

Fairbanks PM_{2.5} Planning
4th in a Series:
Control Measures

March 15, 2012

Overview

- How much progress has been made towards attaining the PM_{2.5} standard?
- Which sources are the biggest contributors to emissions and concentrations?
- What controls are available to provide emission reductions needed to meet the PM_{2.5} standard?
- What combinations of control measures can be assembled to meet the PM_{2.5} standard.
- Next steps

Overview (cont.)

- Series of Assembly Briefings:
 - ❖ Overview and emission inventory development (July)
 - ❖ Modeling/Source apportionment (August)
 - ❖ Regulatory framework (November)
 - ❖ **Control Measures (Today)**
 - ❖ Progress towards attainment

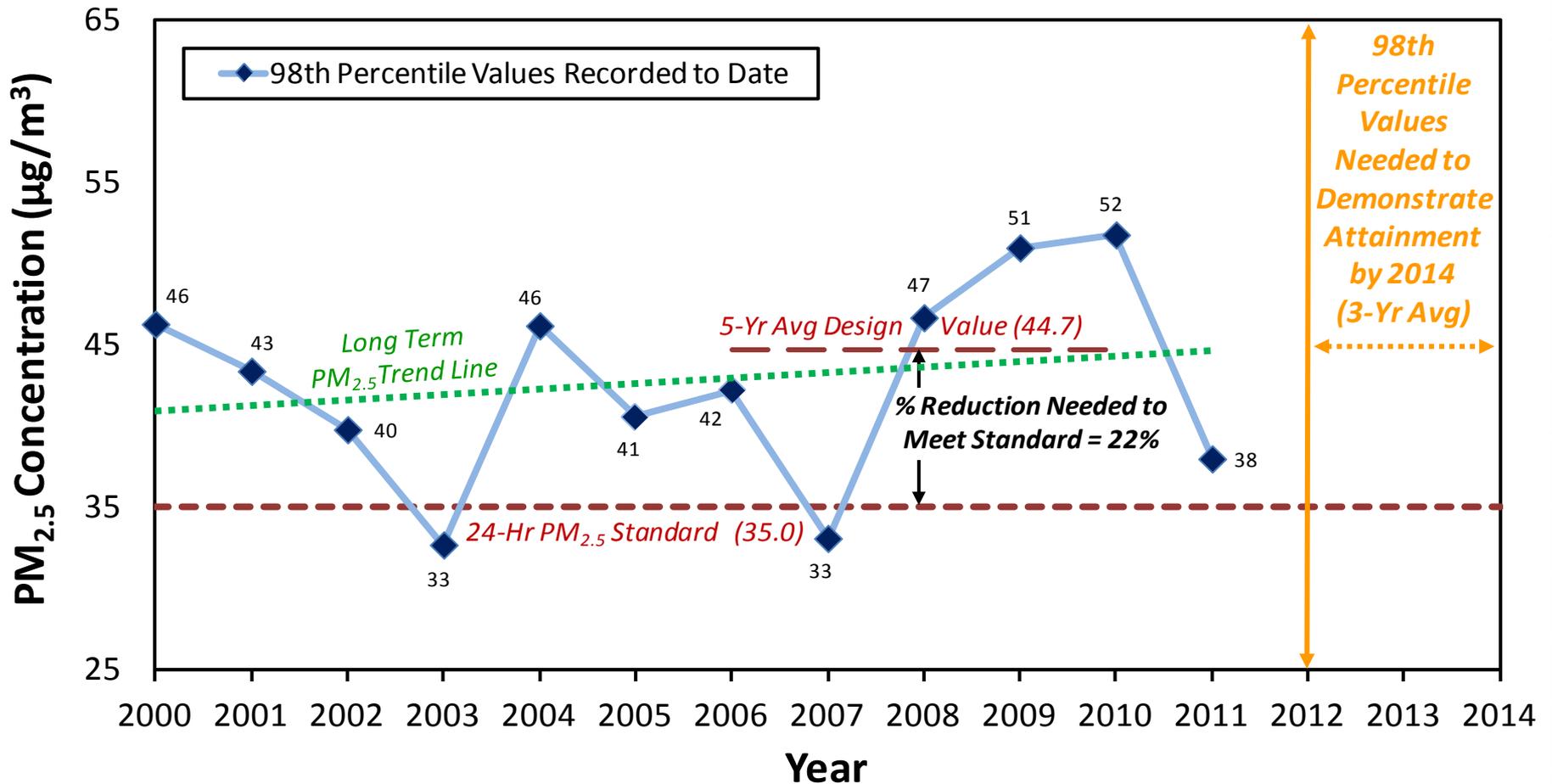
Background

- Borough needs to submit approvable plan by the end of the year
- Multiple models are being used to assess progress towards attainment (regional, dispersion, statistical, CMB-Chemical Mass Balance)
- Key modeling inputs are emissions and meteorology
- Emissions based on local data and lab tests
- Two episodes being used to represent meteorology
- Info presented today based on regional and dispersion models using local emission measurements and worst case meteorology.

Emissions are not the same as Concentrations



Long Term Trend in 98th Percentile PM_{2.5} Concentrations in Fairbanks



How Much of 2010–2011 Improvement Came from Measures Undertaken by Borough, State and Weather

	$\mu\text{g}/\text{m}^3$	% of Total
Borough & State Measures	0.3	2.2
Weather	10.4	75.4
Filter Sampling Interval (Sample every 3rd day - Luck of the Draw)	3.1	22.4
TOTAL	13.8	100.0

Benefits of Measures Implemented in 2011

Control Program	Relative Emission Reductions (% of Baseline Inventory)			
	NOx	SO ₂	PM _{2.5}	µg/m ³
Wood Stove Change Out	0.02%	-0.23%	0.45%	0.14
OWHH Retrofit	0.01%	0.00%	0.32%	0.10
