Impact of Proposed Boiler MACT on 16 Biomass Boilers

at Existing Wood Products Major Source Facilities

November 19, 2010 - Boiler MACT Impact & Control Options

McIlvaine Company Hot Topic Hour

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Presentation Outline

- Meeting Proposed Existing Source MACT Limits
  - Summary Review of 16 Major Source Biomass Boilers
  - Review organized by the 5 MACT pollutants
    - Gaps between measured performance and proposed MACT limits
    - Data gaps where facility testing, other data or emission factors not adequate to determine status
    - Air pollution control (APC) systems suitable for use with existing APC equipment and likely to meet proposed limits
  - BACT-style[1] Cost estimates for 15 of the 16 boilers
  - Utilized specific facility data and information where available
  - Heat input of boilers ranged from 31 to 450 MMBtu/hr of biomass heat input (177 MMBtu/hr average)
  - It is important to develop a multi-pollutant control strategy for maximum effectiveness and minimum cost

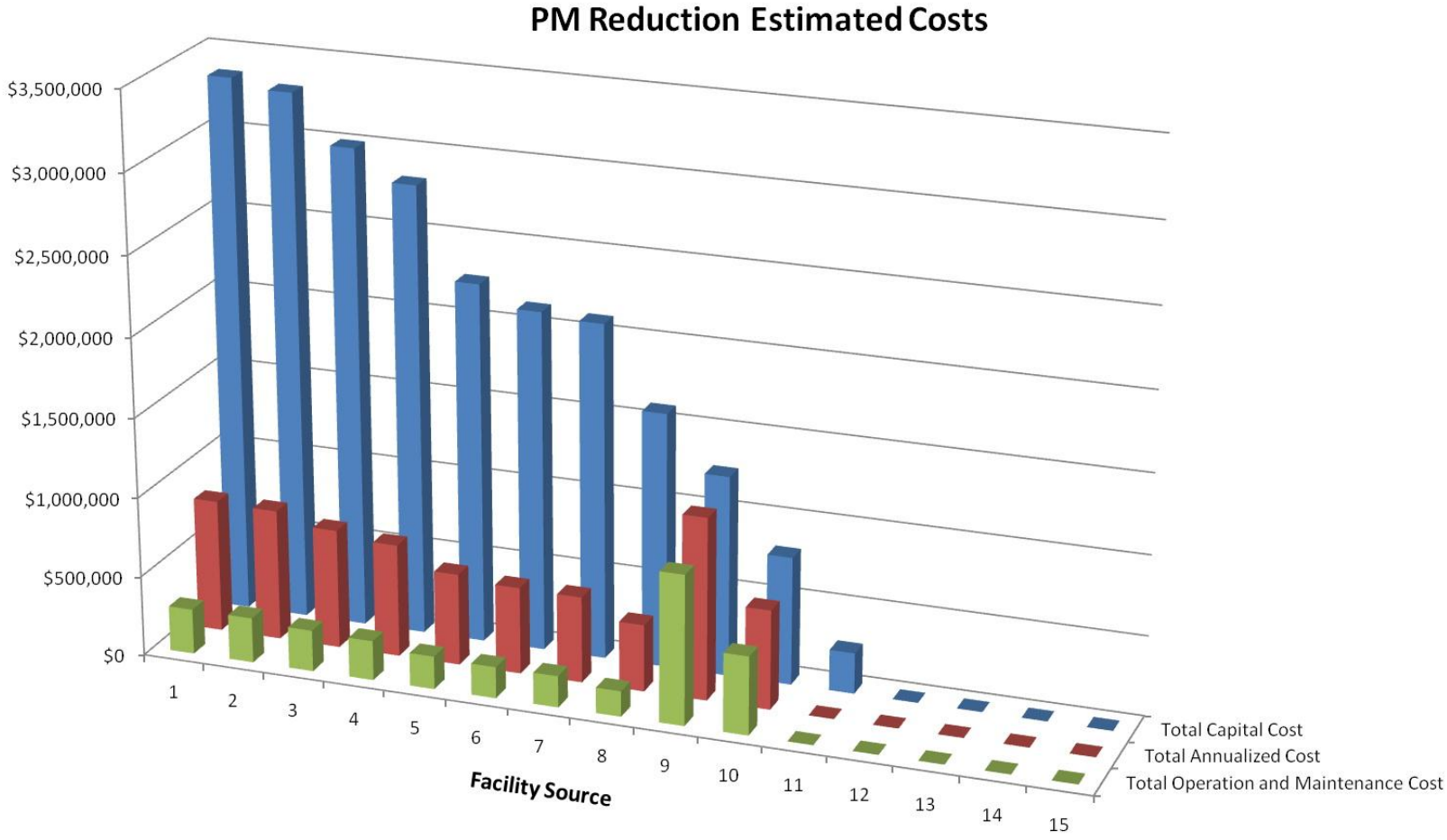
1. BACT-Style is rough estimate following EPA guidelines for Best Available Control Technology Analyses.

