

ACIRS-G10-2022

GENERAL COAL REFERENCE MATERIAL

CERTIFICATE of ANALYSIS

Table 1 Assigned Property Values

| ASSIGNED PROPERTY VALUES | | | |
|--------------------------------|------------------------------|---------------------------------|-----------------------------------|
| | Certified Value ¹ | Standard Deviation ² | Expanded Uncertainty ³ |
| Ash, % d | 10.46 | 0.073 | 0.030 |
| Volatile Matter, % d | 19.79 | 0.127 | 0.053 |
| Gross Calorific Value, MJ/kg d | 32.331 | 0.065 | 0.028 |
| Relative Density, d | 1.379 | 0.012 | 0.006 |
| Total Carbon, % d | 79.45 | 0.230 | 0.086 |
| Hydrogen, % d | 4.365 | 0.057 | 0.022 |
| Nitrogen, % d | 1.801 | 0.017 | 0.006 |
| Total Sulfur, % d | 0.606 | 0.015 | 0.005 |
| Chlorine, % d | 0.052 | 0.004 | 0.003 |
| Phosphorus, % d | 0.020 | 0.001 | 0.002 |
| Mercury, mg/kg d | 0.029 | 0.003 | 0.002 |
| Fluorine, mg/kg d | 76 | 8.7 | 5 |
| Carbonate Carbon, % d | 0.032 | 0.003 | 0.002 |

¹ Certified values are the best estimate of the true value. They are an unweighted robust mean value of an accepted dataset obtained from proficiency testing using ISO/IEC 17025 accredited laboratories, each of whom tested a minimum of three unique samples. The standard test methods used are detailed in Table 2. Where more than one test method was used, significant biases between methods were not observed.

² Standard deviation (s^*) is a robust value used to derive the likely range of results. For normally distributed data, the value for a measurand from a randomly chosen laboratory would be expected to lay within 2 standard deviations of the certified value with 95% probability.

³ Expanded Uncertainty (U) is a robust value estimated on the likely range of the true value of each parameter, including estimation of the uncertainty due to characterisation and heterogeneity, and is calculated from $1.25 \times s^* / \sqrt{n} \times k$ where k is a coverage factor of 2 corresponding to a level of confidence of about 95%.

Note: U for Total Sulfur also includes an estimation due to sample instability.

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 Previous ACIRS-G series: This sample supersedes ACIRS-G9-2021



Accredited for compliance with ISO 17034
 Accreditation Number 21027

*NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

1. Introduction

This report describes the preparation and certification of ACIRS-G10-2022.

This reference material is a higher rank bituminous coal and is intended to be used for quality control purposes for the analysis of similar coals.

2. Description of the Sample and Preparation

ACIRS-G10-2022 comprises a sealed jar containing 125 g (minimum) of coal at a nominal top size of 212 μm . This sample was prepared from 880 kg of a Queensland, Bowen Basin higher rank bituminous coal, at -50 mm top size.

The bulk coal sample was crushed in a swing hammer mill to a nominal top size of 2.36 mm and stabilised over an extended period. The material was then repeatedly mixed by rotary sample division (RSD) until lots of approximately 1.5 kg were obtained which were then air dried and milled to a nominal top size of 212 μm . This pulverised material was further divided by RSD to obtain the representative samples. Each sample was then placed into a plastic bag within sealed HDPE jars.

Between-unit homogeneity was quantified by testing ash, gross calorific value and total sulfur and assessing for sufficient homogeneity in accordance with ISO 17034.

3. Instructions for Handling and Use

This reference material is intended to be used as a quality control tool.

Before first use, empty the sample from the inner plastic bag directly into the HDPE jar.

Before each use, the bottle **must** be thoroughly mixed by end-over-end rotation to re-homogenise the coal sample.

To minimise the risk of compositional changes due to oxidation, store in a cool, dark place in the original container with lid tightly sealed. ACIRS cannot be held responsible for any changes that occur after the sample bottle has been opened.

The minimum sample intake for ACIRS-G10-2022 is established in accordance with the standard test methods listed in Table 2. Corrections to dry basis values should be in accordance with ISO 11722 or equivalent.

4. Characterisation

ACIRS-G10-2022 was characterised in an interlaboratory comparison program conducted by Proficiency Testing Australia in collaboration with ACIRS. This program was conducted specifically for characterisation of ACIRS-G10-2022.

