Alaska Department of Environmental Conservation

Amendments to:

State Air Quality Control Plan

Vol. III: Appendix III.D.7.7

{Appendix to Volume II. Analysis of Problems, Control Actions; Section III. Area-wide Pollutant Control Program; D. Particulate Matter; 7. Fairbanks North Star Borough PM2.5 Control Plan, Serious Requirements}

Public Notice Draft

September 10, 2020

Michael J. Dunleavy, Governor

Jason W. Brune, Commissioner

This document provides the appendix to the revised and/or new language proposed for inclusion in this section of the State Air Quality Control Plan addressing the Fairbanks North Star Borough $PM_{2.5}$ Serious nonattainment area. As shown on the content page, the bold and underlined is the appendix to the revised and/or new proposed language. The appendix documents to the adopted sections of the air quality plan can be found and referenced at the following internet site: http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip/

(This page serves as a placeholder for two-sided copy)

Appendix III.D.7.07

2020 Amendment documents proposed to be added to this Appendix may be found at the end of the document list, on page Appendix III.D.7.7-9

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- Fort Wainwright US Army Garrison and Doyon Utilities BACT Documents

2015-04-24 ADEC Voluntary BACT Analysis for Fort Wainwright (Privatized Emission Units) letter to Eric Dick.pdf
2015-04-24 ADEC Voluntary BACT Analysis for Fort Wainwright (Privatized Emission Units) letter to Kathleen Hook.pdf
2015-10 DU FWA BACT Protocol V2.pdf
2015-12-11 DU BACT Protocol Cover letter V2.pdf
2016-02-03 DU_BACT_protocol_response.pdf
2017-01 S&L SCR Cost Development Methodology.pdf
2017-06 Final BACT_BACM Analyses Tech Memo_NEW.pdf
2017-06-05 Fort Wainwright DSI Amerair Industries LLC Proposal.pdf
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2017-07-10 Cover Letter.pdf
2017-10-20 ADEC BACT Comment Letter Fort Wainwright.pdf
2017-10-20 ADEC Request for Additional Information for Fort Wainwright BACT Analysis.pdf
2018-05-23 DU Preliminary BACT Comments_Final.pdf
2018-05-23 EPA Comments on ADEC Preliminary Draft SIP Dev.pdf
2018-09-13 ADEC BACT Comment Letter Fort Wainwright 09.13.18.pdf
2018-09-13 ADEC Request for Additional Information for Fort Wainwright BACT Analysis 091018.pdf
2019-05-10 Fort Wainwright Attachments OCR.pdf
2019-05-10 Public Notice Fort Wainwright BACT Determination.pdf
2019-07-26 Col. Christopher Ruga e-mail Serious SIP Comments from Fort Wainwright (UNCLASSIFIED).pdf
2019-07-26 Doyon Utilities Serious SIP BACT Analysis Comments [CO 19-067].pdf
2019-07-26 Isaac Jackson e-mail Doyon Utilities Serious SIP BACT Analysis Comments.pdf
2019-07-26 Mark Ingoglia e-mail USAF SIP Comments.pdf
2019-10-04 DU FWA Additional BACT Comments.pdf
2019-11-13 Final Fort Wainwright BACT Determination.pdf
2019-11-13 Fort Wainwright Response to Comments.pdf
Fairbanks PM-2.5 Serious SIP - Information Requ....pdf
RE_ [EXTERNAL] _Fairbanks PM-2.5 Serious SIP - ....pdf

The following documents are included as part of the BACT determination, however due to their electronic nature, they may be found posted separately at: http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip/

2016 scr_cost_manual_spreadsheet_vf Ft Wainwright (Army).xlsm
2016 sncr_cost_manual_spreadsheet_vf Ft Wainwright (Army).xlsm
2017-06-07 Amerair Cost for 50 and 80 percent control sncr (Army).xlsx
2017-07-21 Calculations for Emissions for EPA Tech review (Army).xlsx
2018-02-09 Fort Wainwright Wet Scrubber Cost Analysis (Army).xlsx
2019-04-25 Fort Wainwright - SO2 Controls Economic Analyses (ADEC).xlsx
2019-11-13 Fort Wainwright - SO2 Controls Economic Analyses Final (ADEC).xlsx
2019-11-13 Fort Wainwright SCR Economic Analysis (ADEC).xlsm
2019-11-13 Fort Wainwright SNCR Economic Analysis (ADEC).xlsm

- University of Alaska Fairbanks (UAF) BACT Determination BACT Documents

2010-08 Sargent and Lundy SDA FGD Cost Development Methodology 2010.pdf
2010-08 Sargent and Lundy Wet FGD Cost Development Methodlology 2010.pdf
2013-03 DSI for SO2 Cost Control Development Methodology.pdf
2015-04-24 Voluntary BACT Analysis for UAF.pdf
2015-07 UAF BACT Protocol FINAL.pdf
2015-08-14 UAF BACT Protocol response 081415.pdf
2017-01 FINAL BACT Analysis for UAF Campus.pdf
2017-01 SCR Cost Development Methodology.pdf
2017-05-11 Serious SIP BACT due date email.pdf
2017-10-20 ADEC BACT Comment Letter to UAF.pdf
2017-10-20 ADEC Request for Additional Information for UAF BACT Analysis.pdf
2017-10-20 Voluntary BACT Analysis for UAF letter 042515.pdf
2017-11-04 EPA Comments on ADEC BACT Analysis for UAF.pdf
2017-12-21 UAF Response to EPA-ADEC BACT Comments.pdf
2017-12-21 UAF Response to EPA-ADEC comments on BACT Analysis.pdf
2018-09-13 ADEC Request for Additional Information for UAF BACT Analysis 091018.pdf
2018-09-13 BACT Comment Letter to UAF.pdf
2018-09-13 EPA Comments on ADEC Preliminary Draft SIP Dev.pdf
2018-09-13 Request for Additional Information for the BACT Technical Memorandum for UAF.pdf
2018-11-01 UAF response to ADEC BACT Information Request.pdf
2019-04-23 UAF Response to BACT-SO2 Emissions.pdf
2019-04-29 UAF Response to BACT-SO2 Emissions.pdf
2019-05-10 UAF Attachments OCR.pdf
2019-05-10 UAF BACT Determination.pdf
2019-07-26 Frances Isgrigg e-mail UAF Serious SIP Comments 7-26-19.pdf
2019-07-26 Kerynn Fisher e-mail UAF comments - Fairbanks PM2.5 - Draft SIP 7-26-19.pdf
2019-11-13 Final UAF BACT Determination.pdf
2019-11-13 Final UAF Response To Comments.pdf

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2017-01-24 UAF_BACT_NOx_Tables_3-X (UAF).xlsx
2017-02-08 UAF_BACT_PM2.5_Tables_4-X (UAF).xlsx
2017-02-08 UAF_BACT_Tables_1-2_thru_1-5_and_Summary (UAF).xlsx
2018-11-20 UAF_BACT_SO2_Tables_5-X (UAF).xlsx
2019-11-13 UAF EU3 LNB Economic Analysis (ADEC).xlsx
2019-11-13 UAF EU3 SCR Economic Analysis (ADEC).xlsx
2019-11-13 UAF SCR Economic Analysis (ADEC).xlsm
2019-11-13 UAF SNCR Economic Analysis (ADEC).xlsm
2019-11-13 UAF SO2 Controls Economic Analyses (ADEC).xlsx

- Golden Valley Electric Technology Determination (GVEA) North Pole and Zehnder Facility BACT Documents

2017-11-16 ADEC BACT Comment Letter to GVEA.pdf
2017-11-16 ADEC Request for Additional Information for North Pole and Zehnder Facilities BACT Analyses.pdf
2017-11-16 EPA Comments on GVEA NP and ZND BACT 111517.pdf
2017-11-16 Voluntary BACT GVEA NP and Z letter 042415.pdf
2017-12-22 EPA_453_R-93-007.pdf
2017-12-22 GVEA Response to IR with attachments.pdf
2017-12-22 GVEA Response to IR.pdf
2018-09-13 ADEC BACT Comment Letter to GVEA.pdf
2018-09-13 ADEC Request for Additional Information for North Pole and Zehnder Facilities BACT Analyses 2 091018.pdf
2018-09-13 EPA Comments on ADEC Preliminary Draft SIP Dev 052118.pdf
2018-11-28 _GVEA_AltBact.pdf
2018-11-28 _GVEA_AltBACT_Attachments.pdf
2018-11-28 GVEA Alt BACT with attachments.pdf
2019-05-10 GVEA Attachments.pdf
2019-05-10 GVEA North Pole Attachments.pdf
2019-05-10 Public Notice North Pole BACT Determination.pdf
2019-05-10 Public Notice Zehnder BACT Determination.pdf
2019-11-13 Final North Pole BACT Determination.pdf
2019-11-13 Final Zehnder BACT Determination.pdf
2019-11-13 GVEA North Pole and Zehnder Response to Comments.pdf

The following documents are included as part of the BACT determination, however due to their electronic nature, they may be found posted separately at: http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip/

2017-08-27 North Pole - Section 4 - PM_F (GVEA).XLSX
2017-12-12 North Pole - Section 1 - PTE_F (GVEA).xlsx
2017-12-12 North Pole - Section 3 - NOx_F (GVEA).xlsx
2017-12-12 North Pole - Section 5 - SO2_F (GVEA).xlsx
2017-12-12 Zehnder - Section 1 PTE_F (GVEA).xlsx
2017-12-12 Zehnder - Section 3 NOx_F (GVEA).xlsx
2017-12-12 Zehnder - Section 4 PM_F (GVEA).xlsx
2017-12-12 Zehnder - Section 5 SO2_F (GVEA).xlsx
2018-11-26 A01_North Pole - Section 1 - PTE_F_181121_(GVEA).xlsx
2018-11-26 A04_FuelPrices_1810 (GVEA).xlsx
2018-11-26 A05a_North Pole - Section 5 - SO2_F_181121_ADEC_(GVEA).xlsm
2018-11-26 A05b_Zehnder - Section 5 - SO2_F_181121_ADEC_(GVEA).xlsx
2019-11-13 North Pole - Section 3 - NOx_F (ADEC).xlsx
2019-11-13 North Pole - Section 4 - PM_F (ADEC).xlsx
2019-11-13 North Pole Power Plant SO2 Controls Economic Analysis (ADEC).xlsx
2019-11-13 Zehnder Power Plant SO2 Controls Economic Analysis (ADEC).xlsx
2019-11-13 Zehnder SCR+Water Injection Economic Analysis (ADEC).xlsx

- Aurora Chena Aurora BACT Documents

1990-08 NSPS ICI SO2 RE.pdf

2017-03 Aurora BACT Report.pdf

2017-11-16 ADEC BACT Comment Letter to Aurora.pdf

2017-11-16 ADEC Request for Additional Information for Chena Power Plant BACT Analysis.pdf

2017-11-16 EPA Comments on Aurora BACT 111517.pdf

2017-11-16 Voluntary BACT Analysis Letter Aurora 042415.pdf

2017-12-22 Aurora Response to ADEC BACT Information Request 1.pdf

2017-12-22 ERM Final BACT Addendum for Aurora.pdf

2018-09-10 ADEC Request for Additional Information for Chena Power Plant BACT Analysis.pdf

2018-09-13 ADEC BACT Comment Letter to Aurora.pdf

2018-09-13 EPA Comments on ADEC BACT Analysis for Aurora 052118.pdf

2018-11-01 Aurora BACT Proposal No. 1899-R1.pdf

2018-11-01 Aurora General Arrangement Photo.pdf

2018-11-01 Aurora Preliminary Opinion of Probable Cost with attachments.pdf

2018-11-01 Aurora Preliminary Opinion of Probable Cost.pdf

2018-11-01 Aurora Response to ADEC BACT Information Request 2 with enclosures.pdf

2018-11-01 Aurora Response to ADEC BACT Information Request 2.pdf

2018-11-01 Aurora_DSI_Opinion_of_Probable_Cost_rev0.pdf

2018-11-01 CDS v SDA Cost Comparison for Aurora.pdf

2018-11-01 ICI Boilers 20081118 final_revised-Jan2009.pdf

2018-11-01 NSPS ICI SO2 RE.pdf

2018-11-01 ufc_3_701_01_c1_2018.pdf

2018-11-19 Aurora Proposed BACT Alternative with Appendices.pdf

2018-11-19 Aurora Proposed BACT Alternative.pdf

2019-05-10 Appendix A.pdf

2019-05-10 Appendix B.pdf

2019-05-10 Appendix C.pdf

2019-05-10 Appendix D.pdf

2019-05-10 Aurora Attachments OCR.pdf

2019-05-10 Public Notice Chena BACT Determination.pdf

2019-07-26 AE Comments on Draft SIP.pdf

2019-07-26 BACT Analysis Addendum - Ind Eng Eval_Final_20.pdf

2019-07-26 David Fish e-mail Aurora Energy, LLC's Comments on Draft SIP.pdf

2019-07-26 David Fish e-mail Usibelli Coal Mine, Inc. Comments on Draft.pdf

2019-07-26 UCM Comments on Draft SIP.pdf

2019-11-13 Chena Power Plant Response to Comments.pdf

2019-11-13 Final Chena BACT Determination.pdf

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2017-03 Aurora NOx cost calcs FINAL.XLSX
2017-03 SO2 cost calcs - LSFO - CUECOST3.xlsx
2017-12-22 FINAL-CUECost Calculator.xlsx
2017-12-22 FINAL-DSI Cost Calculator.xlsx
2019-11-13 Chena SCR Economic Analysis ADEC.xlsm
2019-11-13 Chena SNCR Economic Analysis ADEC.xlsm
2019-11-13 Chena SO2 Controls Economic Analyses.xlsx

Fairbanks North Star Borough Evaluation of Electrostatic Precipitators as Retrofit Devices

- Formation Mechanisms and Physical Properties of Particles from Wood Combustion for Design and Operation of Electrostatic Precipitators
- 2-Year Field Monitoring of Electrostatic Precipitators for Residential Wood Heating Systems
- Weston Solutions OekoTube Test Report
- Report on Testing of an Installation of Type "OekoTube OT-2" for Removing Dust from Flue Gases of Domestic Stoves
- Fairbanks North Star Borough Ordinance No. 2018-20-1G Appropriating $458,000 from General Fund Balance to the Transit Enterprise Projects Fund for Wood Stove/Pellet Stove Retrofit Emissions Control Device Testing

Fairbanks North Star Borough Ordinances

- Fairbanks North Star Borough Ordinance No. 2015-01 An Ordinance Amending Chapter 8.21 of the FNSB Code of Ordinances Regarding the PM2.5 Air Quality Control Program, Amending 2.48.120 regarding the Air Pollution Control Commission's Duties, and Amending 1.04.050 Regarding the Fine Schedule to Add Violations of the PM2.5 Air Quality Control Program
- Fairbanks North Star Borough Ordinance No. 2016-21 An Ordinance Amending FNSB 8.21.025 to Require the Removal of Certain Unlisted Hydronic Heaters in the Air Quality Control Zone, Amending the FY 2015-16 Budget by Appropriating $500,000 from the General Fund Fund Balance to the Transit Enterprise Projects Fund to Pay for the Removal of the Unlisted Hydronic Heaters and Suspend all Other Payments from the Voluntary Removal and Replacement Program until May 1, 2017
- Fairbanks North Star Borough Ordinance No. 2016-37 An Ordinance Amending Title 21

Regarding No Oher Adequate Source of Heat Determinations

- Fairbanks North Star Borough Ordinance No. 2017-18 An Ordinance Amending Chapter 21.28 FNSBC regarding the PM2.5 Air Quality Control Program and Amending FNSBC 1.20.080, Fine Schedule

- Fairbanks North Star Borough Ordinance No. 2017-44 An Ordinance Amending Chapter 21.28 FNSBC Regarding the PM2.5 Air Quality Control Program, Amending Title 4 Regarding Air Pollution Control Commission Duties, Amending FNSBC 1.20.080, Fine Schedule, and Amending Appendix E – User Fee Schedule/Transportation of Ordinance No. 2017-20 (FY 2017-18) to Add Permit Application Fees for Solid Fuel Burning Appliance in New Construction

- Fairbanks North Star Borough Ordinance No. 2018-04 An Ordinance Amending Chapter 21.28 FNSBC Regarding Criteria for No Other Adequate Source of Heat Determinations and Amending Borough Listed Appliances

- Fairbanks North Star Borough Ordinance No. 2018-26 An Ordinance Amending Chapter 21.28 FNSBC to Add Definitions and Standards for Retrofit Control Devices, Including Electrostatic Precipitators

- Fairbanks North Star Borough Ordinance No. 2018-54 An Ordinance Amending Chapter 21.28 FNSBC Regarding Air Quality Control Program, FNSBC 1.20.080 Fine Schedule, and Chapter 4.12 FNSBC Regarding Air Pollution Control Commission

2020 SIP Amendment

Content

2020 Evidence of Implementation of Moderate and Serious SIPs Control Measures

2020 Amendment SIP Control Measures Analysis

Electrostatic Precipitators (ESP) Summary Reports

2020 Amendment Revised Cost Effectiveness Analysis Spreadsheet

Cost Effectiveness Analysis of Charbroilers Spreadsheet

2020 Evidence of Implementation of Moderate and Serious SIP Control Measures

Under the Clean Air Act (CAA) Section 189(d), pursuant to 40 Code of Federal Regulations (C.F.R.) § 51.1003(c)(1)[1], the Environmental Protection Agency (EPA) requires a Serious nonattainment area that fails to attain the 24-hour fine particulate matter ($PM_{2.5}$) standard to submit a revised attainment plan that demonstrates that each year the area will achieve at least a 5 percent reduction in emissions of direct $PM_{2.5}$ or a 5 percent reduction in emissions of a $PM_{2.5}$ plan precursor based on the most recent emissions inventory for the area. The detailed information on how the revised attainment plan meets the 5 percent reduction in emissions can be found in the control strategy section. This report is developed to show the commitments of the state to the continued implementation of Moderate Area SIP control measures, and the implementation of the Serious SIP control measures since the Alaska Department of Conservation (DEC) submitted the Serious SIP and the area failed to attain by December 31, 2019.

As indicated in Table 1 below, the implementation of all the Moderate SIP Control Measures is ongoing except the expanded availability of plug-ins, DOT anti-idling and diesel emission reductions, and DEC diesel emission reduction efforts that have been completed. These completed control measures will not be discussed herein. Table 2 shows the 2020 Adopted Serious SIP control measures.

Table 1
Moderate SIP Control Measures

Control Measure/Program	Voluntary Measure	Status	
		Implemented	On-going
Space Heating and Solid Fuel Heating Controls			
Solid Fuel-Fired Heating Device Upgrades	X	X	X
Solid Fuel-Fired Heating Device Emission Standards		X	X
Improving Solid-Fuel Device Operations	X	X	X
Reduced Use of Solid Fuel Heating During Air Pollution Episodes (Curtailment)		X	X
AHFC Energy Programs	X	X	X
Expanded Availability and Use of Natural Gas	X	X	X
Required Replacement of Non-Certified Wood Heating Devices When Properties are Sold (Contingency Measure)		X	X
Enhanced Dry Wood Compliance: Registration of Wood Sellers and Moisture Content Disclosure (Contingency Measure)		X	X
Transportation Control Strategies			
Expanded Availability of Plug-Ins	X	X	Completed
Mass Transit System	X	X	X
DOT Anti-Idling and Diesel Emission Reductions	X	X	Completed

[1] 40 CFR 51.1003

ADEC Diesel Emission Reduction Efforts	X	X	Completed
Federal Diesel Emission Reduction Programs		X	X
Federal Motor Vehicle Control Program		X	X
Open Burning			
Winter Season Open Burning Ban		X	X
Point Source Controls			
Reasonably Achievable Control Technology		X	X
New Source Review Permit Program		X	X

Table 2
2020 Adopted Serious SIP Control Measures

Control Measure/Program	Status	
	Implemented	On-going
Space Heating and Solid Fuel Heating Controls		
Solid Fuel-Fired Heating Device Upgrades	X	X
Solid Fuel-Fired Heating Device Emission Standards (Device Requirements)	X	X
Improving Solid-Fuel Device Operations (Fuel Requirements)	X	X
Reduced Use of Solid Fuel Heating During Air Pollution Episodes (Curtailment)	X	X
Real Estate Requirement and Date Certain Removal	X	X
Wood-Fired Heating Device Registration	X	X
Expanded Availability and Use of Natural Gas	X	X
Transportation Control Strategies		
Mass Transit System	X	X
Federal Diesel Emission Reduction Programs	X	X
Federal Motor Vehicle Control Program	X	X
Small Commercial Sources		
Small Source Information and Requirements	X	X
Open Burning		
Winter Season Open Burning Ban	X	X
Point Source Controls		
Best Available Control Technology	X	X

Solid Fuel-Fired Heating Device Upgrades

The Wood Stove Change-Out Program (WSCOP) or Fairbanks North Star Borough (FNSB) Enhanced Voluntary Removal Replacement & Repair Program, which was started in 2010, is a voluntary incentivized control measure identified in the Moderate Area SIP. This ongoing control measure, reinforced with funds from the Targeted Air Shed (TAS) Grants, is aimed at upgrading or removing solid fuel-fired heating devices to provide immediate and long-term reductions of $PM_{2.5}$ emissions in the nonattainment area.

Borough Ordinance 2015-73 adopted January 14, 2016[2], limits the change-out program to the

[2] Fairbanks North Sate Borough Ordinance No. 2015-73, adopted January 14, 2016

air quality control zone and sets emission limits for solid fuel-fired heating devices installed as part of the change out program. Borough ordinance 2017-44, adopted June 19, 2017[3], requires that a Borough listed vendor/installer properly installs a qualified appliance. The ordinance also requires that the wood and pellet stoves in the nonattainment area must be EPA-certified and have annual average $PM_{2.5}$ emission rating of 2.0 grams per hour or less. Hydronic heaters must be pellet-fired, EPA-certified, and have an emission rate of 0.10 pounds per million BTU or less.

Similarly, the requirements in the TAS Grant, as stated in the revised FY-16 work plan[4], require an average emission level of 0.10 pounds per million BTU and particulate matter annual average emission limit of 2.0 grams per hour. In addition, the FY-17 TAS Grant, which prioritizes the conversion of solid fuel heating devices (SFHDs) used as primary, secondary, or emergency backup heating sources to non-SFHDs, as well as the FY-18 TAS Grant, help with the removal of SFHDs from the nonattainment area, which results in long-term reductions of $PM_{2.5}$ emissions. Replacement options include oil heater, electric heater, natural gas device, or propane heaters, and emergency power backup systems.

The DEC regulation 18 AAC 50.077(i), adopted on January 8, 2020, in consistency with the Borough ordinance 2017-44, requires the owner or operator of a wood-fired heating device to ensure that the device or any retrofit control devices are properly sized and professionally installed.

Tables 1 and 2 below show the eligible devices and replacements, and replacement options and emission limits, respectively, as spelled out in the revised FY-16 TAS work plan.

Table 3. Eligible Devices and Replacements

Device Type	Eligibility Requirement		Replacement Option
Hydronic Heater	All Wood or Coal Hydronic Heaters		1,2,3,4,5,6,7,8
Wood or Coal Stove	Non EPA-Certified	EPA-Certified $\geq$ 2.5 g/hr (new device must also be less than half of old device emission rating)	1,2,4,5,6,7,8
	EPA-Certified Wood Stove (Repair)		9,10
Fireplace	All Fireplaces		1,2,3,4,5,6,7,8

[3] Fairbanks North Sate Borough Ordinance No. 2017-44, adopted June 19, 2017
[4] Revised FY-16 TAS Work Plan

Table 4. Replacement Options and Emission Limits

Replacement Option			Emission Limit
1	EPA-Certified	Catalyst – Equipped Wood Stove or Catalyst-Equipped Insert	≤ 2.0 g/hr
2	EPA-Certified	Pellet Stove or Insert	≤ 2.0 g/hr
3	EPA-Certified	Pellet Hydronic Heater	≤ 0.10 lbs/mmBtu
4	Home Heating Oil Heater		
5	Hot Water District Heat		
6	Electric Heater		
7	Natural Gas Device		
8	Propane Device		
9	Catalytic Converter Repair		
10	Other Emission Reduction System Component Repair		

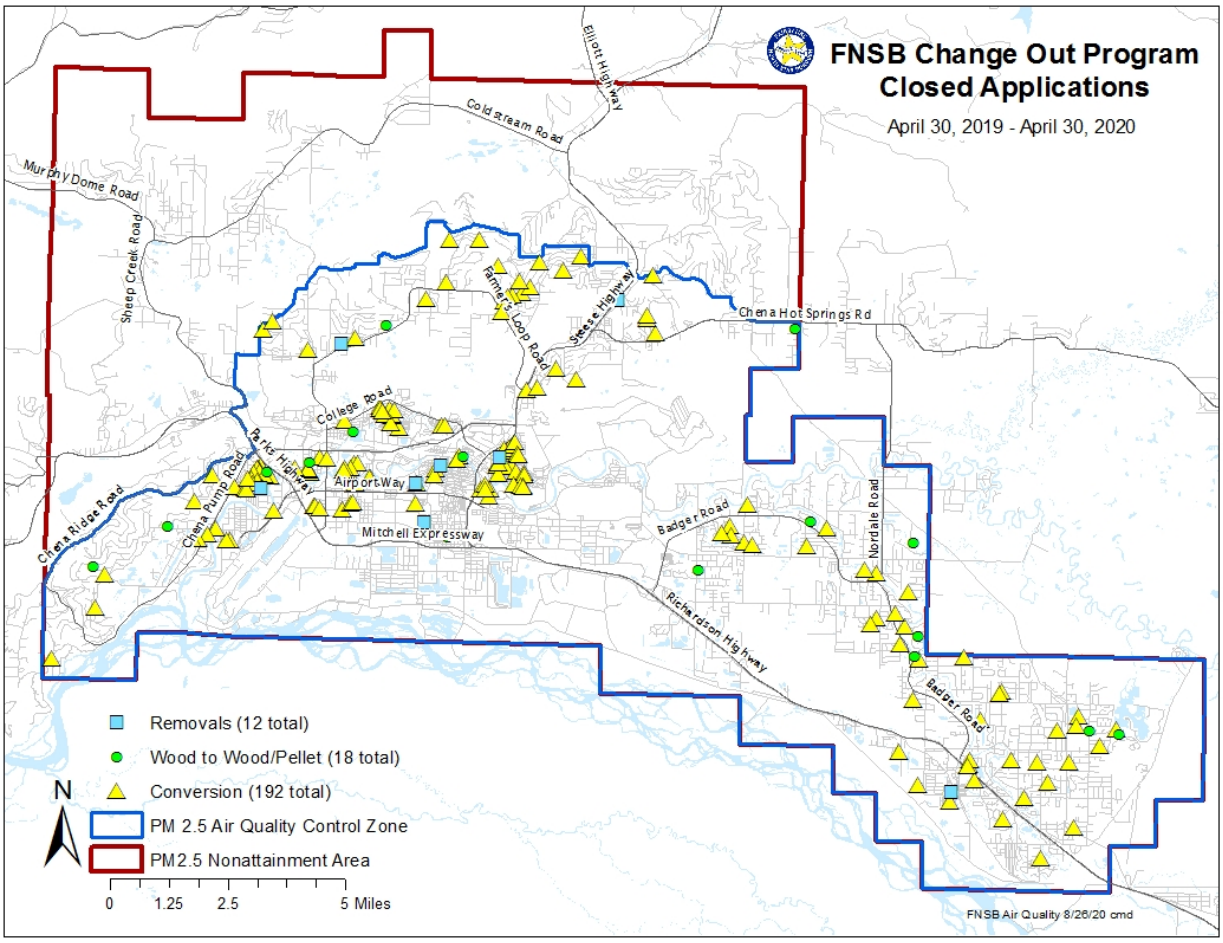
As of April 30, 2020, a total of 383 change outs have been completed with funds from both FY-16 TAS and FY-17 TAS; 226 change outs from the FY-16, and 157 change out from the FY-17.[5,6,7] However, as displayed in Table 3, a total of 2860 change outs have been completed; 100 more than the 2,760 change-outs required by the Moderate Area SIP. Figure 1 provides a map of the locations of change outs or heater removals throughout the nonattainment area from April 30, 2019 through April 30, 2020.

[5] Wood Stove Change Out Program 2019-2020 Brief Statistics
[6] FY-16 TAS-01 2019 1st Quarter Report
[7] FY-17 TAS-01 2019 1st Quarter Report

Table 5. Woodstove Change-Out Statistics

Woodstove Change Out Statistics (as of 4/30/2020)				
	Total Devices Removed, Replaced, or Repaired			
Device Type	**Previous Total**	**Between 4/30/2019 – 4/30/2020**	**Total**	**Percentage of Total Change outs**
Replace Solid Fuel Burning Device	1,925	103	2,028	70.91%
Replace Hydronic Heater (HH)	86	11	97	3.39%
Removal of SFBA (not replaced)	237	10	247	8.64%
Removal of Hydronic Heater (not replaced)	110	2	112	3.92%
Repairs to EPA certified Devices	75	2	77	2.69%
Fireplace Replacements	203	96	299	10.45%
Total	**2,636**	**224**	**2,860**	100%

Figure 1. Map of the locations of change outs or heater removals throughout the nonattainment area.



Solid Fuel-Fired Heating Device Emission Standards (Device Requirements)

To ensure continued commitments to the Moderate Area SIP control measures, and implementation of the best available control measures (BACM) in the Serious Area SIP, the state, on January 8, 2020, adopted by reference, regulations in 18 AAC 50.077 that require all the new solid heating devices being sold or installed in the Fairbanks $PM_{2.5}$ nonattainment area to be DEC-approved and meet the emission standards displayed in Table 6 below. No one may install or reinstall, sell, lease, distribute, or convey a wood-fired hydronic heater, a woodstove, and a wood-fired heating device with a manufacturer-rated heat output of 350,000 Btu per hour or more. Residents are advised to contact DEC staff if a wood-heating device with a manufacturer-heated output of less than 350,000 Btu/hr meets the emission standards in 18 AAC 50.077 but does not appear on the list. On September 1, 2020, DEC removed all devices that do not meet the DEC regulatory requirements in 18 AAC 50.077(c)(3)(ii) from the Approved Device Lists. This requirement states that no valid test run measurement, from the device's certification report, may exceed 6.0 grams per hour. Device reports that exceed this number, have not reported a value, have reported the value in incorrect units, or where the certification report cannot be found, have been removed from the list. The DEC-approved new install device lists can be

found on the solid fuel-fired heating device standards & requirements web page at found at: https://dec.alaska.gov/air/burnwise/standards/

Table 6. DEC 2020-Adopted Emission Standards for New Heating Devices in the Fairbanks Nonattainment Area

Device Type	$PM_{2.5}$ Emission Standard
Woodstoves < 350,000 Btu/hr	2.0 grams/hour
Pellet-Fueled Woodstoves < 350,000 Btu/hr	2.0 grams/hour
Only Pellet-Fired Hydronic Heaters < 350,000 Btu/hr	0.10 lbs/mmBtu

However, existing or currently installed devices on the lists of DEC-exempt wood stoves are exempt from the requirement to remove or replace upon the sale, lease, or conveyance of the property where the devices are installed (see the real estate requirement section for details).

18 AAC 50.077 requires DEC to review certification reports prior to being placed on the DEC-approved list previously mentioned. 18 AAC 50.077(c) identifies 2.0 g/hr as the emission rate used as a requirement for cordwood stoves and pellet fueled stoves, as well as an additional emission requirement that the 1-hr filter pull from the EPA certification test shall not exceed 6.0 g/hr (starting September 1, 2020), that EPA certification is required, and that the certification from EPA will be reviewed by DEC and only approved if the underlying certification test results are accepted. 18 AAC 50.077(e) allows DEC to review manufacturer test results and place a model on DEC's list of devices, which identifies devices that are allowable under 18 AAC 50.077. DEC has been implementing this requirement as evidenced by the following actions:

A website was constructed to serve as the information hub for: regulations, device lists, certification review results, official correspondence, and explanation of regulatory process, which can be accessed at: https://dec.alaska.gov/air/burnwise/manufacturers-vendors/

A letter to device vendors was sent December 16, 2019 notifying vendors of the new emission standards. A letter to device manufacturers was sent February 21, 2020, notifying device manufacturers of the new emission standards and certification review process. Follow-up letters clarifying the process were sent to device manufacturers on June 1, 2020, and July 30, 2020.

The certification review process began in early 2020 and results were posted on DEC's website by September 1, 2020. Preliminary review of the certification reports is shown in Tables 7 and 8. Those devices that have certification test results that failed to meet both of the state's emission standards were removed from the approved device list on September 1. DEC is providing additional time for manufacturers to clarify and resolve other report deficiencies identified during the review of the certification test reports and has provided a process and timeline to rectify concerns prior to disapproval of the affected heating unit.

Table 7 Preliminary Review of Pellet Appliance Certification Reports

Pellet Appliances	
Number of reports reviewed	79
Number of appliances disapproved due to 2.0 g/hr emission limit	0
Number of appliances disapproved due to 1 hr filter pull (missing or over limit)	12
Number of reports with deficiencies	79
Number of approved reports	0
Number of flagged issues with reports	1,319

Table 8 Preliminary Review of Cordwood Appliance Certification Reports

Cordwood Appliances	
Number of reports reviewed	128
Number of appliances disapproved due to 2.0 g/hr emission limit	9
Number of appliances disapproved due to 1 hr filter pull (missing or over limit)	51
Number of reports with deficiencies	128
Number of approved reports	0
Number of flagged issues with reports	2,658

Improving Solid Fuel-Fired Heating Device Operations

Improving the operations of solid fuel-fired heating devices was one of the voluntary measures identified in the Moderate SIP. To achieve this, the Borough and DEC developed a number of measures, including public education, incentives for the use of wood pellets or energy logs, regulations addressing visible emissions from stacks, and the use of appropriate fuels in solid fuel-fired heating devices. The extensive public outreach is intended to encourage residents to employ the best burning practices when using wood heating devices, protect themselves, and to reduce $PM_{2.5}$ emissions in Fairbanks nonattainment area. Examples of the public outreach include the ‘’Split, Stack, Store, & Save” campaign and the repealed Voluntary Burn Cessation Program (VBCP). The education outreach, which is tailored to the individual needs, is propagated through TV/YouTube ad topics, Radio ad topics, web-based outreach, print-based media, public presentations, events, and other outreach methods. Information on the best burning practices can be found on DEC website at: https://dec.alaska.gov/air/burnwise/

The DEC programs and regulations ensure that wood heating devices are being operated properly in the Fairbanks nonattainment area. To ensure the continued commitment to the Moderate SIP control measure and the implementation of the Serious SIP BACM, the DEC adopted regulation 18 AAC 50.075(f) on January 8, 2020. The regulation requires that visible emissions shall not cross property lines, and the emissions must not exceed 20% opacity for more than six minutes in any one hour, except during the first 15 minutes after initial firing of the device, when the opacity limit must be less than 50%.