Meeting Proposed Filterable PM Limit

- Existing PM controls in 16-boiler population:
  - 2 boilers had MC only
  - 1 boiler had MC, with part of the MC exhaust controlled by FF
  - 5 boilers had MC/Wet Scrubber
  - 1 boiler had EFB
  - 6 boilers had DESP (4 meet MACT)
  - 1 boiler had Wet Scrubber/WESP (meets MACT)
- Summary and suggested approach for improved controls:
  - 5 of 16 sources meet proposed MACT PM limit
  - 3 dry MC sources, add DESP
  - 3 WS sources, replace w/ DESP (no room to add a control device)
  - 2 WS sources, add WESP
  - Modify 1 EFB to meet MACT
  - Modify 2 DESP to meet MACT

MC = Multiclone; WS = wet scrubber; DESP = dry ESP; WESP = wet ESP; EFB = electrified filter bed
FF = fabric filter

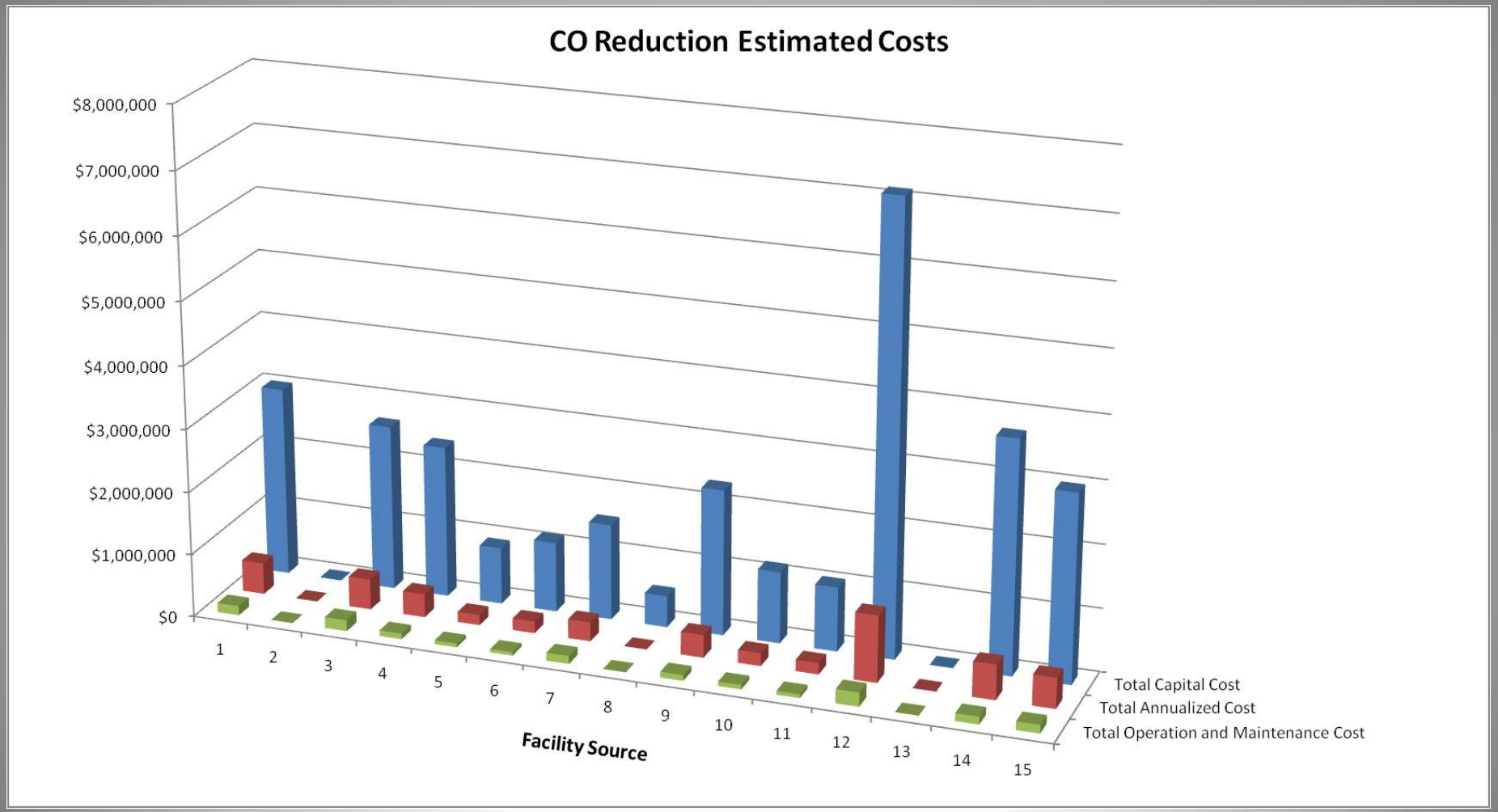
PM Reduction Estimated Costs



Meeting Existing Source Proposed CO Limit

- Existing CO controls in 16-boiler population:
  - Zero boilers had end of pipe controls for CO
  - 16 boilers had a variety of good combustion measures in place
- Current status with respect to proposed CO limit:
  - 4 required no improvement
  - 12 boilers will require from 13% to 79% reduction in CO emissions
    - 3 require improvements achievable with fuel handling and/or combustion improvements
    - 9 require end-of-pipe controls
- Golder assumed that up to a 30% reduction could be achieved through a combination of fuel handling improvements and combustion improvements
- In Golder's experience, combustion/fuel handling improvements are not predictable or straightforward
- Golder suggests that reliable and stable CO reductions over 30% from existing boiler will require end-of-pipe controls.
- Possible end-of-pipe control – Regenerative Catalytic Oxidation System (RCOS)
- The CO reductions required by the proposed limits will clearly require substantial effort and expenditures by many facilities