Twelve accredited Australian coal testing laboratories were invited to participate in the program.

Each participant was provided a minimum of three unique ACIRS-G10-2022 samples. Additionally, a quality control sample was provided to participants for quality assurance purposes.

Participant data was accepted in the characterisation dataset when:

- the laboratory was accredited to ISO/IEC 17025 for the specific parameter,
- testing was conducted by national, international or NATA approved test methods,
- when results met technical acceptability along ACIRS guidelines e.g. meeting standard method precision limits; not identified as an outlier; passed acceptance testing on the supplied quality control sample, and
- where no significant biases are observed.

The certified values and their associated uncertainties were calculated from an unweighted mean value by robust statistical analysis in accordance with Algorithm A of ISO 13528-2015.

The analysis methods that comprise the accepted dataset are detailed in Table 2.

Note:

- This sample has relatively low levels of pyritic sulfur (<0.1%).

Table 2 Methods Used for Certification

| PARAMETER | ANALYSIS METHOD(S) USED ⁵ | n (TOTAL) ⁶ |
|-----------------------|--------------------------------------|------------------------|
| Ash | ISO 1171* (n=36) | 36 |
| Volatile Matter | ISO 562* (n=36) | 36 |
| Gross Calorific Value | ISO 1928* (n=33) | 33 |
| Relative Density | AS1038.21.1.1 (n=27) | 27 |
| Total Carbon | ISO 29541* | 45 |
| Hydrogen | ISO 29541* | 43 |
| Nitrogen | ISO 29541* | 45 |
| Total Sulfur | ISO 19579* (n=36) | 36 |
| Chlorine | ISO 18806 (n=6), ISO 587* (n=12) | 18 |
| Phosphorus | ISO 622* (n=6), ISO 13605+ (n=18), | 24 |
| Mercury | ASTM D 6722 (n=15) | 15 |
| Fluorine | ISO 11724* (n=18), | 18 |
| Carbonate Carbon | ISO 925* | 18 |

⁵ * Includes corresponding methods AS 1038.3-2000 (Ash, VM), AS 1038.5-1998 (GCV), AS 1038.6.4-2005 (C, H, N), AS 1038.6.3.3 (TS), AS 1038.23 (Cm), AS 1038.9.3 (P), AS 1038.8.1 (Cl) + Includes ISO/IEC 17025 accredited in-house methods by this technique

⁶ Total number of results (n) is the number of accepted results in the dataset, each being the average of duplicate results. A minimum of three unique samples were tested by each participant for all parameters.

5. Metrological Traceability

Property values are operationally defined by methods listed in Table 2 using only results from laboratories accredited to ISO/IEC 17025.

6. Period of Validity

Property values for coal samples are subject to change due to the normal oxidation processes for coals. For this reason, the minimum shelf-life until the stated period of validity (September 2026) is provided for oxidation sensitive parameters i.e. for CV, VM, C and H. All other parameters are considered stable until September 2029.

The stability of this sample will be monitored by ACIRS. It is the responsibility of the user to obtain the most recent Certificate for this reference material available at www.acirs.com.au/products/general-coal-reference-material/.

7. Health and Safety

Samples shall be handled in accordance with the Safety Data Sheet available from www.acirs.com.au/products/general-coal-reference-material/.

8. Legal Notice

To the extent permitted by law, ACIRS disclaims all warranties whether expressed or implied with regard to merchantability, non-infringement, or fitness for a particular purpose. In no event will ACIRS be liable for incidental damage or consequential loss arising from the use of this product.

Where the product does not conform to assigned property values, giving due consideration to the stated uncertainties and accepted tolerances, the total liability of ACIRS shall be limited at ACIRS' absolute discretion to either replacement of the product or refund of the purchase price.

9. Revision History

| Document Number | Summary | Date |
|--------------------------|---|------------|
| ACIRS-G10-2022-CoA-rev0 | Original | 22/11/2022 |
| ACIRS-G10-2022-CoA-rev01 | <ul style="list-style-type: none"> - Added certification for Carbon, Hydrogen, Nitrogen and Carbonate Carbon - Reporting of Expanded Uncertainties - n samples updated to a minimum of 3 samples | 24/01/2023 |

10. Authorisation

Approved by Andrew Swanson (ACIRS Commercial Manager)

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