Also, to further support the efforts to reduce emissions through the proper operation of solid fuel-fired devices inside the nonattainment area, the State regulation, 18 AAC 50.076, as amended through September 15, 2018, requires individuals to use the appropriate fuel in their device and use of dry wood (20% moisture content or less) in the winter months (between October 1 and March 31 of every year). However, effective October 1, 2021, the DEC regulation 18 AAC 50.076 will require the sale of only dry wood in the nonattainment area further limiting access to wet wood.

Reduced Use of Solid Fuel-Fired Heaters during Air Pollution Episodes

Before the passage of Prop 4 on October 2, 2018, FNSB worked with DEC to forecast daily air quality during the winter and issued curtailments for the use of wood-fired heating devices in the Fairbanks nonattainment area on days projected to have poor dispersion and higher $PM_{2.5}$ concentrations. To ensure continued implementation of the Moderate Area SIP control measure and the commitments to the Serious SIP's Fairbanks Emergency Episode Plan and regulations governing curtailment announcement after the passage of Prop 4, DEC issued the curtailment alerts for both the 2018/2019 and 2019/2020 winter seasons. Through outreach methods, which includes online sign-up electronic notification, local media outlets (TV, radio) and the Division's Curtailment and Alerts web page at: http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-curtail-alert/, DEC notifies the public about air quality alerts, episodes, and exemptions. Exemptions from a curtailment included in an announcement may consist of areas experiencing power outages and residents who have temporary waivers. Exceptions to individual episodes may also include exceptions based on the class or type of device or based on a device's particulate emission rates. Table 9 below displays the DEC air quality episode thresholds and exceptions for the 2019/2020 winter season.

Table 9. DEC Air Quality Episode Thresholds and Exceptions

Episode Feature	Stage 1 Air Alert	Stage 2 Air Alert
PM2.5 Threshold, micrograms per cubic meter, ($\mu g/m^3$)	20	30
Exceptions During a Power Outage	Yes	Yes

There are two Stages (Stage 1 and Stage 2) of air alerts issued and different exceptions for burning curtailment associated with each Stage. Tables 7.12-5 and 7.12-6 of the Serious SIP Section III.D.7.12 Emergency Episode Plan display the detailed breakdown of the criteria and length requirements for temporary NOASH exceptions/waivers and temporary Stage 1 waivers, respectively.

Below are the regulations that are also triggered by the declaration of an air episode:

- 18 AAC 50.075 (d) – (e)

(d) A person may operate a solid fuel-fired heating device in an area for which the department has declared a PM-2.5 air quality episode under 18 AAC 50.246 or under emergency episode provisions included in a local air quality plan incorporated in the *State Air Quality Control Plan*, adopted by reference in 18 AAC 50.030, only if

(1) visible emissions or opacity from the solid fuel-fired heating device is below the opacity limits identified in the episode announcement for that area as defined in the *State Air Quality Control Plan*, adopted by reference in 18 AAC 50.030; or

(2) the owner or operator of the solid fuel-fired heating device obtains a written temporary waiver from the department or local air quality control program from the opacity limits identified in the episode announcement; the department or local air quality program may grant a temporary waiver after considering

(A) financial hardship information provided by the owner or operator;

(B) technical feasibility information provided by the owner or operator;

(C) potential impact to locations with populations sensitive to exposure to PM-2.5; locations under this subparagraph include hospitals, schools, child care facilities, health clinics, long-term care facilities, assisted living homes, and senior centers;

(D) mitigation measures implemented by the owner or operator to prevent adverse health impacts to individuals sensitive to exposure to PM-2.5; and

(E) the contribution of the device to the exceedance of the PM-2.5 concentration triggering the episode announcement.

(3) the department has not prohibited operation under 18 AAC 50.075(e).

(e) The department may prohibit operation of a solid fuel-fired heating device in an area for which the department has declared a PM-2.5 air quality episode under emergency episode provisions included in a local air quality plan incorporated in the *State Air Quality Control Plan*. The declaration must specify:

(1) the air quality control zone affected by the prohibition;

(2) any applicable exceptions to the prohibition; and

The lowering of the Stage 1 alerts from 25 $\mu g/m^3$ to 20 $\mu g/m^3$, and Stage 2 alerts from 35 $\mu g/m^3$ to 30 $\mu g/m^3$ were included as Serious SIP control measures and implemented by DEC starting on January 8, 2020, the effective date of the revised state regulation. Based on these thresholds, DEC, under the provisions of 18 AAC 50.246, declared air episodes at the more restrictive levels in the FNSB nonattainment area for the remainder of the 2019/2020 winter season. For the 2019/2020 winter season, DEC issued waivers that all expired on April 1, 2020; below are the eligibility requirements for a temporary No Other Adequate Source (NOASH) waiver and a temporary Stage 1 waiver:

Winter 2019-2020 Temporary Waiver No Other Adequate Source of Heat (NOASH)

Eligibility

1) The subject structure must be heated and the structure has no adequate heating source without using solid fuel burning appliances (SFBA);

2) Economic hardship requires use of the SFBA;
3) Complying with the restriction would result in damage to properly including damage to the appliance itself and its heating components;
4) The device is located within the nonattainment area.

To request a NOASH waiver based on economic hardship, a documentation of hardship showing approval for assistance from a list of agencies or programs that provide economic assistance must be provided.

Criteria/documentation needed

1) Documentation that all solid fuel-fired devices located on the property meet State Standards: EPA certified AND 2.5 g/hr rated capacity or 0.32 Ibs/million BTU or less.
2) If device is equipped with a catalyst, proof that the catalyst has been maintained in accordance with the manufacturer recommendations or specifications (If applicable).
3) Documentation/date of last chimney sweep (must be written the past 12 months).
4) Documentation of ability to properly store wood.
5) Location (address) of devices(s).
6) Taken class or training in proper wood burning techniques.

Winter 2019-2020 Temporary Stage 1 Waiver

Eligibility

1) The solid fuel-fired device must be State-listed and EPA-certified with an emissions rating of 2.5 g/hr or less;
2) Masonry heaters and cook stoves may apply for Stage 1 waiver and, if the waiver is granted, continue to use their appliance(s).
3) The device is located within the nonattainment area.

Criteria/documentation needed

1) Documentation that all solid fuel-fired devices located on the property meet State Standards: EPA certified AND 2.5 g/hr rated capacity or 0.32 Ibs/million BTU or less.
2) If device is equipped with a catalyst, proof that the catalyst has been maintained in accordance with the manufacturer recommendations or specifications (If applicable).
3) Documentation/date of last chimney sweep (must be written the past 12 months).
4) Documentation of ability to properly store wood.
5) Location (address) of devices(s).
6) Taken class or training in proper wood burning techniques.

There are a few additional eligibility and documentation requirements for the forthcoming 2020/2021 winter season. Detailed information can be found on the curtailment waiver and exception applications web page at: https://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-nonattainment-curtailment-waivers-and-exceptions/.

During the 2019/2020 winter season, as shown in Table 10, DEC called a total of 24 Stage 1 alerts (15 in North Pole and 9 in Fairbanks) and 34 Stage 2 alerts (25 in North Pole and 9 in

Fairbanks). As shown in Table 11, DEC issued a total of 51 NOASH waivers and 25 Stage 1 waivers. A total of 105 violations was observed for the two Stages for which a total of 99 advisory/compliance letters was sent, as shown in Table 12.

Table 10. Number of Stage restrictions called by DEC during 2019/2020 heating season

Number of Alert Restrictions Called	Stage 1	Stage 2
North Pole:	15	25
Fairbanks:	9	9
Total:	24	34

Table 11. Burn restriction waivers issued by DEC during 2019/2020 heating season

Burn Restriction Waivers Issued	
DEC NOASH Waivers:	51
DEC Stage 1 Waivers:	25
Total:	76

Table 12. Number of Stage violations and advisory/compliance written by DEC 2019/2020 heating season

Violations of Alert Restrictions	
Observed:	105
Advisory/Compliance Letters Sent:	99

DEC is implementing the revised waiver requirements found in Section III.D.7.12 of the Serious SIP for the upcoming 2020/2021 winter season. DEC has also developed an electronic process to provide residents with a mechanism to apply for waivers online and to assist DEC in efficiently managing and maintaining its records related to waiver requests.

AHFC Energy Programs

The Alaska Housing Finance Corporation (AHFC) energy programs have continued to be implemented in the Fairbanks nonattainment area since DEC adopted them as a voluntary measure under the Moderate SIP. Currently, AHFC offers energy efficiency interest rate reduction (EEIRR) program, home energy loan program, and weatherization program.[8] These programs are designed to make homes more energy efficient. As homeowners make energy efficiency improvements, they reduce the amount of fuel and electricity needed for power and heat leading to corresponding air quality benefits due to the reduced fuels being burned for space heating and power generation.

[8] https://www.ahfc.us/efficiency/energy-programs

Under the EEIRR program, AHFC offers interest rate reductions when financing new or existing energy efficient homes or when borrowers make energy improvements to an existing home. Any property that can be energy rated, and otherwise eligible for Alaska Housing financing may qualify for the program.

Under the Home Energy Loan, borrowers may obtain financing to the maximum of $30,000 with a maximum loan term of 15 years. There is a list of energy upgrades from which borrowers can select, and the energy audit of their homes must be performed by an AKWarm Certified Energy Rater. All improvements are required to be completed within 365 days of loan closing.

Individuals who meet income limits are eligible to apply for the AHFC Weatherization at No-cost Program. Local weatherization providers provide program services at no cost to qualified homeowners and renters including single and multifamily homes, mobile homes, apartments, and condominiums. The Weatherization at No-cost Program provides low- and moderate-income households with improvements to their homes which increase the energy efficiency of their dwelling, including measures such as:

- Air sealing attics, crawlspaces, etc.
- Insulating and weather stripping
- Repair and replacement of heating systems
- Replacement of doors and windows
- Installation of fans, smoke alarms, CO detectors

Expanded Availability and Use of Natural Gas

The Moderate Area SIP identified the increase in the availability and use of natural gas as a key to long term reduction of fine particulate matter air pollution in the Fairbanks nonattainment area. Ever since, the State has been committed to expanding the availability of the affordable, cleaner burning fuel options within the nonattainment area. The Interior Energy Project was initiated through legislative action in 2013 to provide the financial tools needed to expand natural gas availability in the Fairbanks and North Pole areas.

The project was initially established through Senate Bill 23, which passed the Alaska Legislature unanimously in April 2013. The legislation authorized the Alaska Industrial Development and Export Authority (AIDEA) to provide the financing package to partner with the private sector for a liquefied natural gas (LNG) plant to supply gas to the Interior and a natural gas distribution system in Fairbanks and North Pole. House Bill (HB) 105 was passed by the Alaska Legislature in 2015 to renew and advance the Interior Energy Project.

The Interior Energy Project included a financial package to act as a catalyst for AIDEA and private-sector partners to finance and develop the supply and delivery of natural gas to Interior Alaska. The initial financing package included a $57.5 million appropriation from the Sustainable Energy Transmission Supply and Development Fund (SETS) to serve as the State's equity stake in the project, low-interest SETS loans, coupled with State-backed AIDEA bonds. The project also leverages previous legislation that provided up to $15 million in natural gas

storage credits for each qualifying LNG storage tank. The components of the state financing project include:

Sustainable Energy Transmission & Supply Development Program (SETS)
- $57.5 million appropriation to directly reduce LNG cost.
- $125 million SETS capitalization to provide optimal commercial structure at 3 percent interest.

AIDEA Bonds
- Authorized for $150 million to provide low-cost capital for the distribution system build out at an anticipated 3 to 4.5 percent interest rate.

Existing Natural Gas Storage Credits
- $15 million per qualifying storage tank to directly reduce the customer utility price.

In 2012, the Interior Gas Utility (IGU) was formed by the borough and municipal governments to oversee the development of a natural gas distribution network to provide service to the Fairbanks and North Pole area. The IGU is a public corporation whose mission is to provide low cost, clean burning, natural gas to the largest number of customers in the Fairbanks North Star Borough as soon as possible.

On September 21, 2017, the AIDEA Board considered and approved a development plan that met the requirements of HB 105. Reaching this milestone provided the Authority access to the remaining IEP financial tools. AIDEA continued to advance IEP goals by pursuing consolidation of the existing natural gas utility infrastructure owned by AIDEA, under Pentex Alaska Natural Gas Company, LLC (Pentex), with infrastructure owned by the IGU.

The overall IEP effort has the following project components: gas supply, liquefaction, transportation, distribution (including storage and regasification), and conversions. In 2015, there was a significant local build out of piped infrastructure for the distribution system in preparation for expanded service into previously unserved areas of Fairbanks and North Pole. The IGU projections estimate new customers will begin to convert to natural gas in the FY2020 timeframe.

On December 20, 2019, the Fairbanks Natural Gas, which is a part of the IGU following the 2018 merger, informed the Regulatory Commission of Alaska that the new 5.25 million-gallon LNG storage facility in Fairbanks has gone into operations. IGU has also embarked on the construction of new LNG storage facilities in North Pole to enable a new gas supply to customers in that region.[9] The North Pole Storage project has a target completion of the summer 2020.

The most recent IGU quarterly report (April 2020) documents progress on all of the components of the Interior Energy Project (IEP) effort, including supply, liquefaction, transportation, distribution and conversions. While progress in each of these categories is relevant to the goal of expanding natural gas service in Fairbanks and North Pole, key actions completed include:

[9] https://www.petroleumnews.com/pntruncate/553473193.shtml

- Construction on the Fairbanks 5.25 million-gallon LNG storage tank was completed and service to the public became available on December 18, 2019.
- Design on the engineering for the North Pole LNG receipt, storage and re-gas facility are complete. Construction was divided into two phases: Ground Improvement and Site Infrastructure. The target date for the infrastructure is the end of September 2020, but the project is being impacted by the COVID-19 pandemic.
- Conversions – the original forecasts were based on the Cardno Enxtrix *Interior Energy Project Natural Gas Conversion Analysis*, finalized in January 2014. Those estimates, however, were updated to reflect more conservative rates of customer conversion based on lower fuel oil prices. Efforts to address homeowner concerns about the cost of financing have focused on securing low-cost loan funds via HB 374 approved on May 12, 2018.

In November 2019, the FNSB Assembly appropriated $1 million for residents to convert from oil to natural gas or propane burning appliances in a continuing effort to improve air quality in the Borough's non-attainment areas. As of September 2020, funds have been expended for 19 changeouts and 1 conversion. An additional 58 change outs and 2 conversions are currently encumbered and applications are pending for an additional 50 changeouts and 1 conversion. The remaining funds are sufficient for up to 5 additional changeouts. Overall, this program, will result in a total of roughly 135 oil to gas conversions. The depletion of available funds has forced the Borough to take down the application website as there is continuing public interest in the program. The schedule for completion of these conversions depends on the weather and when the ground freezes in 2020, all conversions should be completed by the summer of 2021 and available for the 2021/22 winter heating season. The Interior Gas Utility (IGU) has been working in parallel to the Borough by digging and putting in lines to satisfy the backlog of Borough funded conversions and pending owner conversion applications. They plan to continue those efforts until the ground freezes this winter and then add additional lines in the coming years.

Required Replacement of Non-Certified Wood Heating Devices When Properties are Sold and Date Certain Removal

Section 172(c)(9) of the CAA requires nonattainment plans to "provide for the implementation of specific measures to be undertaken if the area fails to make reasonable further progress, or to attain the national primary ambient air quality standard by the (applicable) attainment date …" As such, due to the reclassification of the Fairbanks nonattainment area to a Serious nonattainment area, effective June 9, 2017, the contingency measure in 18 AAC 50.077 requires older wood-fired heating devices to be replaced upon the sale of a property. The contingency measure also provides the ability for limited temporary waivers.

These limited waivers, which may be granted on a case by case basis, depend on the following factors:

- Financial Hardship information provided by the owner or operator;
- Technical feasibility information provided by the owner or operator

- Potential impact to locations with populations sensitive to exposure to $PM_{2.5}$ including hospitals, schools, childcare facilities, health clinics, long-term care facilities, assisted living homes, and senior centers.

DEC regulations in 18 AAC 50.077 and 18 AAC 50.079 (as amended through September 2018) require solid fuel-fired heating devices, including wood stoves, pellet stoves, coal stoves and hydronic heaters, to be removed from a property before sale, lease, or conveyance in the Fairbanks North Star Borough $PM_{2.5}$ nonattainment area unless they are EPA-certified (wood and pellet stoves), have a qualifying Phase 2 "White Tag" (hydronic heaters), or meet current emission standards. The regulations apply to devices located anywhere on the property including inside the home, in a garage, and in outbuildings.

Effective January 8, 2020, the real estate control measure (in the Serious Area SIP) in regulations 18 AAC 50.077 requires the removal of all EPA uncertified devices and outdoor hydronic heaters by December 31, 2024. Devices must be removed or replaced before the sale, lease, or conveyance of property within the nonattainment area. The removed devices are to be rendered inoperable, and no new devices of this type are allowed to be sold and installed in the area. However, there is one exception, and that is if a coal fired device has a wintertime source test conducted, and the source test results meet emission standards found in 18 AAC 50.079.

DEC organizes outreach programs, which include presentation and Q&A sessions, to educate the real estate professionals and vendors in the Fairbanks nonattainment area. As shown in Table 13 below, a total of 1127 letters were sent to real estate professionals, and 577 letters to solid fuel heating device vendors in 2019. There was a total of 10 outreach presentations, one of which was a large presentation to the board of realtors. Others consisted of presentation and Q/A sessions.

Table 13. Contingency Measure Requiring Replacement of Older Wood Heating Devices When Properties Are Sold/Real Estate Requirement

Number of Outreach letters sent to real-estate professionals, vendors etc.	1127 letters to real estate professionals 577 letters to solid fuel heating device vendors.
Outreach (presentations, Q&A) to real-estate professionals, vendors etc.	About 10
Average weekly Real-estate contacts	About 4
Updated ADEC Maintained EPA device list	Was monthly but now weekly
Number of real-estate investigations for noncompliance	About 5
Regular contact with solid fuel device vendors	2 times per year or when changes to regulation will affect them.

Other control measures will assist with the implementation of this control measure. Device registration will allow DEC to compile an inventory of uncertified appliances. The FNSB Wood Stove Change Out program provides a financial incentive to replace old uncertified appliances and provides a location for appliances to be rendered inoperable along with a certificate of destruction documenting the chain of custody. DEC and FNSB have coordinated and developed internal policies to ensure that real-estate transactions can proceed through the FNSB wood stove change out program.

Starting October 2, 2020, the Serious Area SIP contingency measure will go into effect, requiring the removal or replacement of solid fuel fired heaters that are 25 years or older that do not meet the state's 2.0 g/hr emission standard. These heaters must be removed on or before December 31. 2024 or before the device is sold, leased, or conveyed as part of an existing building. DEC initiated outreach to real estate professionals on September 2, 2020 related to the revised requirements.

Wood-fired Heating Device Registration

Wood-fired heating device registration is primarily a voluntary control measure for existing devices under the Serious Area SIP. However, as adopted in regulation 18 AAC 50.077(h) on January 8, 2020, DEC requires the registration of wood-fired heating devices upon the following circumstances:

- Upon the sale or conveyance of a device
- Before closing, if the device is being sold, leased, or conveyed as part of an existing building or other property
- When applying for a waiver
- To participate in the Burn Right Program
- To participate in any wood-stove change-out or conversion programs
- Before closeout of any compliance or enforcement action

The Stoves Registration spreadsheet consists of the number of registered wood-fired heating devices, registration date, reason for registration, registration method, device type, manufacturer, model, manufacture date, installation date, clarification type, emission rate, retrofit control, and location of device.

Enhanced Dry Wood Compliance: Registration of Wood Sellers and Moisture Content Disclosure (Contingency Measure)

The registration of wood sellers and moisture content disclosure was initially implemented as a voluntary measure under the Moderate Area SIP, but was triggered as a regulatory contingency measure upon the reclassification of the Fairbanks nonattainment area to a Serious nonattainment area effective June 9, 2017. DEC regulations in 18 AAC 50.076, as amended through September 15, 2018, require that commercial wood sellers register with the State before selling or providing wood to a person located in the Fairbanks nonattainment area. Also, the provisions in the regulations require that registered wood sellers use a DEC-approved moisture test meter to test the moisture content of a load of wood at the time of sale, provision, or delivery to the consumer.

The requirements for testing the moisture content of split wood, wood rounds or logs that are cut at the time of or before the sale and that are marketed, sold or provided as dry wood are stipulated in the regulations. DEC requires that the registered wood sellers document the measured moisture content on the moisture content disclosure form that the department provides and obtain the consumer's signature or mark unavailable if the customer is not available. The State's Moisture Disclosure Program requires wood sellers to register and provide wood moisture content information to buyers. While the publishing of information on vendors that sell dry wood is increasing the awareness of burning only dry wood in both newer and older wood- fired heating devices, the tracking of moisture content of wood sold, as well as number of the cords of wood sold, is helping to monitor the progress of the contingency measure.

Currently, as shown in Table 14 below, there are 19 registered wood sellers in the Fairbanks nonattainment area, among which are two dry wood sellers. To date, 3,389 forms have been received from the commercial wood sellers, and about 2127.9 cords of woods have been sold. On a monthly average, about 100 forms are received, and about 160 cords are sold. While larger wood sellers are visited once per month, smaller operators are visited less frequently.

DEC regulations in 18 AAC 50.076, as adopted on January 8, 2020, under the Serious Area SIP, require the sale of only dry wood in the Fairbanks nonattainment area, starting October 1, 2021.

Table 14. Registered Wood Sellers Statistics

Number of registered wood sellers (Fairbanks Nonattainment Area)	19
Number of forms received to date	3389 (since 1/1/2019)
Number of cords tracked to date	2127.9
Average number of forms received per month	About 100
Average number of tracked cords sold per month	About 160
Frequency of site visits for moisture checks conducted	2 biggest sellers are visited monthly/ or every two months.

Mass Transit – FNSB Transit Fleet Natural Gas Efforts

DEC identified mass transit as a voluntary measure under the Moderate Area SIP. The Borough started the operation of the Metropolitan Area Commuter System (MACS) fixed routes in 1977. The MACS system, which started with two routes, is now comprised of nine fixed routes in the cities of Fairbanks and North Pole, as well as other nearby communities. The MACS service operates Monday through Friday from 6:00 AM to 9:45 PM and limited routes on Saturday from 8:45 AM to 7:45 PM. There is no Sunday service.

The Borough also operates a door-to-door paratransit service, Van Tran, which began in 1988. The American Disabilities Act of 1990 (ADA) requires all public transit systems that provide fixed route bus and rail service to also provide an alternative transportation service (usually vans and small buses) for people with disabilities who cannot use fixed route bus and train service. This service is usually called "paratransit." The Van Tran service operates up to five nine-passenger vans and gives priority to ADA-certified disabled passengers within a ¾-mile zone around all MACS fixed routes, although they will travel beyond the ¾-mile buffer on occasion.

The vanpool system was updated in 2014 with a new approach to make it a successful operation. Other notable improvements include better bus stop facilities (bus stop signs and shelters) and a bus tracking system for the public. The FNSB intends to build eight more shelters in 2020. The Borough also conducts active public outreach and education to encourage the use of mass transit. Table 13 below displays the number of MACS riders from FY08/09 to FY18/19.

The Borough plans to transition its entire transit revenue service fleet of 25 vehicles comprising of 15 full size transit buses and 10 para-transit vans to compressed natural gas (CNG) over the next 8 years. It is estimated that diesel fuel usage will be reduced by about 105,500 gallons as soon as the transition is complete. While the Serious Area SIP does not include emission reductions from the planned CNG transit conversion, it acknowledges the significant effort of the voluntary measure.

Table 15
Annual MACS Transit Ridership
2008 – 2020

Year	MACS Number of Riders
2008	294,142
2009	357,964
2010	383,773
2011	391,799
2012	428,166
2013	475,875
2014	550,226
2015	533,045
2016	534,705
2017	528,000
2018	469,518

Since submission of the Serious Area SIP in December 2019, significant progress has been made toward the transition to natural gas. The following updates detail the progress made:

Transit Maintenance and Storage Facility Upgrades

In addition to the FNSB grant award through the FTA on May 18, 2017 for $12,800,000 an additional award of $10,400,000 through FTA was announced in August of 2020. Both grant awards will be used for design and construction of a new maintenance/storage facility and will be fully compliant with CNG fuel requirements. As described in Section 7.7.5.5 ground testing on the existing property identified inadequate stability which would require significant measures and funding to correct. Financial and logistical analysis suggested moving the project to an alternate location. An alternate site had been identified at the time of the Serious Area SIP submittal. Having completed environmental studies, ground stability determination, and receiving FNSB Assembly approval, FNSB is finalizing the purchase of the alternate site.

Transit Fleet Replacement Schedule and Funding Sources
In addition to the funding sources mentioned in Section 7.7.5.5, FNSB was awarded 3 years of CMAQ funding beginning in 2021 to be used towards the purchase of CNG vehicles. The award amount for each year is $1,826,850. It is estimated that this will allow for the replacement of 9 additional buses. The FNSB has also been awarded FTA Section 5339 funds for FY 17-20 totaling $449,114. Once appropriated these additional awards provide FNSB with the funding needed for a total replacement of 13 buses and 10 paratransit style vehicles, or approximately 90% of the total fleet vehicles.

The FNSB FY 20/21 budget continues to include the combined use of FTA Section 5307 funding and local match funds to acquire buses. It is the FNSB's intent to continue to use similar funding combinations in the future to procure transit vehicles and continue the transition process.

Acquisition and Installation of CNG Fueling Infrastructure
In April of 2020, FNSB was awarded $1,826,850 in CMAQ funding by FAST Planning for the installation of a CNG fueling infrastructure.

Federal Diesel Emission Reduction Program

The diesel emission reduction programs are still being implemented by the federal government to address diesel emissions in nonattainment areas, including the Fairbanks nonattainment area. EPA's National Clean Diesel Campaign works with manufacturers, fleet operators, air quality professionals, environmental and community organizations, and state and local officials to reduce diesel emissions. The National Clean Diesel Campaign offers Diesel Emission Reduction Act funding opportunities through the competitive National Clean Diesel Funding Assistance Program to fund retrofit projects using Smartway verified diesel emission reduction technologies and the non-competitive State Clean Diesel Grant Program that funds grant and loan projects for clean diesel projects. Smartway is a public-private initiative between EPA, large and small trucking companies, rail carriers, logistics companies, commercial manufacturers, retailers, and other federal and state agencies. Its purpose is to improve fuel efficiency and the environmental performance (reduction of both greenhouse gas emissions and air pollution) of the goods movement supply chains. Smartway evaluates emissions control technologies and determines the eligibility of individual technologies for funding under DERA grants. Federal emissions standards for exhaust and evaporative emissions exist for Light-Duty Vehicles, Trucks, and Motorcycles, Heavy-Duty Engines and Vehicles, and Non-road Engines and Vehicles. These emissions standards on manufacturers have incrementally reduced the amount of emissions

permitted from each type of regulated engine, resulting in cleaner diesel engines. Phase 3 emissions standards started taking effect in 2017.

Federal Motor Vehicle Control Program

The Federal Motor Vehicle Control Program (FMVCP) is the federal certification program that requires all new cars sold in 49 states (excluding California, which it has its own state-mandated certification program) to meet certain emission standards. These standards vary according to vehicle age, with the newer vehicles required to be considerably cleaner than older models. The result of more stringent emission standards over time from newly manufactured vehicles results in a drop in overall emissions from the vehicle fleet in Fairbanks, as older, dirtier vehicles are replaced with newer, cleaner vehicles. Carbon monoxide cold temperature (down to +20° F) emission standards phased in between 1994 and 1996 for passenger cars and light duty trucks significantly enhanced control system performance for all pollutants at the temperatures associated with cold climate exceedances. DEC considered the California Air Resources Board vehicle emission standards as a potential BACM (Measure 54) for the Serious Area SIP but found that they were not cost-effective for the Fairbanks nonattainment area.

Federal Tier 2 emission standards for passenger cars, light trucks and larger passenger vehicles are focused on reducing emissions most responsible for ozone and particulate matter (i.e., nitrogen oxide or NOx and hydrocarbon or HC emissions). Mandated reductions in the sulfur content of gasoline further enhanced the performance of motor vehicle emission control systems. Starting in 2017, Tier 3 standards further reduced both tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles. Additional reductions in gasoline sulfur have made emission control systems more effective for both existing and new vehicles and enabled more stringent vehicle emissions standards. Currently, the EPA's Motor Vehicle Emission Stimulator software (MOVES2014b) is used to assess the benefits of the FMCVP and Tier 2 and Tier 3 emission standards.

Winter Season Open Burning Ban

DEC continues to implement the winter season open burning ban, which was identified under the Moderate Area SIP. DEC regulation in 18 AAC 50.065(f) prohibits open burning during the winter season between November 1 and March 31. DEC contemplated a longer season (including October and April) for open burning restrictions in the nonattainment area, but the available data (from the public comments received in 2014) suggested that there is no significant air quality deterioration from normal open burning during these months. DEC also revised the definition of open burning in 2014 to address the concerns raised by the public regarding small winter fires for recreational warming and ceremonial purposes.

Reasonably Achievable Control Technology and Best Available Control Technology

The CAA section 172 (c) requirements for nonattainment areas apply to the $PM_{2.5}$ nonattainment area. Under this attainment plan, the requirements of CAA Part D, New Source Review (NSR) apply for major stationary sources. Section 302 of the CAA (42 U.S. C. 7602) defines a major stationary source as any stationary facility or source of air pollutants that

directly emits, or has the potential to emit, 100 tons per year of any pollutant. Permits for construction and operation of new or modified major stationary sources within the nonattainment area must be approved through the NSR program. Within the FNSB, ADEC is responsible for issuing construction and Title V operating permits. DEC has incorporated the requirements for Prevention of Significant Deterioration (PSD) and nonattainment New Source Review in 18 AAC 50, Article 3. DEC actively implements its permit programs. The Air Quality Division issues and amends permits, conducts inspections, reviews the reports from industry, provides compliance assistance, and takes enforcement actions when needed.

All the emission units reviewed under the Moderate Area SIP are already implementing the emission control techniques. The emission units for which RACT determinations were made include boilers, process heaters, and turbines. The RACT for $PM_{2.5}$ is a fabric filter system for boilers. Additional $PM_{2.5}$ controls were considered unreasonable for process heaters and turbines. The use of low sulfur fuel was considered as RACT for fuel combustion sources. RACT for NO_X was not recommended because it was determined that NOX is not an efficient method for reducing ambient $PM_{2.5}$ in Fairbanks nonattainment area.

Under the Serious Area SIP, Best Available Control Technology (BACT) was determined as the controls for the emission units of the stationary sources. Currently, EPA is reviewing the BACT for all the five major sources (Fort Wainwright, Aurora, University of Alaska, Fairbanks, GVEA North Pole, and GVEA Zehnder) in the nonattainment area. As of September 2020, DEC has received permit applications resulting from the BACT determinations made for the Serious Area SIP and is working toward issuing updated permit requirements for each of the BACT-affected facilities in the coming months.

Small Source Information and Requirements

Under the Serious Area SIP, DEC identified onetime submittal of information by the small area businesses within the Fairbanks nonattainment area as one of the BACM. On January 8, 2020, DEC adopted the regulation in 18 AAC 50.078 that requires commercial coffee roasters, commercial charbroilers, used oil burner business, and commercial incinerators to submit information regarding their businesses and operations. The regulation also requires coffee roasters which emit 24 pounds or more of particulate matter in 12-month period (which is equivalent to 11,440 pounds or 5.72 tons of coffee per year per unit) to install a pollution control device. As shown in Table 16, DEC sent the first set of letters on December 19, 2019 to the four coffee roasters in the nonattainment area to notify the businesses about the new regulation. The second set of letters, with a reportable information form, was sent on March 4, 2020, to the coffee roasters to fill out, so that DEC can help them calculate the emissions and make final determinations.

On January 28, 2020, DEC sent a letter with a reportable information form to the commercial charbroilers, used oil burners, and commercial incinerators. 187 letters were sent to all the possible owners of charbroilers. 129 letters were sent to all the possible owners of used oil burners and commercial incinerators. The letter was to notify the small businesses about the new regulation, while the form was for them to fill out their business' information and

operations. DEC has compiled the information and made final determinations related to additional controls for these sources in the 2020 amendments to the Serious Area SIP.

Table 16. Small Business, Number of Letters Sent and Date Sent		
Small Area Business	Number of Letter Sent	Date Sent
Coffee Roasters	4	First set of Letters sent on 12/19/2019 Second set of letters sent on 3/4/2020
Commercial Charbroilers	187	1/28/2020
Used Oil Burner	129	1/28/2020
Commercial Incinerators	129	1/28/2020

Control Measures Analysis for Fairbanks $PM_{2.5}$ Nonattainment Area for the 2020 Amendment to the Serious State Implementation Plan

September 10, 2020

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1. Introduction

In November 2009, a portion of the Fairbanks North Star Borough (FNSB or Fairbanks) was designated as a Moderate nonattainment area for the 2006 24-hour Fine Particulate ($PM_{2.5}$) National Ambient Air Quality Standard (NAAQS).[1] On April 28, 2017, EPA officially re-classified the Fairbanks area from "Moderate" to "Serious" nonattainment for the 24-Hour $PM_{2.5}$ standard.[2] The design value used in the Serious SIP for the 2013-2015 period was 124 $\mu g/m^3$ (microgram per cubic meter). The difference between this value and the ambient standard is 89 $\mu g/m^3$, which means that 98th percentile concentrations (the form of the standard) needed to be reduced by 72% to demonstrate attainment. The 2020 Amendment to the Serious SIP (2020 Amendment) has a new base year, 2019, and a lower 4-year modeling design value (64.7 $\mu g/m^3$) reflecting the progress that has been made in reducing emissions and addressing $PM_{2.5}$ air pollution over the last five years. However, significant additional reductions from emission sources are still needed in order to demonstrate attainment.

The purpose of this document is to describe the process of identification and selection of Control Measures for the 2020 Amendment to the Serious $PM_{2.5}$ Attainment Plan for the Fairbanks North Star Borough in Alaska.

Presented below is a review of the regulatory requirements that need to be addressed in the review, analysis and selection of measures for the 2020 Amendment. Also presented is a summary of revisions made to strengthen both FNSB and Alaska Department of Environmental Conservation (DEC) $PM_{2.5}$ regulatory controls included in the Serious Area State Implementation Plan (SIP). Those revisions form the baseline set of controls against which control measures adopted in other communities and agencies are examined for measure selection in the 2020 Amendment. A brief outline of the remainder of the report is also presented.

