

lb/TBtu to 10.9 lb/TBtu (Hg content varied from 0.05 to 0.25 ppm, and averaged 0.112 ± 0.014 ppm on a dry coal basis). As such, units firing lignite coal with lower heating values have to accommodate frequently changing coal quality and require a wide range of flexibility to account for instances of firing high Hg seams of coal to consistently achieve adequate operating margin below the required Hg emission limit.³

The variability of the projected lignite coal quality received from the Center Mine from 2025 through 2036 is shown in Table 3-1.

Table 3-1 — Center Mine Ultimate Coal Analyses (As -Received)

Fuel Parameter	Units	Average	Minimum	Maximum
Carbon	wt. %	40.53	39.73	41.24
Hydrogen (fuel-based)	wt. %	2.78	2.71	2.82
Nitrogen	wt. %	0.30	0.26	0.34
Sulfur	wt. %	0.86	0.68	1.07
Oxygen (by difference)	wt. %	9.97	9.47	10.83
Moisture	wt. %	38.83	38.53	39.25
Ash	wt. %	6.73	6.00	7.87
Higher Heating Value (HHV)	Btu/lb	6,625	6,489	6,739
Mercury Content	ppm	0.091	0.053	0.184
Estimated Hg Emission	lb/TBtu	8.41	4.79	17.42

3.1.3. Hg Removal with ESPs

For ACI on ESP applications, 80% of Hg capture occurs in the flue gas, and 20% occurs on the dust within the ESP (as the dust on the collecting plates are consistently removed as part of the process). Therefore, for ESP applications, achieving ideal mixing and residence time to allow for elemental Hg to oxidize to ionic Hg and for Hg to be adsorbed on the carbon particles (of the PAC or unburned carbon content in the fly ash) is critical. It should be noted that this ratio is the exact opposite for baghouse applications, i.e. 20% capture in-duct and 80% capture on the dust of the filter cake accumulated in the baghouse. For this reason, fabric filters can result in extremely high Hg capture and can improve the capture with any Hg sorbent.

3.1.4. Existing System Limitations

Documented evidence of a lignite unit achieving 1.2 lb/TBtu or below has not been found/reviewed at the time of this report. Minnkota personnel recently completed short-term parametric testing in May 2023 to determine the Hg emissions that could be achieved by maximizing the existing fuel additive and PAC injection. Even when maximizing the fuel additive rate in addition to maximizing the non-halogenated ACI addition, an emission rate of 1.2 lb/TBtu was not able to be achieved. Due to the variability of the coal, a longer period of testing would be required to gauge the Hg emissions that could be achieved just using the capacity within the existing equipment.

³ Based on Response of Minnkota Power Cooperative Clean Air Act Section 114 Request, dated July 29, 2022.