

Use Of CO₂ Emission Rate Data to Derive Achievable NSPS for Coal-Fired Electric Generating Units

Supporting Material for the July 31, 2013 Discussion with

Office of Management & Budget

Prepared by

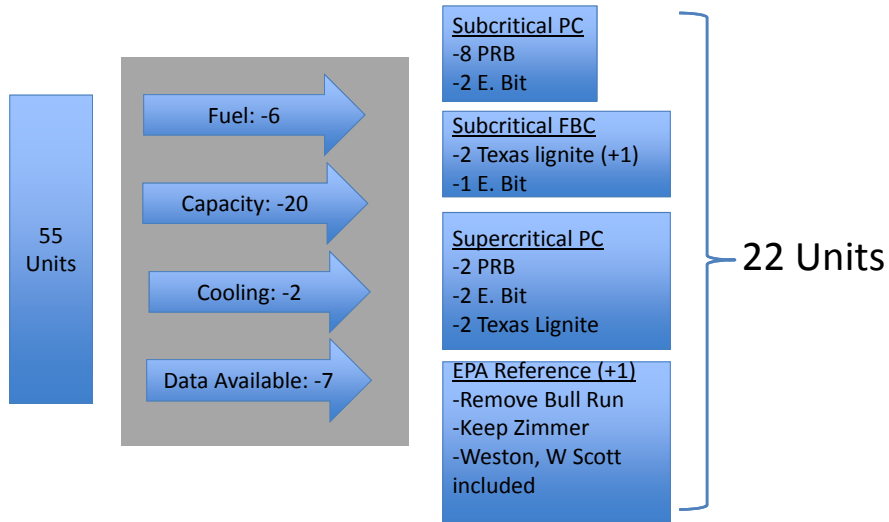
J. Edward Cichanowicz and Michael C. Hein

Consultants to ACCCE

DISCUSSION OUTLINE

- Consider Full “Plate” of Reference Units
- Factors Affecting CO₂ Emissions Rate
- Variability in CO₂ Emissions
- Achievable CO₂ Emission Rates
- Ultra-Supercritical Boiler (AEP Turk) CO₂ Emission Rate Variability

55 "NEW" COAL-FIRED UNITS COMMENCED OPERATION AFTER JAN 1, 2007

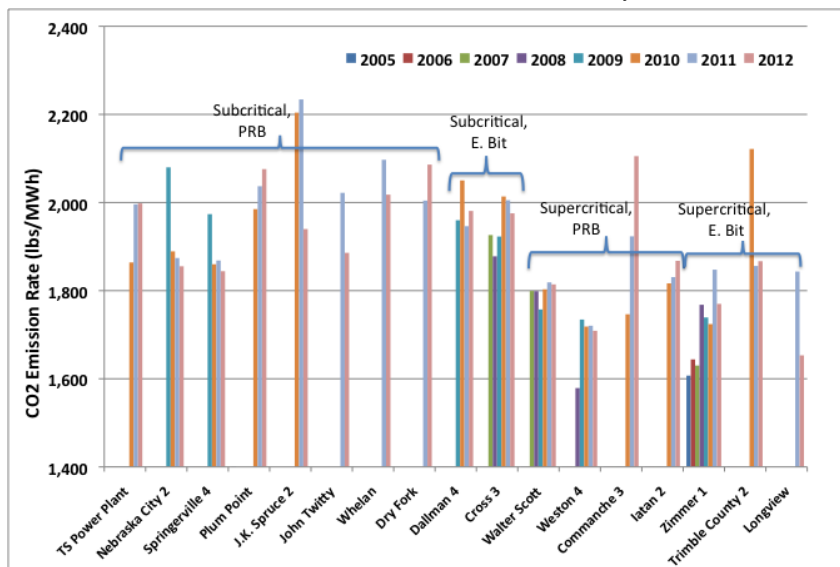


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17 "PC" UNITS FIRING PRB, E. BIT



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WHAT AFFECTS CO₂ EMISSION RATE?