Requirements for 2020 Amendment Analysis

The process for selecting measures for the 2020 Amendment to the Serious SIP is defined in a series of steps detailed in the Final $PM_{2.5}$ Rule.[3] Those steps clarify and update PM_{10} control measure selection guidance presented in the Addendum to the General Preamble[4] for the selection of $PM_{2.5}$ controls for both Reasonably Available Control Measures (RACM), required for Moderate nonattainment areas and BACM for Serious nonattainment areas. Presented below is a summary of the selection guidance presented in the Final $PM_{2.5}$ Rule that is relevant for the 2020 Amendment Plan. The guidance is defined in a series of steps specified in the BACM selection process (i.e., the same process used to select BACM is used to select measures for the 2020 Amendment). The control measure guidance for the 2020 Amendment requires "all

[1] https://www.gpo.gov/fdsys/pkg/FR-2009-11-13/pdf/E9-25711.pdf
[2] https://www.federalregister.gov/documents/2017/05/10/2017-09391/determinations-of-attainment-by-the-attainment-date-determinations-of-failure-to-attain-by-the
[3] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf
[4] https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19940816_59fr_41998-42017_addendum_general_preamble.pdf

control measures must be quantifiable, enforceable, replicable and accountable" as described in Section VI.D.5 of CAA section 189(d).

- **Step 1: Develop a Comprehensive Inventory of Sources and Source Categories of Directly Emitted $PM_{2.5}$ and $PM_{2.5}$ Precursors** – The inventory identifies the contribution of each source category to directly emitted $PM_{2.5}$ and precursor emissions. This information is needed to understand the relative contribution and significance of each source to the overall burden on the nonattainment area. EPA requires the identification of both anthropogenic (man-made) and non-anthropogenic (natural) emissions. It also requires the analysis to start with the base year emissions inventory submitted with the Serious area attainment plan and to update it as necessary to reflect growth, construction, shutdowns, roadway improvements and other relevant changes that affect activity within the nonattainment area. EPA also requires the Step 1 inventory to be consistent with the emissions inventory requirements for Serious area plans.

- **Step 2: Identify Potential Control Measures** – Consistent with earlier guidance, the $PM_{2.5}$ Final Rule requires states to identify controls for each of the primary and secondary emission sources developed to represent activity within the subject nonattainment area. The starting point for assembling a list of controls is the BACM analysis prepared for the Serious SIP. All controls considered, but not adopted must be identified. States are required to examine a wide range of information sources on existing and potential control measures. Measures and technologies considered and implemented in attainment plans are a significant source of information. Other information sources include summaries of control measures assembled by regional planning organizations and local air quality consortiums. EPA also maintains online links to a variety of control programs. States are required to identify both existing and potential new measures for the source categories identified in the base emissions inventory. The goal is to identify a list of control measures that are more stringent than those adopted in the Serious SIP.

- **Step 3: Determine Whether an Available Control Measure or Technology is Technologically Feasible** – This requires the consideration of many factors including impacts on the environment (e.g., air, water, noise, etc.) and energy (e.g., consumption, availability, etc.). Measures targeting area and mobile sources need to consider infrastructure, population size, workforce type and habits, etc. In addition, the critical source parameters needed to assess the impacts of the technology need to be identified (e.g., fuel specifications, travel activity, EPA certification, etc.). A key consideration is whether the identified measure provides an emissions benefit beyond those provided by existing federal, state and local controls (i.e., is it more stringent?). Another consideration is the availability of information to contrast and quantify the emission impacts of an identified measure relative to existing control programs (i.e., again, is it more stringent).

- **Step 4: Determine Whether an Available Control Technology or Measure is Economically Feasible** – This step requires an explicit examination of the costs and emission benefits of the measure leading to an assessment of the $/ton of pollutant reduced. In contrast to the criteria employed in the BACM determination process,

economic feasibility "is a less significant factor." States "may not eliminate a particular control measure as potential BACM if similar sources have successfully implemented such a measure." States are also required to consider technologically feasible measures that have not been implemented by similar sources but can reduce emissions at a cost that is not prohibitive. The Final $PM_{2.5}$ Rule does not establish a specific $/ton threshold for economic feasibility. More expensive control measures must be adopted unless it can be demonstrated that costs and cost effectiveness are prohibitive relative to existing controls.

- **Step 5: Determine the Earliest Date by Which a Control Measure or Technology can be Implemented in Whole or in Part** – The CAA requires Serious area attainment plans to provide for the implementation of BACM no later than 4 years after reclassification of the area to Serious or prior to the statutory attainment date for the area. If a state determines that technologically and economically feasible measures can be implemented in whole or in part during this period they must be adopted and implemented as expeditiously as possible. Since Fairbanks was classified nonattainment for $PM_{2.5}$ in December 2009 the statutory attainment date is December 2019. As Fairbanks was unable to attain the standard by this date and EPA has finalized an action (effective October 2, 2020) that formalizes a finding of failure to attain by December, 2019 and denies the state's request included in the 2019 Serious SIP for an extension to that date (see discussion below addressing failure to attain Notice), the 2020 Amendment Plan requirements mandate annual emission reductions of 5%, thus the BACM requirements become as expeditiously as possible to support the required emission reductions toward attainment.

Revisions to Strengthen $PM_{2.5}$ Regulatory Controls

Recognizing the need to make continued progress towards attainment both the Borough and the state continued to evaluate and adopt regulatory controls after the submission of the Serious area SIP. Since these controls form the baseline against which potential 2020 Amendment control measure technical and economic feasibility is assessed, a summary of the measures adopted is presented below.

Borough Ordinance Revisions

The $PM_{2.5}$ Air Quality Control Program is codified in Chapter 21.28. Numerous changes to the program were debated within the Assembly leading to the adoption of ten separate Ordinances amending the program since the submission of the Moderate Area Plan to EPA December 31, 2014 and January 29, 2015. Collectively, those changes significantly increased the coverage and authority of the program to control emissions within the nonattainment area. Passage of Proposition 4, the Home Heating Reclamation Act, on October 5, 2018, however, required the Borough to remove all the ordinances implementing home heating restrictions, calling air quality alerts, and enforcing them. The proposition is effective for a 2-year period and is set to expire October 2020, unless a new similarly structured proposition is approved by voters in the 2020 election. However, action would need to be taken by the FNSB in coordination with the state to establish or reestablish specific local authorities related to home heating. In the absence of a

local control program, the Clean Air Act requires states to take responsibility for implementing air quality control programs that move the community towards attainment of the NAAQS.

Alaska Administrate Code Revisions

With an effective date of January 8, 2020, the Serious SIP was adopted by reference in state regulation (18 AAC 50). In addition, the following sections of Chapter 50, the Air Quality Code were amended with the same effective date unless otherwise noted:

- 18 AAC 50.030 Adopted Serious SIP Chapters and Appendices
- 18 AAC 50.075(e) Solid Fuel Heating Device Curtailment during air episodes and requirement to withhold fuel within three hours of effective time of a State 1 or Stage 2 Alert
- 18 AAC 50.075(f) Visible Emission requirements for solid fuel heating devices
- 18 AAC 50.076 Solid fuel-fired heating device fuel requirements; requirements for wood sellers
- 18 AAC 50.076(j) - (k) Commercial wood sellers may only sell dry wood unless exempted.
- 18 AAC 50.076(l) Non-commercial wood sellers may not sell wet wood.
- 18 AAC 50.077 Requirement to remove or replace wood-fired heating devices and wood-fired outdoor hydronic heaters Upon Sale of Property that do not meet EPA or state standards and render the device inoperable.
- 18 AAC 50.077(a) Outdoor hydronic heaters may not be sold or installed in the Nonattainment Area.
- 18 AAC 50.077(b) Emissions Standards for new pellet hydronic heaters sold or installed in the Nonattainment Area.
- 18 AAC 50.077(c) Emissions Standards for new woodstoves and pellet stoves sold or installed in the Nonattainment Area.
- 18 AAC 50.077(d) Emissions Standards for new wood-fired heating devices over 350,000 Btu/hr sold or installed in the Nonattainment Area
- 18 AAC 50.077(h) Device Registration requirements
- 18 AAC 50.077(i) - (k) Device Installation requirements
- 18 AAC 50.077(k) Vendors Requirements - wood-fired heating devices
- 18 AAC 50.077(l) Device Requirement remove non-EPA certified devices and outdoor hydronic heaters by December 31, 2024
- 18 AAC 50.077(n) Device Requirements - removal of old EPA certified devices - upon effective date of published EPA finding.
- 18 AAC 50.078(b) Only fuel oil containing no more than 1,000 parts per million (ppm) sulfur may be sold – with an effective date of September 01, 2022
- 18 AAC 50.078(c) - small area sources required to submit information

- 18 AAC 50.078(d) - Commercial coffee roasters must install a pollution control device if any unit emits more than 24 pounds (lbs) of particulate matter (PM) in a 12-month period.
- 18 AAC 50.079(b) may not install or reinstall coal-fired heating devices
- 18 AAC 50.079(c) Requirement to remove coal-fired heating devices Upon Sale of Property unless a wintertime source test shows that it meets emission standards.that do not meet EPA or state standards.
- 18 AAC 50.079(f) all existing coal-fired heating devices shall be removed by December 31, 2024.

In addition to the code revisions noted above, EPA issued a Federal Register Notice[5] on September 2, 2020, finalizing its determination that Fairbanks failed to attain the ambient $PM_{2.5}$ standard by the attainment date. This finding triggered the implementation of the contingency measure included in the Serious $PM_{2.5}$ SIP. The measure that will be implemented effective October 2, 2020, is 18 AAC 50.077(n), date certain removal for EPA certified devices over 2.0 g/hr and over 25 years old. The rule requires owners of wood heaters to:

- Remove/replace all EPA certified stoves that are 25 years or older AND have an emission rating greater than 2.0 g/hr by no later than December 31, 2024, or at the time of a property transaction (e.g. home sale, lease, conveyance) whichever is earlier.
- For similarly emitting devices newer than 25 years before the effective date of the EPA finding, removal or replacement is required before 25 years from the date of manufacture.

Outline for Remainder of the Section

The remainder of this document is organized to present the findings of updated analyses addressing each of the 5 BACM process steps outlined above. Section 2 presents a summary of the calculations prepared to quantify the baseline emission inventory (Step 1). A summary of the process followed to identify potential control measures is presented in Section 3 (Step 2). Section 4 presents the results of the technological feasibility analysis prepared for each of the measures identified in Section 3 (Step 3). Section 5 presents the results of the economic feasibility analysis for each measure determined in Step 3 to be technologically feasible (Step 4). Section 6 presents information on the earliest date at which measures determined to be technologically feasible (and/or adopted in a new state regulation) in Step 3 and economically feasible in Step 4 can be implemented (Step 5). Section 7 presents a summary of the selected

[5] https://www.govinfo.gov/content/pkg/FR-2020-09-02/pdf/2020-17541.pdf?utm_campaign=subscription+mailing+list&utm_source=federalregister.gov&utm_medium=email

control measures for consideration of implementation in the 2020 Amendment to the Serious SIP. Appendix A contains a reference to the state's analysis of the costs of transitioning to lower sulfur heating oil.

2. Step 1 – Develop a Comprehensive Inventory of Sources and Source Categories of Directly Emitted $PM_{2.5}$ and $PM_{2.5}$ Precursors

The first element in the multi-step BACM process consists of the development of an emission inventory (EI) of sources of directly emitted $PM_{2.5}$ and $PM_{2.5}$ precursors within the nonattainment area. This section describes that process. It includes a list of all source categories reflected in the inventory and a summary of the sources and activities in the nonattainment area. It also includes a summary of emissions by source category of both directly emitted $PM_{2.5}$ and its precursors.

Source Categories Inventoried

Overview - The inventory supporting the analysis for the 2020 Amendment Plan was developed in a manner consistent with the EI requirements for Serious Area (and CAA 189(d)) plans specified in EPA's $PM_{2.5}$ Implementation Rule[6] (or PM Rule). This included representation of source activity and emissions on a seasonal, rather than annual basis as provided for under the PM Rule. As discussed in the separate Emission Inventory document, use of seasonal estimates is appropriate for the 24-hour $PM_{2.5}$ standard in Fairbanks since violations of the standard are confined to winter months (October through March) and source activity that triggers these violations peaks during that time.

The inventory was developed using the 2008 base year emission inventory for the Fairbanks $PM_{2.5}$ nonattainment area from the approved Moderate SIP and the 2013 baseline inventory from the submitted Serious SIP as its starting points and then updated based on additional source and activity data collected since preparation of those inventories. The inventory was projected forward to calendar year 2019 and reflects growth, and controls in place at the end of 2018 and is referred to in Section III.D.7.6.6 as the 2019 Baseline inventory. No new sources were identified in the development of the 2019 Baseline inventory; thus, there was no need to expand the search for control measures in this analysis beyond the source categories addressed in the Serious SIP. This inventory covers activity and emissions across the following source types:

1. *Stationary Point Sources* – Industrial facility emissions for major stationary sources based on the major source reporting threshold of 70 tons/year as required for Serious plan inventories under the PM Rule;

2. *Stationary Nonpoint (or Area) Sources* – Includes all remaining stationary sources, including both industrial facilities below the major source reporting threshold above as

[6] Federal Register, Vol. 81, No. 164, August 24, 2016 (FR 81 58010).

well as "traditionally" defined area sources such as residential and commercial space heating and other disperse stationary emission sources;

3. *On-Road Mobile Sources* – Represents activity and emissions from on-road motor vehicles which includes gasoline and diesel-powered passenger cars, light-duty trucks/vans, buses and heavy-duty trucks; and

4. *Non-Road Mobile Sources* – Emissions from all remaining mobile sources than are not on-road certified vehicles. This includes non-road vehicles/equipment such as construction/mining equipment, off-highway vehicles, snowmobiles and other recreational vehicles, aircraft and airfield equipment and locomotives.

Figure 1 shows the boundaries of the Fairbanks $PM_{2.5}$ nonattainment area (shaded region) overlaid on the roadway system in the area. The nonattainment area covers 271 square miles. Figure 1 also shows the names and locations of the six major point sources located within the nonattainment area (using blue dots).

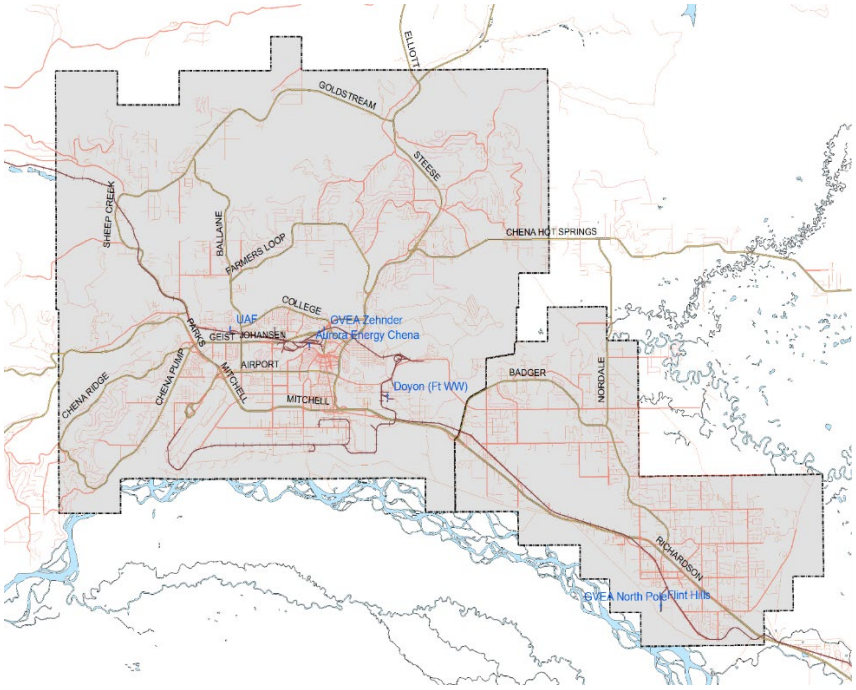

Figure 1. Fairbanks $PM_{2.5}$ Nonattainment Area

Sources Included and Pollutants Covered – The inventory included a review of all anthropogenic and biogenic emission sources within the nonattainment area. As described in greater detail in the Emission Inventory document, it was determined that biogenic emissions were negligible during the winter season represented in the inventory. In addition, fugitive dust sources of $PM_{2.5}$ were also estimated to be negligible under the snow/ice bound conditions reflected in the winter seasonal inventory.

Pollutants represented in the inventory consisted of both direct $PM_{2.5}$ as well as emissions of potential precursor pollutants: sulfur dioxide (SO_2), oxides of nitrogen (NOx), volatile organic compounds (VOC), and ammonia (NH_3).

Summary of Inventory Data Sources and Methods – Table 1 briefly summarizes the data sources and methods used to develop the emissions inventory by source type. It also highlights those elements based on locally collected data. As shown by the shaded regions in Table 1, the majority of wintertime activity and emission factor data supporting the inventory was developed based on local data and test measurements.

Table 1. Summary of Data/Methods Used in SIP Inventory for the 2020 Amendment

Source Type/Category	Source Activity	Emission Factors
Point Sources	Facility and stack-level fuel use and process throughput	Continuous emissions monitoring or facility/fuel-specific factors
Area (Nonpoint) Sources, Space Heating	Detailed wintertime Fairbanks non-attainment area residential heating device activity measurements and surveys	- Test measurements of common Fairbanks wood and oil heating devices using local fuels - AP-42 factors for local devices or fuels not tested (e.g., coal)
Area Sources, All Others	- Seasonal, source category-specific activity from a combination of State/Borough sources - National Emission Inventory (NEI)-based activity for commercial cooking	AP-42 emission factors
On-Road Mobile Sources	Local estimates of seasonal vehicle miles traveled	- MOVES2014b emission factors based on local fleet/fuel characteristics - Augmented with Fairbanks wintertime vehicle warmup and plug-in emission testing data
Non-Road Mobile Sources	- Local activity estimates for key categories such as snowmobiles, aircraft and rail - MOVES2014b model-based activity for Fairbanks for other categories	- MOVES2014b model factors for non-road equipment - AEDT model factors for aircraft - EPA factors for locomotives

For all inventory sectors, emissions were calculated using a "bottom-up" approach that relied heavily on an exhaustive set of locally measured data used to support the emission estimates. For source types for which local data were not available, estimates relied on EPA-developed NEI

county-level activity data and emission factors from EPA's *Compilation of Air Pollutant Emission Factors*,[7] AP-42 database.

Within the inventory, activity and emissions were represented at the individual Source Classification Code (SCC) level, with the exception of the major point sources. Major point source emissions were compiled by SCC, facility, and emission unit.

Revised Serious SIP Estimates – The Serious SIP contained a 2013 Baseline inventory. This inventory was re-developed for the 2019 base year of the 2020 Amendment to the Serious Plan based on updated activity estimates since the Serious SIP development for which key elements are summarized below.

- *Point Sources* – 2008 activity and emissions data were updated to 2019 based on actual annual 2019 fuel use/process throughput by individual facility and emission unit collected by DEC in January-March 2020. (Point source emissions in the Serious SIP for 2019 had been projected from 2013 annual data based on population forecasts.)

- *Space Heating Area Sources* – Space heating energy usage estimates for the 2019 Baseline inventory were based on the same local data/models (2011-2015 Home Heating surveys and Home Heating Energy Model) used in the Serious SIP. However, the wood-oil cross price elasticity effects (shifting energy use between wood and oil as oil prices fluctuate) in the 2020 Amendment were updated based on actual rather than projected 2019 Fairbanks heating oil prices. (As discussed in detail later, this price difference was very small.) A more substantive revision to space heating emissions resulted from the use of more disaggregated estimates of emission reductions from the Borough's Wood Stove Change Out (WSCO) Program. Under the Serious SIP, historical WSCO reductions were estimated based on average household energy usage across all devices. For the 2020 Amendment, energy usage estimates for each household were developed by replacement device/fuel type to be consistent with a more granular methodology developed and used by the Borough to track and report quarterly Targeted Airshed Grant (TAG) data from the WSCO Program required by EPA under the administration of those grants. Finally, the PM emission factor for residential natural gas combustion from EPA's AP-42 database was updated based on more recent testing data collected by Brookhaven Labs.

- *On-Road and Non-Road Mobile Sources* – Under the Serious SIP, on-road vehicle populations and age distributions had been based on 2014 DMV registration data. For the 2020 Amendment, a more recent 2018 DMV registration database was used to develop these MOVES vehicle emissions model inputs. Within the non-road mobile source sector, annual aircraft activity that was assumed to be constant by month within the Serious SIP was revised under the 2020 Amendment based on monthly data collected from the airfields in the nonattainment area that should less aircraft activity during winter months than the rest of the year. (Total annual aircraft operations remain unchanged from the Serious SIP, only the monthly distributions were revised.)

[7] "Compilation of Air Pollutant Emission Factors," Fifth Edition and Supplements, AP-42, U.S. EPA, Research Triangle Park, NC. January 1995.

Summary of Emissions

Emissions for the 2019 Baseline inventory within the Fairbanks $PM_{2.5}$ nonattainment area were updated from the 2013 Serious SIP base year inventory as summarized in the preceding section. They were tabulated by key source sector and updated to reflect the effects of growth through 2019 and controls in place at the end of 2018. Table 2 presents the resulting Control emission inventory estimates, expressed as average day emissions within the winter season for 2019. Emissions of direct $PM_{2.5}$ are highlighted in the first column. Precursor pollutant emissions are also shown. As seen in Table 2, space heating contributes the largest share of direct $PM_{2.5}$, with wood-burning being the dominant fuel type. For NOx and SO_2, point sources are the dominant

Table 2. 2019 Baseline Emissions Inventory (tons/day) by Source Sector

Source Sector	Nonattainment Area Winter Season Emissions (tons/day)				
	$PM_{2.5}$	**NOx**	**SO_2**	**VOC**	**NH_3**
Point	0.57	10.31	5.68	0.03	0.073
Area, Space Heating, All	1.91	2.43	3.88	8.60	0.132
Area, Space Heat, Wood	1.77	0.39	0.16	8.38	0.086
Area, Space Heat, Oil	0.06	1.82	3.62	0.10	0.004
Area, Space Heat, Coal	0.07	0.05	0.09	0.11	0.014
Area, Space Heat, Other	0.01	0.17	0.02	0.01	0.029
Area, Other	0.22	0.36	0.03	2.10	0.046
On-Road Mobile	0.22	1.70	0.01	3.83	0.040
Non-Road Mobile	0.26	0.94	5.41	4.16	0.002
TOTALS	**3.17**	**15.73**	**15.01**	**18.72**	**0.293**

contributor. (The majority of VOC and NH_3 precursors emissions also come from space heating).

To provide a clearer understanding of the significance of each source sector, Table 3 provides a breakdown of the percentage contributions of each sector (or subcategory) to total emissions for each pollutant. As shown in Table 3 over 60% of direct $PM_{2.5}$ comes from space heating. Point sources contribute just under 18% of direct $PM_{2.5}$, with other area sources and mobile sources accounting for the remaining 22%. For NOx, point sources are the major contributor, accounting for 65% of total emissions. Space heating is the second largest NOx source, representing 15%. SO_2 emissions come primarily from point sources (38%), with non-road mobile sources as the next largest share at 36% (most of which comes from aircraft emissions).

Table 3. 2019 Baseline Emissions Inventory
Contributions by Source Sector (% of total pollutant emissions)

Source Sector	Nonattainment Area Winter Season Emissions (tons/day)				
	$PM_{2.5}$	**NOx**	**SO_2**	**VOC**	**NH_3**
Point	17.9%	65.5%	37.9%	0.2%	25.0%
Area, Space Heating, All	60.2%	15.5%	25.9%	46.0%	45.0%
Area, Space Heat, Wood	55.8%	2.5%	1.1%	44.8%	29.3%
Area, Space Heat, Oil	1.9%	11.6%	24.1%	0.5%	1.2%
Area, Space Heat, Coal	2.1%	0.3%	0.6%	0.6%	4.7%
Area, Space Heat, Other	0.4%	1.1%	0.1%	0.0%	9.9%
Area, Other	7.1%	2.3%	0.2%	11.2%	15.8%
On-Road Mobile	6.8%	10.8%	0.0%	20.5%	13.5%
Non-Road Mobile	8.1%	6.0%	36.0%	22.2%	0.7%
TOTALS	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Since the portion of emission sources encompassing all categories except point sources are subject to 5% emission reductions for control measures and recently adopted regulations (point sources are addressed under BACT), these tabulations show that space heating is the dominant, but not singular source of emissions under the2020 Amendment to the Serious SIP.

3. Step 2 – Identify Potential Control Measures

The second step in the 2020 Amendment Plan identification and evaluation process is to identify candidate control measures. In this step, a list of control measures potentially applicable to the mobile and area source $PM_{2.5}$ source categories is developed for consideration for a plan amendment required under CAA Section 189(d). States are required to examine a wide range of information sources on existing and potential control measures in the search for candidate control measures. The Final $PM_{2.5}$ Rule requires the list of potential controls to include "options not previously considered as BACM", control measures being implemented in other nonattainment areas, and measures considered by regional planning organizations and state and local air quality consortiums. The goal is to identify a list of control measures that are more stringent than those adopted in the Serious Area SIP.

The process followed to select control measures for the 2020 Amendment was to assemble a list of the control measures not adopted in the Serious SIP and to review the control measures implemented in serious $PM_{2.5}$ nonattainment communities to determine if any revisions had been adopted since the submission of the Serious SIP.

- Bay Area AQMD, CA
- South Coast AQMD, CA
- San Joaquin Valley, CA
- Maricopa County, AZ
- Puget Sound CAA, WA
- Utah, UT

The review of the control measures employed in these $PM_{2.5}$ programs determined that no new measures had been implemented since submission of the Serious SIP.

Listed below are the measures that were not adopted because they were determined to be technologically infeasible (Step 3), economically infeasible (Step 4) or could not be implemented within the required timeframe (Step 5). Also listed is the source of the control measure, which includes the community implementing the measure, EPA comments and comments submitted for the Fairbanks RACM and BACM analyses. BACT-related sources and control technologies are addressed in the Serious SIP. The Home Heating Reclamation Act in 2018 shifted the implementation of these programs from the Borough to being regulated solely by DEC. All of these measures are addressed in the 2020 Amendment Plan analysis.

A wide range of rules implementing SIP controls were examined to identify control measures for consideration as BACM and 2020 Amendment Plan control measures. Several states and local jurisdictions were found to have multiple rules addressing $PM_{2.5}$ control. Most rules are extensive and contain separate sections addressing definitions, prohibitions, stage restrictions, exemptions, penalties, etc. Use of these links facilitated the comparative evaluation of control program requirements in the Fairbanks North Star Borough and State of Alaska to those of other jurisdictions to determine if those of other jurisdictions are potentially more stringent than

corresponding Fairbanks area requirements - the screening qualification for consideration as BACM as well as for consideration as control measures under CAA Section 189(d) requirements.

After reviewing the range of $PM_{2.5}$ control programs in place across the country, it became apparent that many had similar structures, and detailed requirements reflecting local decisions about how best to implement needed controls. Since the programs reviewed did not fit into a uniform template, evaluations of them had to be conducted in a careful manner to understand requirement nuances. Definitions differ, prohibitions and thresholds for implementation differ, exemptions frequently differ, etc. Thus, while it was tempting to contrast entire regulatory packages to determine which provided the largest reduction in emissions, quantification of reductions was found to be a complex exercise because of the numerous regulatory differences between these packages and that of Fairbanks. Several of the findings made during this initial approach were that:

1. Considerable effort would be required to develop separate spreadsheets for each regulatory package to quantify overall emission benefits in Fairbanks;
2. Individual components of regulatory packages that could provide benefits in Fairbanks could be missed if other components of the same packages offset these benefits when packages were considered in total (i.e., throwing the baby out with the bathwater);
3. Comparisons of individual regulatory elements is easier to analyze and present for review;
4. Comparisons of individual regulatory elements do not require spreadsheet analysis to determine which elements are more stringent;
5. Frequently, the data or estimates needed to contrast measures quantitatively do not exist: impacts on emissions due to differences in exemption details, approved device categories, installation requirements, curtailment requirements, enforcement policies, shifts in behavior, etc.

Collectively, the issues listed above led to a decision to contrast elements of regulatory packages with those of the Borough and the State of Alaska. The search for regulatory elements that appeared to be more stringent than those in Fairbanks and Alaska regulations first produced a list of jurisdictions implementing them and web links to the applicable regulations

The next step was to isolate the specific elements in these rules and regulatory packages that appeared to be more stringent than the corresponding elements in FNSB and Alaska regulations. These elements were assigned short descriptive titles and then organized into groups of common functionality. In other words, all of the specific elements that regulated device installation were grouped together under the group title of "Device Installation – General". Element groups were then organized in a sequence that followed the chronological events in device acquisition, use, and retirement, such as sale, installation, permitting, exemption granting, operation, curtailment during air quality advisories, and removal. Because the analysis of source categories contributing to $PM_{2.5}$ nonattainment in the Borough identified coal burning, heating oil combustion, and motor vehicle travel as being significant, elements of regulations implemented by other jurisdictions that addressed these sources were grouped together in separate categories. The list of these functionality groups and individual regulatory elements evaluated and not

adopted in the Serious SIP is presented in Table 6. Listed with each regulatory element are the jurisdictions implementing these elements. Because some of the measures came from a mixture of sources that were not implementing jurisdictions, they were grouped into the last "Other" category. They included (a) EPA comments[8] on the draft BACM document in May 2018 that identified several additional control measures to be addressed in the analysis. In addition (b), analysis of commercial controls in process at the time of the release of the draft were completed and are included in this analysis. Finally (c), comments received from the public on the Moderate SIP suggested additional control measures and were included in the original RACM analysis, not adopted, considered in the BACM analysis, and not adopted.

In the Serious Area SIP Section 7.7, control strategies from the Air Quality Stakeholders recommendations were cross referenced with the BACM analysis and final regulation package. Due to the multiple processes for identifying control measures, and overlap between the measures, a crosswalk and summary was developed in Table 7.7-6 of the Serious Area SIP. The crosswalk and summary table were reviewed to determine if any Air Quality Stakeholder measures were identified but not adequately addressed. The results of the review show that each Air Quality Stakeholder measure was either associated with a control measure in the Serious Area SIP BACM analysis, or was classified as non-regulatory, or was a recommendation for named point sources and addressed in the BACT analysis.

Table 4. Control Measures Implemented in $PM_{2.5}$ Nonattainment Areas and Suggested in SIP Comments That Have Not Been Implemented in FNSB or only Implemented in Part.

Measure Description	Areas Implementing Measure
Sale of Devices - New	
1. Surcharge on Device Sales	Washington, WA
Sale of Devices – Used	
6. Prohibit installation of flue dampers unless device was certified using a flue damper	Missoula City-County MT
8. Prohibit installation of Solid Fuel Heating Device (SFHD) in new construction	South Coast AQMD CA San Joaquin Valley APCD CA Bay Area AQMD CA
9. Limit the density of SFHD in new developments	San Joaquin Valley APCD CA East Kern AQMD CA
10. Install EPA-certified device whenever a fireplace or chimney is remodeled	Bay Area AQMD CA
Device Installation - Hydronic Heaters	
11. Prohibit use of rain caps on stacks	Maine, ME
12. Require minimum stack height relative to rooflines of nearby unserved buildings	Maine, ME New York, NY Utah, UT

[8] Attachment to a letter from Dan Brown to Denise Koch, 5/23/2018, EPA comments on ADEC Preliminary Draft Serious SIP Development materials for the Fairbanks serious PM2.5 nonattainment area.

Table 4. Control Measures Implemented in $PM_{2.5}$ Nonattainment Areas and Suggested in SIP Comments That Have Not Been Implemented in FNSB or only Implemented in Part.

Measure Description	Areas Implementing Measure
14. Require installation of thermal mass to improve efficiency and prevent frequent cycling in selected new units	U.S. Environmental Protection Agency
Device Operation – Opacity	
18. No Visible Emissions during Curtailment Periods	Puget Sound CAA WA Maricopa County AZ
Device Operation – Permits	
23. Require exempt households to display a decal visible from a point of public access	Ada County ID
Device Operation – NOASH	
25. Require detailed application or inspection to verify need	Puget Sound CAA WA
27. Require annual renewal of waiver	Maricopa County AZ
28. Set income threshold	Missoula City-County MT Maricopa County AZ
29. Allow only NOASH households to burn during curtailment periods	Utah, UT
Fuels	
31. Require sale of only dry wood during late summer to end of winter	South Coast AQMD CA
32. Require dry wood to be clearly labeled to prohibit marketing of non-dry wood as dry wood	San Joaquin Valley APCD CA Bay Area AQMD CA
Open Burning	
35. Restrict burning during air pollution events	Ada County ID Klamath County OR
Curtailment Programs – Averaging Period	
38. Ambient PM2.5 concentration (1-hr average)	Idaho, ID
Curtailment Programs – Thresholds	
39. Use of AQI as Basis for Curtailment Threshold	Idaho, ID
Curtailment Program – Exemptions	
42. Burn down period	Puget Sound CAA WA Maricopa County AZ
45. Elevation-based	South Coast AQMD CA
46. Lack of electrical or natural gas service availability	Utah, UT South Coast AQMD CA San Joaquin Valley APCD CA
Coal	
50. Require low sulfur content coal	Missoula City-County MT Puget Sound CAA WA
Ultra-low Sulfur Diesel/Heating Oil	

Table 4. Control Measures Implemented in $PM_{2.5}$ Nonattainment Areas and Suggested in SIP Comments That Have Not Been Implemented in FNSB or only Implemented in Part.

Measure Description	Areas Implementing Measure
51. Ultra-low Sulfur Heating Oil	Missoula City-County MT New York, NY Pennsylvania, PA
Used Oil	
52. Operation and sale of small "pot burners" prohibited	Vermont, VT
53. No Sale or Exchange of Used Oil for Fuel, unless it Meets Constituent Property Limits	Vermont, VT
Transportation	
54. Adopt CARB vehicle standards	Pennsylvania, PA Klamath County OR
55. School bus retrofits	Klamath County OR
56. Road paving	Nogales AZ Pinal County AZ Klamath County OR
57. Transportation Control Measures (TCMs)*	South Coast AQMD CA
58. Controls on road sanding and salting	Utah, UT
59. I/M Program*	Pennsylvania, PA
60. Vehicle Idling	EPA Comment
Other	
61. Fuel Oil Boiler Upgrade – Burner Upgrade/Repair	EPA Comment
62. Fuel Oil Boiler Upgrade – Replacement	EPA Comment
63. Require Electrostatic Precipitators	FNSB
64. Weatherization and Energy Efficiency	EPA Comment
67. Coffee Roasters	Commercial
68. Charbroilers	Commercial
69. Incinerators	Commercial
70. Used Oil Burners	FNSB
R1. Regional Kilns	RACM
R7. Ban Use of Hydronic Heaters	RACM
R15. Ban New Installations – Wood Stoves	RACM
R17. Ban Use of Wood Stoves	RACM
R20. Transportation Control Measures	RACM
R29. Increase Coverage of District Heating System	RACM

* Measures 57 & 59 are addressed in the Measure R20 Transportation Control Measure feasibility analysis.