AHFC Home Energy Rebate	0.01%	0.03%	0.01%	0.00
AHFC Weatherization	0.06%	0.01%	0.02%	0.01
Borough Switch to #1 Oil	-0.38%	0.32%	-0.07%	0.00
Cumulative Total	-0.28%	0.13%	0.72%	0.26

Notes: Red numbers indicate emission increases rather than reductions.
Percent average reductions over January/February episodes.

Winter Weather Was Much Milder in 2011

- Compared to the prior year, the winter months of 2011 had:
 - ❖ 8 fewer days with average temperature below -10F
 - ❖ 10 fewer days with very calm winds
 - ❖ 11 fewer days with very strong inversions
 - ❖ A total of **66** more days with high ventilation rates (a combination of weakened inversions and higher wind speeds)
- The weather difference is enough to pull the 2011 design value down **20%** below the 2010 value.

Key Findings

- 2010–2011 PM_{2.5} weather-related reductions cannot be relied upon to reach attainment
- Borough needs to select controls that produce large reductions in emissions to demonstrate attainment of the PM_{2.5} standard

Emission Totals

(Entire Modeling Area, Jan-Feb Episode Avg.)

Source Category	PM _{2.5} (tons/day)	%
Point Sources*	1.92	32%
On-Road Vehicles	1.11	19%
Space Heating – Total	2.73	46%
Space Heating – Wood	2.65	45%
Space Heating – Heating Oil	0.05	<1%
Space Heating – Other (coal, waste oil, etc.)	0.03	<1%
Other Sources (Other Area & Non-Road)	0.15	2%
TOTAL	5.91	100%
Emission Reductions needed for attainment	1.95	~33%

* Not emitted at ground level

Point Source Emissions

- Actual day and hour specific emissions data for Jan-Feb and Nov 2008 modeling episodes supplied by:
 - ❖ Flint Hills North Pole Refinery
 - ❖ GVEA Zehnder & North Pole
 - ❖ Eielson AFB
 - ❖ Aurora Energy
 - ❖ UAF Campus Plant
 - ❖ Doyon Utilities (private Wainwright units)
- Data included stack parameters (height, flowrates, etc.) to determine plume heights above ground

