



Revised Stakeholder Control Package Analysis

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November 15, 2018

Revised Control Measure Package Analysis Overview

- > Polling/discussions from October 17 meeting rolled into a broadened package of 49 recommended measures
- > Each measure evaluated for emission reduction potential with assumptions/data to support quantitative analysis of episodic reductions
- > To simplify analysis all measures were evaluated in 2024, the latest possible Serious SIP extension year
- > Combined emission benefits were estimated (accounting for overlap)
- > Modeling results were scaled from October package

Screening of Measures for Analysis

Measure Category	No.	Description	Modeled?	Notes
Registration	1	Require registration of all "heating" devices	Indirectly	Affects compliance
Point Sources	2	Alternative BACT Banking Fund for offset dollars to pay PM reductions	No	Pending proposal
	3	Point Sources pay annual assessment to the Alternative BACT Offset Fund		
	4	Offset funds used primarily to reduce impacts of wood smoke, not on studies		
	5	Eligibility for Point Sources to pay offsets requires that offsets yield greater PM _{2.5} reductions than ADEC proposed BACT/MSM		
	6	Speciation study to determine point source SO ₂ contributions		
	7	Alternative BACT measures specific to each point source		
Fuel Control	8	Expanded natural gas penetration/use in Fairbanks	No	Considered in SIP
	9	Build and operate a public-private kiln for wood drying	Yes	Similar to Package 1, affects commercially sold wood
	10	Establish a dry for wet wood exchange program	Yes	
	11	Require all homes with SFBA's to have appropriate wood storage	Yes	Affects "cut-own" wood group
	12	Mandate shift from #2 fuel oil to #1 fuel oil borough-wide; ULSD contingency	Yes	Similar to Package 1
	13	Require sale of only dry wood when commercially available, exemption for 8-foot rounds	No	Reinforces 9 & 10
	14	Add surcharge to price of #2 fuel oil	No	May trigger wood increase
Energy Efficiency	15	Funding for program to improve residential energy efficiency in NA Area hot-spots	Yes	120 homes/year
	16	Require home energy audit at the time of home sale	No	Voluntary
Device Removal	17	Mandatory removal of outdoor hydronic heaters, uncertified devices and SFBA's not meeting state standards	Yes	Similar to Package 1
	18	Require notice and proof of destruction or surrender of removed, uncertified devices	No	Overlaps 17 & 20
	19	Offer higher incentives for replacing SFBA's in multi-family structures under WSCOP	No	Marginal benefit
	20	Prohibit use & require removal of coal-only heaters from homes & small commercial sites	Yes	Similar to Package 1
	21	Create incentives for fuel oil boiler upgrades	Indirectly	Captured in other measures

Screening of Measures for Analysis (cont.)

Measure Category	No.	Description	Modeled?	Notes
Device Control – existing devices	22	Require permanent installed alternative heating method in rental units, with exemption for current NOASH permit holders	Yes	40% rentals in NA Area, oil as alternative heat
	23	Require catalytic device change out per manufacturer’s specifications, with mandatory chimney sweep and device check on annual or biennial basis	Yes	Assumed average catalyst useful life of 6 years
	24	Require inspection for NOASH renewals	Indirectly	Via compliance rate
	25	Allow only NOASH households to burn during curtailment periods (single stage program)	Yes	Curtailment at 25 ug/m3
	26	Require renewal of Stage 1 permits	Indirectly	Via compliance rate
	27	Require inspection for Stage 1 eligibility		
Device Control – new devices	28	Require installation permit for all new SFBA and restrict the types of devices allowed	Yes	Combined with 30
	29	Require installation of device meeting state emission standards whe fireplace/chimney is remodeled	No	Marginal benefit
	30	Prohibit sales of SFBAs that don’t meet state standards	Yes	Combined with 28
	31	Allow SFBA in new construction as secondary heat only; primary heating system must have sufficient capacity to heat the building	No	Modest benefit
	32	Require all aftermarket controls on SFBAs to be professionally installed, with exemption for existing devices	No	Difficult to quantify
	33	Require all SFBAs to be properly sized and professionally installed, with exemptions for existing devices		
Compliance and Enforcement	34	Adopt legislation giving ADEC citation authority	Indirectly	Applied under separate Curtailment compliance scenarios
	35	Increase funding for curtailment enforcement		
	36	Use infrared cameras to observe heat signature for solid-fuel heating device operations		
	37	Increase penalties for burning wet wood		
	38	Point Sources sponsor curtailment enforcement teams to supplement staffing during Stage 1 and 2 alerts		
	39	Authorize warrants for inspection of devices being operated during curtailment periods		

Screening of Measures for Analysis (cont.)