All of the above controls are focused on the reduction of particulate emissions. As noted in the Modeling Chapter of the $PM_{2.5}$ Serious SIP neither VOC nor NOx are significant precursor pollutants in the Fairbanks $PM_{2.5}$ nonattainment area. There is no need to identify control measures for these precursor pollutants. With regard to ammonia, EPA commented that "Unless NH_3 is demonstrated to be insignificant for this area, the serious area plan will need to include an

evaluation of NH_3 and potential controls for all source categories including point sources." While a precursor demonstration of NH_3 insignificance is not feasible, a literature search for non-point source ammonia controls found no controls for Fairbanks emission sources. Controls addressing agriculture and animal waste ammonia, the predominant sources in lower-48 communities, are well documented, but those sources do not exist in Fairbanks. Therefore, no ammonia controls have been included in the 2020 Amendment Plan analysis.

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4. Step 3 – Determine Whether an Available Control Measure or Technology is Technologically Feasible

The third step in the 2020 Amendment Plan identification and evaluation process is the analysis of the technological feasibility of each of the candidate measures identified in Step 2. As noted above, it requires the consideration of many factors including impacts on the environment (e.g., air, water, noise, etc.) and energy (e.g., consumption, availability, etc.). Measures targeting area and mobile sources need to consider infrastructure, population size, workforce type and habits, etc. In addition, the critical source parameters needed to assess the impacts of the technology need to be identified (e.g., fuel specifications, travel activity, EPA certification, etc.). A key consideration is whether the identified measure provides an emissions benefit beyond those provided by existing federal, state and local controls (i.e., is it more stringent).

As discussed in Step 2 the approach employed in selecting measures for analysis focused on differences between elements of individual rules implemented in $PM_{2.5}$ nonattainment areas and those currently implemented by the Borough and the State for the Fairbanks $PM_{2.5}$ nonattainment area. This section provides the results of detailed comparisons between the selected candidate measures and existing State regulations to determine if the candidate measures are more stringent and can provide emission reductions beyond those of currently implemented measures. Step 2 identified a total of 47 control measures for consideration in this analysis.

The presentation of analysis findings follows a generic format with the following components:

- Measure #, Title
- Implementing Jurisdiction
- Regulation Weblink(s)
- Background
- Analysis
- Conclusion

This format is designed to provide transparency in the information used to prepare the analysis. The weblink(s) allow easy access to the referenced rules discussed in the background and analysis presentations.

Measure 1: Surcharge on Device Sales

Applicable Jurisdiction(s)

- Washington State

Regulation Weblink(s)

- https://dor.wa.gov/find-taxes-rates/other-taxes/solid-fuel-burning-device-tax

Background

A Washington State regulation imposes a fee upon the sale of solid fuel wood burning devices within the state. This regulation was adopted in or prior to 1987.[9] The fee, originally established at $15/unit, is currently set at $30/unit.[10]

This regulation requires that revenues from the program be used solely for the purposes of public education and enforcement of the solid fuel burning device program," with revenue distributed as follows:

a) 34% of the funds shall be distributed to the Woodsmoke Education Program, run by the state air agency, the Washington Department of Ecology, for the purposes of enforcement and educating the public about the effects of solid fuel heating devices on air quality and methods for achieving better efficiency from solid fuel burning devices; and
b) The remaining 66% of the funds are made available to local air authorities with enforcement programs under the Woodsmoke Enforcement Program on the basis of population.

If a local air authority is not in place, does not implement an enforcement program, or elects not to receive the funds, the funds that would otherwise be distributed under this subsection are transferred to the Department of Ecology. Businesses selling new wood stoves are also required to distribute and explain educational materials.

The biennial 2015-2017 budget for the Washington Department of Ecology estimated an income of $547,000 from the combined Woodsmoke Education and Enforcement Program, with $38,000 being allocated to the Department of Ecology for administration of affected programs and $509,000 allocated to the Air Quality Program. Of this $509,000, 34% (or roughly $173,000) was used to fund the statewide Woodsmoke Education Program. $274,000 of the remaining 66% (or $336,000) was disbursed to local agencies to fund both woodstove education and enforcement grants.[11] (Not all of the available funds are requests.)

EPA commented that implementing a surcharge "may be a helpful way to supplement limited funds. Implementation efforts within the nonattainment area could benefit from $24,000 of additional funding whether used for a code enforcer or other support of the wood smoke programs."

[9] Washington Laws, 1990, available at http://leg.wa.gov/CodeReviser/documents/sessionlaw/1990c128.pdf?cite=1990%20c%20128%20%C2%A7%206; Accessed 10/10/2017.
[10] Washington State Department of Revenue, available at https://dor.wa.gov/find-taxes-rates/other-taxes/solid-fuel-burning-device-tax; Accessed 10/10/2017.
[11] State of Washington Department of Ecology, Budget & Program Overview 2015-2017, available at https://fortress.wa.gov/ecy/publications/documents/1501007.pdf; accessed 10/12/2017.

Analysis

Discussions with Washington Department of Ecology staff[12] found that surveys they conducted were not able to clearly estimate emission benefits from state-level education/outreach, nor were they able to provide quantitative estimates of their emission benefits based on how funds were pooled and used by local agencies. Similar findings were confirmed based on communication with the Puget Sound Clean Air Agency, one of the local air authorities that receives funding from the Department of Ecology. They too combine funds received from the Wood Stove Education and Enforcement program with revenues from other sources and use the funding for education and enforcement related to burn restrictions, but they could not easily quantify the benefits of the specific funded programs. In addition, the revenues received from this program by the local agencies are small relative to the funds received from other sources.[13]

Given the co-mingling of monies from device sale surcharges with other funding sources, both Washington State and its local air agencies cannot easily estimate emission benefits attributed to either education or enforcement-related programs.

Another consideration is that DEC has no authority to collect the funds obtained through surcharges. Funds collected from surcharges in Alaska go straight into the state's general fund, they are not allocated to DEC unless the legislature appropriates those funds to the agency. The implementation of this measure would require the annual allocation of the collected funds to DEC for use in enforcement and/or education. The uncertainty of this allocation means that the measure is not permanent and enforceable, and therefore does not support a SIP commitment. The only way that could occur would be through a Constitutional Amendment. The Dedicated Funds Clause of the Constitution of the State of Alaska prohibits the dedication of "proceeds of any state tax or license" to "any special purpose." AK Const. Art. 9 § 7. A constitutional amendment changing this long-standing provision is highly unlikely. Even if support could be garnered, multiple years would be required to amend the state constitution.

Conclusion

DEC lacks the authority required to implement this measure, therefore it is technologically infeasible and cannot be considered as a measure for the 2020 Amendment to the Serious SIP.

Measure 6: Prohibit Installation of Flue Dampers Unless Device was Certified Using Flue Damper

Applicable Jurisdiction(s)

- Missoula, Montana

[12] Personal communication with Stuart Clark, Washington Department of Ecology, 10/12/2017. Personal communication with Matthew Vandrush, Washington Department of Ecology, 10/12/2016.
[13] Personal communication with Amy Warren, Puget Sound Clean Air Agency, October 13, 2017.

Regulation Weblink(s)

- https://www.missoulacounty.us/home/showdocument?id=8452

Background

With respect to enclosed combustion devices, the term "draft" refers to the negative pressure created at the air inlet to the combustion chamber by the buoyancy of hot combustion gases exiting the combustion chamber through a vertical stack or chimney. The magnitude of stack draft is primarily governed by the difference in temperature between outdoor air and the combustion gases within the stack, and the volume of the stack (or chimney). Since outdoor air and stack gas temperatures change both seasonally and during a typical diurnal heating cycle, the amount of draft can vary similarly.

In residential wood stoves and inserts, inlet air and combustion gas flow rates are generally controlled by a damper installed at the inlet airports to the combustion chamber. Where building codes and wood burning regulations allow, dampers can also be installed downstream of the combustion chamber in the exhaust stack to directly regulate combustion gas flow rates. Many dampers require manual adjustment, but some are thermostatically controlled to open the damper when combustion chamber temperatures decline during the burndown phase.

Solid fuel burning appliances are designed to operate within an optimum draft range. If the draft is set too low, insufficient air is available to sustain combustion except when very small quantities of fuel are present in the combustion chamber. If the draft is set too high, excess air (beyond what is needed for proper combustion) is allowed into the combustion chamber which reduces combustion temperatures and reduces the device's heating efficiency (resulting in increased fuel use) and may also result in unsafe operation. The optimum range of draft for properly installed and operated residential wood-burning devices such as wood stoves and fireplace inserts typically falls in the negative pressure range of minus 0.04 to 0.08 inches of water column.

Analysis

The BACM analysis of this measure is unchanged - Missoula, Montana is the only jurisdiction to enforce a regulation prohibiting the installation of a flue (exhaust stack) damper unless the device is specifically certified with a flue damper. The staff from the Montana Department of Environmental Quality could not locate a staff report associated with the adoption of this regulation by their Board in 1986 as part of the Montana Clean Air Act. They also suggested that no analysis was conducted to review the likely impact of flue damper installation on emissions prior to adoption.[14]

[14] Personal communication with Julie Mohr, Montana Department of Environmental Quality, October 5, 2017; Personal communication with Benjamin Schmidt, Missoula City/County Health Department, October 6, 2017.

During wintertime conditions in Fairbanks flue draft varies dramatically beyond the optimal range due to wider temperature differences between flue gases and ambient air. When outdoor temperatures fall to the -10 to -20°F range typical of ambient $PM_{2.5}$ violations in Fairbanks, draft negative pressures can reach or exceed minus 0.20 inches of water column, which is well in excess of the typical design ranges for wood stoves and inserts.[15] Under these conditions, resident time of hot combustion gases in a wood stove or fireplace insert will be reduced, increasing the quantity of fuel needed to be burned to maintain the target indoor temperature. Thus, use of a flue damper will reduce inlet air and exhaust gas flowrates and the resulting draft to within the designed operating ranges of woodstoves and fireplace inserts and provide an emissions reduction benefit through reduced fuel consumption. With regard to the installation of new wood burning devices, the 2015 NSPS mandates that owner manuals specify whether flue dampers are required and professional installers are required to observe installation instructions. 18 AAC 50.077(j) requires the use of installers certified by the National Fireplace Institute and/or the Masonry Heaters Association as appropriate.

Conclusion

The BACM analysis concluded that the benefits of this measure in an arctic environment are likely to increase emissions through increased fuel combustion. That finding has not changed, this rule will produce no benefit for new installations; therefore, the measure is technologically infeasible and not eligible for consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 8: Prohibit Installation of Solid Fuel Heating Device in New Construction

Implementing Jurisdiction(s)

- South Coast AQMD, Bay Area AQMD

Regulation Weblink(s)

- http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-445.pdf?sfvrsn=4
- https://www.baaqmd.gov/~/media/dotgov/files/rules/regulation-6-rule-3/documents/20191120_r0603_final-pdf.pdf?la=en

Background

The South Coast Air Quality Management District prohibits the installation of a wood-burning device into any new construction (Section 445.d.1) except in new developments where no natural gas service exists within 150 feet of the property line (Section 445.f.2). Devices installed in new construction without natural gas service are limited to USEPA certified wood-burning heaters, pellet stoves, masonry heater, or dedicated gaseous-fueled fireplaces (Section 445.d.2). South Coast AQMD does not require a permit for device installation or operation.

[15] Personal communication with Kent Severns, The Woodway, Fairbanks, AK, October 6, 2017.

The Bay Area Air Quality Management District prohibits the installation of a wood-burning device in any new construction building effective November 1, 2016 (Section 6-3-306). The Bay Area regulation does not provide an exemption from this requirement in areas not served by natural gas infrastructure.

Fairbanks had regulations addressing the installation of solid fuel devices in new construction, but they were removed with the passage of the Home Heating Reclamation Act. The state has no regulations governing installation of wood-burning devices specific to new construction, but does have 18 AAC 50.077 governing the sale and installation of any wood fired heating device which covers not only new construction but also all sales and installations in existing construction.

Analysis

While Fairbanks currently has natural gas service, it is capacity constrained and will not be in a position to expand service to new customers until 2020 in Fairbanks and 2021 in North Pole..[16] As a result, the installation requirements in the South Coast rule that would be applicable if adopted by the state would be limited solely to the type of device installed.

Alaska has implemented new regulations that establish more stringent emission ratings for new heating devices and related installation requirements. Those regulations, however, do not prohibit the installation of wood-burning devices in new construction. Backup heating systems are essential for survival in an arctic environment as loss of primary heating is not an uncommon occurrence with many causes including: extreme cold temperatures, ice storms, fuel supply loss, power outages, etc. DEC has required in regulations effective January 8, 2020, that wood heaters may not be installed as a sole source of heat in structures within the nonattainment area, with an exception for small, dry cabins on two acre or larger parcels (see 18 AAC 50.077(j)(2)).

DEC often hears from FNSB residents who have significant concerns regarding the need for non-electric backup heating systems in their homes. As described in the Emission Inventory, the predominant heating method within the residential space heating sector is residential fuel oil. All fuel oil boilers and heaters require electricity to operate the auxiliary systems such as fans and pumps. Given the subarctic climate and periodic power failures, these individuals have real safety concerns for themselves and their families as well as concerns about damage to their property.

These concerns and expressed needs for reliable backup heat are likely very different in the FNSB nonattainment area than in the San Francisco Bay Area where the BACM prohibition originates. However, based on the Borough's woodstove changeout/conversion program it is technically feasible to design a new home with adequate backup heating systems that do not rely on solid fuel heating appliances.

Even though it may be technically feasible in certain situations, without widespread availability to natural gas there are limited technologies to provide backup heat to address the safety

[16] AIDEA IGU Financing Agreement op. cit., Appendix A

concerns. While voluntary programs are in place, only 28 emergency power back up systems have been installed through the Borough's program. With the limited number of actual installations, DEC is cautiously optimistic that the emergency power back up systems will become a proven technology, but at this point the limited installations do not demonstrate that this technology is feasible in every situation. Due to the importance of these systems to ensure citizens safety in an arctic climate, it is not prudent to exclude an entire sector of proven residential heating technology that many citizens rely on for an immediate safety concern.

In order to address new installations DEC is implementing 18 AAC 50.077. This regulation is broader than just new construction; by regulating at the point of sale any new installation, including installation in existing homes, is affected. 18 AAC 50.077(a) includes a general prohibition on the installation of wood fired heating devices within the area, with exceptions defined in subsequent sections. No outdoor hydronic heaters may be sold or installed unless pellet fueled. 18 AAC 50.077(b) identifies 0.10 lb/MMBtu as the emission rate used as a requirement for pellet fueled hydronic heaters, that EPA certification is required, and that the certification from EPA will be reviewed by DEC and only approved if the underlying certification test results are accepted. 18 AAC 50.077(c) identifies 2.0 g/hr as the emission rate used as a requirement for cordwood stoves and pellet fueled stoves, an additional emission requirement that the 1-hr filter pull shall not exceed 6.0 g/hr, that EPA certification is required, and that the certification from EPA will be reviewed by DEC and only approved if the underlying certification test results are accepted. 18 AAC 50.077(d) identifies 2.0 g/hr as the emission rate for wood-fired heating devices whose rated size is 350,000 Btu/hr or greater, that EPA certification is required, and that the certification from EPA will be reviewed by DEC and only approved if the underlying certification test results are accepted. 18 AAC 50.077(e) allows DEC to review manufacturer test results and place a model on DEC's list of devices, which identifies devices that are allowable under 18 AAC 50.077.

18 AAC 50.077 is more stringent than current EPA certification for cordwood stoves because the emission limit is set at 2.0 g/hr, regardless of test method. EPA Step 2 certification has an emission limit of 2.5 g/hr for cordwood stoves that are certified with ASTM 3053, a.k.a. the cordwood method. 18 AAC 50.077 is more stringent than current EPA certification for cordwood and pellet stoves because of the additional emission limit on the 1-hr filter pull of 6.0

g/hr. EPA Step 2 certification has no limit on the 1-hr filter pull. 18 AAC 50.077 also requires another layer of oversight and report review by requiring that DEC perform certification reviews.

Preliminary review of the certification reports shows:

Pellet Appliances	
Number of reports reviewed	79
Number of appliances disapproved due to 2.0 g/hr emission limit	0
Number of appliances disapproved due to 1 hr filter pull (missing or over limit)	12
Number of reports with deficiencies	79
Number of approved reports	0
Number of flagged issues with reports	1,319

Cordwood Appliances	
Number of reports reviewed	128
Number of appliances disapproved due to 2.0 g/hr emission limit	9
Number of appliances disapproved due to 1 hr filter pull (missing or over limit)	52
Number of reports with deficiencies	128
Number of approved reports	0
Number of flagged issues with reports	2,658

Although the list of approved devices will change as manufacturers submit additional information, with some appliances ultimately being approved for sale, 18 AAC 50.077 provides regulatory requirements limiting the type of new appliances to only the cleanest appliances available. As noted previously, 18 AAC 50.077(j)(2) does prevent the installation of wood heaters as the sole source of heat in new construction in the area with a minor exception, but prescribing requirements on the primary source of heat in structures is a much broader restriction related to building and land use.

Additionally, DEC has no land use authority to impose restrictions on new construction. By state statute, land use authority is reserved to local governments. AS 29.40. Therefore, the only feasible method to implement this measure is by regulating at the point of sale by limiting the appliances to those with the lowest emissions, which also allows residents to adequately back up heating systems.

Conclusion

DEC lacks the land use authority required to implement this measure, and the measure as written contains no provisions for back-up heating requirements, therefore it is technologically infeasible to implement as written and cannot be considered as a measure for the 2020 Amendment to the Serious SIP. 18 AAC 50.077 is the only technologically feasible method to implement this measure and was adopted with the Serious Area SIP and is considered equivalent to the Bay Area measure.

Measure 9: Limit the Density of Solid Fuel Heating Devices in New Construction

Implementing Jurisdiction(s)

- San Joaquin Valley APCD, Eastern Kern APCD

Regulation Weblink(s)

- https://www.valleyair.org/rules/currntrules/r4901.pdf
- http://www.kernair.org/Rule%20Book/4%20Prohibitions/416_1%20Wood%20Burning%20Heaters%20and%20Fireplaces.pdf

Background

The San Joaquin Valley Air Pollution Control District in California limits the number of wood burning heaters allowed in new residential developments. Two limits apply to developments with housing densities greater than 2 residences per acre: no wood burning fireplaces may be installed in these residences, and no more than two U.S. EPA Phase II-certified wood heaters may be installed per acre in these residences. For developments with housing densities less than or equal to two residences per acre, the regulation allows no more than one wood burning fireplace or U.S. EPA Phase II-certified wood heater per residence. (Section 4901.5.3.2)

The Eastern Kern Air Pollution Control District in California prohibits the installation of wood burning fireplaces in new residential subdivisions that consist of 10 or more dwellings. (Section 416.1.VI)

Fairbanks allowed for the installation of solid fuel burning devices in new construction provided that permits had been issued by the Borough, devices were Borough-listed, and installation was performed by a Borough-listed installer, among other requirements. These regulations were removed after passage of the Home Heating Reclamation Act.

Analysis

Alaska DEC does not have the information or programs to address land use authority required to limit the number of solid fuel burning devices that can be installed in single dwellings newly constructed, nor limit the number of devices that can be installed per acre in new residential developments. Multiple years would be required for DEC to gather data and evaluate options, possibly obtain necessary authority, and establish the regulatory requirements to implement this measure. Instead, DEC has regulated wood heater installation so that no new structure may have wood as its sole source of heat (18 AAC 50.077(j).

Additionally, DEC has no land use authority to impose restrictions on new construction. By state statute, land use authority is reserved to local governments. AS 29.40.

Conclusion

DEC lacks the land use authority required to implement this measure, therefore it is technologically infeasible and cannot be considered as a measure in the 2020 Amendment to the Serious SIP.

Measure 10: Install EPA-Certified Device Whenever a Fireplace or Chimney is Remodeled

Implementing Jurisdiction(s)

- Bay Area AQMD

Regulation Weblink(s)

- https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-6-rule-3-woodburning-devices/documents/rg0603.pdf?la=en

Background

The Bay Area AQMD requires that a gas-fueled, electric, or EPA-certified device be installed whenever a fireplace or chimney is remodeled at a cost that exceeds $15,000 and requires a local building permit (Section 6-3-307).

Fairbanks limited wood heating devices in new construction to Borough-listed appliances (Section 21.28.030E) but did not require the replacement of non-Borough-listed appliances with listed versions upon the remodeling of a residence or of a fireplace or chimney. These regulations were removed after passage of the Home Heating Reclamation Act.

Analysis

The Bay Area AQMD measure would require the upgrading of wood heating appliances in affected Borough residences in which remodeling projects included fireplace or chimney modifications that exceeded $15,000 in cost. Alaska DEC does not have the information or programs to address land use/building code authority needed to govern building/remodeling permits. Multiple years would be required for DEC to gather data and evaluate options, possibly obtain necessary authority, and establish the regulatory requirements to implement this measure.

Additionally, DEC has no land use authority to impose restrictions on new construction. By state statute, land use authority is reserved to local governments. AS 29.40.

Conclusion

DEC lacks land the land use authority required to implement this measure; therefore, it is technologically infeasible and cannot be considered as a measure for the 2020 Amendment to the Serious SIP.

Measure 11: Prohibit Use of Rain Caps on Stacks

Implementing Jurisdiction(s)

- State of Maine

Regulation Weblink(s)

- https://www1.maine.gov/sos/cec/rules/06/096/096c150.doc

Background

Outdoor wood boilers (OWBs) are generally used to provide heat for residential structures. Firewood is burned in the unit, sited outside the residence, with the energy released by combustion transferred to the residence through circulation of a thermal fluid.

In some locations, operators of outdoor wood boilers attach a rain cap (or weather cap) to the stack from which emissions produced by the outdoor wood boiler are released. This rain cap is attached to prevent moisture (rain, snow, etc.) from entering the stack during periods of non-operation and causing exposed surfaces to rust.

Analysis

The BACM analysis of this measure is unchanged - Maine is the only jurisdiction that currently enforces a regulation related to the use of rain caps on outdoor wood boiler stacks, prohibiting the installation of caps unless specifically required by the manufacturer of the boiler.[17] Personal communications with staff members of the Maine Department of Environmental Protection indicated that the regulation was adopted in Maine between 2007 and 2008 primarily in response to complaints from citizens about the use of boilers by neighbors.[18] More than one staff member indicated that no scientific or statistical analysis was conducted by the staff during development of the regulation. One said specifically that he "did not know if the rule had worked well," and one said that only one comment was entered into testimony in the meeting at which the Maine DEQ Board adopted the regulation; the only responsive in the record mentioned that the use of a rain cap impeded buoyant plume rise of smoke exiting a stack and resulted in higher ground-interior level impacts at downwind residences. [19]

[17] Regulation can be downloaded at http://www.maine.gov/dep/air/woodsmoke/woodcombustion.html
[18] Personal communication on October 4, 2017 with Jeff Crawford, Air Bureau, Maine Department of Environmental Protection; Personal communication on October 5, 2017 with Tom Graham, Air Bureau, Maine Department of Environmental Protection.
[19] Personal communication on October 4, 2017 with Jeff Crawford, Air Bureau, Maine Department of Environmental Protection; Personal communication on October 5, 2017 with Tom Graham, Air Bureau, Maine Department of Environmental Protection.

The average precipitation rate in Fairbanks is much lower than that of Maine, particularly in the winter months. Whereas Maine averages more than forty inches of precipitation per year, Fairbanks averages less than eleven.[20,21] In addition, whereas ~54%, or 22 inches, of Maine's precipitation falls during the winter nonattainment months (October through March), only 31%, or 3 inches, of precipitation in Fairbanks falls during those months. Discussions with Fairbanks North Star Borough Air Quality Program staff found that rain caps are not used in Fairbanks, and thus a regulation prohibiting rain caps would have no impact on emissions.[22]

Conclusion

The BACM conclusion is unchanged - the prohibition of rain caps by Maine DEC was intended to improve smoke dispersion, not reduce emissions. Because of the very low inversion heights that are experienced in Fairbanks during the winter heating season, a prohibition of rain caps would not improve plume dispersion in the vertical direction, much less reduce emissions. Since the need for rain caps in Fairbanks is limited and Borough staff have previously indicated that existing OWBs are not equipped with them, a regulation prohibiting rain caps on OWB stacks would produce no emission benefit and is therefore technologically infeasible and not eligible for consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 12: Require Minimum Stack Height for OWBs Relative to Nearby Rooflines

Applicable Jurisdiction(s)

- State of Maine

Regulation Weblink(s)

- http://www.maine.gov/dep/air/woodsmoke/woodcombustion.html

Background

Outdoor wood boilers (OWBs) are generally used to provide heat for residential structures. Firewood is burned in the unit, located outside the residence, with the energy released by the combustion process transferred into the interior of the residence through circulation of a thermal fluid.

[20] Data collected for Portland, ME; Augusta, ME; and Lewiston, ME from U.S. Climate Data at https://www.usclimatedata.com/climate/maine/united-states/3189; Accessed 10/12/2017.
[21] Data collected for Fairbanks, AK from U.S. Climate Data at https://www.usclimatedata.com/climate/fairbanks/alaska/united-states/usak0083; Accessed 10/12/2017.
[22] Personal communication with Todd Thompson, Fairbanks Borough Air Quality Department, October 10, 2017.

The boilers generate emissions by the combustion of wood fuel, and those emissions can be transported to impact neighboring residences. Ground-level concentrations of emissions at downwind residences can be influenced by the heights at which emissions exit exhaust stacks and whether wind flows at exit points are impacted by the heights of structures near these exhaust stacks.[23]

Maine is the only state that currently regulates the minimum height of exhaust stacks serving newly-installed OWBs. The regulation specifies a minimum stack height of ten feet or "two feet higher than the peak of the roof of the structure being served by the OWB" if:

1) the OWB has a particulate emission rating greater than 0.60 lbs/MMBtu and is within 500 feet of any nearby residence, or
2) the OWB has a particulate emission rating of 0.60 lbs/MMBtu or less and is within 300 feet of any nearby residence.[24]

Additionally, the regulation requires the extension of an existing OWB exhaust stack if a new residence is constructed within the setback distances specified in the regulation.

Analysis

The BACM analysis of this measure is unchanged - as with the Maine-only regulation prohibiting the use of rain caps on OWB exhaust stacks, staff members of the Maine Department of Environmental Protection reported that the regulation was adopted in Maine between 2007 and 2008 primarily in response to nuisance complaints from citizens about the use of OWB by neighbors.[25] More than one staff member indicated that no scientific or statistical analysis was conducted by the staff during development of the regulation to estimate its benefits. One said specifically that he "did not know if the rule had worked well," and one said that no public comments were received in relation to the stack height requirements prior to or during the public hearing at which the Maine DEQ Board adopted the regulation.

Maine adopted this rule to minimize disputes between neighbors; the rule has no effect on emissions and was not developed to reduce ambient $PM_{2.5}$ concentrations other than at nearby downwind residences. The rule predates federal regulation of OWBs, which mandates that owner manuals provide "guidance on proper installation information, including stack height".[26] A survey of owner manuals found installation instructions specifying that chimney height extend

[23] Minnesota Pollution Control Agency, AERMOD Evaluation of Outdoor Wood Boiler Stack Height and Setback
[24] Regulation can be downloaded at http://www.maine.gov/dep/air/woodsmoke/woodcombustion.html
[25] Personal communication on October 4, 2017 with Jeff Crawford, Air Bureau, Maine Department of Environmental Protection; Personal communication on October 5, 2017 with Tom Graham, Air Bureau, Maine Department of Environmental Protection.
[26] https://www.federalregister.gov/documents/2015/03/16/2015-03733/standards-of-performance-for-new-residential-wood-heaters-new-residential-hydronic-heaters-and

above the roofs of surrounding buildings. [27] Industry guidance contained in Best Burn Practice for Wood Burning Outdoor Furnace recommends that stack extend 2 feet above surrounding roof top peaks.[28]

The addition of a regulation specifying minimum stack heights for OWBs would not lead to a reduction in $PM_{2.5}$ emissions but could reduce $PM_{2.5}$ concentrations downwind of newly installed OWBs or newly-constructed residences near OWBs.

Conclusion

The BACM conclusion is unchanged - because of the lack of any emission reduction resulting from adoption of a minimum stack height regulation, this measure is technologically infeasible and not eligible for consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 14: Require Installation of Thermal Mass to Improve Efficiency and Prevent Frequent Cycling in Selected New Units

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

- None

Background

The initial review of applicable SIPs and EPA guidance documents mistakenly identified a measure requiring the installation of thermal mass to prevent frequent burn cycling in hydronic heaters.

Analysis

The BACM analysis of this measure is unchanged - a review of the literature, applicable SIPs, EPA guidance documents, hydronic heater certification documents and the final rule for hydronic heaters issued in 2015 (Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces)[29] could find no requirements for installing thermal mass in hydronic heaters. The final rule for hydronic heaters and forced air

[27] https://centralboiler.com/media/1803/9000166_manual_classic_27-jan-2014.pdf
[28] https://www.hpba.org/Portals/26/Documents/Government%20Affairs/NSPS%20Members/HPBA%202014%20NSPS/Attachment13TechEnvironmentalAirDispersionModelingReportofEClassic2300July2012.PDF?ver=2016-11-21-105529-197
[29] https://www.gpo.gov/fdsys/pkg/FR-2015-03-16/pdf/2015-03733.pdf

furnaces discussed concerns about cycling conditions, operations, etc., but included no requirement for the addition of thermal mass to reduce cycling. The limited detail provided with this measure, along with the findings of the literature review, do not support any quantifiable permanent and enforceable emission reductions.

Conclusion

The BACM conclusion is unchanged - 40 CFR 51.100 defines BACM as a control measure that "generally can achieve greater permanent and enforceable emission reductions … than can be achieved through implementation of RACM". This measure cannot achieve permanent and enforceable emission reductions greater than can be achieved through implementation of RACM, does not meet the definition of BACM and is dismissed from consideration as control measure for the 2020 Amendment to the Serious SIP.

Measure 18: No Visible Emissions during Curtailment Periods

Applicable Jurisdiction(s)

- Maricopa County, Arizona

Regulation Weblink(s)

https://www.maricopa.gov/DocumentCenter/View/2016/P-26---Residential-Woodburning-Restriction-Ordinance-PDF

Background

A Maricopa County ordinance[30] allows wood stoves certified as the sole source of heat in a residential dwelling to continue operating during curtailment periods provided that these stoves emit no visible emissions, i.e. 0% opacity. Most other jurisdictions with wood burning regulations limit visible emissions from wood stoves permitted to operate during curtailment periods to 20% opacity.

Communication with staff members from Maricopa County's Air Quality Department indicated that no staff report was prepared when the "no visible emission" regulation was first adopted in 1994.[31] Communication with a staff member from Montana's Department of Environmental Quality indicated that Montana, where ambient temperatures during the winter nonattainment season can drop to low levels that approach those in Fairbanks, maintains a restriction that allows

[30] Ordinance P-26, Section 3.C.1 of Maricopa County Ordinance P-26: Residential Woodburning Restriction, available at https://www.maricopa.gov/DocumentCenter/View/5332; accessed October 12, 2017.
[31] Personal communication with Johann Kuspert, Maricopa County Air Quality Department, September 28, 2017.

visibility up to 20%.[32] Historical EPA literature states that "It can be difficult to distinguish pollutant-containing mists from innocuous water droplets that are generated from steam condensation,"[33] and advises inspectors that "if the temperature is low...consider the possibility of a steam plume that does not evaporate easily."[34] Academic literature summarizing EPA's Method 9 states:

> In cold weather, steam is often a part of the emission. In order to make an accurate reading, opacity must be read after the steam has dissipated. This change is readily visible as the apparent opacity will drop significantly but stay constant after that.[35]

Analysis

The BACM analysis of this measure is unchanged - two additional considerations in Fairbanks are that (1) daylight is limited during winter months to no more than 5 hours/day in December, January and February, the period when elevated $PM_{2.5}$ concentrations are most likely to occur, and (2) oil- and gas-fired heating devices generate condensing moisture plumes but are not required to cease operation during curtailment periods. These factors have led the Borough in the past to develop a checklist of considerations to differentiate between wood/coal stoves and oil/gas furnaces. These considerations include:

- Odor – smelling the smoke is often the first and best indication of wood or coal burning;
- Multiple Stacks – frequently an indication of a secondary heating device besides a furnace;
- Location of Stack – stacks located over a garage connected to the house is typically for an oil/gas furnace; stacks over separated garages and sheds/shops is an indication of a SFBD; stacks located above a common area, such as a living room, are an indication of a SFBD;
- Black Soot around Stack – black residue over snow & around stacks indicates solid fuel burning;
- Dark or Colored Smoke – darker colored smoke can be an indication of low temperature wood burning and coal burning;
- Cycling Smoke Plumes – an abrupt change in the plume is an indication of an oil/gas furnace;
- Piles or Stacked Cut Wood – are a clear indication of a wood burning device;

[32] Personal communication with Benjamin Schmidt, Montana Department of Environmental Quality, October 6, 2017.
[33] Rose, Thomas H, Visible Emission Evaluation Procedures Course Student Manual APT/ Course 325 Final Review Draft, 1995, available at https://www3.epa.gov/ttnemc01/methods/VECourse.pdf; accessed October 12, 2017.
[34] Eastern Technical Associates and Entrophy Environmentalist, Inc., Visible Emissions Field Manual EPA Methods 9 and 22, EPA 340/1-92-004, 1993, available at https://www3.epa.gov/ttnemc01/methods/VEFieldManual.pdf; accessed 10-12-2017
[35] University of Nebraska-Lincoln, Safe Operating Procedure: Opacity of Emissions from Combustion Sources and Operating Log Record, 2017, available at https://ehs.unl.edu/sop/s-opacity_emissions.pdf; accessed October 12, 2017.

- Exterior chutes – are an indication of a coal burning device;
- Property Database Check – the Borough's database can provide information on original installations, Deed Restrictions, etc.