CO Reduction Estimated Costs



Meeting Existing Source Proposed HCl Limit

- Existing HCl controls in 16-boiler population:
  - Wood ash in boiler has some inherent control effectiveness for HCl, perhaps 25% control efficiency, otherwise
  - 10 boilers had no controls effective for acid gases
  - 6 boilers had existing wet scrubbers (some inherent effectiveness, and ability to add reagent, if not currently used).
- Current status with respect to proposed HCl limit:
  - 9 boilers had no data, therefore status unknown
  - 6 boilers are in compliance with proposed limit
  - 1 boiler will require 75% reduction (fuel has saltwater contact)
- Golder's impression - HCl limit will not be a problem unless elevated chlorine in the fuel
- Elevated chlorine can come from salt water exposure or panel resin
- Dry sorbent injection (sodium bicarbonate or lime) possible for sources with a dry ESP, however, need significant residence time

Meeting Existing Source Proposed Mercury Limit

- Existing Hg controls in 16-boiler population:
  - 3 boilers had no controls that would remove mercury
  - 7 boilers had DESP, WESP, or EFB (perhaps 25% - 50% CE depending on Hg speciation)
  - 6 boilers had wet scrubbers (perhaps 50% -70% CE, depending on speciation).
- Current status with respect to proposed Hg limit:
  - 8 boilers had no data, therefore status unknown
  - 4 boilers are in compliance with proposed limit
  - 4 boilers will require from 10% to more than 100% reduction
- Golder's impression is that Hg limit will not be a problem for most sources unless elevated mercury in the fuel
- If required reduction is over 90% then changes to fuel stream will be required
- Activated carbon injection (ACI) may be used to control Hg upstream of PM control device .
- Initial design for ACI - 2 second residence time, 3+ lbs/MMacf injection rate
- Work with ACI vendor to conduct pilot study.