Measure Category	No.	Description	Modeled?	Notes
Education	40	Develop a public relations strategy for communicating with media and the community about Fairbanks air quality issues that promotes a positive and proactive approach to public outreach and education	No	Difficult to quantify
(All voluntary, no credit for the SIP)	41	Communicate the costs of PM _{2.5} non-attainment, including increased medical costs, loss of federal highway funds and construction jobs, increased electric costs for residents and businesses, and other health and societal costs	No	Reductions limited for voluntary measures in SIP
	42	Be clear that the goal is not to eliminate wood burning, but to preserve our ability to heat with wood by agreeing not to burn during inversions		
	43	Seek additional venues and audiences for Dr. Owen Hanley's talk on the health impacts of PM _{2.5}		
	44	Develop other high-impact presentations that make the science and consequences of PM _{2.5} pollution clear and compelling, such as the FNSB's demonstration of burning dry vs. wet wood		
	45	Learn from behavioral economics and social marketing how to identify and address barriers to changing behaviors		
	46	Partner with the Cooperative Extension to provide classes in responsible wood burning		
	47	Coordinate with local schools to incorporate air quality messages and alerts in daily announcements		
	48	Encourage teachers to include air quality science and health impacts in lesson plans		
	49	Engage the public through events that are creative and entertaining, such as a contest for building the best modular dry wood storage		

Analysis Approach

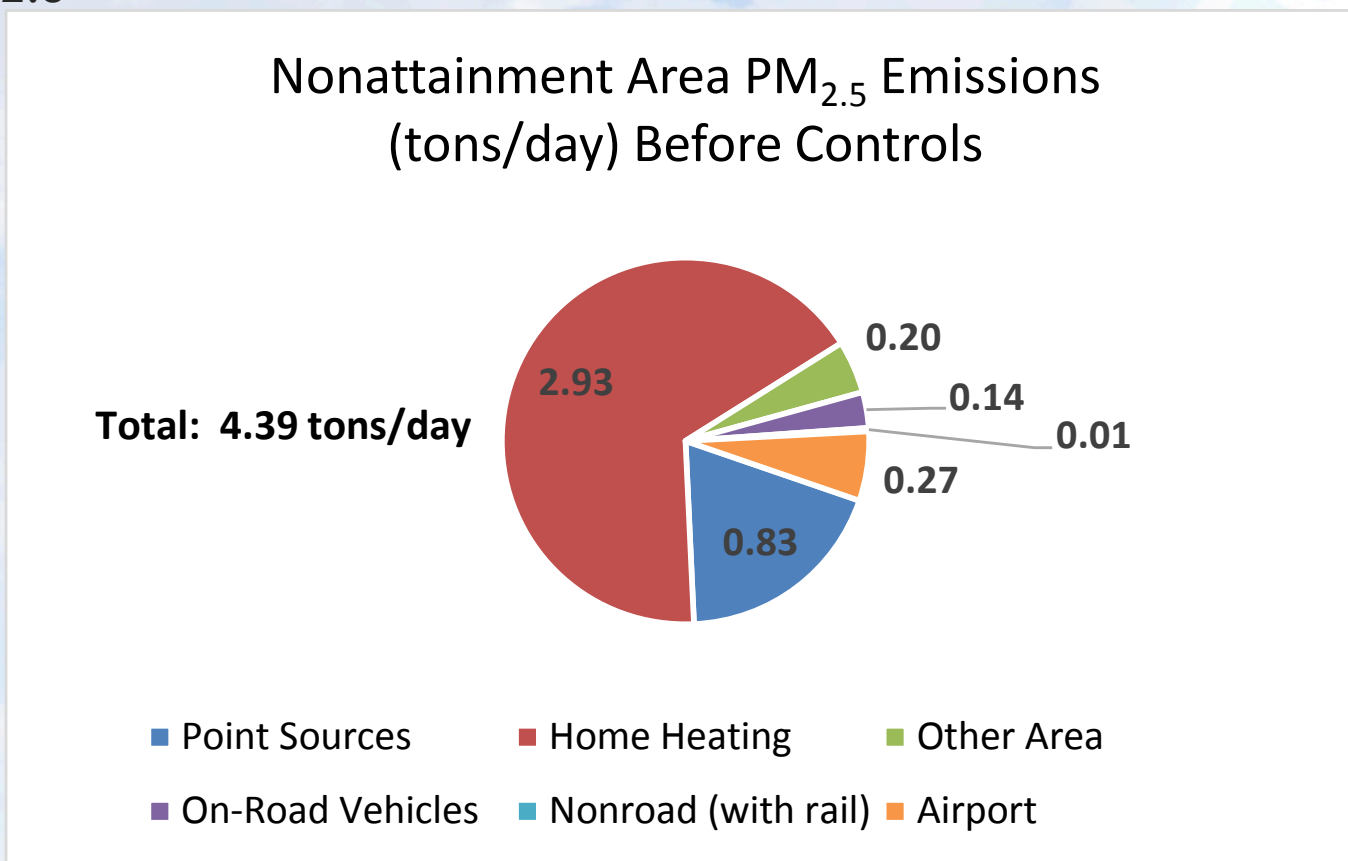
- > Calculated emission benefits by measure from a baseline 2024/2019 projected inventory:
 - ❖ Similar to October (Package 1) analysis
 - ❖ Projected space heating to 2024 (more robustly represented F35-related growth), all other sectors to 2019
 - ❖ Benefits from individual measure not additive since they affect same set of sources (space heating)
 - ❖ Accounted for measure overlap using SIP methods at detailed source category level (SCC)