This checklist allowed Borough field personnel to efficiently determine whether plumes are coming from homes violating Stage 1 or Stage 2 Alerts. Borough personnel were able to survey 40 homes per day during a 5-hour shift (8 homes per hour) to determine compliance with Stage 1 or Stage 2 Alerts. Compliance was determined by observing a SFBD in operation, without the need for an opacity observation. Opacity observations during stage restrictions would add the problem of differentiating steam from particles, compounding the previously identified difficulties of limited daylight and differentiating from oil and gas fired heating devices. A reduction in the limit to zero visibility would require any field staff to monitor each home for a minimum of 20 minutes to identify if a continuous plume with decreasing opacity represents a wood-fired device during startup, and to record the minimum number of observations required by EPA Method 9. Enforcing a zero opacity standard during curtailment would limit the number of homes observed per hour to 2 or less (20+ minutes opacity reading time plus travel time, identification of stacks, etc.). The reduction in the number of homes observed would significantly reduce the identification of Alert violations and benefits of the enforcement program. As a result, implementation of this measure would result in increased emissions during curtailment periods as fewer homes would be inspected for compliance. Fairbanks is no longer enforcing this measure because of the passage of the Home Heating Reclamation Act. While the state is now enforcing this measure under the Episode Chapter of the $PM_{2.5}$ Serious SIP, the same issues noted above apply as the implementation of the measure would lead to a reduction in the number of homes inspected for compliance.

Conclusion

The BACM conclusion for this measure is unchanged. It is technologically infeasible because a more stringent visibility standard would reduce the number of homes inspected, reduce the number of violations identified and allow for an increase in wood burning emissions. Therefore, this measure is not eligible for consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 20: Require Renewals with Inspection Requirements

Implementing Jurisdiction(s)

- San Joaquin Valley APCD

Regulation Weblink(s)

- https://www.valleyair.org/rules/currntrules/r4901.pdf

Background

San Joaquin Valley APCD prohibits wood-fired heating devices from being operated during a Level One Episodic Wood Burning Curtailment except for USEPA Phase II certified devices and pellet stoves, provided that these are registered with the District (Rule 4901 Section 5.6.1). Qualifying wood heaters are eligible for registration by submitting a completed application and supplemental documentation to the District including certification by a District Registered Wood Burning Heater Professional that the device is either a Phase II certified device or a pellet stove (Section 5.9.2.1). If the device for which registration is being sought is more than one year old at the time of initial registration, the application for registration much include proof of inspection by a Registered Professional (Section 5.9.2.1.3). In areas where natural gas service is not available, registration is not required for a device to be operated during a Burning Curtailment.

Registrations are valid for a period of up to three years. Registration may be renewed by submitting a Registration Renewal application with verification that the wood burning device has been inspected by a Registered Professional to verity that it is maintained pursuant to manufacturer specifications (Section 5.10.3).

Fairbanks allowed Borough-listed devices to continue operating during a Stage 1 air alert if such devices had approved Stage 1 waivers. Borough-listed devices included USEPA Phase II certified wood stoves, USEPA certified hydronic heaters, masonry heaters, cook stoves, or other devices emitting 2.5 gm/hr or less as documented by accepted testing. Stage 1 waivers did not have expiration dates. These regulations were removed after passage of the Home Heating Reclamation Act.

EPA commented that the Fairbanks requirements lacked the regular renewal and inspection opportunities to verify proper device operation.

Analysis

All three agencies require the registration or permitting of wood heating devices in order to be operated during burning curtailment periods. Adopted in the Serious Area SIP, 18 AAC 50.077(h) requires all wood fired-heating devices to be registered when applying for any waivers described in the State Air Quality Control plan. The Episode Chapter of that document details the requirement for the issuance of a waiver and the related renewal and inspection requirements separately for related application, renewal and inspection requirements for all solid-fuel heating devices. All devices require an initial inspection/maintenance verification by either the owner or a professional installer. All devices with an emissions rating of >7.5 g/hr are only eligible for 2 annual NOASH waivers. Devices with an emission rating of >7.5 g/hr are not allowed a Stage 1 waiver. Lower emitting devices are eligible for longer NOASH or Stage 1 waiver periods (up to 2, 3 and 4-years). These requirements are consistent with those specified in San Joaquin Valley and address EPA's comments.

Another difference between the regulations is that San Joaquin Valley's wood burning control season applies to the months of November through February (4901 Section 3.30) while Fairbanks wood burning season applies to the months of October through March (18 AAC

50.076(b). Fairbanks wood burning controls apply for a 6-month period, while San Joaquin Valley's controls apply for a 4-month period. The difference in wood burning control periods more than compensates for any differences in waiver periods.

Conclusion

The adoption of the referenced Episode Chapter requirements and state regulations are sufficient to meet the 2020 Amendment Plan requirements of this measure, therefore the measure is technologically feasible, implemented in an alternate/equivalent form, and no additional analysis is required.

Measure 23: Require Exempt Households to Display a Decal Visible from a Point of Public Access

Implementing Jurisdiction(s)

- Ada County, Idaho

Regulation Weblink(s)

- http://www.sterlingcodifiers.com/codebook/index.php?book_id=447

Background

The Ada County Development Services Department exempts NOASH households and Department-listed low emission wood heating devices from having to cease operation during curtailment periods (Section 5-10-8.A). One of the requirements for a valid exemption is that each affected household display an exemption decal visible from a point of public access.

Previously, the Borough prepared lists of residences registered as NOASH households and those heated with Borough-approved appliances. These lists were used by Borough enforcement staff in the field to identify such residences during Stage 1 Alert periods as exempt from wood burning curtailment requirements. The authority for the Borough to assemble these lists disappeared with the passage of the Home Heating Reclamation Act and DEC maintains and updates these lists as it implements the curtailment program.

Analysis

The BACM analysis of this measure is unchanged - the Ada County measure is intended to facilitate field compliance inspections by highlighting non-exempt residences with visible smoke plumes for enforcement actions. Because of the high prevalence of oil heaters in all Borough residences (79.0%), determination of compliance with curtailment requirements requires a minimum of 20-minute opacity observations – except in the case of NOASH residences - to ascertain oil versus wood fuel sources of visible emissions. Determination of compliance at NOASH residences, which constitute only 2.2% of residences in the nonattainment area, can be ascertained as quickly by examination of a list of NOASH addresses as by observation of a

visible decal. Moreover, the Borough prepared lists of residences have been made available to state enforcement staff and are being used to identify registered NOASH residences using tablets with maps noting their locations. The adoption of decals will add no benefit to current enforcement efforts.

Conclusion

The BACM conclusion is unchanged - the adoption of a visible decal regulation will not provide an emissions reduction benefit during Stage 1 Alerts and, thus, is not technologically feasible. Therefore, this measure is not available for consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 25: Require Detailed Application or Inspection to Verify Need for No Other Adequate Source of Heat (NOASH) Permit

Implementing Jurisdiction(s)

- Puget Sound Clean Air Agency (PSCAA)

Regulation Weblink(s)

- http://www.pscleanair.org/219/PSCAA-Regulations

Background

The Puget Sound Clean Air Agency (PSCAA) exempts households with no other adequate source of heat (NOASH) from curtailment requirements if the residences or commercial buildings were constructed prior to July 1, 1992 and not substantially remodeled after that date, and the households have been granted exemptions by the agency (Section 13.05.d.1.a). PSCAA grants NOASH exemption only after receipt and review of a detailed application form.[36]

Fairbanks previously exempted NOASH households from having to cease burning wood during Stage 1 Alerts provided that such households have registered with the Borough. The Borough granted NOASH determinations only after receipt and review of detailed application form that must be notarized before submittal[37]. Regulations mandating these Borough requirements were removed after passage of the Home Heating Reclamation Act and the implementation of the Alert and waiver programs is now implemented by DEC.

As noted earlier, EPA commented that the Fairbanks requirements lacked the regular renewal and inspection opportunities to verify proper device operation.

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[36] Personal communication between Amy Warren, PSCAA, and Meena Rezaei, Trinity Consultants, on December 15, 2017. Application available for download at: http://www.pscleanair.org/DocumentCenter/View/163; accessed on January 14, 2018.
[37] Application was for download at: http://fnsb.us/transportation/Pages/Change-Out-Program.aspx; accessed on January 14, 2018

Analysis

The Episode Chapter of the $PM_{2.5}$ Serious SIP noted in the introduction details of Alaska's exception and waiver requirements including:

- Length of waivers based on age and emission rate of the device
- Annual renewals on oldest and highest emission rated devices
- 3rd party inspection of device to verify proper installation required
- 3rd party inspection of maintenance (chimney sweep) required
- Device registration required
- Documentation of dry wood required

Exceptions/Waiver levels are detailed in Tables for Stage 1 and Stage 2 Alerts. The structure is intended to provide incentives to upgrade existing devices while at the same time acknowledging the number of devices already changed out as part of the wood stove change out program. A detailed application and verification documentation is required prior to issuance of any exception or waiver.

These requirements are consistent with PSCAA NOASH curtailment and application requirements and address EPA comments about renewal and inspection opportunities to verify proper device operation.

Conclusion

The adoption of the referenced Episode Chapter requirements are sufficient to meet the plan requirements of this measure, therefore the measure is technologically feasible, has been adopted and implemented in alternate form, and no additional analysis is required for the 2020 Amendment.

Measure 27: Require Annual Renewal of Waiver

Implementing Jurisdiction(s)

- Maricopa County

Regulation Weblink(s)

https://www.maricopa.gov/DocumentCenter/View/2016/P-26---Residential-Woodburning-Restriction-Ordinance-PDF

Background

Maricopa County AZ requires that residential sole source of heat (NOASH) permits be renewed annually (Ordinance P-26, Section 4.A). This regulation is intended to annually confirm compliance of the permitted household with NOASH requirements and minimize the number of

permits issued to non-compliant households. Section 4.A also prohibits the initial issuance of a NOASH permit after December 31, 1995 and allows for annual permit renewal if the initial permit was issued before December 31, 1995 and the household and device continue to meet permit requirements.

Fairbanks required that NOASH households apply and be approved in order to continue burning during curtailment periods. NOASH designations were valid for one year and required renewal to remain valid.[38] The Borough regulations were removed with the passage of the Home Heating Reclamation Act.

Analysis

The exception and renewal requirements for NOASH waivers are specified in the Episode Chapter of the $PM_{2.5}$ Serious SIP. It mandates that all registrations require verification by certified installers. Renewal requirements vary by age, control technology and emission rating. Higher emitting devices older than 10 years are limited to 2 annual renewals. Thus, pre-2010 higher emitting devices are only allowed 2 renewals. Longer renewal periods are allowed for lower emitting devices. Maricopa does not limit the number of renewals for devices installed prior to December 31, 1995. Also, 18 AAC 50.077(a) requires that a person may not install, reinstall, sell, lease, distribute, or convey wood-fired heating devices that lack a valid EPA certification under 40 C.F.R. 60.533 or any wood-fired outdoor hydronic heaters, except pellet fueled devices. This requirement ensures rapid turnover of the existing stock of older, higher emitting wood-burning devices over the next 5 years, whereas the Maricopa regulation relies on a much slower turnover of pre 1996 wood-burning devices, while providing no incentive to retire post 1995 wood burning devices. Thus, the older Maricopa NOASH devices can continue to operate into the future, whereas in Alaska those devices (and many more) are required to be rendered permanently inoperable by December 31, 2024.

Collectively, the new Alaska regulations provide greater emission reductions than would be produced by the adoption of Measure 27.

Conclusion

The adoption of the referenced Episode Chapter requirements and state regulations are sufficient to meet the plan requirements of this measure, therefore the measure is technologically feasible, adopted and implemented in alternate form, and no additional analysis is required.

Measure 28: Set Income Threshold [for Curtailment Exemption]

Implementing Jurisdiction(s)

- Missoula MT; Maricopa County AZ

[38] Personal communication between Nicholas Czarnecki, FNSB Air Quality Division, and Bob Dulla, Trinity Consultants, on December 19, 2017.

Regulation Weblink(s)

- https://www.missoulacounty.us/home/showdocument?id=8452

https://www.maricopa.gov/DocumentCenter/View/2016/P-26---Residential-Woodburning-Restriction-Ordinance-PDF

Background

The Missoula City-County Air Pollution Control Program exempts households qualifying for energy assistance from burning curtailment requirements (Section 9.207). Maricopa County grants temporary exemptions from curtailment requirements to households qualifying for energy assistance (Section 4.B).

Fairbanks did not exempt households from curtailment requirements solely on the basis of income, but did allow the granting of sole-source-of-heat exemptions to households in which "economic hardships require the applicant's use of a solid fuel burning appliance" provided that the appliance is Borough-listed, in addition to other requirements. The Borough regulations were removed with the passage of the Home Heating Reclamation Act.

Analysis

The Missoula City-County measure allows low income households to continue burning during curtailment periods. While Alaska will also allow low income households to continue burning during curtailment periods (per the Episode Chapter of the $PM_{2.5}$ Serious SIP), NOASH exceptions/waivers are not exempt from the restrictions noted above in Measure 27. This means the pool of NOASH waivers will become increasingly cleaner (i.e., lower emitting) over the next 5 years. At this point, Alaska has established the economic hardship thresholds for NOASH waivers, consistent with the previous Borough thresholds, economic hardships must provide documentation of enrollment in one of several assistance programs. 2020 amendments to the Episode Chapter include defining the specific programs that qualify for economic hardship. Suitable documentation of economic hardship must include receipt of assistance for: unemployment, Denali Kid Care, WIC, or social security/disability.

Overall, the removal or permanent inoperability requirements of 18 AAC 70.077(a) & (l) will result in greater emission reductions in the near term than any differences in the definition of economic hardship and is therefore more stringent.

Conclusion

The adoption of the 2020 amendments to the Episode Chapter requirements and state regulations are sufficient to meet the plan requirements of this measure, therefore the measure is technologically feasible, adopted and implemented, and no additional analysis is required.

Measure 29: Allow Only NOASH Households to Burn During Curtailment Periods

Implementing Jurisdiction(s)

- Utah Department of Environmental Quality

Regulation Weblink(s)

- https://rules.utah.gov/publicat/code/r307/r307-302.htm

Background

The Utah Department of Environmental Quality exempts only households with no other adequate source of heat (NOASH) from the requirement to cease operation of wood heating devices during curtailment periods in $PM_{2.5}$ nonattainment areas in the state (Section R307-302-3.4). Fairbanks exempted households with NOASH waivers, wood burning appliances with Stage 1 waivers, and wood burning appliances in households affected by power failures from similar curtailment requirements during Stage 1 Alerts. The Borough regulations were removed following the approval of the Home Heating Reclamation Act, however, the State regulations remain in place. The State waiver program has mirrored the Borough program.

Analysis

Utah calls burn bans when concentrations are forecast to reach or exceed 25 $\mu g/m^3$. Alaska's Episode Chapter of the $PM_{2.5}$ Serious SIP calls Stage 1 Alerts when concentrations are forecast to exceed 20 $\mu g/m^3$ and Stage 2 Alerts when concentrations are forecast to exceed 30 $\mu g/m^3$. During a Stage 1 Alert those with a NOASH or a Stage 1 waiver may continue to operate wood heating devices. During a Stage 2 Alert only those with a NOASH may continue to operate wood heating devices. Section III.D.7.12 Emergency Episode Plan contains the detailed breakdown of the criteria and length requirements for temporary NOASH exceptions/waivers and temporary Stage 1 waivers. During the 2019/2020 winter season, as shown in Table 5, DEC called a total of 24 Stage 1 Alerts (15 in North Pole and 9 in Fairbanks) and 34 Stage 2 Alerts (25 in North Pole and 9 in Fairbanks)

Table 5 Number of Stage restrictions called by ADEC during 2019/2020 heating season

Number of Alert Restrictions Called	Stage 1	Stage 2
North Pole:	15	25
Fairbanks:	9	9
Total:	24	34

During the 2019/2020 winter season, as shown in Table 6, DEC issued a total of 51 NOASH waivers and 25 Stage 1 waivers.

Table 6 Burn restriction waivers issued by DEC during 2019/2020 heating season

Burn Restriction Waivers Issued	
DEC NOASH Waivers:	51
DEC Stage 1 Waivers:	25
Total:	76

By lowering the Stage 2 threshold to be equivalent with Utah's NOASH only threshold of 25 $\mu g/m^3$ the near term emission reductions would only result from Stage 1 wood heating devices ceasing operation, because all other wood burning appliances are required to cease operation at the Stage 1 level of 20 $\mu g/m^3$. Comparing the number of Stage 1 waivers issued in the 2019/2020 heating season to the 2019 emission inventory estimates of wood heating devices, there were 25 Stage 1 Waivers and approximately 13,899 SFBAs, Stage 1 waivers accounted for approximately 0.2% of the inventory of SFBAs. Any near-term benefits for lowering the Stage 2 threshold to 25 $\mu g/m^3$ would be negligible.

Implementing a curtailment threshold at 20 $\mu g/m^3$ that applies to all but 0.2% of the estimated inventory is more stringent than implementing a single stage threshold to 25 $\mu g/m^3$. Therefore, at the present time, DEC's two stage thresholds are more stringent than Utah's one stage threshold.

DEC recognizes that this analysis is not static; for example, as the number of Stage 1 waivers grow the potential benefits of this measure will increase. Likewise, as the North Pole monitor moves closer to attainment, the number of Stage 1 alerts may also increase in proportion to Stage 2 alerts. The low percentage of Stage 1 waivers compared to the estimated 2019 inventory of appliances is also not fully understood. However, as the curtailment program becomes a cultural norm in Fairbanks, participation in the Stage 1 program and the NOASH program may rise. As the number of Stage 1 waivers rise, there may be a point where Utah's single stage curtailment at 25 $\mu g/m^3$ could be more stringent than DEC's current two stage curtailment.

Conclusion

The adoption of the referenced Episode Chapter requirements are presently sufficient to meet the plan requirements of this measure, therefore the measure is technologically feasible, adopted and implemented, and no additional analysis is required. Recognizing that the analysis is dynamic and changes may occur as the curtailment program becomes more widely accepted and the area moves closer to attainment, DEC has evaluated this measure as a contingency measure for future adoption if triggered.

Measure 31: Require Sale of Only Dry Wood during Late Summer to the End of Winter

Implementing Jurisdiction(s)

- South Coast Air Quality Management District

Regulation Weblink(s)

- http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-445.pdf

Background

SCAQMD's Rule 445 limits the sale of commercial firewood to seasoned only firewood from July 1 through the end of February the following year. Seasoned firewood is defined to have a moisture content of 20 percent or less by weight as determined by approved hand-held moisture meters or an alternate method defined by the California Air Resources Board. Commercial wood sellers are free to sell both seasoned and non-seasoned firewood during the remaining months of the year. The goal is to restrict the supply of unseasoned wood available for use during winter months.

Fairbanks North Star Borough Code[39] and Alaska regulation did not allow burning of firewood with a moisture content exceeding 20%. The Code was modified to remove this requirement from Borough code after voter approval of the Home Heating Reclamation Act. The state regulation to burn dry wood remains in effect.

Alaska regulations[40] require mandatory registration of commercial wood sellers, the use of uniquely numbered three-part moisture disclosure forms, which document the date the wood was cut and findings of moisture measurements of three pieces of wood for each cord sold. The wood seller is required to sign the form, date when it was delivered and obtain signature of the customer purchasing the wood. The wood seller is also required to provide the customer with a copy of the signed disclosure form and submit to the state the department's copy of the completed disclosure form.

EPA commented that while the "Borough has SIP approved dry wood requirements that prohibit the burning of wet wood and moisture disclosure requirements by sellers, we believe that a measure limiting the sale of wet wood during the winter months should be further analyzed for MSM consideration."

Analysis

Alaska's 18 AAC 50.076 has been modified to include new subsections that effective October 1, 2021, ensure that all the wood being sold or provided has a moisture content of less than 20%, but with one exception for eight foot or longer round logs. This exception requires the wood seller to ensure the buyer has the ability to store the wood for the next season and will not use the wet wood for the season in which it is sold. Subsections (d)(e) & (g) require commercial wood sellers to register with the ADEC; (j) includes requirements to ensure that wood with a less than 20% moisture content is being sold after the effective date, along with the exception. 18 AAC

39 http://www.codepublishing.com/AK/FairbanksNorthStarBorough/#!/FNSBC21/FNSBC2128.html#21.28

40 http://burnwise.alaska.gov/requirements.htm

50.076(l) would limit non-commercial sellers to selling dry wood. Dry wood is defined as either:

- properly seasoned, split and stored covered for at least 9 months, unless confirmed dry;
- mechanically dried, where the drying process has been inspected and approved by the department to ensure consistency and reliability; or
- harvested from an inspected fire killed source that has been split, stacked, stored and confirmed dry prior to freezing;

Wood sellers are required to test, using a commercially available moisture test meter that the department has approved for accuracy, measure moisture content periodically to verify and ensure stock is dry prior to selling. They are also required to document the measured moisture content and keep a record of the measurements over the seasoning period and sign an affidavit form that the department provides attesting the wood is dry prior to sale.

The new rules recognize that commercial wood sellers will need time to build up the necessary supply of dry wood required to satisfy overall firewood demand. In the intervening period, wood sellers are required to follow the regulations outlined in the background discussion.

Lacking infrastructure, such as kiln capacity sufficient to dry a season's worth of wood, the only technically feasible method of drying commercially available cordwood to less than 20% moisture content is to air dry the wood. A study of the time required to dry wood in Fairbanks [1] found that a minimum of six summer months with covered storage is required to dry wood from spring cutting to a moisture level below 20%. However, DEC regulation 18 AAC 50.076 (k) has set the minimum of 9 months drying time, unless confirmed, to ensure that the wood is dry given the variation in wood drying with different storage options. The same study determined that wood cut in the fall dries much more slowly and essentially stops drying once the wood becomes frozen. At this time the community lacks adequate storage space to dry the wood required to fill the commercial market. The summer of 2020 will be used by the commercial wood sellers to secure the space and construct structures to air dry the wood. Cord wood harvested during the spring of 2021 could then be stored and dried by October 2021 which is the most expeditious schedule that the commercial wood industry can follow to meet the requirements of this rule.

DEC received a number of comments suggesting that the sale of 8-foot round logs should be allowed to continue in the future. These comments asserted that many buyers of 8-foot rounds have multi-year storage capacity and process their logs years in advance to ensure proper seasoning. DEC recognizes that 8-foot rounds cannot be burned as is, but must be processed by the buyer so this wet wood can't be immediately burned without some up front effort. This means that buyers can't easily or unintentionally add this wood to their heating device. DEC revised the final regulations to accommodate the continued sale of 8-foot rounds, but added provisions that these sales can only occur if the wood seller confirms that the buyer will not burn wet wood in the coming season based on dry wood supply and storage/processing capacity for seasoning wood.

Recent wood sales data show that 8-foot rounds account for 20.17% of wood sales in the Fairbanks nonattainment area. The sales estimates show approximately 1,511 cords of 8-foot logs were sold compared to a total of 7,491 cords sold and is a small fraction of the cordwood consumed in the non-attainment area which is 66,217 cords per year showing that 8-foot rounds account for approximately 2.28% of cordwood consumed in the non-attainment area. The low sales volume of 8-foot rounds combined with the requirement that it cannot be burned in the coming season ensures that the year-round dry wood sales mandate for Fairbanks after October 1, 2021 more than offsets the seasonal dry wood sales requirements mandated in Measure 31; they also address EPA's comments.

Conclusion

The adoption of the referenced state regulations is more than sufficient to meet the 2020 Amendment Plan requirements of this measure, therefore the measure is technologically feasible, adopted and implemented, and no additional analysis is required.

Measure 32: Require Dry Wood to be Clearly Labeled to Prohibit Marketing of Non-Dry Wood as Dry Wood

Implementing Jurisdiction(s)

- South Coast Air Quality Management District; San Joaquin Valley Air Pollution Control District; Bay Area Air Quality Management District

Regulation Weblinks(s)

- http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-445.pdf
- http://www.valleyair.org/rules/currntrules/r4901.pdf

https://www.baaqmd.gov/~/media/dotgov/files/rules/regulation-6-rule-3/documents/20191120_r0603_final-pdf.pdf?la=en

Background

SCAQMD's Rule 445 limits the sale of commercial firewood to be seasoned only firewood from July 1 through the end of February the following year. Seasoned firewood is defined to have a moisture content 20 percent or less by weight as determined by approved hand-held moisture meters or an alternate method defined by the California Air Resources Board. Rule 445 also contains labeling requirements:

> *Effective November 4, 2013, no commercial firewood seller shall sell, offer for sale, or supply wood-based fuel without first attaching a permanently affixed indelible label to each package or providing written notice to each buyer at the time of purchase of bulk firewood that at a minimum, states the following:*
>
> *Use of this and other solid fuel products may be restricted at times by law. Please check (1-877-4NO-BURN) or (www.8774NOBURN.org) before burning.*

San Joaquin Valley AQMD's Rule 4901 has firewood marketing restrictions:

No person shall sell, offer for sale, or supply any wood which is orally or in writing, advertised, described, or in any way represented to be "seasoned wood" unless the wood has a moisture content of 20 percent or less by weight

Bay Area AQMD Regulation 6 also has requirements governing the sale of wood:

Any person offering for sale, selling or providing solid fuel or wood intended for use in a wood-burning device within District boundaries shall:

Attach a label to each package of solid fuel or wood sold that states the following:

"Use of this and other solid fuels may be restricted at times by law. Please check 1-877-4-NO-BURN or http://www.8774noburn.org/ before burning."

If wood is seasoned (not to include manufactured logs), then the label must also state the following:

"This wood meets air quality regulations for moisture content to be less than 20 % (percent) by weight for cleaner burning."

Analysis

Current Alaska regulations[41] require mandatory registration of commercial wood sellers, the use of uniquely numbered three-part moisture disclosure forms, which document the date the wood was cut and findings of moisture measurements of three pieces of wood for each cord sold. The wood seller is required to sign the form, date when it was delivered and obtain signature of the customer purchasing the wood. The wood seller is also required to provide the customer with a copy of the signed disclosure form and submit to the state the department's copy of the completed disclosure form. The state is assembling the submitted forms into an electronic data base to track the moisture levels and volume of wood sold. Separate requirements address wood measurements and deliveries at temperatures below 32° F. All wood with measurements exceeding 20% is assumed to be wet.

The moisture disclosure forms require the buyer to declare:

I understand that starting October 2015, only dry wood may be burned between October 1 and March 31.

While Alaska does not require firewood to be labeled, it does require the buyer to sign a form documenting whether the wood is seasoned or unseasoned.

[41] https://dec.alaska.gov/air/anpms/sip/18aac50-reference-materials/

Current DEC requirements to have the customer sign a form documenting whether the wood is seasoned or unseasoned ensures that the customer has seen information about the moisture content of the wood being purchased. DEC's requirement is more stringent than other labeling requirements which the customer may or may not see, let alone acknowledge.

While current DEC regulations require wood sellers to document and distribute detailed information regarding the moisture content of the wood. SCAQMD Rule 445 limits the sale of commercial firewood to be seasoned only firewood from July 1 through the end of February the following year, eliminating excess emissions from commercially sold wet wood, and is therefore more stringent than current DEC regulations.

As discussed above in the analysis of Measure 31, wood sellers currently lack the infrastructure required to dry and store a season's worth of commercial firewood. Time will be required for wood sellers to secure the space and construct the structures to air dry wood. The summer of 2020 will be the earliest opportunity for commercial wood sellers to secure the space and construct structures to air dry the wood. Cord wood harvested during the spring of 2021 could then be stored and dried by October 2021 which is the most expeditious schedule that the commercial wood industry can follow to meet the requirements of this rule.

DEC has therefore adopted regulations in 18 AAC 50.076 (d)(e)&(g) that require commercial wood sellers to sell only dry wood year round after October 1, 2021. Subsection(j) includes requirements to ensure that wood with a less than 20% moisture content is being sold after the effective date. 18 AAC 50.076 (k) has set the minimum of 9 months drying time, unless confirmed, to ensure that the wood is dry given the variation in wood drying with different storage options. 18 AAC 50.076 (l) would limit non-commercial sellers to selling dry wood. Dry wood is defined as below 20% moisture content. Monitoring, recordkeeping, and reporting requirements are also included in the proposed regulations to ensure compliance with the 20% moisture standard. The adoption of the revisions incorporated into 18 AAC 50.076 are sufficient to meet 2020 Amendment Plan requirements for this control measure.

As noted above, DEC received a number of comments suggesting that the sale of 8-foot round logs should be allowed to continue in the future. These comments asserted that many buyers of 8-foot rounds have multi-year storage capacity and process their logs years in advance to ensure proper seasoning. DEC recognizes that 8-foot rounds cannot be burned as is, but must be processed by the buyer so this wet wood can't be immediately burned without some up-front effort. This means that buyers can't easily or unintentionally add this wood to their heating device. DEC therefore revised the final regulations to accommodate the continued sale of 8 foot rounds, but added provisions that these sales can only occur if the wood seller confirms that the buyer will not burn wet wood in the coming season based on dry wood supply and storage/processing capacity for seasoning wood.

As noted in the analysis of Measure 31, recent wood sales data show that 8-foot rounds account for 20.17% of wood sales in the Fairbanks nonattainment area. The sales estimates show approximately 1,511 cords of 8-foot logs were sold compared to a total of 7,491 cords sold and is a small fraction of the cordwood consumed in the non-attainment area which is 66,217 cords per

year showing that 8-foot rounds account for approximately 2.28% of cordwood consumed in the non-attainment area. The low sales volume of 8-foot rounds combined with the requirement that it cannot be burned in the coming season ensures that the year-round dry wood sales mandate for Fairbanks after October 1, 2021 more than offsets the seasonal dry wood sales requirements mandated in Measure 31. They also ensure that seasonal labeling requirements offset the seasonal labeling requirements of Measure 32.

Conclusion

The adoption of the referenced state regulations are sufficient to meet the plan requirements of this measure, therefore the measure is technologically feasible, adopted and implemented in alternate form, and no additional analysis is required.

Measure 35: Restrict Burning During Air Pollution Events

Implementing Jurisdiction(s)

- Klamath County; Ada County

Regulation Weblink(s)

- http://www.co.klamath.or.us/EH/Air%20Quality%20&%20Burning/Klamath%20County%20Clean%20Air%20Ordinance.htm
- http://www.sterlingcodifiers.com/codebook/index.php?book_id=447

Background

Klamath County OR prohibits open burning during burning curtailment periods (Section 406.100.4.a). Oregon Department of Environmental Quality regulations exempt recreational fires and ceremonial fires from open burning requirements (Section 340-264-0040).

Ada County ID prohibits the open burning of refuse or solid fuel during declared air quality alerts (Section 5-10-8.C). County regulations also exempt recreational or warming fires from open burning restrictions provided that such fires do not violate air pollution alerts (Section 5-2-7-2.D).

Alaska Department of Environmental Conservation prohibits open burning in $PM_{2.5}$ nonattainment areas between November 1 and March 31 (Section 18 AAC 50.065.f). These regulations also exempt ceremonial fires from open burning restrictions (Section 18 AAC 50.990.65.B).

Analysis

The BACM analysis of this measure is unchanged - the measures adopted by Klamath County and Ada County contain the same exemptions from open burning restrictions for recreational

fires as are contained in the Alaska regulations. Exempt fires are rarely ignited in Fairbanks when ambient temperatures reach subzero levels that are typical during Stage 1 Alert periods.[42] The removal of the ceremonial fire exemption will have no measurable emissions benefit in the Fairbanks nonattainment area.

40 CFR 51.1000 defines BACM as a control measure that "generally can achieve greater permanent and enforceable emission reductions … than can be achieved through implementation of RACM". Given that the measure does not result in a quantifiable emission benefit this control measure does not meet the definition of BACM.

With no quantifiable emission benefit and some associated cost to implement, the dollar per ton value would be infinite which shows economic infeasibility as well.

Conclusion

The BACM conclusion of these measures is unchanged - the measures as adopted by Klamath County and by Ada County do not meet the definition of BACM and 2020 Amendment Plan requirements and are economically infeasible. These measures have been dismissed from consideration as control measures for the 2020 Amendment to the Serious SIP..

Measure 38: Ambient $PM_{2.5}$ Curtailment Threshold (1-Hr Average)

Applicable Jurisdiction(s)

- Cache Valley and Cities, Idaho

Regulation Weblink(s)

- https://adminrules.idaho.gov/rules/2014/58/0101.pdf

Background

Many jurisdictions with wood smoke control programs have adopted specific air quality thresholds for triggering burn bans, or curtailments, during which certain activities that produce $PM_{2.5}$ emissions are prohibited, or at least severely restricted. The Idaho Department of Environmental Quality (IDEQ) is the only regulatory agency found to trigger curtailment periods on the basis of ambient $PM_{2.5}$ levels measured over 1-hour averaging periods. Most other air quality agencies with burn ban authority base curtailment decisions on $PM_{2.5}$ levels averaged over 12- to 24-hour periods. Most importantly, this local 1-hour threshold in the Cache Valley and cities of Idaho applies only to curtailment or cessation of open burning, not wood-based residential space heating.

[42] Personal communication between Nicholas Czarnecki, FNSB Air Quality Division, and Bob Dulla, Trinity Consultants, on January 25, 2018.

Under the Idaho Administrative Code, IDEQ has the authority to issue a Stage 1 Forecast and Caution when "particulate concentrations reach, or are forecasted to reach, and persist, at or above the levels listed" in the table below.[43] Under the Stage 1 Air Pollution Forecast and Caution, "there shall be no new ignition of open burning of any kind." In addition, the director of the IDEQ may request the cessation of open burning. (Again, this Stage 1 Forecast and Caution applies only to open burning and does not apply to residential wood heating.)

Table 7. Stage 1 Forecast Levels

Pollutant	Standard
$PM_{2.5}$	80 µg/m^3 1 hour average
$PM_{2.5}$	50 µg/m^3 24 hour average
PM_{10}	385 µg/m^3 1 hour average
PM_{10}	150 µg/m^3 24 hour average

This authority is also found in IDEQ's Air Pollution Emergency Rule.[44]

Analysis

The BACM analysis of this measure is unchanged - discussions with staff members of IDEQ[45] and the Utah Department of Environmental Quality (UDEQ)[46] found the jurisdictions share a common $PM_{2.5}$ nonattainment area and thus coordinate regulations on many air quality issues; they indicated that the 1-hour standard is outdated and no longer used. Staff members from UDEQ indicated that they had no regulations based upon 1-hour standards and that all regulations were based upon 24-hour averaging periods. The $PM_{2.5}$ thresholds, for example, have never been updated to correlate to the current NAAQS standards. Staff from IDEQ instead use a 24-hour concentration of 30 µg/m^3 as a curtailment threshold and are considering a lowering of their 24-hour standard if that proposed by Utah is accepted and required by EPA.

Moreover, the Alaska Department of Environmental Conservation (DEC) already has a state regulation in place[47] that prohibits open burning in the Fairbanks $PM_{2.5}$ nonattainment area between November 1 and March 31, the period that essentially corresponds to historical $PM_{2.5}$ violations.

