

## TRACE ELEMENTS in COAL REFERENCE MATERIAL ACIRS-M2-2018

### CERTIFICATION REPORT

Date of Issue: June, 2018  
 Report Number: CR-M2-2018-rev0  
 Previous ACIRS-M2 series: This is the first in the series

Production and certification of this sample was conducted in accordance with ISO 17034 and ISO Guide 35.

**Table 1 Assigned Values**

	<b>Assigned Property Values<sup>1</sup></b>	<b>Standard Deviation<sup>2</sup></b>	<b>Expanded Uncertainty<sup>3</sup></b>	<b>Number of laboratories</b>
Fluorine, mg/kg d	176	6	4	16
Arsenic, mg/kg d	0.3	0.09	0.07	9
Mercury, mg/kg d	0.041	0.003	0.002	11
Ash, % d	9.32	0.09	0.06	18

**Table 2 Indicative Values**

	<b>Indicative Values<sup>4</sup></b>	<b>Standard Deviation<sup>2</sup></b>	<b>Expanded Uncertainty<sup>3</sup></b>	<b>Number of laboratories</b>
Selenium, mg/kg d	0.3	0.05	0.04	8
Cadmium, mg/kg d	0.02	0.002	0.002	6

## 1. Notes

1. Property values are the best estimate of the true value and are based on the robust mean of technically valid results from inter-laboratory studies test programs using data from the following analysis methods;
  - Ash: ISO 1171 and equivalent methods
  - Fluorine: ISO 11724 and equivalent methods
  - Mercury: ASTM D6722 and equivalent methods
  - Arsenic and Selenium: ISO 11723 and equivalent methods
  - Cadmium: ISO 23380 and equivalent guidelines.
2. Standard deviation (sd) is a robust value used to derive the likely range of results. The value for a measurand from a randomly chosen laboratory would be expected to lay within 2 standards deviations of the certified value with 95% probability.
3. The expanded uncertainty provides the user with information on the likely range of the true (but unknown) value for each parameter and has been estimated in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM) with a coverage factor  $k=2$ , corresponding to a level of confidence of about 95%. For Arsenic, Cadmium and Selenium  $k$ -factors of 2.3, 2.4 and 2.3 respectively were chosen according to the  $t$ -distribution for sets of results.
4. Indicative values are provided where the relative uncertainty of the robust mean, or distribution of data, was considered unacceptably high and are not considered to be property values.

## 2. Description of the Sample and Preparation

ACIRS–M2-2018 comprises a sealed jar containing approximately 50 g of coal at a nominal top size of 212  $\mu\text{m}$ .

This sample was prepared from a 25 kg bulk sample of a higher rank bituminous coal sourced from the Queensland, Bowen Basin in 2017. This material, at 50 mm top size, was air-dried and then crushed in a swing hammer mill to a nominal top size of 2.36 mm. The material was then repeatedly mixed by rotary sample division (RSD) until lots of approximately 0.5 kg were obtained which were then air dried and milled to a nominal top size of 212  $\mu\text{m}$ . This pulverised material was further divided by RSD until representative 50 g samples were obtained. Each sample was then placed into sealed amber glass jars.

Homogeneity of the batch was confirmed by comparison of the dry ash value of each sample against the ash repeatability criteria of ISO 1171.

## 3. Instructions for Use

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

Before the bottle is opened, it **must** be thoroughly mixed by end-over-end rotation so that the material is re-homogenised.

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

## 4. Characterisation

ACIRS-M2-2018 was tested during inter-laboratory studies conducted as part of ACARP research project C25044 during 2017-18. The accepted data-set included analyses tested by the following analytical methods;

- Ash – by ISO 1171 and equivalent methods
- Fluorine – by ISO 11724 and equivalent methods
- Arsenic and Selenium – by ISO 11723 and equivalent methods

- Mercury – by ASTM D6722 and equivalent methods, and for
- Cadmium – by ISO 23380 and equivalent guidelines.

Results were evaluated for technical competency before inclusion in the certification dataset e.g. meeting standard method precision limits and by outlier identification. Robust statistical techniques were then used in the characterisation process in accordance with the guidelines of:

- IUPAC, 2006 International Harmonized Protocol for the Proficiency Testing of Analytical Chemical Laboratories
- ISO 13528-2005, Statistical design for use in proficiency testing by interlaboratory comparison, and
- ISO Guide 35 -2006, Reference Materials – General and statistical principles for certification.

## 5. Period of Validity

Property values are considered stable until February 2023.

The stability of assigned property values will be monitored by ACIRS and it is the responsibility of the user to obtain the most recent documentation for this reference material available at [www.acirs.com.au/products/](http://www.acirs.com.au/products/)

## 6. 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/](http://www.acirs.com.au/products/general-coal-reference-material/)

## 7. 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.

## 8. Revision History

Document Number	Summary	Date
CR-M2-2018-rev0	Original (rev0)	01/06/2018

## 9. Authorisation

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