Analysis Approach (cont.)

- > October (Package 1) analysis ignored implications of Prop. 4 passage on compliance/enforcement authority and impacts - optimistic outlook
- > Current uncertainty from state election may impact state-led measure compliance/penetration
- > Two cases of control benefits were considered:
 - ❖ [Optimistic](#) - Assumes well-funded compliance and enforcement buttressed by 100% registration
 - ❖ [Base](#) - Reflects preliminary “starting point” estimate of state-based compliance and enforcement
- > Together they link back to the October analysis and provide a current outlook on measure effectiveness

Baseline (pre-control) PM_{2.5} Inventory

- > Home heating represents about two-thirds of total PM_{2.5} emissions in nonattainment area



Comparison of Key Assumptions for Optimistic and Base Case Analyses

- > Key “conceptual” compliance and penetration assumptions
- > Highlighted columns indicate differences

Measure Category	No.	Description	Optimistic	Base
Registration	1	Registration	100% penetration	Less than 100% penetration
Fuel Control	9-11	Kilns (9), Dry Wood Exchange (10), Wood Storage (11)	100% compliance for 9 &10, 75% compliance for 11	100% compliance for 9 &10, 35% compliance for 11
	12	Shift from #2 Fuel Oil to #1 Fuel Oil	100% penetration	100% penetration
Energy Efficiency	15	Residential Energy Efficiency Improvements	120 homes/year starting in 2024	120 homes/year starting in 2024
Device Removal	17	Mandatory Removal of SFBAs not Meeting State Standards	75% compliance	35% compliance
Device Control – existing devices	22	Alternative Heating in Rental Units	75% compliance	35% compliance
	23	Catalytic Device Change Outs	75% compliance	35% compliance
	25	NOASH Only During Curtailment (Single-Stage Program)	75% compliance	35% compliance
Device Control – new devices	28,30	Installation Permits for New SFBAs (28) & Prohibit Sales of SFBAs not Meeting State Standards (30)	75% compliance	35% compliance
Compliance and Enforcement	34	Adopt Legislation Giving ADEC Citation Authority	50% curtailment compliance (was 35% for October analysis)	35% curtailment compliance
	35	Increase Funding for Curtailment Enforcement		
	36	Use Infrared Cameras to Observe SFBA Heat Signature		
	37	Increase Penalties for Burning Wet Wood		
	38	Point Sources Sponsor Curtailment Enforcement Teams		
	39	Authorize Warrants for Device Inspection when Operated Under Curtailment		

Nonattainment Area Emissions Before and After Stakeholder Controls - **Optimistic Comparisons**

- > Space Heating PM_{2.5} emission reductions increase from 74% to 82% between October and current analysis
- > SO₂ reductions similar since driven by #2 to #1 Oil