The 1-hour concentration-based threshold adopted in Idaho applies to curtailment/cessation of open burning, not residential space heating. DEC's existing regulation (18 AAC 50.065)

[43] Idaho Department of Environmental Quality, Idaho Administrative Code, Rules for the Control of Air Pollution in Idaho, IDAPA 58.01.01, available at https://adminrules.idaho.gov/rules/2014/58/0101.pdf; Accessed October/10/2017.
[44] https://www.deq.idaho.gov/media/344469-emerg_rule_fs.pdf; Accessed October 10, 2017.
[45] Personal communication with Melissa Gibbs, Idaho Department of Environmental Quality, October 5, 2017.
[46] Personal communications with Bo Call, Utah Department of Environmental Quality, October 4, 2017; Personal communication with Joel Karmazyn, October 5, 2017.
[47] 18 AAC 50.065

prohibits open burning in the nonattainment area during the winter season. Thus, implementation of the Idaho 1-hour average threshold for curtailing open burning would have no impact on wood smoke emissions during the wintertime nonattainment season in Fairbanks, and is not applicable to curtailment or restrictions on residential space heating. In summary, DEC's ban on open burning during the winter season is more stringent than this measure.

40 CFR 51.1000 defines BACM as a control measure that "generally can achieve greater permanent and enforceable emission reductions … than can be achieved through implementation of RACM". Given that the measure does not result in a quantifiable emission benefit this control measure does not meet the definition of BACM.

With no quantifiable emission benefit and some associated cost to implement, the dollar per ton value would be infinite which shows economic infeasibility as well.

Conclusion

The BACM conclusion is unchanged - the adoption of this measure will provide no emissions benefit in the Fairbanks nonattainment area, therefore the measure does not meet the definition of BACM and is economically infeasible. This measure has been dismissed from consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 39: Use of AQI as Basis for Curtailment Threshold

Applicable Jurisdiction(s)

- Cache Valley and Cities, Idaho

Regulation Weblink(s)

- http://www.deq.idaho.gov/media/930593-cache-valley-pm2-5-sip-appendices-1212.pdf

Background

Franklin County and the Cache Valley cities in Idaho use a $PM_{2.5}$ Air Quality Index (AQI) level of 75 as the threshold for declaring a burn ban (curtailment) for residential wood stoves. This level is equivalent to an ambient concentration of 23.5 $\mu g/m^3$.[48] Most other jurisdictions that regulate residential wood burning specify $PM_{2.5}$ concentration-based thresholds for a curtailment declaration (typically in the 25-35 $\mu g/m^3$ range) rather than specifying AQI levels. DEC's concentration based thresholds for Stage 1 and Stage 2 are 20 and 30 $\mu g/m^3$.

The Cache Valley attainment plan submitted to the EPA by the Idaho Department of Environmental Quality states, in many locations, that burning is prohibited when the AQI for the

[48] https://airnow.gov/index.cfm?action=airnow.calculator

region reaches 75 or higher.[49] The restriction applies, in one section, to "all wood burning, including but not limited to, within a solid fuel heating appliance designed for wood fuel (commonly known as a 'wood stove') or open fireplace" and in another to "any open burning of any kind."

Analysis

The BACM analysis of this measure is unchanged - personal communication with Idaho DEQ[50] staff suggested that the adoption of an AQI-based threshold rather than a $PM_{2.5}$ concentration-based threshold was motivated solely by the desire to avoid having to rewrite regulations to modify the "trigger level" when EPA revised the NAAQS. The AQI is itself a function of the NAAQS standard and so, when the standard is reduced by EPA, the concentration equivalent to an AQI of 75 – or any other measure of AQI – would correspondingly be reduced as well.[51] Thus the jurisdiction would not need to modify its regulation in response to a NAAQS change. The staff member indicated that no documentation existed to suggest whether the use of AQI- or concentration-based thresholds would be more effective at reducing emissions.

Further communication with the Idaho DEQ suggested that the use of an AQI- rather than a concentration-based threshold did not likely affect the compliance rate of affected woodstoves and that the news release containing the curtailment order typically did not even mention the criteria used to initiate the curtailment.

40 CFR 51.1000 defines BACM as a control measure that "generally can achieve greater permanent and enforceable emission reductions … than can be achieved through implementation of RACM". Given that the measure does not result in a quantifiable emission benefit this control measure does not meet the definition of BACM.

With no quantifiable emission benefit and some associated cost to implement, the dollar per ton value would be infinite which shows economic infeasibility as well.

Conclusion

The BACM conclusion is unchanged - given the equivalence between AQI and $PM_{2.5}$ concentration thresholds the question of technological feasibility depends on the stringency of adopted AQI thresholds; therefore, this measure provides no emission benefit and does not meet the definition of BACM or a control measure for this 2020 Amendment and is economically

[49] Idaho Department of Environmental Quality, Cache Valley Idaho $PM_{2.5}$ Nonattainment Area SIP, Appendix E: Reasonably Available Control Methods, 2006, available at http://www.deq.idaho.gov/media/930593-cache-valley-pm2-5-sip-appendices-1212.pdf; Accessed October 10, 2017.
[50] Personal communication with Melissa Gibbs, Idaho Department of Environmental Quality, October 5, 2017.
[51] Calculator for AQI maintained by EPA at https://airnow.gov/index.cfm?action=airnow.calculator

infeasible. This measure has been dismissed from consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 42: Burn Down Period

Implementing Jurisdiction(s)

- Puget Sound CAA; Maricopa County

Regulation Weblink(s)

- http://www.pscleanair.org/219/PSCAA-Regulations
https://www.maricopa.gov/DocumentCenter/View/2016/P-26---Residential-Woodburning-Restriction-Ordinance-PDF

Background

The Puget Sound Clean Air Agency requires solid fuel burning devices to be shut down when a First Stage of Impaired Air Quality (curtailment) has been declared (Sections 13.05.a.1 and 13.05.d.1.a). Certain categories of devices, such as pellet stoves, Oregon DEQ-certified Phase 2 devices, Washington DOE-certified devices, and devices in households with no other adequate source of heat, are allowed to continue operating during a curtailment period provided that all applicable registration requirements are met. When a curtailment period is declared, fuel to non-exempt devices must be withheld, and combustion in these devices – as evidenced by visible smoke from a chimney – must cease within three hours after the declaration is issued (Section 13.05.b).

Maricopa County defines "Burn-Down Period" as "That period of time, not to exceed three hours after declaring a restricted-burn period, required for the cessation of combustion within any residential wood-burning device, outdoor fire pit, wood-burning chimney, or similar outdoor fire by withholding fuel or by modifying the air-to-fuel-ratio" (Section P-26.2.D). This regulation also stays enforcement of visible emission limits for three hours after a curtailment declaration is issued (Section P-26.3.D.4).

Fairbanks' regulations did not specifically exempt smoke emitted during burn down periods from compliance with opacity limits, but do exempt visible emissions from a chimney in excess of the opacity standard for a period not to exceed 30 minutes during a curtailment period before citing unauthorized wood heating devices for unlawful operation during a curtailment period. Those Borough regulations were removed following the passage of the Home Heating Reclamation Act.

Analysis

In the Serious SIP, effective January 8, 2020, Alaska added a regulation subsection 18 AAC 70.075(e)(3) "that fuel to non-exempt devices must be withheld, and combustion in these devices

– as evidenced by visible smoke from a chimney – must cease within three hours of the effective time of the declaration."

The addition of this subsection matches the burn down requirements set in Measure 42. Therefore, the adoption of this measure addressed the BACM requirement for this measure.

The Serious SIP is a chapter of the State Air Quality Control Plan that is adopted by reference into state regulation at 18 AAC 50.030. As a result, the Fairbanks Emergency Episode Plan as described in Section III.D.7.12 is enforceable by DEC. This section of the SIP outlines for the public the specifics related to episodic control requirements within the nonattainment area along with the process DEC uses for announcing episodes. DEC revised Section III.D.7.12 to incorporate the language added to 18 AAC 50.075(e) to ensure that the burn down requirements are clearly identified within the local Episode Plan.

DEC also uses a fixed episode announcement template that will have the burn down language included so that every curtailment called within the nonattainment area will contain the burn down language.

Conclusion

The adoption of the referenced state regulations are sufficient to meet the 2020 Amendment Plan requirements of this measure, therefore the measure is technologically feasible, adopted and implemented, and no additional analysis is required.

Measure 45: Elevation Exemption from Wood Burning Curtailments

Implementing Jurisdiction(s)

- South Coast Air Quality Management District; Utah Department of Environmental Quality

Regulation Weblink(s)

- http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-444.pdf
- https://rules.utah.gov/publicat/code/r307/r307-302.htm#T3

Background

In the South Coast, Mandatory Winter Burning Curtailment is defined to occur:

> *..during the consecutive months of November through February where the burning of solid fuels is restricted for portions of the South Coast Air Basin at elevations below 3,000 feet above Mean Sea Level (MSL) based on air quality criteria contained in AQMD Rule 445 (Wood Burning Devices).* (emphasis added)

Utah's Rule 307 (Solid Fuel Burning) provides exemption from wood burning restrictions for sources located at elevations above 7,000 feet.

Alaska DEC does not provide an elevation exemption from burning curtailment requirements.

Analysis

The BACM analysis of this control measure is unchanged - a review of topographical maps found that no portion of the Fairbanks $PM_{2.5}$ nonattainment area is at an elevation above 3,000 feet MSL. This finding was confirmed by the Borough's Air Quality Division. The existing Alaska DEC air quality regulations do not provide an elevation exemption from burning curtailment requirements.

40 CFR 51.1000 defines BACM as a control measure that "generally can achieve greater permanent and enforceable emission reductions … than can be achieved through implementation of RACM". Given that the measure does not result in a quantifiable emission benefit this control measure does not meet the definition of BACM.

With no quantifiable emission benefit and some associated cost to implement, the dollar per ton value would be infinite which shows economic infeasibility as well.

Conclusion

The BACM conclusion is unchanged - this measure would not result in a quantifiable emission benefit and thus does not meet the definition of BACM and control measure requirements for the 2020 Amendment and is economically infeasible. This measure has been dismissed from consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 46: Lack of Electrical or Natural Gas Service Availability

Implementing Jurisdiction(s)

- South Coast Air Quality Management District; San Joaquin Valley Air Pollution Control District

Regulation Weblink(s)

- http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-445.pdf?sfvrsn=4
- https://www.valleyair.org/rules/currntrules/r4901.pdf

Background

The South Coast Air Quality Management District exempts wood heating devices from burning curtailment requirements in households where there is no existing infrastructure for natural gas service within 150 feet of the property line (Section 445.f.7.C).

San Joaquin Valley Air Pollution Control District exempts wood burning fireplaces and wood burning heaters from burning curtailment requirements in areas where natural gas service is not available (Section 4901.5.6.3.1).

Fairbanks did not exempt households from curtailment requirements due to a lack of natural gas service but it did allow all wood heating devices affected by an electrical power failure to be used for space heating purposes during Stage 1 alerts. Fairbanks curtailment requirements were removed with the passage of the Home Heating Reclamation Act.

Analysis

The BACM analysis of this control measure is unchanged - the Episode Chapter of the $PM_{2.5}$ Serious SIP, provides an exception for cases where electrical power outages prevent use of alternative heating devices. This requirement is not overly broad as electricity is required to power all alternative (i.e., non-wood) heating devices, since they require pumps, fans, resistance coils, valves, etc. for operation. Thus, with the exception of wood-fired heating there is no alternative source of heat when there is an electrical power outage, unless the home has a generator.

40 CFR 51.1000 defines BACM as a control measure that "generally can achieve greater permanent and enforceable emission reductions … than can be achieved through implementation of RACM". Given that the measure does not result in a quantifiable emission benefit this control measure does not meet the definition of BACM.

With no quantifiable emission benefit and some associated cost to implement, the dollar per ton value would be infinite which shows economic infeasibility as well.

Conclusion

The BACM conclusion for this measure is unchanged - since the adoption of this measure will provide no emission reductions in Fairbanks, it does not meet the definition of BACM or the control measure requirements for the 2020 Amendment and is economically infeasible. This measure has been dismissed from consideration as a control measure to the 2020 Amendment to the Serious SIP.

Measure 50: Require Low Sulfur Content Coal

Implementing Jurisdiction(s)

- Puget Sound Clean Air Agency, State of Utah

Regulation Weblink(s)

- https://pscleanair.gov/DocumentCenter/View/354/Regulation-I?bidId=

Background

Section 13.04 of the Puget Sound CAA regulations restricts the sulfur content of coal burned in a solid fuel burning device. It allows only the burning of:

Coal with sulfur content less than 1.0% by weight burned in a coal only heater.

Utah regulates the sulfur and ash content of coal for residential use, with the following restrictions:

(1) After July 1, 1987, no person shall sell, distribute, use or make available for use any coal or coal containing fuel for direct space heating in residential solid fuel burning devices and fireplaces which exceeds the following limitations as measured by the American Society for Testing Materials Methods:

(a) 1.0-pound sulfur per million BTU's, and
(b) 12% volatile ash content.

(2) Any person selling coal or coal containing fuel used for direct residential space heating within the State of Utah shall provide written documentation to the coal consumer of the sulfur and volatile ash content of the coal being purchased.

Alaska DEC does not regulate the sulfur content of coal burned in solid fuel burning appliances.

Analysis

The BACM analysis of this control measure is unchanged - the Usibelli Coal Mine is the source of all coal marketed and burned in Fairbanks. Their factsheet[52] indicates the sulfur content of coal from the Healy mine is typically 0.2% with a range of 0.08% - 0.28%. The Healy mine supplies the coal burned in Fairbanks.

Fairbanks has no restriction on the sulfur content of coal marketed and burned within the $PM_{2.5}$ nonattainment area; therefore, the Puget Sound regulation is more restrictive. The sulfur content of Healy coal, however, is well below the 1% threshold mandated by Puget Sound. Therefore, while the Puget Sound regulation is more restrictive, its imposition in Fairbanks will have no effect on coal burning and no emissions benefit.

The Healy fact sheet indicates that the heat content of their coal is 7,560 BTU/lb. Using this value, 132.3 lbs. of coals is needed to produce 1 million BTU. This value combined with the 0.2% content of coal produces 0.26 lbs. of sulfur, which is well below Utah sulfur threshold 1.0 lb. per million BTU. The Healy coal has a 7% average ash content ranging from 4% - 12%, which falls below the 12% volatile ash content Utah threshold.

[52] http://www.usibelli.com/coal/data-sheet

Alaska adopted 18 AAC 50.079 with the Serious Area SIP. 18 AAC 50.079 (f) requires the owner of an existing coal-fired heating device to render the device inoperable by the earlier of December 31, 2024; or before the device is sold, leased, or conveyed as part of an existing building. The Emergency Episode Plan adopted with the Serious Area SIP does not provide for a NOASH provision for residential coal-fired heating devices. Current regulations will continue to force turnover of coal-fired heating devices and replacement with non-coal alternatives.

Conclusion

The BACM conclusion is unchanged - the Puget Sound and Utah coal content regulations, if adopted by Alaska DEC, would not reduce $PM_{2.5}$ emissions in Fairbanks as the sole source of coal used in the Borough continuously satisfies the Puget Sound and Utah specifications, and current regulations require the removal of all residential coal-fired heating devices; therefore, this measure is not technologically feasible and not eligible for consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure 51: Ultra-low Sulfur Heating Oil

Implementing Jurisdiction(s)

- Northeast States and Alaska

Regulation Weblink(s)

- https://noraweb.org/wp-content/uploads/2014/11/NEMARegion_ULSDBioChart2014.pdf

https://www.epa.gov/diesel-fuel-standards/diesel-fuel-standards-and-rulemakings **Background**

EPA mandated the production of ultra-low sulfur (15 ppm) Diesel fuel by domestic oil refineries in 2006. Since this mandate addressed only motor vehicle fuel, no reduction in the sulfur content of home heating oil was required. Concerns about the need for reductions in ambient $PM_{2.5}$, SO_2 and regional haze, however led the Northeast states, where most heating oil consumption in the U.S. occurs, to implement laws mirroring the federal Diesel-fuel standard for motor vehicles.

In 2012, New York, which at the time had over a million households using heating oil, was the first northeastern state to set a home heating oil sulfur content standard of 15 ppm. Massachusetts, New Jersey and Vermont followed suit with a less stringent 500 ppm standard in 2014, but are all scheduled to require 15 ppm sulfur levels for heating oil by 2018. In 2016, Maine instituted a 50 ppm standard but will also require 15 ppm levels by 2018.[53] In addition many of the Mid-Atlantic States (including the District of Columbia) have also mandated the use of 15 ppm heating oil by 2018. Overall, 10 states plus selected communities in other states (e.g., Philadelphia) have ultra-low sulfur heating oil requirements.[54]

[53] http://blog.smarttouchenergy.com/ultra-low-sulfur-heating-oil-and-premium-fuels
[54] https://nefi.com/news/docs/heating-oil-standards-chart.pdf

During the development of the Nonroad Diesel rule, Alaska requested: 1) that June 1, 2010, be the deadline for conversion to 15 ppm sulfur highway Diesel fuel in rural Alaska; 2) that June 1, 2010, be the deadline for conversion of all nonroad, locomotive, and marine (NRLM) diesel fuel to 15 ppm sulfur content in rural Alaska; and 3) that the 15 ppm standard applicable to locomotive and marine diesel fuel produced in, imported into, and distributed or used within rural Alaska be moved up to June 1, 2010 (from the June 2012 nationwide date in the final Nonroad Diesel rule. Because the storage and distribution systems in rural Alaska are not capable of handling more than one grade of fuel, this federal rule effectively converted home heating fuel to a 15-ppm sulfur limit when it was implemented.

While EPA did not comment on Measure 51, it provided many comments about the state's draft report assessing the cost of producing ultra-low sulfur fuel and requested a further exploration of supply side costs and economies of scale. It also stated the "BACM analysis must start with a transparent and detailed economic analysis of exclusively supplying ultra-low sulfur heating oil to the nonattainment area."

Analysis

EPA mandated the production of ultra-low sulfur Diesel fuel in 2006; the northeast states have mandated the production and use of home heating oil with a 15-ppm sulfur limit. Storage limitations caused communities in rural Alaska to shift all distillate fuel, including home heating oil, to a 15 ppm sulfur limit when the EPA mandate for ultra-low sulfur Diesel fuel was implemented for various sources that existed or came into those communities. The use of 15 ppm home heating oil in an arctic environment has continued since 2010 without problems.

In response to the EPA comments, Alaska expanded the cost report[55] addressing the potential changes in residential home heating expenditures in the Fairbanks $PM_{2.5}$ nonattainment area given hypothetical requirements to switch to different types of heating oil. *Section I* evaluates the fuel cost difference between ultra-low sulfur (ULS) and current heating fuels – high sulfur (HS) No. 1 or No. 2 – and the cost difference between HS No. 1 and HS No. 2. *Section II* assesses how price differences found between fuels would affect household heating expenditures for the typical FNSB household. A copy of the report is included in the Appendix to Chapter 7 of the $PM_{2.5}$ Serious SIP. This information is used in the Step 4 cost effectiveness analysis and is not discussed here.

Conclusion

Alaska addressed the requirement to shift from #2 to # fuel oil by adopting 18 AAC 50.078(b) , which limits fuel oil to no more than 1,000 parts per million (ppm) sulfur may be sold – with an

[55] Residential Fuel Expenditure Assessment of a Transition to Ultra-Low Sulfur and High Sulfur No. 1 Heating Oil for the Fairbanks PM-2.5 Serious Nonattainment Area, February 2019, Prepared by The Alaska Department of Environmental Conservation Economist in collaboration with the University of Alaska Fairbanks Master of Science Program in Resource and Applied Economics.

effective date of September 01, 2022. A significant portion of the U.S., including rural Alaska, is using 15 ppm sulfur content heating oil; therefore a shift from No. 2 to ULS is technologically feasible and should be assessed for economic feasibility for the 2020 Amendment Plan.

Measure 52: Operation and Sale of Small "Pot Burners" Prohibited

Implementing Jurisdiction(s)

- State of Vermont

Regulation Weblink(s)

- http://dec.vermont.gov/sites/dec/files/aqc/laws-regs/documents/AQCD_Regulations_2016_Dec.pdf

Background

Section 5-221 Prohibition of Potentially Polluting Materials in Fuel, subsection 2. Used Oil, contains the following restriction:

> *Effective July 1, 1997, the burning of used oil in small fuel burning equipment described as "pot burners" or "vaporizing" burners shall be prohibited, as shall the retail sale of these burners.*

Neither the Borough nor the State have any regulations restricting the sale of small waste or used oil burners. ADEC regulations restrict the operation of waste oil appliances during Stage 1 and Stage 2 Alerts. The State has no additional controls addressing the sale or operation of waste oil appliances.

Analysis

Vermont regulations prohibit both the operation and sale of small waste oil burning devices. Neither Alaska nor the Borough prohibit the sale of small waste oil burning devices. DEC has regulations that restrict the operation of waste oil devices during Air Quality Alerts. The analysis section of Measure 70 discusses the available waste disposal methods for used oil and identifies a potential environmental impact regarding any prohibition or regulation of used oil combustion.

Conclusion

Alaska has no regulations governing the sale or operation of waste oil appliances or the use of waste oil used as a heating fuel; therefore, the Vermont measures addressing waste oil are eligible for consideration as a 2020 Amendment Plan control measure. The analysis in Measure 70 identified a potential environmental impact and measures prohibiting or regulating the burning of used oil were determined to be technically infeasible due to environmental impacts. However, an economic analysis was also conducted and the results of a cost effectiveness analysis of this measure, presented in Step 4, show this measure is economically infeasible.

Measure 53: No Use Sale or Exchange of Used Oil for Fuel, unless it Meets Constituent Property Limits

Implementing Jurisdiction(s)

- State of Vermont

Regulation Weblink(s)

- http://dec.vermont.gov/sites/dec/files/aqc/laws-regs/documents/AQCD_Regulations_2016_Dec.pdf

Background

Section 5-221 Prohibition of Potentially Polluting Materials in Fuel, subsection 2. Used Oil, contains the following restriction:

> *No person shall cause or permit the use, purchase, sale or exchange in trade for use as a fuel in fuel burning equipment in Vermont of any used oil unless:*
>
> *(i) The used oil has constituents and properties within the allowable limits set forth in Table A of this section prior to blending except as provided in subsection (e) below. The Air Pollution Control Officer may prohibit the combustion of used oils containing constituents or properties not listed in Table A of this section if he/she determines that combustion of such used oil may present an unreasonable risk to public health or welfare*

Table A: Used Oil Constituents and Properties (Prior to Blending)

Constituent/Property	***Allowable[1]***
Arsenic	*5 ppm maximum*
Cadmium	*2 ppm maximum*
Chromium	*10 ppm maximum*
Lead	*100 ppm maximum*
Flash Point	*Must be 100 degrees F or more*
Total Halogens	*1000 ppm maximum*
Polychlorinated Biphenyls (PCBs)	*< 2 ppm maximum*
Net Heat of Combustion	*8000 BTU/lb minimum*
1Note: units of parts per million (ppm) are by weight on a water free basis.	

Neither the State nor the Borough have regulations addressing the purchase, sale or exchange of used oil. They also do not have regulations setting limits on waste or used oil properties.

Analysis

Vermont regulations restrict the allowable content and transfer of waste oil used as heating fuel. There are no such restrictions governing waste or used oil as a heating fuel in Fairbanks. The analysis section of Measure 70 discusses the available waste disposal methods for used oil and identifies a potential environmental impact regarding any prohibition or regulation of used oil combustion.

Conclusion

Alaska has no regulations governing the content, use or transfer of waste oil used as a heating fuel; therefore, the Vermont measures addressing waste oil are eligible for consideration as a control measure for the 2020 Amendment to the Serious SIP. The analysis in Measure 70 identified a potential environmental impact and measures prohibiting or regulating the burning of used oil were determined to be technically infeasible due to environmental impacts. However, an economic analysis was also conducted and the results of a cost effectiveness analysis of this measure, presented in Step 4 show this measure is economically infeasible.

Measure 54: Adopt CARB Vehicle Emission Standards

Implementing Jurisdiction(s)

- California Air Resources Board(CARB)

Regulation Weblink(s)

- https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/lev-program/low-emission-vehicle-lev-iii-program

Background

Under Section 177 of the federal Clean Air Act, states that choose to adopt vehicle standards that are more stringent than the federal standards for new vehicles can only adopt California's vehicle emission standards. To date 14 states have opted-in to California's vehicle emissions standards. The most current version of California's Low Emission Vehicle (LEV) III regulations limit greenhouse gases and traditional tailpipe pollutants (HC, CO, NOx and PM). These regulations were modified by California in 2015 to align the California and federal Tier 3 motor vehicle emission standards. The federal Tier 3 rules were finalized in 2014 by the U.S. EPA and reduced tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles and allowable emissions from heavy-duty vehicles. The California LEV III and federal Tier 3 regulations are consistent from model year 2017 through 2024 for particulate emissions. Starting in 2025, however, the stringency of the LEV III standards will be increased from 3 mg/mi to 1 mg/mi, while the federal Tier 3 standards will

remain at 3 mg/mi. Thus, an extremely small reduction in motor vehicle particulate emissions (i.e., 2 mg/mi) will become available in late 2025 and succeeding years.

Analysis

To put 2 mg/mi reduction into perspective, 1 million miles of travel by vehicles meeting the more stringent 2025 – 2028 LEV III particulate emission standards would produce a reduction of 4.4 lbs. Several factors must be considered when assessing the benefit of adopting the LEV III standards, including:

- An analysis of the most recent DMV registrations (April 2018) showed the statewide population of vehicles was 644,312 and a total of 97,600 were registered in Fairbanks. Assuming vehicle ownership is proportional to population, the number of vehicles registered in the nonattainment area is 82,980. Since Alaska would be required to adopt the CARB vehicle standards on a statewide basis, it means 87% of the light duty passenger cars and light-duty trucks sold each year starting in 2025 would be required to meet the more stringent standards without a supporting mandate.

- Assuming wintertime driving travel is roughly 50 miles per vehicle per day (more than twice the value employed in the Fairbanks travel demand model forecasts), it would take 20,000 vehicles to produce 4.4 lb/day reduction in PM emissions. Assuming the 2 mg/mi reduction applied to the entire vehicle fleet, which it does not because the California and federal emission standards for medium/heavy duty vehicles are equivalent through this period, the total reduction potential within the Fairbanks PM nonattainment area would be on the order of 18 lbs per day (in reality less).

The magnitude of the emission reduction potential must be considered in light of the disproportionate impact on the rest of the Alaska vehicle fleet. Recently, the federal government has proposed to rollback the California vehicle emission standards for Model Years 2021 – 2026, so the availability of the basis for this measure is in question. In addition, a review of the literature about the costs of implementing the California vehicle emission standards shows there is considerable controversy. Assuming that the net cost between increased new vehicle price versus improved fuel economy and lowered fuel consumption is zero, Oregon, which adopted the California vehicle emission standards estimated that the administrative cost of complying with the California vehicle emission standards is $5.43/vehicle[56]. Using that price and the 2 mg/mile PM benefit over the 100,000 mile certified life of the emission control system would produce a cost effectiveness estimate of $25,000/ton of PM removed. Since Oregon's population is 5.5 times larger than Alaska's (based on a comparison of 2018 populations), it means that administrative cost estimate would be distributed over a significantly smaller fleet of new vehicle sales in Alaska and the administrative of cost of adopting California vehicle emission standards would be significantly higher than the $25,000/ton estimate. Given this information, the statewide adoption of the CARB LEV III emission standards is not cost effective and is not warranted for the Fairbanks $PM_{2.5}$ nonattainment area.

[56] https://www.oregon.gov/deq/Rulemaking%20Docs/levzev2018fis.pdf

Conclusion

The minimal Fairbanks emissions benefit from a statewide adoption of CARB LEV III emission standards is not cost effective and therefore not eligible for consideration as a measure for the 2020 Amendment to the Serious SIP.

Measure 55: School Bus Retrofits

Implementing Jurisdiction(s)

- Oregon Department of Environmental Quality, Lane Regional Air Protection Agency

Regulation Weblink(s)

- https://www.gpo.gov/fdsys/pkg/FR-2017-11-14/html/2017-24539.htm
- http://www.lrapa.org/DocumentCenter/View/2108

Background

The RACM analysis in the Oakridge, Oregon Moderate $PM_{2.5}$ attainment plan lists Diesel retrofits of school buses as a primary control measure. No specific emissions credit, however, is listed for this measure. The 2016 update to the SIP, which EPA proposed for approval, lists implementing diesel retrofits of school buses as a local transportation control measure. It also states:

> *No specific credit was taken for these mobile source programs in the 2015 attainment year emission inventory other than the normal reductions over time included in the MOVES2014a modeling.*

Neither Fairbanks nor the state has a regulation mandating the replacement of Diesel-powered school buses. The Fairbanks RACM analysis evaluated *retrofit of diesel fleet (school buses, transit)* as a transportation control measure. The measure was determined to be technologically infeasible as were all measures listed in the category of transportation controls.

Analysis

EPA offers funds for the replacement of Diesel school buses through its Clean Diesel Program. The Diesel Emissions Reduction Act (DERA) provides grants for projects that reduce emissions from existing diesel engines. DERA has funded numerous diesel replacement projects in Alaska. DERA funds are currently being used to replace five diesel generators in four rural communities in Alaska. Other programs have funded diesel garbage truck, power generation and school bus replacement projects. The most recent diesel replacement program conducted in Fairbanks is a joint DEC/DOT&PF project[57] that replaced three heavy duty construction trucks, placed in service by the State of Alaska in 1986. That project was completed in 2010.

[57] http://dec.alaska.gov/air/anpms/projects-reports/akdot

Oregon has funded several school bus replacement programs and included them in the Oakridge RACM analysis for the Moderate SIP, which EPA has proposed to approve. That plan, however, takes no specific emissions credit for the program and states that its benefits are included in fleet turn over benefits tracked by EPA's motor vehicle emissions simulator model (MOVES)2014b.

The Fairbanks North Star School District confirmed[58] that the school bus contractor will change in August 2021 and that the entire fleet of Diesel school buses will be replaced with gasoline powered school buses by the end of that month. The primary reason for the change is that gasoline engines warm up more rapidly than Diesel engines and they in turn provide more rapid and efficient heating for passengers; another benefit is that operating costs will decline because of the difference between gasoline and Diesel fuel prices. A side benefit of this change is that PM emission from gasoline vehicles is significantly lower than for Diesel vehicles, therefore school bus retrofits contemplated under this measure would increase not decrease PM emissions.

Conclusion

Since the conversion from gasoline to Diesel powered school buses contemplated by this measure would increase PM emissions, this measure is technologically infeasible and not eligible for consideration as a measure for the 2020 Amendment to the Serious SIP.

Measure 56: Road Paving

Implementing Jurisdiction(s)

- Klamath Falls, Oregon

Regulation Weblink(s)

- http://www.oregon.gov/deq/FilterDocs/KFallsAttPlan2012.pdf

Background

The 2012 $PM_{2.5}$ attainment plan for Klamath Falls includes a road paving control measure. The analysis lists road paving as an existing control measure and states:

> *PM2.5 emissions generated by motor vehicle traffic have been reduced over the years through efforts to pave roads, minimize the use of sanding material, and to control mud and dirt track out from industrial, construction and agricultural operations. Six miles of unpaved road have been paved in the nonattainment area since 2008, resulting in reductions from re-suspended road dust.*

The $PM_{2.5}$ emission reduction benefit of road paving is listed as "minimal".

[58] Telephone conversation between Dwane Taylor of the Fairbanks North Star Borough School District and Robert Dulla, Trinity Consultants, August 18, 2020

Alaska does not have an emissions control measure addressing road paving in urban areas. An analysis[59] prepared in 2006 identified road paving as a fugitive dust control measure for implementation in rural communities in Alaska. Fairbanks has no control measures addressing road paving. Unlike many communities in the lower-48, roads in the Fairbanks nonattainment area remain frozen during winter months. The emissions inventory discussion in Step 1 noted that fugitive dust sources of $PM_{2.5}$ are estimated to be negligible under the snow/ice bound conditions reflected in the winter seasonal inventory.

Analysis

The Klamath Falls SIP claims "minimal" $PM_{2.5}$ emission benefit for a fugitive dust control measure. Since fugitive dust emissions in Fairbanks are negligible during the winter, the application of fugitive dust controls with "minimal" benefits in a more moderate climate will produce no benefits.

Conclusion

Fugitive dust control measures will provide no wintertime $PM_{2.5}$ benefit in Fairbanks, therefore it is technologically infeasible and not eligible for consideration as a measure for the 2020 Amendment to the Serious SIP.

Measure 57: Other Transportation Control Measures

As noted in the Step 2 discussion, Measures 57 & 59 are addressed in the Measure R20 Transportation Control Measure feasibility analysis.

Measure 58: Controls on Road Sanding and Salting

Implementing Jurisdiction(s)

- Utah Department of Environmental Quality

Regulation Weblink(s)

- https://documents.deq.utah.gov/air-quality/pm25-serious-sip/DAQ-2017-011685.pdf
- https://documents.deq.utah.gov/air-quality/pm25-serious-sip/DAQ-2017-011686.pdf
- https://documents.deq.utah.gov/air-quality/pm25-serious-sip/DAQ-2017-011687.pdf

Background

[59] *https://dec.alaska.gov/air/anpms/Dust/Dust_docs/DustControl_Report_032006.pdf*

Draft BACM analyses for the Logan, Provo, and Salt Lake Areas in Utah's Serious $PM_{2.5}$ SIP has identified Road Salting & Sanding as a control measure. The analysis prepared for each community included the following finding:

> *R307-307 Road Salting & Sanding: The purpose of this rule is to establish emission control for wintertime road salting. This is an existing rule that was part of the PM10 SIP (Section IX, Part A, Page 57) that was approved by EPA on December 6, 1999 (64 FR 68031). A RACT analysis was conducted as part of that SIP. The rule was amended by expanding the applicability to include PM2.5 nonattainment areas as part of the moderate PM2.5 SIP. The actual PM emission reduction is unknown however, past UDAQ studies have indicated that road salt plays a minimal role related to this SIP. Consequently, no further analysis is warranted.*

Fairbanks and Alaska do not have an emissions control measure addressing either road sanding or road salting. Unlike many communities in the lower-48, roads in the Fairbanks nonattainment area remain frozen during winter months. The emissions inventory discussion in Step 1 noted that fugitive dust sources of $PM_{2.5}$ are estimated to be negligible under the snow/ice bound conditions reflected in the winter seasonal inventory.

