acirs
AUSTRALIAN COAL INDUSTRY REFERENCE SAMPLES

General Coal Reference Material

ACIRS-G11-2026

PRODUCT INFORMATION LEAFLET

Table 1 Assigned property values

	Property Value[1]	Standard Deviation[2]	Expanded Uncertainty[3]
Ash, % d	10.45	0.053	0.023
Volatile Matter, % d	19.73	0.12	0.051
Gross Calorific Value, MJ/kg d	32.234	0.066	0.031
Relative Density, d	1.380	0.011	0.005
Total Carbon, % d	79.51	0.39	0.19
Hydrogen, % d	4.380	0.071	0.034
Nitrogen, % d	1.763	0.027	0.013
Phosphorus in coal, % d	0.0169	0.0004	0.0002
Total Sulfur, % d	0.602	0.013	0.005
Chlorine, % d	0.057	0.005	0.003
Fluorine, mg/kg d	64	4.8	2.6
Selenium, mg/kg d	0.75	0.031	0.020

1 Assigned property 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 section 4. 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 x s*/√n x *k* where k is a coverage factor of 2 corresponding to a level of confidence of approximately 95%.

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

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Previous ACIRS G series RM: This sample supersedes ACIRS-G10-2022

ilac-MRA NATA

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

Table 2 Informational values[4]

	Mean	Range of Results	Number of Results
Antimony, mg/kg d	0.26	0.2 – 0.3	9
Arsenic, mg/kg d	0.43	0.3 – 0.6	14
Boron, mg/kg d	3.9	1.3 – 6.7	12
Cadmium, mg/kg d	0.034	0.02 – 0.05	12
Mercury, mg/kg d	0.026	0.02 – 0.03	9
Pyritic Sulfur, % d	0.036	0.03 – 0.05	6
Sulfate Sulfur, % d	0.022	0.018 – 0.023	6
Carbonate Carbon, % d	0.033	0.02 – 0.04	6

[4] Informational values are provided where the relative uncertainty of the robust mean or distribution of data was considered unacceptably high, or the number of participant results are low. These are not considered to be assigned property values.

1 Introduction

This report describes the preparation and characterisation of ACIRS-G11-2026.

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-G11-2026 comprises a sealed jar containing 125 g (minimum) of coal at a nominal top size of 212 µm. This sample was prepared from 870 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.

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-G11-2026 is established in accordance with the standard test methods listed in Table 3. Corrections to dry basis values should be in accordance with ISO 1170 or equivalent.

4 HOMOGENEITY ASSESSMENT AND CHARACTERISATION

Between-unit homogeneity for ACIRS-G11-2026 was quantified by testing ash, gross calorific value and total sulfur and assessing for sufficient homogeneity in accordance with ISO 17034.

ACIRS-G11-2026 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-G11-2026.

Twelve accredited Australian coal testing laboratories were invited to participate in the program. Each participant was provided three unique ACIRS-G11-2026 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,
- results met ACIRS' technical acceptability guidelines, e.g., standard method precision limits were met; not identified as an outlier; acceptance criteria met on the supplied quality control sample, and
- no significant biases were observed.

The assigned values and their associated uncertainties were calculated from an unweighted mean value by robust statistical analysis in accordance with Algorithm A of ISO 13528:2022, Annex C.3.1. The analysis methods that comprise the accepted dataset are detailed in Table 3.

Table 3 Methods used for characterisation

Parameter	Analysis Method	Number of Results[5]
Ash	ISO 1171 (30), AS 1038.3-2000 (3)	33
Volatile Matter	ISO 562 (33), AS 1038.3-2000 (3)	36
Gross Calorific Value	ISO 1928	29
Relative Density	AS 1038.21.1.1-2008	29
Total Carbon, Hydrogen, Nitrogen	ISO 29541	27
Phosphorus in coal	ISO 13605 (9), AS 1038.14.1 (3), AS 1038.14.3 (3)	15
Total Sulfur	ISO 19579 (27), AS 1038.6.3.3 (9)	36
Chlorine	ISO 587 (9), ISO 18806:2019 (6), In-house IC (3), In-house XRF (6)	24
Fluorine	ISO 11724 (9), In-house IC (12)	21
Selenium	ISO 11723 (6), In-house (9)	15
Antimony	In-house	9
Arsenic	ISO 11723 (6), In-house (8)	14
Boron	AS 1038.10.3 (3), In-house (9)	12
Cadmium	ASTM D6357 (3), In-house (9)	12
Mercury	ASTM D6722 (6), In-house (3)	9
Pyritic and Sulfate Sulfur	AS 1038.11 (3), In-house (3)	6
Carbonate Carbon	ISO 925	6

[5] Number of results is the total accepted results in the dataset, each result being the average of duplicate results. Three unique samples were tested by each participant laboratory for all parameters. In-house methods are ISO/IEC 17025 accredited techniques.

5 METROLOGICAL TRACEABILITY

Property values are operationally defined by methods listed in Table 3 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 (April 2030) is provided for oxidation sensitive parameters, i.e., for CV, VM, C and H. All other parameters are considered stable until April 2033.

The stability of this sample will be monitored by ACIRS. It is the responsibility of the user to obtain the most recent documentation 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 regarding 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

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ACIRS-G11-2026-PIL-rev0	Original	16/04/2026

10 AUTHORISATION

Approved by: Andrew Swanson (ACIRS Commercial Director)

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