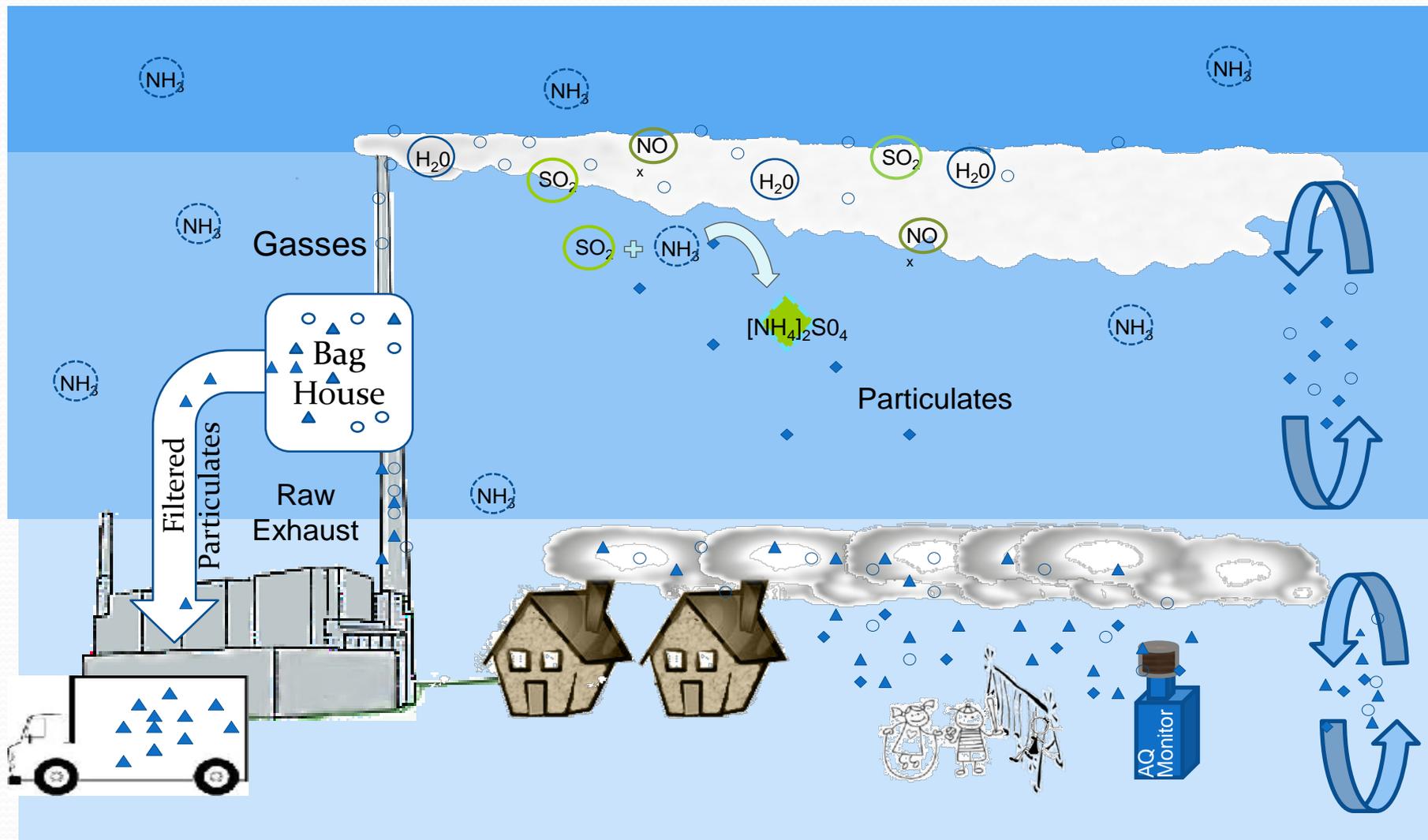
On Road Vehicle Emissions

- Fairbanks cold temperature testing indicates EPA MOVES model overestimates gasoline vehicle emissions under arctic conditions
 - ❖ No representation of block heater benefits (~ 70% reduction in cold start emissions)
 - ❖ EPA estimate of temperature dependence of cold start emissions more than twice measured values
- FMATS travel estimates combined with EPA MOVES emissions factors indicate vehicles are roughly 20% of PM_{2.5} emissions
- Revisions to account for Fairbanks testing will reduce vehicle share of PM_{2.5} emissions

