. Bottles of liquid should be kept sealed tightly and stored in a cool, dry location. Property values are valid for 2 years from the initial date of certification if handling and storage instructions are followed. Property values are rendered null and void if the CRM is in any way modified or damaged.

### Reported Values

Reported values of a chemical element or constituent indicate the amount of each present in the overall material matrix and are metrologically traceable to the International System of Units (SI) derived unit of mass fraction expressed as a percent (%). Reported calorimetric values indicate the heat of combustion of the overall material matrix and are metrologically traceable to the derived unit of British Thermal Units per pound (BTU/lb). Certified values are reported as the mean property value with an expanded uncertainty ( $U_{95\%}$ ). The true value of the measurand is believed to lie within the expanded uncertainty coverage interval with 95% confidence. Expanded uncertainty is calculated by application of a coverage factor ( $k$ ) to the combined standard uncertainty ( $u_c$ ). For laboratory uncertainty budgets, the combined standard uncertainty can be calculated as  $u_c = U_{95\%}/k$ , where  $k$  is approximately equal to 2. The estimation of combined standard uncertainty ( $u_c$ ) includes contributions from material homogeneity, primary calibrants, characterization, and other factors. Sampling and calculation of reported values for each measurand are performed using practices consistent with ISO 17034:2016 and ISO Guide 35. Certified values are accredited under Alpha Resources, LLC ISO/IEC 17025 and ISO 17034 certificates issued by ANSI National Accreditation Board (ANAB), AT-1200 and AR1920.

**Table 1. Certified values for AR1622, Lot 240730.**

Property	Certified Value	$U_{95\%}$	Method & Detection	n
%Sulfur	2.08	0.12	X-ray Fluorescence	30

Certified values were validated using the following primary reference standards:

<b>NIST SRM</b>	1622e
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**Table 2. Reference values for AR1622, Lot 240730.**

Property	Value	Method & Detection
%Carbon	85.08	Combustion/IR or TC
%Hydrogen	11.91	Combustion/IR or TC
%Nitrogen	0.20	Combustion/TC
Calorific Value (BTU/lb)	18850	Bomb Calorimetry

### Homogeneity

This product was manufactured using blending and mixing to minimize overall heterogeneity. Samples were randomly selected using practices consistent with ISO Guide 35 Section 7. Homogeneity was evaluated by replicate analysis. Within- and between-sample variance was evaluated using Analysis of Variance (ANOVA).

### Methods and References

ARI-LAB-619 – Alpha Resources Method, Analysis By X-Ray Fluorescence

ASTM D5291-21 – Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants

ASTM D240-19 – Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter

ISO/IEC 17025:2017 – General requirements for the competence of testing and calibration laboratories

ISO 17034:2016 – General requirements for the competence of reference material producers

ISO 33401:2024 – Reference materials – Contents of certificates, labels, and accompanying documentation

ISO Guide 30:2015 – Terms and definitions used in connection with reference materials

ISO Guide 35:2017 – Reference materials – General and statistical principles for certification



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