Analysis

Utah is planning to expand the applicability of the Road Sanding & Salting control measure, a PM_{10} fugitive dust control measure, to the Logan, Provo and Salt Lake $PM_{2.5}$ nonattainment areas. The analysis states that the $PM_{2.5}$ benefit of the measure is "unknown" and no credit is taken for the measure.

Since fugitive dust emissions in Fairbanks are negligible during the winter, the application of fugitive dust controls with "unknown" benefits in Utah's more moderate climate will produce no benefits in Fairbanks.

Conclusion

Fugitive dust control measures will provide no wintertime $PM_{2.5}$ benefit in Fairbanks, therefore this measure is technologically infeasible and not eligible for consideration as a measure for the 2020 Amendment to the Serious SIP.

Measure 59: I/M Programs

As noted in the Step 2 discussion, Measures 57 & 59 are addressed in the Measure R20 Transportation Control Measure feasibility analysis.

Measure 60: Vehicle Idling Restrictions

Implementing Jurisdiction(s)

- Many – EPA published a report summarizing state and local idle control programs in 2008.[60]

Regulation Weblink(s)

- None

Background

EPA received "multiple inquiries regarding community interest in controlling emissions from idling" and commented that "these types of controls should be further evaluated in BACM and MSM analyses."

Analysis

The EPA compilation of idle programs listed regulations from 31 different states. A review of the regulations listed in the report found the programs were focused on controlling heavy-duty vehicle activity for a variety of reasons, including: noise, fuel consumption and emissions. Controls addressing light-duty vehicle activity were conspicuously absent. A literature review and related searches could find no SIPs taking particulate emissions credit for anti-idling programs. Texas for example has an extensive anti-idling program focused on reducing NOx emissions. Another consideration is that a survey of heavy-duty truck operators in Fairbanks conducted by DEC staff found that none kept their vehicles idling for extended periods (e.g., overnight) as it was cheaper from both a fuel consumption and a maintenance perspective to keep their vehicles stored indoors when not in use.

A complicating factor when considering the benefits of anti-idling programs in Alaska is that emission control system performance deteriorates at cold temperatures when engines are turned off and catalysts cool down. A study conducted by Sierra Research[61] found there was little or no air quality benefit from turning off a warmed-up vehicle if it was going to be started soon thereafter. For example, they found that turning-off a warmed vehicle during a short (60 minute or less) shopping errand provides no CO air quality benefit. The emissions from a vehicle left running were roughly comparable to a vehicle that was turned off and re-started at the end of the errand. That is because the catalyst cools down when the engine is turned off and emissions increase when the engine is restarted (the colder catalyst takes time to warm up and control is lost while it warms up). The increased start up emissions are roughly equivalent to the emissions

[60] EPA420-B-06-004 "Compilation of State, County and Local Anti-Idling Regulations", April 2008
[61] Di Genova, F., et al, "Fairbanks Cold Temperature Vehicle Testing: Warmup Idle, Between-trip Idle, and Plug-in," prepared for Alaska Department of Environmental Conservation by Sierra Research, January 2002.

produced by running the engine during the time of the idle restriction. While that study did not address tradeoffs in particulate emission reductions it demonstrated that lower-48 control program benefits do not necessarily apply in Alaska and that careful consideration of cold temperatures on emission control system performance needs to be considered in the evaluation of anti-idling programs. Sierra conducted a test program[62] for DEC that measured light-duty vehicle $PM_{2.5}$ emissions under alternative temperatures and modes of operation. The data and analysis conducted in that study, however, have not been used to assess the potential benefits of an anti-idling program on $PM_{2.5}$ emissions during winter operating conditions in Fairbanks.

That study, however, has been used, with EPA approval, to assess the impact of block heaters on gasoline vehicle emissions in the SIP (see Attachment C of the emissions inventory). Analysis of the effect of block heaters on PM were found to parallel those of CO by soak period (engine off intervals - 0.1 hrs, 0.3 hrs, 0.75 hrs, 1.25 hrs, etc.). This finding supports the claim that catalytic control of PM emissions parallels the control of CO emissions and therefore the impact of idle control on CO emissions has a similar impact on PM emissions (i.e., the idle benefits cannot be discerned).

Given the challenges of assessing the benefits of an anti-idling control program in Alaska, the finding that it produced no CO emission benefit for light-duty gasoline powered vehicles and the finding that no SIPs have taken credit for particulate emission reductions leads to the conclusion that there is no evidence this measure produces a particulate emissions benefit.

Conclusion

There is no evidence this program provides a particulate emissions reduction under cold temperature conditions in Fairbanks, therefore it is not technologically feasible and not eligible for consideration as a control measure for the 2020 Amendment to the Serious SIP..

Measure 61: Fuel Oil Boiler Upgrade – Burner Replacement/Repair

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

- None

Background

EPA commented that the benefits of fuel oil boiler maintenance should be investigated as a control measure.

[62] DiGenova, F. et al, "Characterizing Vehicular Contributions to PM2.5 in Fairbanks, Alaska, Volume 1: Dynamometer-Based Emissions Measurements, Vehicle Keep-warm Activities and MOVES Analysis, December 2012 (Volumes 1 – 4)

Analysis

Despite the finding that no benefits for this type of control program have been found in SIPs, information collected for the emissions inventory found that over 60% of the homes in the nonattainment area are heated with fuel oil and most are equipped with fuel oil boilers. Discussions with local vendors and repair technicians were conducted to determine the magnitude of potential fuel consumption benefits from cleaning and replacing burners. It was found that the benefits depend on the age of the boiler and level of regular maintenance.

Brookhaven National Laboratory conducted an extensive evaluation of [63] the effects of maintenance on fuel consumption and emissions of fuel oil boilers and found significant benefits; little information however was found about the benefits of burner replacement. Despite this limitation and the lack of detailed information about the age of fuel oil boilers and related maintenance intervals, it is clear that a program mandating regular maintenance has the potential to reduce fuel use and emissions from fuel oil boilers.

Conclusion

Test measurements have demonstrated that improved fuel oil boiler maintenance reduces fuel consumption and emissions, therefore this measure is technologically feasible. This finding addresses EPA's comments. The results of a cost effectiveness analysis of this measure, presented in Step 4, show this measure is economically infeasible and therefore not eligible for consideration as a 2020 Amendment Plan control measure.

Measure 62: Fuel Oil Boiler Upgrade – Replacement

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

- None

Background

EPA commented that the benefits fuel oil boiler upgrades should be investigated as a control measure.

Analysis

[63] Roger J. McDonald, Brookhaven National Laboratory, "Evaluation of Gas, Oil and Wood Pellet Fueled Residential Heating System Emissions Characteristics" Energy Sciences and Technology Department, December 2009

Despite the finding that no benefits for this type of control program have been found in SIPs, information collected for the emissions inventory found that over 60% of the homes in the nonattainment area are heated with fuel oil and most are equipped with fuel oil boilers. Discussions with local vendors and repair technicians were conducted to determine the magnitude of potential fuel consumption benefits from upgrading/replacing fuel oil boilers. It was found that the benefits depend on the age of the boiler and level of regular maintenance.

Brookhaven National Laboratory conducted an extensive evaluation[64] of emissions from a variety of fuel oil boilers and furnaces (e.g., conventional, condensing, etc.) using fuels of varying sulfur levels and found that technology has a significant benefit. Detailed information about the age and maintenance intervals of the existing stock of fuel oil boilers, however is required to assess the benefits of a program mandating upgrades/replacement. While this information is not available for homes located in the nonattainment area, the Brookhaven report indicates that newer technologies reduce emissions.

Conclusion

Test measurements have demonstrated that more efficient fuel oil boilers reduce emissions, therefore this measure is technologically feasible. This finding addresses EPA's comments. The results of a cost effectiveness analysis of this measure, presented in Step 4, show this measure is economically infeasible and therefore not eligible for consideration as a 2020 Amendment Plan control measure.

Measure 63: Require Electrostatic Precipitators

Implementing Jurisdiction(s)

- None

Regulation Weblink(s).

- None

Background

ESPs are pollution control devices that use electrical forces to remove fine particulate matter (PM) from exhaust streams. PM collection in an ESP occurs in three steps: suspended particles are given an electrical charge; the charged particles migrate to a collecting electrode; and the collected PM is dislodged or cleaned from the collecting electrode. ESP technology has been available for over a century and successfully employed on numerous industrial applications in the U.S., and throughout the world, with typical PM control efficiencies of 90% – 99%. Central to achieving the

[64] Roger J. McDonald, Brookhaven National Laboratory, "Evaluation of Gas, Oil and Wood Pellet Fueled Residential Heating System Emissions Characteristics" Energy Sciences and Technology Department, December 2009

aforementioned performance is site specific design, continuous monitoring, and periodic maintenance; i.e. ESPs are not one size fits all and are not plug and play.

Other countries, most notably European countries, have implemented ESPs on residential wood stoves. The technology transfer from the industrial sector to the residential sector required each country to address key issues not inherent in the technology itself; e.g. site-specific design, continuous monitoring, and periodic maintenance. A review of regulations from Zurich, Switzerland, found that ESPs may be retrofitted on handcrafted wood stoves to meet standards in cases where laboratory certification is not practical. Zurich also encourages the use of ESPs in general to reduce emissions, but does not provide any additional regulatory incentive to use an ESP. Notable regulations that address monitoring and maintenance requirements include:

- Annual inspections to verify proper device operation and use of clean dry fuel;
- Annual chimney sweep by certified professional;
- All hydronic heating systems subject to emission measurements every 2 years;
- Only dry and untreated wood may be burned. In case of doubt, an ash sample is collected, analyzed by a laboratory, and judged by the authorities; and,
- Minimum of 60% control efficiency for retrofit control devices, such as ESPs.

No SIPs or EPA guidance documents were identified requiring the installation of an ESP or any retrofit control device on residential wood stoves.

During development of the Serious Area SIP, FNSB and ADEC were engaged in a testing program to evaluate the efficacy of ESPs as a retrofit control device for various solid fuel appliances. The testing program was completed, and reports were made public in July of 2020. The results of the program are discussed below in the Analysis section.

Analysis

A review of applicable SIPs and EPA guidance documents could find no requirements for retrofitting wood stoves with ESPs. While ESPs appear to offer potential emission reductions, there are several obstacles to successful implementation. The lack of a regulatory framework and regulatory authority to certify and guarantee long term performance is one obstacle, specifically:

- The EPA does not have any certification process for retrofit control devices on wood stoves; and,
- The regulatory framework at the local, state, and federal level lack the necessary language to exclude devices with unproven performance (e.g. homemade devices).

No other jurisdiction in the United States has implemented a monitoring and maintenance plan at a residential level that guarantees operation of a retrofit emission control device which create the following obstacles:

- ESPs require professional installation: there are a lack of trained professionals and currently no way to verify installation;

- ESPs require periodic chimney cleanings: currently there is no way to verify cleaning; and,
- ESPs require periodic maintenance: there are a lack of trained professionals and currently no way to verify maintenance.

The implementation strategy, i.e. incentive for residents to purchase and install ESPs, is not clearly identified, which is another obstacle. Community members view ESP installation in lieu of burn bans as the incentive to install; however that strategy could lead to worse air quality conditions if ESP performance deteriorates over time, and there are legal issues regarding backsliding with the Fairbanks Serious Area Plan. Another implementation strategy would be a requirement to install ESPs on certain devices (e.g. devices that are exempt from burn bans), which would achieve the highest air quality benefit but would likely be viewed as regulatory overreach by the community.

Acknowledging the obstacles presented above, community interest remained high in determining whether the addition of an ESP would allow wood-burning to continue when burn bans were in effect, specifically Stage 2 Alerts where only those with a NOASH are allowed to operate solid fuel appliances. To address this interest, FNSB commissioned a testing project to measure the effect of ESPs on PM emitted from an EPA Step 2 certified pellet stove and develop an emission factor suitable for use in a SIP. To provide additional information in support of the FNSB study, ADEC commissioned a small parallel study to measure the effect of ESPs on two EPA Step 2 cordwood appliances: non-catalytic and catalytic.

Brief summaries of the test results are presented in this analysis, however significant insight into the operational performance of the ESP evaluated are contained in the test reports, which are incorporated by reference, but not discussed here. The test reports are available on ADEC's and FNSB's websites at:

http://www.fnsb.us/transportation/Pages/Retrofit-Emission-Control-Device-Testing.aspx

https://dec.alaska.gov/air/anpms/communities/adec-esp-cordwood-test-report/

https://dec.alaska.gov/air/anpms/communities/fnsb-esp-pellet-test-report/

FNSB Step 2 certified pellet stove test summary:
The FNSB-commissioned test program employed two different methods of PM measurement: an EPA filter based method (modified ASTM E2515 protocol), which collects total PM emitted over the entire test and a not yet EPA certified method that uses a tapered element oscillating microbalance (TEOM) that collect time-resolved measurements of PM emitted during the test. The former is the primary measurement method but provides no insight into performance during different phases of operation (startup, high, medium, and low burn). Fueling protocols followed ASTM E2779 which is consistent with EPA certification requirements. The program collected data on PM emitted upstream and downstream from the ESP unit simultaneously to allow a calculation of the efficiency of the unit in reducing emissions. A total of 6 controlled replicate tests were conducted to support development of an emission factor.

Key findings include:

- The overall reduction in PM measured by the primary filter method was 72%; the average TEOM reduction was 47%;
- PM reductions achieved with a pellet stove plus ESP are insufficient to achieve equivalency with fuel oil appliances;
- TEOM measurements found particulate removal varied by phase of operation ranging from 25% during medium burn to 74% during high burn;
- TEOM measurements showed that ESP performance is significantly limited by the occurrence of arcing events, which are caused when the electric field responsible for trapping particles collapses; and,
- Sufficient data was gathered to support development of an emission factor for an ESP equipped Step 2 pellet appliance.

DEC Step 2 certified catalytic and non-catalytic cordwood appliances test summary:
The ADEC-commissioned test program employed two different methods of PM measurement: an EPA filter-based method (modified ASTM E2515), which collects total PM emitted over the entire test and a not yet EPA certified method that uses a TEOM that collects time-resolved measurements of PM emitted during the test. The former is the primary measurement method but provides no insight into performance during different phases of operation (startup, high, medium, and low burn). Fueling protocols followed the Integrated Duty Cycle (IDC), developed by New York State Energy Research & Development Agency (NYSERDA) and Northeast States for Coordinated Air Use Management (NESCAUM). The IDC fueling protocol is not consistent with current EPA certification requirements but provides emission loading representative of real-world conditions. Given the limited scope of the DEC program, insufficient resources were available to support the collection of simultaneous measurements of PM up and downstream of the ESP unit. Instead, non-simultaneous measurements were collected from baseline (no ESP) and controlled (ESP installed) tests; average differences between the baseline and controlled tests were used to calculate the estimated efficiency in reducing emissions. 3 replicate tests were completed for baseline and controlled emissions except for the baseline for the catalytically controlled stove where 2 replicate tests were completed.

Key findings include:

Non-catalytic Cordwood Stove Performance

- The ESP failed due to excessive creosote build-up after 34 hours of operation with dry fuel in a controlled environment. The excessive creosote buildup coupled with an ignition source, such as electrical arcing, is believed to present a potential safety hazard for homeowners;
- It is recommended that the manufacturer update its device design to address the creosote concerns and demonstrate performance using test protocols approved by FNSB, DEC and/or EPA. It is further recommended that thorough testing on a new design be conducted by the manufacturer on noncatalytic devices of the size used in FNSB prior to further use or testing by FNSB;
- When creosote impacted measurements are ignored, ESP control efficiency was found to range between 66-73% (filter based versus TEOM measurements) for relatively high

emitting non-catalyst cordwood stoves. TEOM measurements showed significant variability in ESP control efficiency ranging from 33-92% depending on the test phase of the IDC; and,
- If the creosote concerns can be addressed, ESPs offer significant emission reduction potential for non-catalyst cordwood stoves, which could aid community efforts to improve air quality.

Catalytic Cordwood Stove Performance
- The test results for the ESP equipped catalytic cordwood stove indicate a control efficiency of 1%; and,
- The low emission levels of catalytic cordwood stoves combined with poor ESP performance during the startup test phase and the almost nonexistent reduction in overall emissions suggest that the addition of ESP control for these stoves offers little benefit to the community. However, other variables such as typical number of start-ups influence the overall emission reduction and additional data gathered through simultaneous measurement of PM before and after the ESP could provide additional insight to the efficacy of ESPs on catalytically controlled cordwood appliances.

During the winter of 2019/2020 Golden Valley Electric Association (GVEA) funded an ESP pilot project. The project was funded at $125,000 for two years with a goal of installing 80 ESPs in the nonattainment area over a 2-year period (40 each year). On December 12, 2019 a meeting was held including multiple stakeholders where homeowner agreements, chimney cleaning, and professional installation issues were resolved. Key takeaways include that prior to each ESP being installed the appliance and chimney would be inspected by a licensed chimney sweep to verify that the appliance was installed correctly and that the chimney would be professionally cleaned prior to ESP installation. In a July 21, 2020 FNSB Air Pollution Control Commission (APCC) meeting GVEA provided a report on the community pilot project to install ESPs in the North Pole area. Key takeaways from GVEA's report include:

- 17 ESPs were installed in the North Pole area during January – February 2020;
- Upon inspection after the burn season, nearly half the installed ESPs had failed due to excessive creosote buildup;
- The cause (e.g. wet wood, appliance type, appliance operation, or ESP operation) of excessive creosote buildup was not determined; and
- GVEA stopped project funding on a go-forward basis.

Meeting agenda and audio tracks are available on the FNSB website under the July 21, 2020 Meeting Documents at:
http://www.fnsb.us/Boards/Pages/Air-Pollution-Control-Commission.aspx

By definition, a control measure must result in permanent and enforceable emission reductions. A clear implementation strategy has not been identified, therefore for the purposes of this analysis the measure evaluated is: Mandatory installation of an ESP on any appliance that receives a NOASH waiver. These appliances are allowed to operate during the meteorological

conditions that lead to the highest ambient PM concentrations, and a quantifiable decrease in emissions during episodic conditions would lead to improved air quality.

Analysis of the FNSB and DEC test results, combined with the testimony from GVEA, provide a weight of evidence that SFBAs encompass a large range of operational and emission characteristics which have a dramatic effect on ESP performance. As with any post combustion emission control technology, the ESP functions best on appliances with the emission loading and stack effluent characteristics it was designed for with performance decreasing as operational parameters fall outside of design constraints. Due to the large range of appliances within the SFBA source category the control strategy conclusions are divided into the following categories:

- EPA Step 2 Certified Appliances:
  - Pellet stove;
  - Non-catalytic cordwood stove; and,
  - Catalytic cordwood stove.
- All other SFBAs, including but not limited to: hydronic heaters, fireplaces, EPA Step 1 certified appliances, non-certified appliances, fireplace inserts, and any other device that would qualify for a NOASH under the Emergency Episode Plan in the Serious Area SIP.

Regarding potential safety concerns, it is beyond the scope of this analysis to evaluate the safe use of an ESP or any technology. Potential safety concerns that were identified during analysis are characterized as potential because those concerns are identified but not verified. A complete investigation of product safety was not conducted, therefore a conclusion of "no potential safety issues identified" means none were discovered during analysis and should not be construed as no safety issues exist.

Conclusion

EPA Step 2 certified pellet stove:

FNSB testing shows a quantifiable emission benefit for including an ESP as a control on EPA Step 2 certified pellet stoves. No potential safety issues were identified during analysis. This measure, mandatory installation of an ESP on a pellet stove that receives a NOASH waiver, is technically feasible to implement. The results of a cost effectiveness analysis of this measure, presented in Step 4, show this measure is economically infeasible and therefore not eligible for consideration as a 2020 Amendment Plan control measure.

EPA Step 2 certified non-catalytic cordwood stove:

DEC testing shows a potential emission benefit for including an ESP as a control on a Step 2 certified non-catalytic cordwood stove, additional testing is required to demonstrate a quantifiable emission benefit. The DEC testing and GVEA pilot project provide a weight of evidence identifying a potential safety issue due to accelerated creosote buildup. Due to the identification of a potential safety issue this measure, mandatory installation of an ESP on a non-

catalytic cordwood stove, is technically infeasible to implement and is dismissed from the control measure analysis.

EPA Step 2 certified catalytic cordwood stove:

DEC testing shows a limited potential emission benefit (less than 1% emission reduction) for including an ESP as an additional control on a Step 2 certified catalytic cordwood stove, additional testing is required to demonstrate a quantifiable emission benefit. The DEC testing did not identify a potential safety issue. The GVEA pilot project identified excessive creosote buildup in a catalytic cordwood stove. Due to the identification of a potential safety issue and the limited potential emission benefit this measure, mandatory installation of an ESP on a catalytic cordwood stove is technically infeasible to implement and is dismissed from the control measure analysis.

All other SFBAs:

No additional testing was completed on the other SFBA categories. Due to the potential safety issue of accelerated creosote buildup observed during DEC testing and the GVEA pilot project, mandatory installation of an ESP on a SFBA is technically infeasible to implement and is dismissed from the control measure analysis.

Measure 64: Weatherization and Energy Efficiency

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

- None

Background

EPA commented that weatherization and heat retention programs should be evaluated as a control measure. They suggested evaluating the benefits of energy audits and increased insulation. The survey of SIPs did not identify any control measures mandating weatherization and claiming related emission reduction benefits.

Analysis

Given the high cost of home heating, Alaska has many programs for improving home heating efficiency. The Alaska Housing Finance Corporation offers a variety of programs that offer information (e.g., air sealing, appliance efficiency, insulation, home maintenance, ventilation, etc.) and financial incentives (home energy loans, rebates and low income weatherization, etc.) to improve home heating efficiency. The Alaska Energy Authority also provides a wide range of programs to improve heating efficiency. Another source of information for constructing new

homes is the IECC Compliance Guide for Homes in Alaska, which provide guidance on air sealing, fenestration, insulation and ducts. All these programs and codes lead to home heating efficiency improvements, which reduce emissions.

A control measure must provide permanent and enforceable emission reductions. All the programs mentioned are voluntary programs, and do not provide enforceable emission reductions. In order to provide enforceable emission reductions, the programs would need to be mandatory and regulated. The leap from voluntary to mandatory requires significant work. An applicability mechanism needs to be identified that requires when a home's efficiency would be reviewed, such as: home sale, application for an exemption, or purchase of a SFBA. Then a threshold for energy efficiency needs to be determined and the required actions need to be outlined. While recommendation 16 from the Air Quality Stakeholders group, used in development of the Serious SIP, identifies a possible applicability mechanism with the requirement for a home energy audit at the time of home sale, the Stakeholders Group could not agree on a threshold or required actions.

Conclusion

Programs which stimulate home heating system replacement produce heating efficiency improvements and credit for both the efficiency improvement and emissions reductions are accounted for in the control measure analysis for the SIP. Energy audits, increased insulation and related weatherization measures are also being implemented on a voluntary basis, so they are clearly technologically feasible as a voluntary measure. However, the leap from voluntary to mandated measure requires significant work and a long-term funding commitment. The literature review did not provide any model rules, and there are significant gaps to address including applicability, thresholds, requirements, and legal authority. Due to the gaps identified, and that a similar measure has not been mandated, this measure is technically infeasible as a mandated measure and dismissed from the analysis for the 2020 Amendment to the Serious SIP.

Measure 67: Coffee Roasters

Implementing Jurisdiction(s)

- Colorado

Regulation Weblink(s)

- https://www.colorado.gov/pacific/sites/default/files/AP_Coffee-Roasting.pdf

Background

Alaska Department of Environmental Conservation (DEC) regulation 18 AAC 50.055 imposes emission limits on industrial processes and fuel-burning equipment that are applicable to coffee roasting operations in the Fairbanks North Star Borough. This regulation limits the opacity of visible emissions from fuel-burning equipment to no more 20 percent averaged over any six

consecutive minutes.[65] Prior to 2019, neither DEC nor the Borough have adopted regulations specific to emissions from coffee roasting operations.

A number of jurisdictions outside of Alaska do have permit requirements for facilities from which emissions exceed a specific threshold, and coffee roasting facilities are not exempted from these requirements.

A summary of the State Implementation Plans for Colorado,[66] as developed by the Regional Air Quality Management Council[67] – which was established in 1989 to serve as the lead air quality planning agency for the Denver metropolitan area – indicates that in 1987, Denver was designated as a "Group I" nonattainment area for PM_{10} and then designated as a moderate attainment area in 1990 with regard to the 24-hour PM_{10} standards. Among the control measures contained within the 1993 PM_{10} Attainment SIP was one that stated that:

All existing permits and applicable provisions of AQRs[68] No. 1 and 3 enforced for both minor and major industrial sources of PM_{10}, NO_x and SO_2.

The Colorado Department of Public Health and Environment (CDPHE) currently enforces Regulation Number 3: Stationary Source Permitting and Air Pollutant Emission Notice Requirements,[69] which requires that:

For criteria pollutants, Air Pollutant Emission Notices are required for: each individual emission point in a nonattainment area with uncontrolled actual emissions of one ton per year or more of any individual criteria pollutant (pollutants are not summed) for which the area is nonattainment; each individual emission point in an attainment or attainment/maintenance area with uncontrolled actual emissions of two tons per year or more of any individual criteria pollutant (pollutants are not summed).

Also listed within Regulation Number 3 is a list of facilities for which exemption from Regulation Number 3 could be granted, but coffee roasting facilities are not included within that list. In fact, in 2014 the CDPHE's Air Pollution Control Division released a memo entitled "An Overview of Colorado Air Regulations for Coffee Roasting",[70] which lists these same limits for exemptions, implying that the requirement has been maintained despite Colorado having achieved attainment status for PM_{10}. Lastly, direct communication with the Air Pollution Control Division of the Colorado Department of Public Health confirmed that no regulation has ever

[65] http://dec.alaska.gov/media/1038/18-aac-50.pdf, accessed June 20, 2018.
[66] https://raqc.egnyte.com/dl/SMXBbYwYdO/StateImplementationPlanSummaries2018.pdf_; updated January 2018, accessed April 11. 2018.
[67] http://raqc.org/
[68] Air Quality Regulation
[69] Colorado Department of Public Health and Environment, Air Quality Control Commission, Regulation Number 3: Stationary Source Permitting and Air Pollutant Emission Notice Requirements, available at https://www.colorado.gov/pacific/sites/default/files/5-CCR-1001-5.pdf, accessed April 11, 2018.
[70] https://www.colorado.gov/pacific/sites/default/files/AP_Coffee-Roasting.pdf

been developed specifically for coffee roasting facilities within Colorado and that any permitting requirements for coffee roasting facilities within Colorado has just been part of the overall permitting or New Source Review requirements.[71]

The requirements for coffee roasting operations exceeding either of the emission thresholds are the maintenance of visible emissions at opacity levels of 20% of less, and the use of a cyclone capable of reducing uncontrolled particulate matter emissions by at least 70%.[72]
In addition to Colorado, other jurisdictions have indicated a requirement for coffee roasters to apply for permits related to their operations:

- Oregon requires permits for facilities that process thirty or more tons of roasted coffee per year.[73]
- The San Diego County Air Pollution Control District Rules require a permit for "any coffee roaster with a maximum capacity above 11 pounds"[74] and guidance specific to coffee roasting operations states that emissions from coffee roasting "are typically controlled using a combination of a cyclone and either an afterburner or wet-scrubber."[75]
- Washington Administrative Code 173-401-530 defines the threshold for insignificant emissions, and thus permitting requirements, as 0.75 tons per year of PM_{10}[76] and does not exempt coffee roasters.
- The Rules of the South Coast Air Quality Management District (SCAQMD) mention coffee roasting facilities only as facilities for which no permits are required unless a facility is subject to Regulation IX (Standards for Performance of New Stationary Sources), or Regulation X (National Emissions Standards for Hazardous Air Pollutants), both of which are general in nature and not related specifically to coffee roasting facilities.[77,78]

[71] Communication with Casey Houlden, Air Pollution Control Division, Colorado Department of Public Health, April 16, 2018; Communication with Leah Martland, Air Pollution Control Division, Colorado Department of Public Health, April 16, 2018
[72] An Overview of Colorado Air Regulations for: Coffee Roasting, Colorado DPHE Air Pollution Control Division, Small Business Assistance Program, 8/2014, p. 7, https://www.colorado.gov/pacific/sites/default/files/AP_Coffee-Roasting.pdf (accessed on June 14, 2018)
[73] http://www.oregon.gov/deq/FilterPermitsDocs/aqgp116.pdf
[74] https://www.arb.ca.gov/drdb/sd/curhtml/R11.pdf
[75] https://www.sandiegocounty.gov/content/sdc/apcd/en/engineering/Permits/Engineering_Phase_2/Coffee_Roasters.html
[76] http://apps.leg.wa.gov/wac/default.aspx?cite=173-401-530
[77] SCAQMD, 2017, Rules. Available at https://www.epa.gov/sites/production/files/2018-01/documents/south_coast_district_rules_compilation_dec_2017.pdf, accessed May 2, 2018.
[78] http://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/regulations-ix-and-x

- The Sacramento Metropolitan Air Quality Management District has also not adopted any regulations specific to coffee roasting facilities,[79] but does maintain a specific webpage to assist coffee roasting facilities with the acquisition of a permit for new installations or modifications of facilities.[80]
- The Puget Sound Clean Air Agency does not have any regulations specific to coffee roasting facilities,[81] and coffee roasting facilities are not listed in Regulation 1-9,[82] which sets requirements for specific sources.[83]
- The New York State Department of Environmental Conservation does not have any apparent regulations specific to coffee roasters,[84] and the list of SIP-approved measures applicable in New York does not include any specific to coffee roasting operations,[85] implying that such operations in New York State are subject only to permit requirements.
- The Idaho Department of Environmental Quality, in rule 58.01.01, Rules for Control of Air Pollution in Idaho, makes no specific mention of coffee roasting facilities.[86]
- The Bay Area Air Quality Management District, in a manner similar to the SCAQMD, states that coffee roasting facilities "with a roasting capacity of less than 15 pounds of beans or nuts per hour" are "exempt from the requirements of Sections 2-1-301 and 302," which are the permitting standards for construction and operation of facilities.[87]

To ensure that coffee roasters are properly represented in the emissions inventory, DEC staff identified batch roasting facilities located within the nonattainment area and conducted a telephone survey to collect information on capacity (lbs/year), utilization, existing controls, etc. Due to concerns about regulation and competition the responses were limited and provided no insight into their operations. One respondent, however noted their facility employed a thermal oxidizer to control emissions.

Analysis

The permit requirement of the San Diego County Air Pollution Control District for use of a cyclone in combination with an afterburner or wet scrubber appears to constitute the most stringent emission control requirement on emissions from coffee roasting operations. The use of

[79] https://www.epa.gov/sites/production/files/2018-01/documents/sacramento_metropolitan_air_quality_management_district_aqmd_rules_compilation_dec_2017.pdf
[80] http://www.airquality.org/businesses/permits-registration-programs/permit-applications-recordkeeping-advisories/coffee-bean-roasting-operations
[81] http://www.pscleanair.org/219/PSCAA-Regulations
[82] http://www.pscleanair.org/DocumentCenter/View/342/1-9-PDF
[83] http://www.pscleanair.org/101/Permits-Registration; http://www.pscleanair.org/181/Title-V-Operating-Permits
[84] http://www.dec.ny.gov/regulations/regulations.html
[85] https://www.epa.gov/sips-ny/epa-approved-statutes-and-regulations-new-york-sip
[86] https://adminrules.idaho.gov/rules/current/58/580101.pdf
[87] https://www.epa.gov/sites/production/files/2018-01/documents/san_francisco_bay_area_air_quality_management_district_baaqmd_rules_compilation.pdf

a cyclone with an afterburner or wet scrubber will typically result in visible emissions from coffee roasting operations that are substantially less than 20 percent opacity. Although this permit requirement is not contained in an approved $PM_{2.5}$ SIP, the inclusion of this control technology as the standard for control expected in a permit application makes this technology eligible for consideration as BACM.

The finding that a thermal oxidizer is currently used to control emissions from a facility located within the nonattainment area demonstrates that this measure is technologically feasible.
As noted in the introduction, a new regulation, 18 AAC 50.078(d), effective January 8, 2020, requires coffee roasters within an area identified in 18 AAC 50.015(b)(3) to install a pollution control device on any unit that emits 24 lbs or more of particulate matter within a 12-month period. The requirement for installation of control equipment on coffee roasters is 1 year from the effective date of regulation. The department may waive the requirements of this subsection if the facility provides information demonstrating that control technology is technically or economically infeasible. A spreadsheet[88] is available for sources to provide the information required to assist in calculating the estimated air emissions for coffee roaster(s) based on the specifics of each roaster and how much coffee is roasted each year.

Conclusion

The adoption of the referenced state regulations are sufficient to meet the BACM requirements of this measure, therefore the measure is technologically feasible, adopted and implemented in alternate form, no additional analysis is required, therefore it is not eligible for consideration as a 2020 Amendment Plan control measure.

Measure 68: Charbroilers

Implementing Jurisdiction(s)

- Bay Area Air Quality Management District (California)
- South Coast Air Quality Management District (California)
- San Joaquin Valley Unified Air Pollution Control District (California)

Regulation Weblink(s)

- http://www.baaqmd.gov/~/media/dotgov/files/rules/reg-6-rule-2-commercial-cooking-equipment/documents/rg0602.pdf?la=en;
- http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1138.pdf?sfvrsn=4,
- http://www.valleyair.org/rules/currntrules/r4692.pdf

[88] http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-small-source-information-requirements/.

Background

Alaska Department of Environmental Conservation (DEC) regulation 18 AAC 50.055 imposes emission limits on industrial processes and fuel-burning equipment that are applicable to charbroiling operations in the Fairbanks North Star Borough. This regulation limits the opacity of visible emissions from fuel-burning equipment to no more 20 percent averaged over any six consecutive minutes. Neither DEC nor the Borough have adopted regulations specific to emissions from charbroiling operations.

Charbroiling – either chain-driven or under-fire - is a method of flame-cooking meat that is popular in restaurants or other commercial cooking operation where speed and production volume in the preparation of cooked meats are priorities. In chain-driven charbroiling, meat is carried on a slotted, conveyorized grill between two sets of gaseous fuel burners, one above the grill and one below.[89] In under-fire charbroiling, a stationary slotted grill holds the meat while it is exposed to radiant heating from gaseous fuel burners located below the grill. A few air quality regulatory agencies have adopted emission control requirements to reduce $PM_{2.5}$ emissions from charbroiler operations.

