Quantification of Emission Reductions from “Top 14” Control Measures

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Presentation for the Air Quality Stakeholders
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Presentation Overview

- Categorized Control Measures
- Limitations
- Overlap in Emissions Reductions
- Emissions Reductions Chart
- Assumptions
- Things to Consider
Control Measures

Curtailment
Registration (M22 & 19)
GVEA Tariff (S1)

Future Restrictions
Permits (M3)
Installation Restrictions (MR5 & 8)

Sulfur Dioxide
ULSD (M51)
Boiler Upgrades (E3)
Control Measures Cont.

Removal of SFBAs
- Registration (M22)
- Removal (M16 & P9)
- Prohibit Use (M49)

Dry Wood
- Required Sales (M31)
- Exchange (S13)

Retrofit Control Devices
- Require ESP (S3)
Limitations!

- Analysis represents upper bound of emissions reductions possible
- Required numerous assumptions
- Assumptions were biased high
- Emission Inventory vs. Actual Inventory
- Overlap not accounted for
Double Counting of Emissions Reductions

Existing new construction permit requirement

Uncertified HHs

Measure 5 - Ban new installations of hydronic heaters (HHs)
Effects on Other Control Measures

6,385 Non-Borough Listed Appliances

- Date Certain Removal
- Wood Stove Change Out Program
SUMMING IS MEANINGLESS!
2019 Winter Season Nonattainment Area Emission Reductions of PM$_{2.5}$
### Preliminary 2013 Baseline Winter Season Nonattainment Area Emissions (tons/day) by Source Sector

<table>
<thead>
<tr>
<th>Source Sector</th>
<th>PM$_{2.5}$</th>
<th>NO$_x$</th>
<th>SO$_2$</th>
<th>VOC</th>
<th>NH$_3$</th>
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<tbody>
<tr>
<td>Point Sources</td>
<td>1.25</td>
<td>10.58</td>
<td>7.44</td>
<td>0.21</td>
<td>0.051</td>
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<tr>
<td>Area Sources, Space Heating, All</td>
<td>2.62</td>
<td>2.32</td>
<td>3.62</td>
<td>9.56</td>
<td>0.137</td>
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<td>Area, Space Heat, Wood</td>
<td>2.46</td>
<td>0.39</td>
<td>0.08</td>
<td>9.35</td>
<td>0.092</td>
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<tr>
<td>Area, Space Heat, Oil</td>
<td>0.06</td>
<td>1.72</td>
<td>3.42</td>
<td>0.10</td>
<td>0.003</td>
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<tr>
<td>Area, Space Heat, Coal</td>
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<td>0.05</td>
<td>0.10</td>
<td>0.11</td>
<td>0.013</td>
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<td>Area, Space Heat, Other</td>
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<td>0.16</td>
<td>0.02</td>
<td>0.01</td>
<td>0.028</td>
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<tr>
<td>Area Sources, Other</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>0.33</td>
<td>0.000</td>
</tr>
<tr>
<td>On-Road Mobile Sources</td>
<td>0.26</td>
<td>3.63</td>
<td>0.04</td>
<td>4.41</td>
<td>0.055</td>
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</tbody>
</table>
Cumulative Benefits of Future Restrictions
PM$_{2.5}$ Per Calendar Year

![Bar chart showing the cumulative benefits of future restrictions for PM$_{2.5}$ per calendar year from 2019 to 2025. The benefits increase over the years, with the highest benefit in 2025 at 0.066 Tons/Winter Day.](chart.png)
Assumptions - Curtailment

• Measure 22 – Registration

  ➢ Modeled as an effective improvement to the compliance rate of the SFBA Curtailment Program

  ➢ Assumed compliance rate 20% and 50%
Assumptions – Future Restrictions

- **Measure 3 (Building Permits) & Measure 8 (Prohibit Installation of SFBAs in New Construction)**
  - Assumed 50% compliance rate
  - Measure 8 not included due to overlap
  - High-side estimate of annual new home sales in Borough to account for Eielson-related growth
  - Assume measure allows new wood devices, but all have to be EPA-certified types
  - Total and wood device-specific average household energy use estimated from 2011-2015 Home Heating Survey
  - Baseline emissions (from both wood and other fuels) first calculated for affected households with uncertified devices
  - "With Measure" emissions then calculated using appropriate certified device emission factors
  - Heating efficiency differences also accounted for between uncertified and EPA-certified wood devices
Assumptions – Future Restrictions

• Hydronic Heaters

  ➢ High-side estimate of annual new home sales in Borough to account for Eielson-related growth

  ➢ Assume this high-side annual new home sales represents households that might add a new heating device

  ➢ SIP currently assumes an 80% Unqualified/20% Phase 2 Qualified split in outdoor hydronic heaters (OHHs)

  ➢ Total and wood device-specific average household energy use estimated from 2011-2015 Home Heating Survey

  ➢ Baseline emissions (from both wood and other fuels) first calculated for affected OHHs households

  ➢ "With Measure" emissions calculated assuming OHH installations are displaced by equivalent energy heating oil use
Assumptions – Sulfur Dioxide

- Assumed 100% compliance rate for ULSD
- Assumed 5% per year for fuel boiler upgrades
- Local heating oil used for space heating reflects a blend of #1 and #2 distillate.
- Residential #1 and #2 split based on responses from 2011-2015 Fairbanks Home Heating (HH) Survey.
- Commercial use assumed to be #1 distillate.
- Local #1 and #2 fuel sulfur content based on 2012 samples measured by SwRI.
- Winter heating fuel use fraction (relative to annual) calculated from 2011-2015 HH Survey.
Assumptions – Removal of SFBAs

- Assumed 50% compliance rate

- Modeled as an effective improvement to the compliance rate of the SFBA Curtailment Program

- Use 2022 projected uncertified device counts in nonattainment area from 2011-2015 Home Heating Survey

- Assume this measure affects fireplaces, uncertified stoves/inserts, unqualified OHHs and coal heaters

- Total and wood device-specific average household energy use estimated from 2011-2015 Home Heating Survey

- Baseline emissions (from both wood and other fuels) first calculated for affected households with uncertified devices, or other affected devices

  - "With Measure" emissions then calculated using energy-equivalent heating oil emission factors

  - Heating efficiency differences also accounted for between uncertified devices, heating oil devices, and coal heaters
Assumptions – Dry Wood

- Assumed 50% compliance rate
- Get 2019 projected wood device episodic daily fuel use from SIP inventory
- Use fractions of owner cut vs. commercially purchased wood from 2011-2015 Home Heating Survey
- Calculate commercially purchased wood volume from these fractions
- Compute wood moisture net energy adjustment for assumed "control" wood moisture relative to 36.5% MC baseline
- Calculate adjusted wood device emissions for the commercially purchased episodic wood use
Assumptions – Retrofit Control Devices

- Assumed ESP installed on all devices except: fireplaces, OWBs & coal (100% market penetration)

- Assumed 100% availability, 60% control efficiency on certified devices, 40% control efficiency on uncertified devices

- Modeled as an effective improvement to the compliance rate of the SFBA Curtailment Program

- Get 2019 projected solid fuel burning device episodic daily fuel use from SIP inventory

- Assumed ESP reductions limited to PM only (not gaseous pollutants)

- Calculate control reduction combining control efficiency and penetration rate
Things to Consider ...

- Gauge control measure effectiveness to focus on largest emission reductions
- Overlap will reduce overall emission benefits by ~50%
- Emission inventory vs. Actual will depend on implementation
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Questions?