RTI INTERNATIONAL | Memorandum

TO: Bill Maxwell, U.S. Environmental Protection Agency, OAQPS (C439-01)

FROM: Jeffrey Cole, RTI International

DATE: December 2003

SUBJECT: MACT Floor Unit Conversion from Input-based Standard to Output-based Standard in the Proposed National Emission Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units

Since all the reported data obtained throughout the development of the proposed rule are in the current input-based format of pounds per trillion British thermal units (lb/TBtu) heat input, EPA applied an efficiency factor to the current format to develop the output-based HAP limits (pounds per megawatt-hour; lb/MWh). The efficiency factor approach was selected because the alternative of converting all the reported data in the database to an output-basis would require extensive data gathering and analyses. Applying a baseline gross efficiency would essentially convert the selected heat input-based HAP level to an output-based emission limit.

The output-based standard must be associated with a baseline efficiency. Most existing electric utility steam generating plants fall in the range of 24 to 35 percent efficiency[1]. However, newer units operate around 35 percent efficiency; therefore, 35 percent was selected as the baseline efficiency for new units; 32 percent was selected as the baseline efficiency for existing units.

[1] Memorandum and attachment from W. Maxwell, EPA/CG, to Utility MACT Project Files, December 2003. Power plant efficiency table.

The efficiency of electric utility steam generating units usually is expressed in terms of heat rate, which is the ratio of heat input, based on higher heating value (HHV) of the fuel, to the energy (i.e., electrical) output. The heat rate of a utility steam generating unit operating at 32 percent efficiency is 11.3 joules per watt hour (10,700 Btu per kilowatt hour; Btu/kWh); the heat rate for units operating at 35 percent efficiency is 10.3 joules per watt hour (9,800 Btu/kWh).

Equation 1. Conversion factor for Hg or Ni from TBtu to lb/MWh for Existing Sources

$$1\ \text{TBtu}/1{,}000{,}000{,}000{,}000\ \text{Btu} * 3.414\ \text{Btu/W-h} * 1{,}000{,}000\ \text{W-h/MW-h} * (1/0.32) = 10.7 \times 10^{-6}\ \text{TBtu/MW-h}$$

Equation 2. Conversion factor for Hg or Ni from TBtu to lb/MWh for New Sources

$$1\ \text{TBtu}/1{,}000{,}000{,}000{,}000\ \text{Btu} * 3.414\ \text{Btu/W-h} * 1{,}000{,}000\ \text{W-h/MW-h} * (1/0.35) = 9.8 \times 10^{-6}\ \text{TBtu/MW-h}$$

Existing coal-fired electric utility units have to meet a MACT floor based on the top 12 percent of the bituminous coal-fired data (4 units), the top 12 percent of the subbituminous coal-fired data (4 units), the top 5 lignite-fired units, the top 2 refuse coal-fired units, and the top 2 IGCC units. The average is adjusted for variability and a confidence interval of 97.5 percent.[2] This MACT floor limit is then converted from input-based standard (lb/TBtu) to output-based standard (lb/MWh) by multiplying by 10.7×10^{-6}.

Newly constructed coal-fired electric utility units have to meet a MACT floor based on the top unit in all coal ranks or process types. This top unit is the unit with the lowest emission level after adjusting for variability and a confidence interval of 97.5 percent. This MACT floor limit is then converted from input-based standard (lb/TBtu) to output-based standard (lb/MWh) by multiplying by 9.8×10^{-6}.

---

[2] Memorandum and attachments from W. Maxwell, EPA/CG, to Utility MACT Project Files, November 26, 2003. Analysis of variability in determining MACT floor for coal-fired electric utility steam generating units.