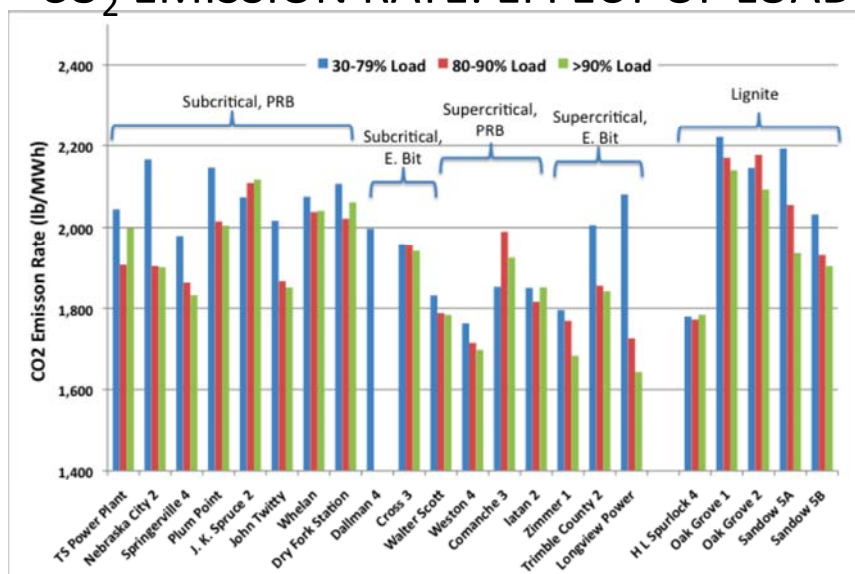
- Steam Conditions (Supercritical vs. Subcritical)
- Heat Rejection Method
 - Once-thru vs. cooling towers (wet, dry, hybrid)
 - Cooling towers: ambient temperature, humidity
- Coal Composition (Moisture, Acid Dewpoint)
- Operating Duty
 - First year can be atypical
 - % maximum capacity (excess air, steam turbine)
 - Cycling vs. steady state

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CO₂ EMISSION RATE: EFFECT OF LOAD



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CAPTURE, REFLECT CO₂ VARIABILITY?

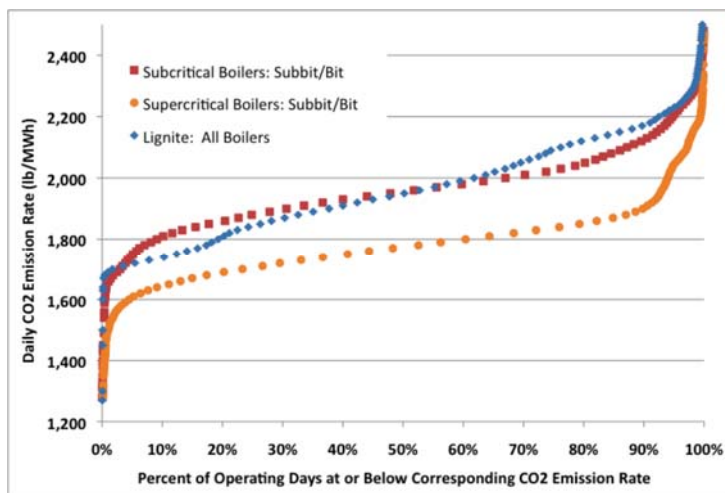
- Statistically Treat Data from Many Units
- Example: 1997 NO_x NSPS
 - Limited data: Use hourly data to calculate block, rolling averages for units with NO_x controls
 - Statistical method¹: EPA found 30-day NO_x limits attained with infrequent “failure” (1%, 1/yr; 1/10 yrs)
- Parallel for 2013 CO₂ NSPS
 - Limited data: annual basis
 - Same statistical method can derive annual emissions

¹ New Source Performance Standards, Subpart Da – Technical Support for Proposed Revisions to NO_x Standard, EPA-453/R-94-012, June 1997

ANALYTICAL APPROACH

- Eliminate 1st Year - Atypical (1 to 11 months)
- “Pool” Data From Exhibit 6 in Categories
- Explore Key Variables
 - Fuel type (PRB vs. E. Bit vs. lignite)
 - Boiler type (PC subcrit, FBC subcrit, PC supercrit)
- Focus on Three Categories
 - Subcritical boilers: subbit/bit
 - Supercritical boilers: subbit/bit
 - Fluid bed, “PC” boilers: lignite

