

AN EXPLANATION OF THE LOW NOX EMISSION CHARACTERISTICS OF AUSTRALIAN BLACK COALS

K.M. Sullivan¹, M. Whitehouse²

¹*K M Sullivan & Associates Pty Ltd., Sydney, Australia*

²*Casella CRE Energy, Mitcheldean, UK*

Australia's black coals are considered to contain above average levels of elemental nitrogen. However, in similar plants under comparable conditions, Australian coals produce lower NO_x emissions than many internationally-traded coals, including coals of lower nitrogen content. Previous studies have provided no explanation of this phenomenon. High temperature laboratory equipment developed at Casella CRE Energy has been demonstrated to accurately simulate p.f.-combustion conditions. It has been used to successfully reproduce the NO_x release behaviour of Australian black coals and provide reasons for the lower emissions. A pilot scale test rig has also verified the results. Coal nitrogen exists in volatile and char-bound forms. The rate of nitrogen release was characterised for selected Australian and Internationally-traded coals. The faster nitrogen is released, the greater the opportunity for it to be reduced rather than oxidised. Volatile nitrogen is the major contributor to NO_x formation in uncontrolled combustion but, even when low-NO_x burners are fitted, volatile nitrogen can be converted to NO_x if its release is slow. For the Australian coals a large proportion of the total nitrogen was released rapidly during devolatilisation. However, for the International coals, nitrogen was released more slowly or more of it was retained in the char. The conversion of char nitrogen to NO_x was also measured. The results showed the percentage conversion to be similar for the Australian and Internationally-traded coals. Overall this means that, for a given nitrogen content, the Australian black coals would produce less NO_x than the International coals, when fired under comparable conditions.