October (Package 1) Optimistic Case						
Sector	PM2.5 Emissions (tons/day)			SO2 Emissions (tons/day)		
	Before	With Control	Reduction (%)	Before	With Control	Reduction (%)
Point Sources	0.83	0.83		7.13	7.13	
Home Heating	2.93	0.77	74%	4.17	2.30	45%
Other Area	0.20	0.20		0.02	0.02	
On-Road Vehicles	0.14	0.14		0.04	0.04	
Nonroad (with rail)	0.01	0.01		0.01	0.01	
Airport	0.27	0.27		11.32	11.32	
TOTALS	4.39	2.23	49%	22.68	20.81	8%

November (Package 2) Optimistic Case						
Sector	PM2.5 Emissions (tons/day)			SO2 Emissions (tons/day)		
	Before	With Control	Reduction (%)	Before	With Control	Reduction (%)
Point Sources	0.83	0.83		7.13	7.13	
Home Heating	2.93	0.52	82%	4.17	2.37	43%
Other Area	0.20	0.20		0.02	0.02	
On-Road Vehicles	0.14	0.14		0.04	0.04	
Nonroad (with rail)	0.01	0.01		0.01	0.01	
Airport	0.27	0.27		11.32	11.32	
TOTALS	4.39	1.98	55%	22.68	20.89	8%

Nonattainment Area Emissions Before and After Stakeholder Controls - **Optimistic vs. Base Comparisons**

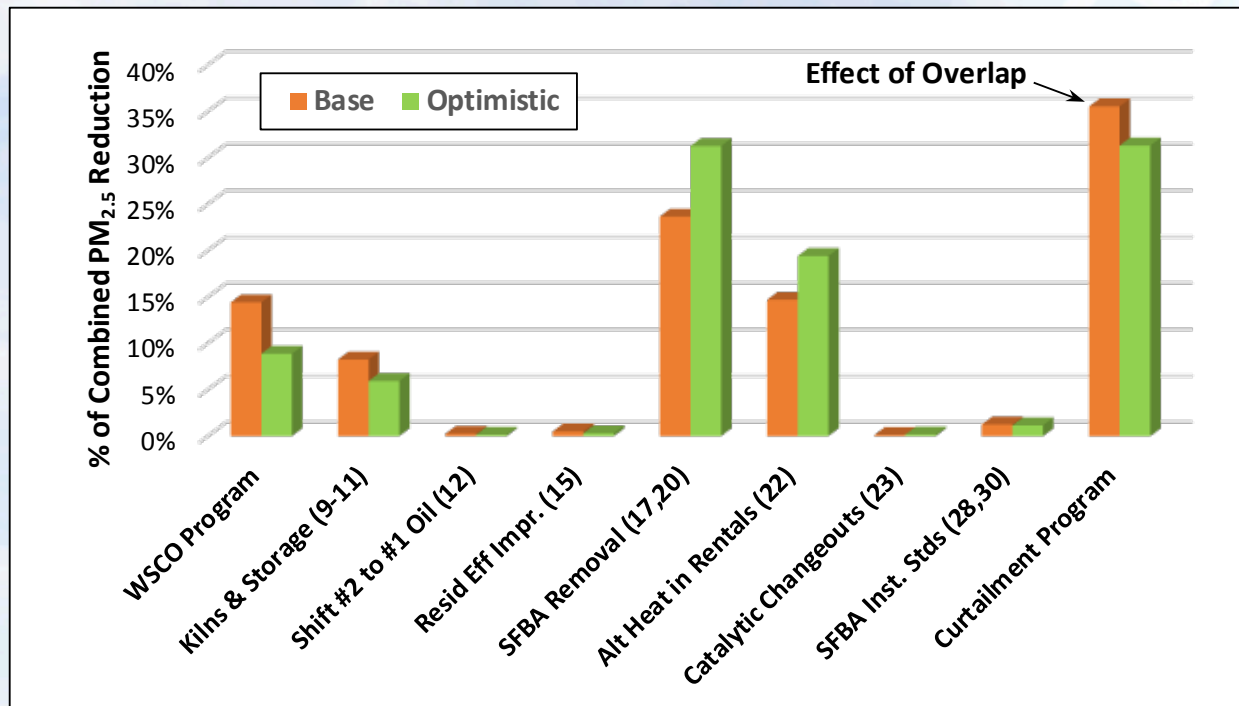
- > Space Heating PM_{2.5} emission reduction drop from 82% under Optimistic case to 64% under Base case
- > SO₂ reductions similar since driven by #2 to #10oil

