Boiler MACT
Hot Topic Hour

March 10, 2011
Boiler MACT

• Boiler MACT is:
  - MACT - Maximum Achievable Control Technology
  - Air Toxics
  - HAPS - NESHAP
  - CAA - 112

• Quick Rule Summary

• Synthetic Area Source (HCl reduction)

• Fuel Definitions/Issues
  - CISWI (RCRA fuels)

• Solutions
  - PM, CO, HCl, Hg, D/F

• Nalco Mobotec Solution Summary
Nalco Mobotec Focus

- **Nalco Mobotec’s Focus**
  - Existing Sources
  - Major Sources
  - Solid Fuels (including CISWI)

- **Boiler MACT**
  - Regulates 188 HAPs, directly or via surrogates

- **Major source**
  - Greater than 10 tons per year of one HAP
  - Greater than 25 tpy of multiple HAPs
  - PM and CO are not HAPs
Simple Summary

- **PM** 0.039 lb/MBtu
  - PM is a surrogate for non-Hg metals HAPs
  - ESPs can get there, but they must work well (99.X% removal)

- **CO limits vary depending on unit type**
  - CO is a surrogate for non-dioxin/furan organic HAPs
  - Tuning or combustion modifications will likely be sufficient

- **HCl** 0.035 lb/MBtu (= 25 ppm @ 6% O₂ dry)
  - HCl is a surrogate for acid gas HAPs
  - Scrubbers will get them; otherwise, duct sorbent injection

- **Hg** 4.6 lb/TBtu
  - Hg is a HAP and is regulated directly due to bioaccumulation
  - Oxidizers and activated carbon
  - Fuel and backend dependent (survey equipment & stack temperature)

- **Dioxin/Furan (D/F) limits vary depending on unit type**
  - D/F are HAPs and are regulated directly due to bioaccumulation
  - Reachable with good combustion (will vary with CO)
Synthetic Area Source

- **Area Source**
  - Emits < 10 tons per year of any one HAP
  - Emits < 25 tons per year of multiple HAPs

- **HCl is the only HAP that will commonly exceed 10 tpy**

- **Synthetic Area Source:**
  - Install DSI to reduce HCl to potentially qualify as an Area Source

- **Other HAPs that “might” be able to contribute to the 25 tpy limit:**
  - Chlorine (Cl\(_2\)) - unlikely to reach 10 tpy for any boiler
  - Hydrogen fluoride (HF) - unlikely to reach 10 tpy for any boiler
  - VOC HAPs (only an issue for some combustion processes)
    - Acetaldehyde, Benzene, 1,3-Butadiene, Formaldehyde, Hexane
  - Metals - unlikely to reach 10 tpy for any boiler
    - Arsenic Compounds, Beryllium Compounds, Cadmium Compounds, Chromium Compounds, Cobalt Compounds, Lead Compounds, Manganese Compounds, Mercury Compounds, Nickel Compounds, Radionuclides, Selenium Compounds
Final Area Source Limits

Area (Minor) Source (not a major source)

<table>
<thead>
<tr>
<th>Existing/New</th>
<th>Fuel</th>
<th>Paticulate Matter (PM [lb/MMBtu])</th>
<th>Hydrogen Chloride (HCl [lb/MMBtu])</th>
<th>Mercury (Hg [lb/TBtu])</th>
<th>Carbon Monoxide (CO [ppm @7% O2])</th>
<th>Dioxin/Furans (Total TEQ [ng/dscm])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>Coal</td>
<td>--</td>
<td>--</td>
<td>4.8</td>
<td>400</td>
<td>--</td>
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<tr>
<td>Existing</td>
<td>Biomass</td>
<td>--</td>
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<td>--</td>
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<td>--</td>
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<tr>
<td>Existing</td>
<td>Oil</td>
<td>--</td>
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<td>--</td>
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<tr>
<td>New</td>
<td>Coal</td>
<td>0.03 (0.42)</td>
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<td>4.8</td>
<td>400</td>
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<tr>
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<td>Oil</td>
<td>0.03</td>
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</tbody>
</table>

Limits in (brackets) are for smaller units, < 30 MMBtu/hr
For even smaller units, < 10 MMBtu/hr, work practice standards apply

Note that everything (e.g., PM) may still be regulated by other regulations and/or permitting processes. There may be GACT requirements. Always check for overlapping regulations!
What is my fuel category? (Major Source)

- Fuel Categorization is by annual heat input basis

- Solid Fuel
  - Burns more than 10% solid fossil fuel (not solid waste!)
  - If it burns more than 10% biomass then it is “biomass fired”
    - Biomass boilers have organic HAP concerns (CO surrogate)
  - Otherwise it is “coal fired”; includes, but not limited to:
    - Coal
    - petroleum coke
    - tire derived fuel (TDF)

- Liquid
  - If < 10% “solid fuel” and > 10% liquid = “liquid fired”
  - Two categories: continental and non-continental

- Gas
  - If none of the above, then “gas fired”
  - Two categories: Gas 1 (NG & refinery gas) and Gas 2 (other)
More on Solid Fuels

• Traditional fossil fuels are still fuels
  - Coal
  - Oil
  - Natural gas

• Biomass fuels are:
  - Biomass or bio-based solid fuel means any solid biomass-based fuel that is not a solid waste

• Coal fired includes:
  - Coal
  - petroleum coke
  - tire derived fuel (TDF) - RCRA issues...

