

ACIRS Stability Statement

Introduction

The stability of Reference Materials (RM) is of crucial importance to both users and suppliers of coal-based products, given that coal is an organic material that will, over time, react with the atmosphere.

Following the guidelines as established in AS/NZS ISO 33405:2024 (previously ISO Guide 35) *Reference materials – Guidance for Characterization and assessment of homogeneity and stability*, ACIRS have conducted numerous stability studies on its RMs, since 2011, to define each RM's period of validity and to monitor product stability.

While most parameters are stable over a long period of time, there are oxidation-sensitive parameters in coal, including Volatile Matter (VM), Calorific Value (CV), Carbon (C), Hydrogen (H), and forms of sulfur (FOS), i.e., sulfate sulfur (Ss) and pyritic sulfur (Sp) which can deteriorate more quickly. The extent of change over time is rank and parameter dependent. It is most rapid after the initial exposure to air before transitioning to a more stable degradation profile once the material processing phase has been completed.

ACIRS' production processes include bulk sample selection, aging (6 months minimum) and storage (G-series refrigeration prior to sale) and are designed to reduce the deterioration of the samples over time. In addition, the G-series documentation recommends refrigeration when stored at the laboratory.

Observations

Stability monitoring has confirmed a four-year period of validity on oxidation-sensitive parameters. Longer periods of validity have been confirmed on non-oxidation-sensitive parameters. Findings in Table 1 reflect ACIRS stability monitoring to date, i.e., they are not definitive, rather represent work in progress as ACIRS continues to monitor RM stability.

Table 1: Period of validity established for coal matrix parameters

ACIRS Series	Parameter	Matrix	Shelf life / Period of Validity (years)
G-Series	VM, CV, Ss, Sp, C, H	Coal	4*
G-Series / M-Series / S-Series	Ash, RD, P, Cl, Hg N, F	Coal	10
M-Series	As, Se, Cd	Coal	7
S-Series	Total Sulfur (TS)	Coal	13
H-Series	HGI	Coal	1.5**
A-Series	All parameters	Coal Ash	9

**Changes are within method repeatability limits*

***18-month period of validity is dictated by ASTM D409/D409M*

ACIRS has monitored the stability of our RMs over a thirteen-year period. Figures 1 and 2 include stability monitoring data for Total Sulfur and Ash for our Sulfur and General Coal RMs. The plots in Figures 1 and 2 indicate stability for % Total Sulfur and % Ash for 10 years or more.

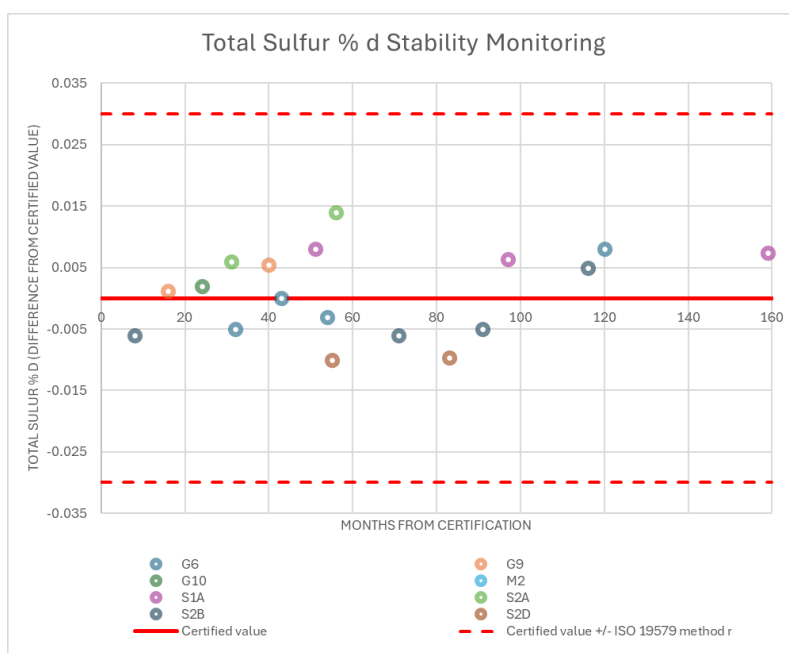


Figure 1: Total Sulfur Stability Monitoring on ACIRS Sulfur and General Coal RMs

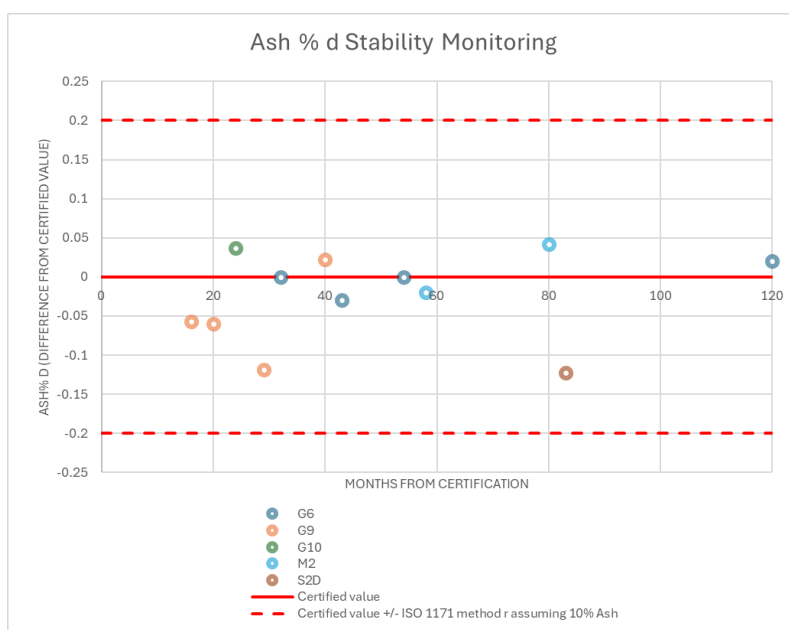


Figure 2: Ash Stability Monitoring on ACIRS Sulfur and General Coal RMs



Although ASTM D409/D409M has set the period of validity for HGI RMs at 18 months, ACIRS has confirmed H-Series stability to 22 months post certification with no statistically significant difference between the monitored value and the certified value, at the 95% confidence level. Further HGI stability testing is planned, and this may confirm HGI stability beyond two years.

Concluding Comment

ACIRS follows the guidelines established in AS/NZS ISO 33405:2024 (previously ISO Guide 35) *Reference materials – Guidance for Characterization and assessment of homogeneity and stability* to monitor the stability of our RMs, and reviews our data and conclusions with an experienced professional statistician. ACIRS is committed to understanding the stability of specific parameters in coal, and providing continued advice to customers using ACIRS products.

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