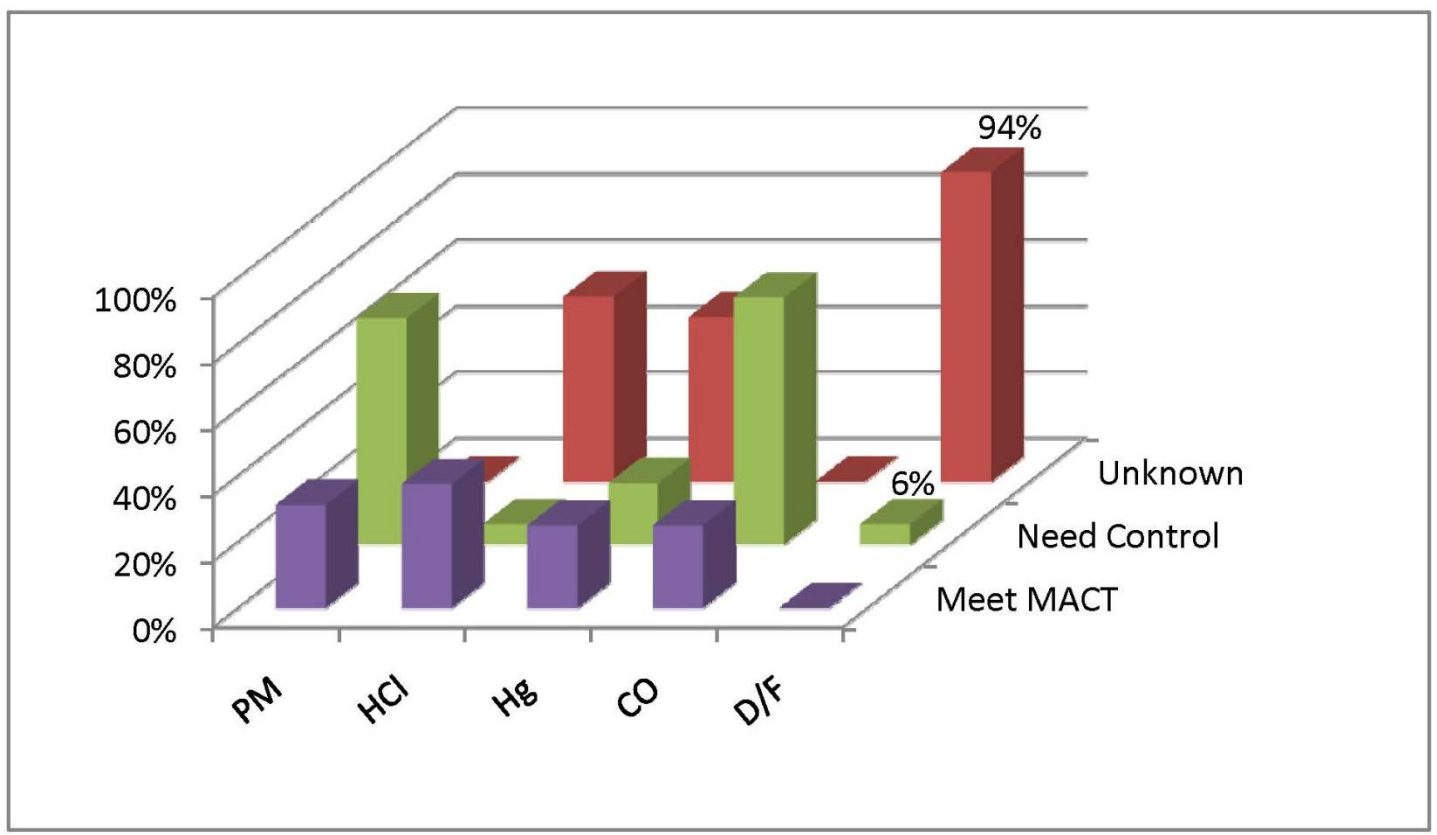
Meeting Existing Source Proposed Dioxin/Furan Limit

- Existing Dioxin/Furan (D/F) controls in 16-boiler population:
  - Zero boilers had controls installed specifically to address D/F
  - All 16 boilers have some sort of PM control device, which have some amount of control effectiveness (D/F trapped in PM is removed)
- Current status with respect to proposed D/F limit:
  - 15 boilers have no data so compliance status is unknown
  - 1 boiler needs 80% reduction in D/F (small fraction of this fuel stream is solid waste added to the hogged fuel)
- Given the scarcity of data, Golder does not venture any opinion regarding how many boilers will require D/F controls
- According to EPA, rapid cooling of boiler exhaust to less than 400F before PM control device is an effective control, but may not be easy for existing boilers
- Explore activated carbon injection (ACI) if D/F reductions are needed
- While ACI use is fairly straightforward and effective when the PM control device is a fabric filter, more difficult and costly with other PM control devices
- Golder suggests working with ACI vendor to conduct pilot study.

Cost Estimates for HCl, Hg, DF

- For HCl, only one boiler definitely had to implement controls, and fuel management would handle.
- If dry sorbent injection (DSI) required:
  - DSI Capital Cost ~ $800,000
  - Operation Cost ~ $120,000/yr (varies by HCl emissions)
  - Total Annualized Cost ~ $225,000
- For Hg & DF; ACI would handle both pollutants at the same time if required control efficiency <95%
- If activated carbon injection (ACI) required:
  - ACI Capital Cost ~ $800,000
  - Operation Cost ~ $300,000/yr average (varies by CFM)
  - Total Annualized Cost ~ $408,000

Summary of 16 Boilers - Existing Source Limits



- PM – Clear picture, high investment but straightforward solutions
- HCl & Hg – Many unknowns, but fuel management and some ACI will handle
- CO – Clear picture, very high investment, end-of-pipe controls hard to swallow
- D/F –Uncertainty Rules! ACI may be required (but will it suffice?)

Summary and Conclusion

- The Boiler MACT creates a challenging era, no path is easy
- Many aspects of a boiler compliance and design become more critical because of the very thin margin for error in emissions limits
- A careful review of the pollutants that must be controlled for each boiler can provide a strategy tailored to the specific situation for maximum effectiveness and minimum cost.
- It is important to understand, or work with those who do understand, the whole range of pollutant controls and their interaction in order to employ a winning multi-pollutant control strategy

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