• Solid Waste
  - Solid wastes are burned in an incinerator (CISWI MACT)
  - Solid wastes are defined by RCRA

• Hazardous Waste
  - Something entirely different (and heavily regulated)
RCRA - Resource Conservation and Recovery Act

• Identification of Non-Hazardous Materials That Are Solid Waste

• This Resource Conservation and Recovery Act (RCRA) final rule identifies which non-hazardous secondary materials are, or are not, solid wastes when burned in combustion units. Under the rule:
  - Units that burn non-hazardous secondary materials that are solid waste under RCRA would be subject to the section 129 Clean Air Act (CAA) requirements
  - Units that burn non-hazardous secondary materials that are not solid waste under RCRA would be subject to the section 112 CAA requirements.

• In general, non-hazardous secondary materials burned in combustion units are identified as solid wastes unless:
  - The material is used as a fuel and remains within the control of the generator and it meets the legitimacy criteria;
  - The following materials have not been discarded in the first instance and meet the legitimacy criteria when used as a fuel:
    • scrap tires removed from vehicles and managed under an established tire collection program
    • resinated wood residuals;
  - The material is used as an ingredient in a manufacturing process that meets the legitimacy criteria;
  - The material has been sufficiently processed to produce a fuel or ingredient that meets the legitimacy criteria; or
  - Through a case-by-case petition process, it has been determined that material handled outside the control of the generator has not been discarded and is indistinguishable in all relevant aspects from a fuel product.
## Final Major Source Limits

**Major Source (facility > 10 t/yr of a single or > 25 t/yr of 2 or more HAP)**

<table>
<thead>
<tr>
<th></th>
<th>Particulate Matter (PM) [lb/MMBtu]</th>
<th>Hydrogen Chloride (HCl) [lb/MMBtu]</th>
<th>Mercury (Hg) [lb/TBtu]</th>
<th>Carbon Monoxide (CO) [ppm @3% O2]</th>
<th>Dioxin - Furans (TEQ) [ng/dscm]</th>
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<tbody>
<tr>
<td><strong>Existing - New Fuel Firing Method</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Existing Coal Stoker</td>
<td>0.039</td>
<td>0.035</td>
<td>4.6</td>
<td>270</td>
<td>0.003</td>
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<tr>
<td>Existing Coal Fluidized Bed</td>
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<td>4.6</td>
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<td>Existing Liquid Non-continental</td>
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<td>0.0032</td>
<td>0.78</td>
<td>51</td>
<td>0.002</td>
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</tbody>
</table>
Boiler MACT Solutions

• Summary of all solutions for each pollutant:
  - PM
  - CO
  - HCl
  - Hg
  - D/F

• Summary of the Nalco Mobotec solutions
PM Solutions

- **Fabric Filters (Bag Houses) are the obvious 100% solution**
  - However, many cold side ESPs will meet the regulations

- **Wet ESPs are often discussed because of HAP co-benefit**
  - Expensive and have not seen broad application

- **Tuning & modifying marginal ESP units**
  - Mods (new TR sets, larger plate separation, more fields)
  - Chemical additives to improve ash resistivity
  - Combustion modifications to reduce LOI and ash carry over
  - Fuel switch (e.g., lower ash fuel)
  - Derate (worse case)

- **Beware that other “MACT Solutions” might affect the ESP**
  - For example, trona injection for HCl capture.
CO Solutions

• Tuning, Tuning, Tuning

• Combustion Modifications
  - Burner modifications
  - Boosted OFA systems

• Fuel distribution

• CO catalysts will likely not be required

• Chemical additives

• Fuel switching or co-firing
HCl Solutions

- Desulphurization systems capture HCl as co-benefit
- Ultimate solution: WFGD (or DFGD, for now)
- Today’s solution: Duct (or Dry) Sorbent Injection (DSI)
  - Trona
  - Sodium Bicarbonate
  - Hydrate
- Other chemical additives (duct or furnace)
  - Magnesium chemistries
  - Duct injection, furnace injection, or fuel additives
- Fuel switching or blending
- Wet ESPs too
Mercury Solutions

- Halogen Oxidizers

- Activated Carbon Injection
  - Can ruin ash sales and affect ESP performance
  - Beware of high SO$_3$ and high stack temperatures (!)

- Alkali injection
  - Usually as a co-benefit from other technologies

- Proprietary sorbents
  - Many in development for utility market
  - Goal is usually to preserve ash sales or multi-pollutant

- Co-benefit from acid gas reduction
  - Scrubbers (wet or dry) and DSI
  - Oxidizers augment Hg control
  - Watch out for water mercury regulations when using scrubbers
Dioxin / Furan Solutions

• Activated Carbon Injection
  - With wet ESP for MSW incinerators
  - ACI for Boiler MACT will certainly work

• However, good combustion practices will likely be enough
  - D/F is primarily “grown” in the back pass
  - Eliminating precursors, reduces D/F formation
  - Focus on low CO

• Fuel management, fuel switching, or operational changes
  - Low Cl, high VM, NOx-impacts?

• Catalytic D/F reduction exists (Gore Remedia bags)

• Testing is very expensive
  - $3k - $5k per data point + 1 month turnaround

• Good news: test once and done
• Bad news: EPA reconsideration...
SUMMARY:
Nalco Mobotec Strategy

- **Tune for CO and D/F**
  - Install ROFA if more CO reduction is required (we will provide guarantees)
  - ACI if more D/F reduction required

- **DSI for HCl**
  - Trona, sodium bicarbonate, or hydrated lime
  - Can be demonstrated using portable equipment

- **Oxidizers and carbon for Hg**
  - Can be demonstrated using portable equipment

- **PM**
  - Test
  - Upgrade ESP if needed
  - Baghouse is the ultimate solution

- **Demonstrations**
  - We are currently heavily loaded doing demonstrations
  - Highly recommend setting up demonstrations before testing firms are booked

- **Contact:**
  - Brian Higgins
  - bhiggins@nalcomobotec.com
  - 415-370-0921