November (Package 2) Optimistic Case						
Sector	PM2.5 Emissions (tons/day)			SO2 Emissions (tons/day)		
	Before	With Control	Reduction (%)	Before	With Control	Reduction (%)
Point Sources	0.83	0.83		7.13	7.13	
Home Heating	2.93	0.52	82%	4.17	2.37	43%
Other Area	0.20	0.20		0.02	0.02	
On-Road Vehicles	0.14	0.14		0.04	0.04	
Nonroad (with rail)	0.01	0.01		0.01	0.01	
Airport	0.27	0.27		11.32	11.32	
TOTALS	4.39	1.98	55%	22.68	20.89	8%

November (Package 2) Base Case						
Sector	PM2.5 Emissions (tons/day)			SO2 Emissions (tons/day)		
	Before	With Control	Reduction (%)	Before	With Control	Reduction (%)
Point Sources	0.83	0.83		7.13	7.13	
Home Heating	2.93	1.07	64%	4.17	2.33	44%
Other Area	0.20	0.20		0.02	0.02	
On-Road Vehicles	0.14	0.14		0.04	0.04	
Nonroad (with rail)	0.01	0.01		0.01	0.01	
Airport	0.27	0.27		11.32	11.32	
TOTALS	4.39	2.53	42%	22.68	20.84	8%

Which Measures Produce the Most Reduction?

- > Breakdown of PM_{2.5} space heating emission reductions from Base (64%) and Optimistic (82%) cases
- > SFBA Removal (Measure 17,20) and Curtailment provide largest shares of reductions, followed by Alt. Heat in Rentals (Measure 22)
- > Lower curtailment share for Optimistic case reflects accounting for overlap



How do These Emission Reductions Translate to Air Quality Impacts?

- > Ambient PM_{2.5} concentrations are not directly proportional to emission reductions:
 - ❖ Differences in spatial distributions (horizontally and vertically)
 - ❖ Secondary formation of PM_{2.5} in atmosphere from gaseous precursors and chemical reactions
- > Photochemical grid model (CMAQ) used to estimate ambient PM_{2.5} concentrations by grid cell across modeling area
- > CMAQ run for October Stakeholder package estimated:
 - ❖ 65 µg/m³ ambient PM_{2.5} at North Pole Fire Station
 - ❖ 26 µg/m³ ambient PM_{2.5} at Downtown Fairbanks monitors
- > “Model-Scaling” analysis performed for November Stakeholder package - accounts for relative impacts of each source sector and pollutant based on existing CMAQ run

Comparison of Modeling Results

- > October Control Package CMAQ-modeled results were compared to CMAQ-scaled estimates for the November package (both Optimistic and Base cases)
- > Although modeled Future Design Values (FDVs) exceed the 35 $\mu\text{g}/\text{m}^3$ standard, the November package (using Optimistic assumptions) shows further progress toward attainment

Monitor	October CMAQ FDVs	November Control Package CMAQ-Scaled Estimates	
		Optimistic Case FDVs	Base Case FDVs
Downtown (State Office Building)	26 $\mu\text{g}/\text{m}^3$	23 \pm 3 $\mu\text{g}/\text{m}^3$	28 \pm 4 $\mu\text{g}/\text{m}^3$
North Pole Fire Station	65 $\mu\text{g}/\text{m}^3$	50 \pm 5 $\mu\text{g}/\text{m}^3$	73 \pm 8 $\mu\text{g}/\text{m}^3$

- > Base case results reflect a “starting point” the state will need to build upon within the SIP
- > SIP modeling will also examine impacts beyond monitor grid cells

Conclusions/Takeaways

- > Most significant emission reductions come from SFBA Removal and Curtailment measures
- > Measure benefits are significantly affected by assumed compliance and penetration levels
- > The November package (with Alternate Heating in Rentals measure) shows further progress toward attainment
- > The Stakeholder Group efforts have significantly assisted the SIP development process:
 - ❖ Measures evaluated and local factors/funding
 - ❖ Thinking beyond BACM, tailored to local conditions
 - ❖ Provides a valuable reference point for State's SIP efforts

Questions?