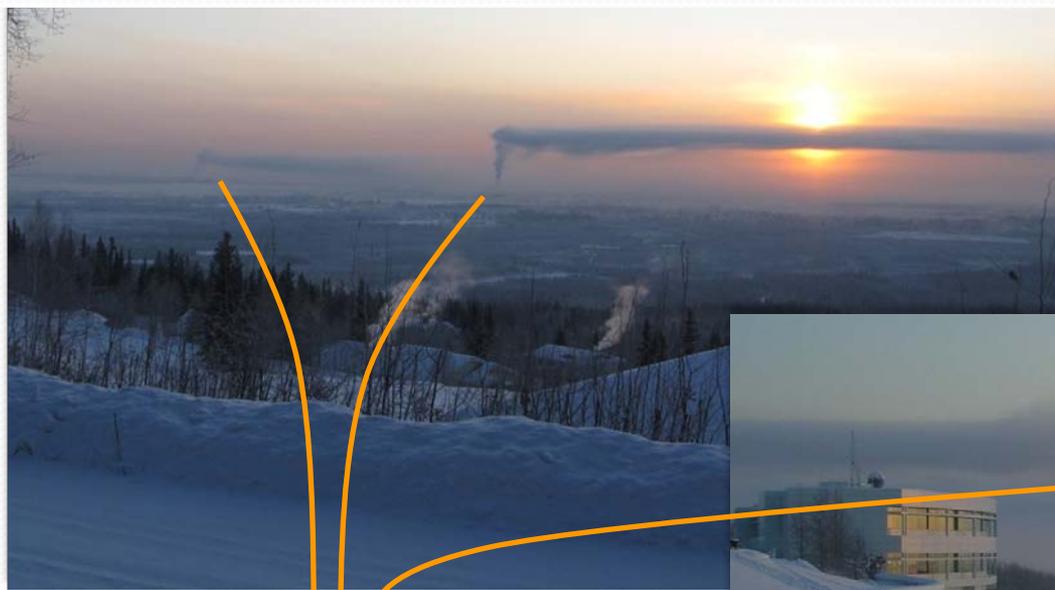
Space Heating Emissions

- Based on detailed local data:
 - ❖ **CCHRC Device Instrumentation Study** – Heating usage measurements collected in 30 homes (with mixture of devices) for about 6 weeks each during winter 2010-11
 - ❖ **Home Heating Telephone Surveys** – Randomly-polled surveys of winter and annual space heating use in 2011, 2012 (700 households/survey)
 - ❖ **OMNI Test Labs** – Heating device emission measurements using Alaska fuels
 - ❖ **FNSB Assessor Building/Parcel Database** – provided location and size (ft²) of residential and most commercial buildings
- OMNI Labs tests showed lower emission rates than EPA (AP-42) defaults – 25-75% lower PM
- OMNI rates used where available and appropriate

Models Needed to Translate Emissions to Concentrations



Using Dispersion Modeling to Translate Point Source Emissions into Concentrations Recorded at Monitors



All combined point sources contribute 5 % directly emitted $PM_{2.5}$ and up to 15% additional $PM_{2.5}$ (secondary sulfate).

