Tip of the Week

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Predicting Sulfur Dioxide Emissions from Coal Analysis

The following Tip comes courtesy of <u>Jack Bionda</u>.

When measuring SO_2 emissions either with electronic instrumentation or by a wet chemical method, it is often useful to compare the measured values to expected values based on the sulfur content of the fuel being burned. This comparison indicates whether the measurements are in reasonable agreement with the levels one would anticipate. A simple Excel <u>workbook</u> allows the computation of the volumetric concentration of SO_2 (ppmvd) based on the fuel ultimate analysis and the excess O_2 concentration in the flue gas.

The result from this spreadsheet is the theoretical estimate of the SO_2 in the flue gas assuming all of the fuel bound sulfur is converted to SO_2 . However, not all of the sulfur is converted to SO_2 . A small amount (approximately 1%), is converted to SO_3 and H_2S . Generally speaking, if your measurement shows agreement within 2-3% of this calculated theoretical value, the measurement should be considered valid.

The calculations behind this approach are as follows:

Moles of sulfur $(n_S) =$	$(\% S / 100) * (1 / MW_S)$
Moles of carbon $(n_c) =$	$(\% C / 100) * (1 / MW_{c})$
Moles of hydrogen (n _H) =	$(\% H / 100) * (1 / MW_{H_2})$
Moles of oxygen $(n_0) =$	$(\% O / 100) * (1 / MW_{O_2})$
Moles of nitrogen $(n_N) =$	$(\% N / 100) * (1 / MW_{N_2})$

$$\frac{(4.762(n_c + n_s) + 0.9405n_H - 3.762n_{O_2, fuel})}{1 - 4.762 \left(\frac{\% O_{2, fg}}{100}\right)}$$

Moles of flue gas $(n_{fg}) =$

SO₂ (ppmvd) =
$$\left(\frac{n_s}{n_{fg}}\right) x 10^6$$

SO₂ (lb/10⁶ Btu) =
$$\left(\frac{\% S}{100}\right) x \left(\frac{MW_{SO_2}}{MW_S}\right) x \left(\frac{1}{HHV}\right) x 10^6$$