CUMULATIVE DISTRIBUTION: DAILY CO₂ DATA (w/o 1st Yr)

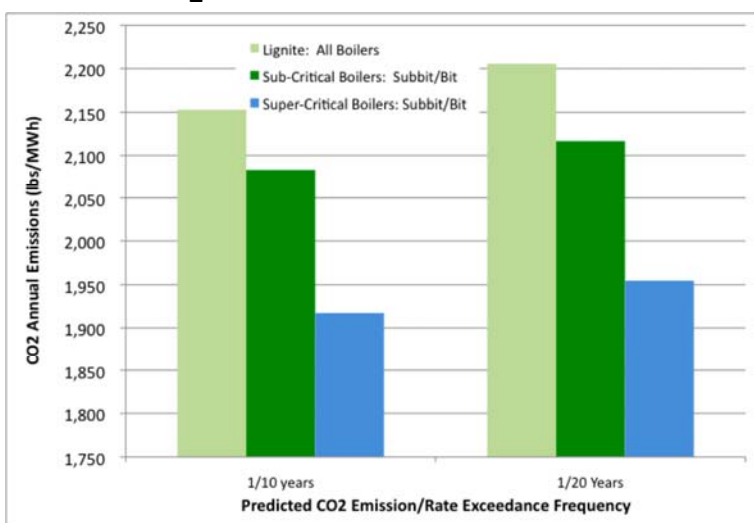


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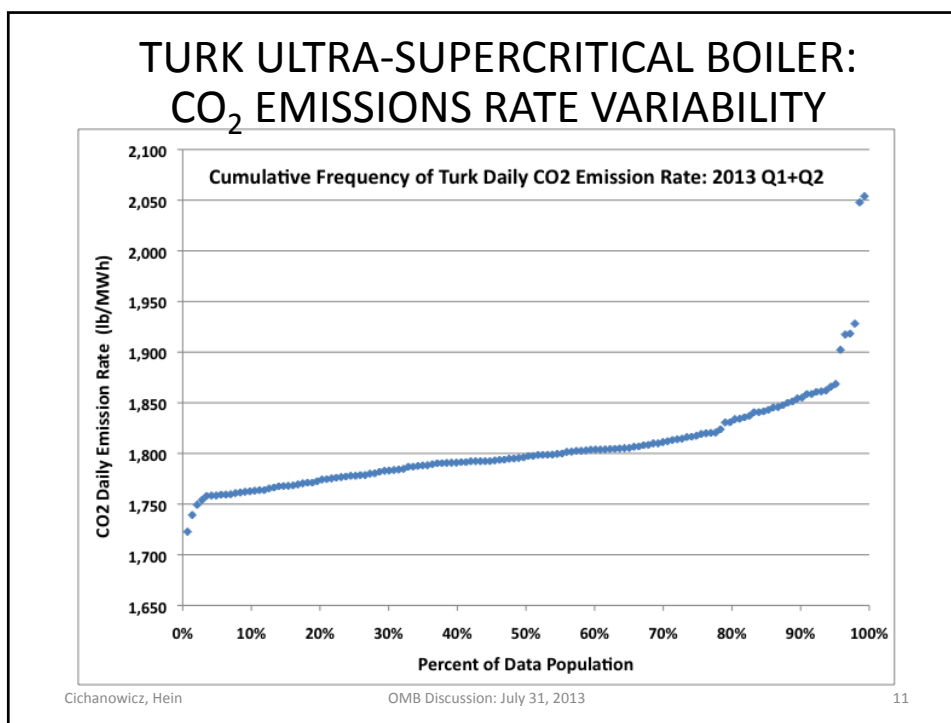
ANNUAL EMISSION RATE PER DAILY CO₂ DATA: TWO "FAILURE" RATES



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OBSERVATIONS: CO₂ EMISSION DATA

- 22 New Units Since 2007 Suggest
 - Subcritical: 2,080 lbs/MWh
 - Lignite: 2,150 lbs/ MWh
 - Supercritical: 1,915 lbs/MWh
- Limited Data from Ultra-Supercritical Units
 - Thermal efficiency (LHV-Basis) typically reported
 - Coal composition to convert to HHV-basis
 - Operating conditions unknown
- Hourly CO₂, MWh Data for Realistic Analysis

Questions?