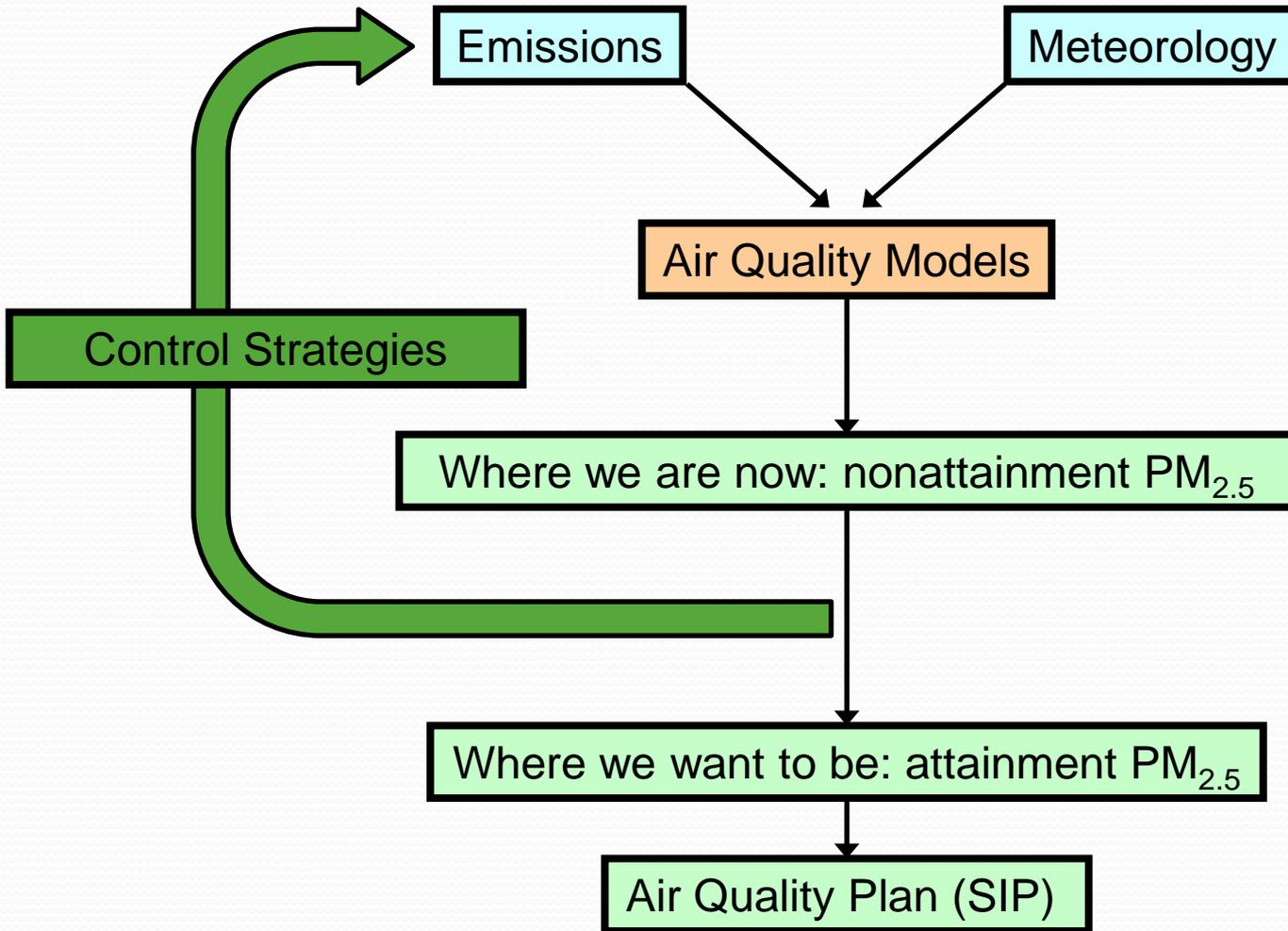
Dispersion Modeling Method

- Used winter 2008 hourly emission values for given from each of the point sources.
- November 2-17 and January 23-February 10.
- All six point sources in the nonattainment area were modeled.
- Modeled one point source at a time.

Key Findings

- Point sources contribute 5% of primary PM_{2.5}
- Estimates of up to an additional 15% contribution from secondary formation.
- Point sources do contribute (up to 20%), but are not the largest contributor.

Modeling Diagram



Space Heating Measures – Short Term

- Expansion of existing programs
 - ❖ Dry wood
 - ❖ Wood stove change out
 - ❖ AHFC
 - ❖ OWHH retrofits
- Fuel sulfur reductions
- Financial support for cleaner fuels
- Opacity restrictions
- State OWHH standards

Space Heating Measures – Longer Term

- Expansion of district heat system
- Large scale natural gas availability
- Technology forcing OWHH standards

Mobile Source Measures

- Expanded plug-ins
- Expanded transit and vanpooling
- Locomotive idle reductions
- Diesel retrofits/repair and alternate fuels
- Heavy-duty vehicle idling reductions (electrification)
- Commercial vehicle emissions enforcement
- Require companies to use newer/cleaner off-road equipment (e.g. construction)

Point Source Measures

- Potential to Emit revisions
- SO₂ controls
- Fuel switching (e.g., natural gas)
 - ❖ GVEA-NP switch from #4 HAGO to #2 fuel oil, etc.
- Possible controls (RACT/RACM)
- Establish small source permit program (mid-size sources, waste oil, etc.)

RACT/RACM

- Section 172 of CAA requires each attainment plan to “provide for the implementation of all reasonably available control measures as expeditiously as practicable”.
- RACT (Reasonably Available Control Technology) refers to measures applicable to stationary sources.
- RACM (Reasonably Available Control Measures) refers to measures applicable to mobile, area or stationary sources.
- Requirement to determine whether available controls are technologically or economically feasible.
- State is working to prepare RACT/RACM analysis and is currently investigating requirements.

Multi-Fuel Control Package (Preliminary Results)

Control Program	Relative Emission Reductions (% of Baseline Inventory)			
	NO _x	SO ₂	PM _{2.5}	µg/m ³
Expanded Wood Stove Change Out	0.09%	-0.96%	2.10%	0.7
Expanded OWHH Retrofit	0.10%	0.05%	4.65%	1.5
AHFC Home Energy Rebate by 2014	0.15%	0.42%	0.14%	<0.1
AHFC Weatherization by 2014	0.25%	0.06%	0.06%	<0.1
Public Education - Dry Wood	0.45%	0.21%	13.68%	4.4
Point Source Cntrls (Desulfurization)	-	37.04%	-	0.0 – 1.4
Shift from #2 to #1 Heating Oil	-0.27%	12.57%	-0.04%	0.1 – 0.6
Expanded Vehicle Plug-Ins	TBD	TBD	TBD	TBD
Expanded Transit and Vanpooling	TBD	TBD	TBD	TBD
Cumulative Total	4.13%	50.45%	22.04%	6.8 – 8.7

Notes: **Red** numbers indicate emission increases rather than reductions.
Percent average reductions over January/February episode.

Wood Burning Control Package (Preliminary Results)

Control Program	Relative Emission Reductions (% of Baseline Inventory)			
	NO _x	SO ₂	PM _{2.5}	µg/m ³
Expanded Wood Stove Change Out	0.03%	-0.34%	0.66%	0.2
Expanded OWHH Retrofit	0.04%	0.02%	1.63%	0.5
AHFC Home Energy Rebate by 2014	0.15%	0.42%	0.14%	<0.1
AHFC Weatherization by 2014	0.25%	0.06%	0.06%	<0.1
Public Education - Dry Wood	0.16%	0.08%	4.80%	1.6
Curtail Wood Use on High PM Days	TBD	-1.20%	27.23%	8.8
Expanded Vehicle Plug-Ins	TBD	TBD	TBD	TBD
Expanded Transit and Vanpooling	TBD	TBD	TBD	TBD
Cumulative Total	0.62%	-0.97%	34.52%	11.3

Note: Red numbers indicate emission increases rather than reductions.
Percent average reductions over January/February episode.

Next Steps

- Complete emission inventory revisions and model development for both episodes
- Analyze control measures – emission reductions, implementation issues, costs, and cost-effectiveness
- Use results to:
 - ❖ Assess continuation/change in existing measures
 - ❖ Assemble packages of measures to demonstrate attainment
 - ❖ Assess time required to attain standard
- Presentations of findings to PCC, public meetings/open houses and Assembly