The Bay Area Air Quality Management District (BAAQMD) adopted Regulation 6, Rule 2 (Commercial Cooking Equipment) in 2007 to reduce PM emissions from both chain-driven and under-fire charbroiling sources.[90] The rule requires:

- for chain-driven charbroilers with a throughput of at least 400 pounds of beef per week, the use of a catalytic oxidizer that reduced PM_{10} emissions to no more than 1.3 pounds per 1000 pounds of beef cooked per manufacturer's certification, or any other control device that limits the PM_{10} emissions to 0.74 pounds per 1000 pounds of beef cooked as determined by onsite source testing; and
- for under-fire charbroilers processing more than 800 pounds per week on more than 10 square feet of cooking area, the use of a control device certified to limit PM_{10} emissions to no more than 1 pound of PM_{10} per 1,000 pounds of cooked beef. According to a staff at BAAQMD, electrostatic precipitators haven been installed in commercial kitchens in San Francisco and San Jose, but the district is yet to enforce control requirements for under-fire charbroilers. The reason they gave is that no control technologies have been certified. The District, however, made a commitment

[89] South Coast Air Quality Management District, Preliminary Draft Staff Report: Proposed Amended Rule 1138 – Control of Emissions from Restaurant Operations, 2009, available at http://www.aqmd.gov/docs/default-source/rule-book/support-documents/rule-1138/par1138pdsr.pdf, accessed on April 12, 2018.
[90] Bay Area Air Quality Management District, Regulation 6 – Particulate Matter Rule 2 Commercial Cooking Equipment, http://www.baaqmd.gov/~/media/dotgov/files/rules/reg-6-rule-2-commercial-cooking-equipment/documents/rg0602.pdf?la=en, accessed on June 21, 2018.

in their 2016 $PM_{2.5}$ Plan to adopt the control measure for under-fire charbroilers in 2025.[91]

The South Coast Air Quality Management District adopted Rule 1138 (Control of Emissions from Restaurant Operations) in 1997 to control emissions from chain-driven charbroilers only.[92] The Rule requires the use of catalytic oxidizers to control PM_{10} emissions from chain-driven charbroilers, but does not set a specific emission limit. Charbroilers in operation as of November 14, 1997 are allowed a ten-year delay in compliance. All new or retrofitted charbroiler systems must submit source test data to the AQMD upon initial startup with catalytic oxidizers installed. Chain-driven charbroilers permitted with a meat processing limit of less than 875 pounds of meat per week, as documented by weekly records maintained for five years of meat purchased and cooked, and demonstrating through source testing that PM_{10} emissions are less than one pound per day, are exempt from the requirement to use a catalytic oxidizer.

AQMD tried in 2009 to amend Rule 1138 to regulate particulate emissions from under-fire charbroilers. However, to date, the District has not been able to identify control measures that are both technologically and economically feasible for under-fire charbroilers.[93]

The San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) last amended Rule 4692 (Commercial Charbroiling) in 2018. The June 21, 2018 amendments, which are largely administrative, require the owners or operators of commercial cooking operations with under-fire charbroilers that do not cook 400 pounds or more of meat per week or more than 10,800 pounds in any 12-month period to submit a one-time information report. The Rule requires under-fire charbroilers owners to register their units under Rule 2250 (Permit Exempt Equipment Registration) and to comply with certain weekly recordkeeping requirements. The Rule requires commercial cooking operations with chain-driven charbroilers 400 pounds or more of meat per week to be equipped and operated with a catalytic oxidizer certified by South Coast AQMD to have a control efficiency of at least 83% for PM_{10} emissions.[94,95] Charbroilers processing less than 875 pounds of meat per week are exempt from the requirement to install catalytic oxidizers if weekly records of meat purchased and cooked are maintained for five years and source testing demonstrates the maximum meat processing rates at which PM_{10} emissions are maintained at less than one pound per day. Charbroilers processing less than 400 pounds of meat per week, or less than 10,800 pounds in the most recent 12-month period and less than 875 pounds in any single week, are exempt from the requirements to install catalytic converters and from the requirements for source testing.

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[91] https://www.federalregister.gov/documents/2020/07/02/2020-12690/approval-and-promulgation-of-implementation-plans-designation-of-areas-for-air-quality-planning, accessed on July 7, 2020.
[92] http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1138.pdf?sfvrsn=4, accessed on June 21, 2018.
[93] Ibid. 92
[94] https://www.federalregister.gov/documents/2020/05/29/2020-11261/air-plan-approval-california-san-joaquin-valley-unified-air-pollution-control-district-and-feather, accessed on July 7, 2020
[95] https://www.valleyair.org/rules/currntrules/r4692.pdf, accessed on July 7, 2020

The Utah Department of Environmental Quality last amended R307-303 (Commercial Cooking) in 2018 to control $PM_{2.5}$ emissions from chain-driven charbroilers in $PM_{2.5}$ nonattainment counties.[96] This regulation requires the use of catalytic oxidizers on all chain-driven charbroilers in these jurisdictions, regardless of meat processing capacity. The regulation also requires that the opacity of exhaust from catalytic oxidizers serving chain-driven charbroilers not exceed 20% using U.S. EPA Method 9.

Analysis

The Utah DEQ regulation requires catalytic oxidizers on all chain-driven charbroilers in specified counties, but does not require the catalytic oxidizers to be certified to a specific emission limit as required by the Bay Area AQMD or the San Joaquin Valley UAPCD. However, unlike the Utah DEQ, the Bay Area AQMD and the San Joaquin Valley UAPCD have a regulation for the control of PM emissions from the under-fire charbroilers. Catalytic oxidizers satisfying the Bay Area AQMD mass emission rate or the San Joaquin Valley UAPCD control efficiency should operate at visible emission opacities considerably below the Utah DEC 20% limit. These controls are technologically feasible.

As noted in the introduction, DEC adopted a new regulation 18 AAC 50.078(c), effective January 8, 2020, that requires charbroilers to submit information on their location, operation type (chain driven versus underfire), number of operations, fuel used, # of lbs of meat cooked/week, etc. This information is required to better characterize this source category and develop charbroiler regulations, if warranted.

Conclusion

The adoption of the referenced state regulations is sufficient to meet the BACM requirements of this measure, therefore the measure is technologically feasible and eligible for Step 4 cost effectiveness analysis. The Step 4 analysis of the information collected under 18 AAC 50.078(c) found that installing catalyst oxidizers on charbroiling facilities is not cost effective, and therefore not eligible for consideration as a 2020 Amendment Plan control measure.

Measure 69: Incinerators

Implementing Jurisdiction(s)

- South Coast AQMD
- Washington State
- Colorado
- New York State

[96] https://rules.utah.gov/publicat/code/r307/r307-303.htm, accessed on June 21, 2018.

Regulation Weblink(s)

- See listed footnotes below

Background

The Alaska Department of Environmental Conservation, under the Alaska Administrative Code 18.AAC.50.050 – Incinerator Emission Standards, PM emissions are restricted to the levels, which vary with the size of the facility, that are shown in the following table:[97]

Incinerator	Particulate Matter Standard
Rated capacity less than 1,000 pounds per hour	No limit
Rated capacity greater than or equal to 1,000 but less than 2,000 pounds per hour	0.15 grains per cubic foot of exhaust gas corrected to 12 percent carbon dioxide and standard conditions, averaged over three hours
Rated capacity greater than or equal to 2,000 pounds per hour	0.08 grains per cubic foot of exhaust gas corrected to 12 percent carbon dioxide and standard conditions, averaged over three hours
An incinerator that burns waste containing more than 10 percent wastewater treatment plant sludge by dry weight from a municipal wastewater treatment plant that serves 10,000 or more persons	0.65 grams per kilogram of dry sludge input

These restrictions were most recently amended in 2008.

Under a regulation last amended in 1992, San Joaquin Valley APCD Rule 4203 (Particulate Matter Emissions from Incineration of Combustible Refuse) restricts particulate matter emissions from refuse incinerators to less than 0.10 pounds per 100 pounds of refuse burned. [98] The rule also limits particulate emissions to 0.10 grains per dry standard cubic foot (gr/dscf) of exhaust gas corrected to 12% CO_2 for incinerators having burn rates in excess of 100 pounds per hour, and to 0.30 gr/dscf corrected to 12% CO_2 for incinerators having burn rates less than or equal to 100 pounds per hour.

[97] Alaska Administrative Code Title 18, Environmental Conservation, Chapter 50 Air Quality Control, available at https://www.epa.gov/sites/production/files/2017-10/documents/sip-ak-approved-regulations-18-aac-50.pdf, accessed April 16, 2018

[98] San Joaquin Valley Unified Air Pollution Control District, Rule 4203 Particulate Matter Emissions from Incineration of Combustible Refuse (Adopted May 21, 1992, Amended December 17, 1992), available at http://www.valleyair.org/rules/currntrules/r4203.pdf, accessed April 12, 2018

South Coast AQMD Rule 473 (Disposal of Solid and Liquid Wastes) imposes similar particulate matter emission limits on incinerators.[99] For incinerators with design combustion rates greater than 110 pounds per hour, the emission limit is 0.1 gr/dscf corrected to 12% CO_2. For incinerators with design combustion rates less than or equal to 110 pounds per hour, the emission limit is 0.3 gr/dscf corrected to 12% CO_2.

The Washington Department of Ecology Rule 173-434-130 (Solid Waste Incinerator Facilities) requires that incinerators capable of burning 250 or more tons of solid waste per day emit no more than 0.020 gr/dscf corrected to 7% O_2, and that incinerators capable of burning more than 12 tons but less than 250 tons of solid waste per day emit no more than 0.030 gr/dscf corrected to 7% O_2. In addition, Rule 173-434-160 requires the combustion zone temperature not fall below 1600 degrees F, or not average less than 1800 degrees F over any fifteen-minute period, or that the combustion air leaving the chamber must maintain an oxygen concentration of at least 3% on a wet basis.[100]

Restrictions similar to those in Alaska have been adopted by the Colorado Department of Public Health & Environment, where - in areas designated as non-attainment or attainment/maintenance for particulate matter - no owner or operator of an incinerator is allowed to cause or permit particulate matter emissions of more than 0.10 gr/dscf corrected to 12 % CO_2. In areas designated as attainment for particulate matter, the emission limit is 0.15 gr/dscf corrected to 12 % CO_2.[101]

San Diego County Air Pollution Control District Rule 53 limits combustion particulate emissions from incinerators to 0.10 gr/dscf corrected to 12% CO_2, except for those with a rated capacity of 100 pounds per hour or less, which are limited to 0.30 gr/dscf corrected to 12% CO_2.[102]

New York State Department of Environmental Conservation Codes, Rules and Regulations Chapter III, Part 219 (Incinerators), Subpart 2.2 (Emission Limitations) limits particulate matter emissions from incinerators statewide to 0.010 gr/dscf corrected to 7% O_2. Subpart 6.2 (Existing Incinerators – New York City, Nassau and Westchester Counties; Particulate Emissions) limits particulate emissions from existing incinerators to values displayed in the following figure:

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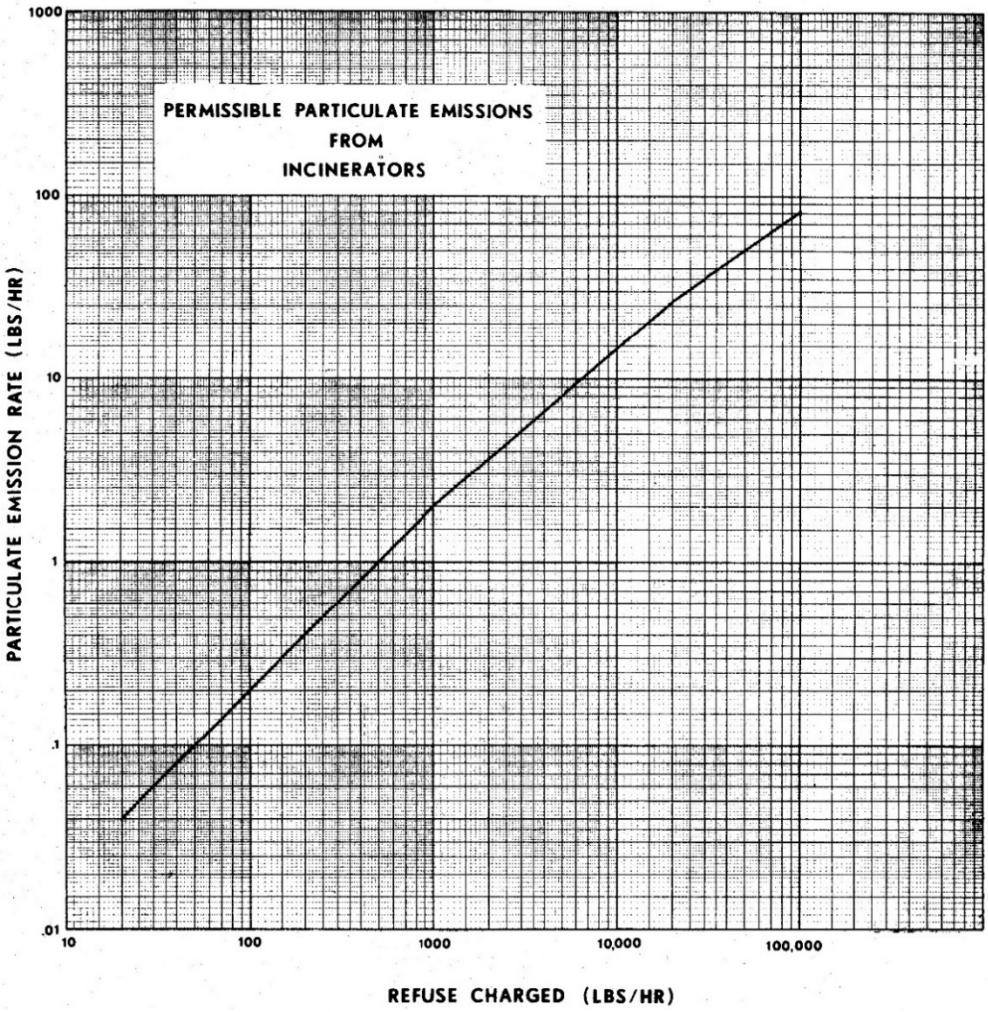
[99] http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-473.pdf?sfvrsn=4, accessed on June 25, 2018.
[100] Washington State Legislature, Chapter 173-434, Solid Waste Incinerator Facilities, available at http://apps.leg.wa.gov/wac/default.aspx?cite=173-434&full=true, accessed April 12, 2018
[101] Colorado Department of Public Health and Environment, Air Quality Control Commission, Regulation No. 1 Emission Control for Particulate Matter, Smoke, Carbon Monoxide, and Sulfur Oxides 5 CCR1001-3, 2007, available at https://www.colorado.gov/pacific/sites/default/files/5-CCR-1001-3.pdf, accessed April 12, 2018
[102] San Diego County Air Pollution Control District, Rule 1. Title, available at https://www.epa.gov/sites/production/files/2018-01/documents/san_diego_county_air_pollution_control_district_apcd_rules_compilation_dec_2017.pdf, accessed April 16, 2018

FIGURE 1



New York State DEC regulations also limit particulate emissions for existing incinerators in other portions of the state to values displayed in a different, less restrictive figure. Other sections of Part 219 place restrictions on the O_2 and CO_2 exhaust content and minimum combustion temperatures, among other requirements.[103]

Analysis

The regulatory emission limitations of particulate matter from incinerators enforced by San Joaquin Valley APCD, South Coast AQMD, San Diego County APCD, Washington State DEQ,

[103] Westlaw Compilation of New York Codes, Rules, and Regulations, Subpart 219-2 Municipal and Private Solid Waste Incineration Facilities, available at https://govt.westlaw.com/nycrr/Browse/Home/NewYork/NewYorkCodesRulesandRegulations?guid=Ib66e7530b5a011dda0a4e17826ebc834&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)&bhcp=1, accessed April 12, 2018.

Colorado DPHE, and New York State DEC are all more restrictive than those applicable to incinerators in Fairbanks, and are therefore technologically feasible.

In the Serious Area SIP, regulation 18 AAC 50.078(c) was adopted which required incinerators to submit information on location, type (medical, liquid, solid, etc.), process, fuel, throughput, hours of operation, etc. The Serious Area SIP committed to surveying potential sources and evaluating the results to determine if more stringent incinerator regulations are required.

After the Serious Area SIP was adopted DEC sent 129 requests for information to businesses that may have an incinerator. DEC received 39 responses to the requests for information. Of the 39 responses received, 36 verified that there is no incinerator present at the business location and 3 verified that there is an incinerator present at the location. The sources identified as incinerators were:

Device Make & Model	**Source Type**	**Process Description**	**Operating Hours**
Omni EH-350	Used Oil	Burning of Used Oil	30
Home Made	Cardboard & Paper	Burning	3hr/2week
Home Made	Wood-Brush	Manual Load	Summer use only

The Omni EH-350 used oil burner is addressed under Measure 70: Used Oil Burners and is not considered an affected source for the purposes of this analysis. The homemade cardboard and paper burner is the equivalent of a residential burn barrel and not an affected source under the incinerator source category. The homemade wood-brush burner operates seasonally with only summer usage and does not contribute to winter-time air pollution episodes, and is therefore not considered an affected source.

DEC does not have any record of permitted sources under the incinerator source category. Therefore, there are no existing incinerators to be affected by a regulation change.

Conclusion

The final PM2.5 implementation rule 51.1010(c)(1) and (2) reads in part “The state shall identify all sources of direct PM2.5 emissions… The state shall identify all potential control measures to reduce emissions from all sources…” This control measure does not control emissions from any source within the nonattainment area and is therefore dismissed from the control strategy analysis requirements for the 2020 Amendment Plan.

Measure 70: Used Oil Burners

Implementing Jurisdiction(s)

- State of Vermont

Regulation Weblink(s)

- https://dec.vermont.gov/sites/dec/files/aqc/laws-regs/documents/AQCD%20Regulations%20ADOPTED_Dec132018.pdf

Background

Measures 52 and 53 addressed controls mandated by the State of Vermont prohibiting the burning of used fuel oil in small "pot burners" or vaporizing burners. Both measures were determined to be technologically feasible. During development of the Serious Area SIP, while considering a set of regulations governing the accumulation, distribution and burning of used oil, it was determined that little information is available about the extent of used oil burning in Fairbanks. Calls to local vendors confirmed that used oil is burned, however, no detailed information about the number of facilities and homes burning waste oil or the volumes used had been collected.

Analysis

In the Serious Area SIP, regulation 18 AAC 50.078(c) was adopted which required used oil burners to submit information on the location, # of burners, rating, operating hours, fuel use/hour, etc. After the Serious Area SIP was adopted, ADEC sent 129 requests for information to businesses that may have a used oil burner. DEC received 47 responses to the requests for information. Of the 47 responses received, 31 verified that there is no used oil burner present at the business location and 16 verified that there is a used oil burner present at the location. Some businesses had multiple used oil burners for a total of 19 used oil burners. Fuel source was reported as 18 from auto/engine oil and 1 with a mix of restaurant oil with auto/engine oil. Fuel quality reported contained varied results including "filtered", "raw", "good", "high", and "excellent". Due to the varied results the fuel quality is not useful information. Operating hours varied from 2 to 24 hour per day. No control equipment was reported. Fuel usage ranged from 0.25 gal/hr to 3.0 gal/hr with an average of 1.61 gal/hr.

Used oil is a waste stream which can pollute the environment if not recycled or disposed of properly. Used motor oil is insoluble, persistent, and can contain toxic chemicals and heavy metals. It is a major source of oil contamination of waterways and can result in pollution of

drinking water sources. Used oil from one oil change can contaminate one million gallons of fresh water – a years' supply for 50 people[104]. Known methods of used oil disposal include[105]:

- Reconditioned on site – Impurities are removed from the used oil, which is then reused. While this form of recycling might not restore the oil to its original condition, it does prolong its life.
- Inserted into a petroleum refinery – Used Oil is introduced as a feedstock into refinery production processes.
- Re-refined – Involves treating used oil to remove impurities so that it can be used as a base stock for new lubricating oil. Re-refined prolongs the life of the oil resource indefinitely. This form of recycling is the preferred option because it closes the recycling loop by reusing the oil to make the same produce that it was when it started out, and therefore uses less energy and less virgin oil.
- Processed and burned for energy recovery – Involves removing water and particulates so that used oil can be burned as fuel to generate heat or to power industrial operations. This form of recycling is not as preferable as methods that reuse the material because it only enables the oil to be reused once. Nonetheless, valuable energy is provided (about the same as provided by normal heating oil).

The environmental concerns with used oil disposal were brought up by the Air Quality Stakeholders group during Serious SIP development in the fall of 2018. Used oil control measures were not included in the final recommended control package for the Serious SIP in part due to environmental concerns because there was no alternate disposal method available other than burning the used oil. Air Quality Stakeholders were concerned that small business may improperly dispose of the used oil resulting in environmental damage if combustion of used oil was regulated.

Environmental Compliance Consultants (ECC), a local used oil marketer, was contacted to determine disposal methods available in the FNSB. Used oil is collected in the FNSB and stored in holding tanks, there are no processing or recycling facilities in the FNSB. Used oil is transferred overland to ECC's Anchorage facility where it is run through a low-temperature heating and filtration system to reduce the basic sediment and water content before being sold for energy recovery to industrial clients. According to ECC, all used oil in Alaska is processed and burned for energy recovery, and if the used oil is not going to be burned it has to be shipped to the lower 48 for recycling.

The FNSB Solid Waste manager was contacted to determine how the FNSB disposes of used oil received at the landfill. Prior to Fiscal Year 2020-2021, FNSB operated multiple used oil burners where all used oil collected from landfill operations and FNSB Transportation/Transit operations was filtered then combusted for space heating needs. The FNSB Solid Waste Department transitioned to an alternate disposal method in Fiscal Year 2020-2021. All used oil collected is first shipped to an Emerald collection center in Seattle, WA then shipped to its final destination,

[104] U.S. Environmental Protection Agency: Managing, Reusing, and Recycling Used Oil, https://www.epa.gov/recycle/managing-reusing-and-recycling-used-oil, accessed 8/21/2020
[105] U.S. Environmental Protection Agency: Managing Used Oil: Answers to Frequent Questions for Businesses, https://www.epa.gov/hw/managing-used-oil-answers-frequent-questions-businesses, accessed 8/21/2020

Green American Recycling, LLC at one of their cement plants in either Iowa or Missouri. Current cost was reported at $2.51 per gallon to pick up, ship, and dispose.

Any disposal method other than burning the used oil for energy recovery will require overland transportation. In Alaska overland transportation of hydrocarbon products is common, such as the transportation of ULSD to the North Slope oil fields. Highways connecting interior Alaska to Anchorage or other seaports are rough with frost heaves and challenging winter driving conditions. The challenging driving conditions add to the risk factor of transportation and accidents involving the overland transportation of hydrocarbon products are a common occurrence. These accidents result in environmental damage due to spilled product. Any disposal method that requires an increase in overland transportation will also increase the risk of environmental damage.

Conclusion

Combustion of used oil is the only acceptable disposal method available in the FNSB without shipping the used oil to the lower 48. Prohibiting or regulating the combustion of used oil in the FNSB would place a burden on the small businesses that rely on combustion of used oil as a waste disposal method, encouraging a small percentage to improperly dispose of the used oil. Due to the severe environmental impacts used oil can have on waterways and drinking water, and the probability that prohibiting or regulating the combustion of used oil would lead to improper disposal, this measure is dismissed from consideration as a measure for the 2020 Amendment to the Serious SIP as technically infeasible due to potential environmental impacts.

Measure R1: Regional Kilns

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

- http://dec.alaska.gov/air/anpms/comm/docs/fbxSIPpm2-5/Appendix_III.D.5.07_Adopted_12.24.14.pdf

Background

BACM analysis requirements specified in the final $PM_{2.5}$ rule mandate the consideration of "options not previously considered as RACM/RACT for the area". The moderate SIP considered funding the construction of a Regional Kiln to provide a source of dry wood. The RACM analysis determined the measure to be technologically infeasible because of concerns about the demand for dry wood and emissions from fuels used to dry the wood.

EPA commented that this measure should be further evaluated for BACM and MSM.

Analysis

The review of SIP commitments did not identify a single program which mandates the construction of Regional Kilns to provide a source of dry wood. Instead, several programs implemented measures that require the use of dry wood in solid fuel burning devices. Fairbanks implemented a requirement that prohibits burning wood that "has more than 20 percent moisture content" in a solid fuel burning appliance.[106]
A review of the RACM analysis shows that the technologically infeasible determination cited potential adverse environmental impacts due to the increase in regional emissions from kiln-dried firewood compared to air-dried firewood because of the fuel required to operate the kiln. Recently Aurora Energy Solutions, LLC announced plans[107] to install and operate a wood drying kiln in Fairbanks. Operations are expected to start in September 2020 and produce 2,000 cords of dried birch (only) 20% moisture content firewood for the 2020/2021 winter. Heat from a coal-fired cogeneration power plant that Aurora Energy operates in downtown Fairbanks will be used to dry the wood. Details of the design and permitting for the facility are not currently available, but a mixture of waste and production heat are expected to be used to dry the wood. A call[108] to the company found that "firm prices have not been established" for the dried firewood, but will be competitive with the market and in the range of $350 - $375/cord delivered and $425/cord stacked.

Clearly the heat available to Aurora Energy Solutions limits the RACM/BACM concerns about wood drying emissions. While the Aurora wood drying emissions increment is unknown, the modifications required to construct the facility need to satisfy DEC permitting requirements. Aurora's decision to build the facility is market driven and existing regulations ensure that the facility has no undue environmental impacts. There is, however, no guarantee the Aurora kiln will continue to operate under adverse economic conditions.

Under the Final $PM_{2.5}$ Rule a control measure must result in permanent and enforceable emission reductions. While a regional kiln will introduce a supply of cleaner fuel in the form of dry cordwood, there is no mechanism that guarantees the additional dry wood introduced into the market will offset the use of wet cordwood resulting in emission reductions. While a regional kiln is beneficial to the community and the airshed a regional kiln fails to meet the requirements of permanent and enforceable emission reductions to be considered a control measure.

Conclusion

The RACM/BACM analysis concerns are still valid. This control measure is technologically infeasible because it does not require any existing entity to build a kiln, and it does not meet the control measure requirements of permanent and enforceable emission reductions; therefore, it is dismissed from consideration as a control measure for the 2020 Amendment to the Serious SIP.

106 http://www.codepublishing.com/AK/FairbanksNorthStarBorough/#!/FNSBC21/FNSBC2128.html#21.28.030
107 https://www.heatyourway.com/our-products
108 Robert Dulla to Aurora Energy Solutions, LLC staff on 8/13/20

Measure R7: Ban Use of Hydronic Heaters

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

https://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-regulations/

Background

BACM analysis requirements specified in the final $PM_{2.5}$ rule mandate the consideration of "options not previously considered as RACM/RACT for the area". The moderate SIP considered banning the use of hydronic heaters. The RACM analysis determined the measure to be technologically infeasible because it did include a provision for homes with no other adequate source of heat. Another consideration was that on very cold days some residences with alternate heat sources find them to be inadequate and need to supplement with heat from wood combustion.

Analysis

The BACM analysis of this control measure is unchanged - the review of SIP commitments did not identify a single program with unrestricted bans on using hydronic heaters. Instead, those programs with curtailments specify the conditions under which curtailments/Air Quality Alerts are called and those programs include a variety of exemptions for homes with NOASH certifications, economic hardship, etc. Fairbanks has implemented a measure mandating Stage 1 and Stage 2 alerts which restrict wood burning when concentrations are forecast to exceed established concentration thresholds (i.e., 20 and 30 $\mu g/m^3$ respectively as of January 8, 2020). Under these conditions use of hydronic heaters are prohibited except under the exemptions specified in the rule.[109]

While a SIP commitment banning outdoor wood boilers (furnaces, etc.) was not identified, several communities in Connecticut (e.g. West Hartford, Hamden, Avon, etc.) were found to have ordinances banning outdoor wood boilers because of nuisance complaints. Commitments to implementing those ordinances, however are not contained in Connecticut's $PM_{2.5}$ SIP.[110] The SIP references a state statute (Section 22a-174k),[111] which restricted the installation of new outdoor wood burning furnaces until EPA issued regulations for hydronic heaters; it also specified setback requirements for new installations. The recent passage of the Fairbanks Home Heating Reclamation Act required the removal of any solid fuel burning regulations, so again the Borough lacks the authority to curtail wood stove use. The new state regulations implemented in

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109 http://www.codepublishing.com/AK/FairbanksNorthStarBorough/#!/FNSBC21/FNSBC2128.html#21.28.030

110 http://www.ct.gov/deep/cwp/view.asp?A=2684&Q=419074&depnav_GID=1619

111 https://law.justia.com/codes/connecticut/2012/title-22a/chapter-446c/section-22a-174k/

18 AAC 50.077 and the Episode Chapter of the $PM_{2.5}$ Serious SIP restrict wood-fired heating device operation, but do not ban all operation.

A review of the RACM analysis shows that there are still technologically infeasible elements for this measure, most notable the lack of exemption for those with no other adequate source of heat.

Conclusion
The BACM conclusion is unchanged - this control measure is technologically infeasible due to lack of exemption for those with no other adequate source of heat and is dismissed from consideration as a control measure. for the 2020 Amendment to the Serious SIP

Measure R15: Ban New Installations – Wood Stoves

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

https://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-regulations/

Background

BACM analysis requirements specified in the final $PM_{2.5}$ rule mandate the consideration of "options not previously considered as RACM/RACT for the area". The moderate SIP considered a measure requiring a ban on new installations of wood stoves. Analysis of the measure was limited:

> *A ban on new installations would not reduce emissions from wood stoves in the near term, but would ultimately reduce emissions as wood stoves were retired; however, this approach could have the negative effect of prolonging the use of existing, dirty units because replacing them with newer, much cleaner units would not be allowed. This measure would not result in quantifiable reductions in the four years after designation.*

Discussion of other wood stove restrictions (e.g., limit the number of new installations allowed in new construction, allow new installations but only if one or more existing stoves were retired first, etc.) was also presented. Ultimately, the RACM analysis determined the measure to be technologically infeasible because it lacked the authority to implement it. That finding was based on a referendum prohibiting the Borough's regulation of home heating which lapsed. The recent passage of the Fairbanks Home Heating Reclamation Act required the removal of any solid fuel burning regulations, so again the Borough lacks the authority to remove or replace uncertified wood-fired heaters.

Analysis

The BACM analysis for this control measure is unchanged - the state has implemented new regulations that establish strict emission ratings for new heating devices and related installation requirements. Those regulations, however, do not prohibit the installation of wood-burning devices. Backup heating systems are essential for survival in an arctic environment as loss of primary heating is not an uncommon occurrence with many causes including: extreme cold temperatures, ice storms, fuel supply loss, etc.

DEC often hears from FNSB residents who have significant concerns regarding the need for non-electric backup heating systems in their homes. As described in the Emission Inventory, the predominant heating method within the residential space heating sector is residential fuel oil. All fuel oil boilers and heaters require electricity to operate the auxiliary systems such as fans and pumps. Given the subarctic climate and periodic power failures, these individuals have real safety concerns for themselves and their families as well as concerns about damage to their property.

These concerns and expressed needs for reliable backup heat are likely very different in the FNSB nonattainment area than in the lower 48. However, based on the Borough's woodstove changeout/conversion program it is technically feasible to equip a home with adequate backup heating systems that do not rely on solid fuel heating appliances.

Even though it may be technically feasible in certain situations, without widespread availability to natural gas there are limited technologies to provide backup heat to address the safety concerns. While voluntary programs are in place, only 28 emergency power backup systems have been installed through the Borough's program. With the limited number of actual installations, DEC is cautiously optimistic that the emergency power backup systems will become a proven technology, but at this point the limited installations do not demonstrate that this technology is feasible in every situation. Due to the importance of these systems to ensure citizens safety in an arctic climate, it is not prudent to exclude an entire sector of proven residential heating technology that many citizens rely on for an immediate safety concern.

In order to address new installations DEC is implementing 18 AAC 50.077 which is discussed in detail under Measure 8.

Conclusion

While this measure is technologically feasible, an economic analysis of its cost effectiveness, presented in Step 4, shows that it is economically infeasible in an arctic environment and therefore not eligible for consideration as a 2020 Amendment Plan control measure.

Measure R17: Ban Use of Wood Stoves

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

https://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-regulations/

Background

BACM analysis requirements specified in the final $PM_{2.5}$ rule mandate the consideration of "options not previously considered as RACM/RACT for the area." The moderate SIP considered banning the use of wood stoves. The RACM analysis determined the measure to be technologically infeasible because it did not include an exemption for homes with no other adequate source of heat. Another consideration was that on very cold days some residences with alternate heat sources find those sources to be inadequate, and need to supplement with heat from wood combustion.

EPA commented that this measure should be further evaluated for BACM and MSM.

Analysis

The BACM analysis of this control measure is unchanged - the review of SIP commitments did not identify a single program with unrestricted bans on using wood stoves. Instead, those programs with curtailments specify the conditions under which curtailments/Air Quality Alerts are called and those programs include a variety of exemptions for homes with NOASH certifications, economic hardship, etc. Fairbanks has implemented a measure mandating Stage 1 and Stage 2 alerts which restrict wood burning when concentrations are forecast to exceed established concentration thresholds (i.e., currently 20 and 30 $\mu g/m^3$ respectively as of January 8, 2020). Under these conditions use of wood stoves are prohibited except under the exemptions specified in the rule.[112] The recent passage of the Fairbanks Home Heating Reclamation Act, required the removal of any solid fuel burning regulations, so again the Borough lacks the authority to curtail wood stove use. The new state regulations implemented in 18 AAC 50.077 and the Episode Chapter of the $PM_{2.5}$ Serious SIP restrict wood-fired heating device operation, but do not ban all operation.

112 http://www.codepublishing.com/AK/FairbanksNorthStarBorough/#!/FNSBC21/FNSBC2128.html#21.28.030

Conclusion

The BACM conclusion is unchanged - this control measure is technologically infeasible due to lack of exemption for those with no other adequate source of heat and is dismissed from consideration as a control measure for the 2020 Amendment to the Serious SIP.

Measure R20: Transportation Control Measures

Implementing Jurisdiction(s)

- None

Regulation Weblink(s)

https://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-moderate-sip/
See Appendix III.D.5.07 Control Strategies (12/24/14)

Background

5% Plan analysis requirements specified in the final $PM_{2.5}$ rule mandate the consideration of "options not previously considered as BACM for the area". The moderate SIP and the Serious SIP considered several transportation control measures, including:

- HOV lanes
- Traffic flow improvement program
- Create non-motorized traffic zones
- Employer-sponsored flexible work schedules
- Retrofit diesel fleet (school buses, transit fleets)
- On-road vehicle I/M program
- Heavy-duty vehicle I/M program
- State LEV program

Transportation control programs in place at the time included:

- Expanded availability of plug-ins; electrical outlets were installed on 1,500+ parking spaces between 2008 & 2015
- Ordinance mandating—for employers with 275+ parking spaces—electrification of outlets at temps < 21° F between November 1 and March 31
- Public education focused on the benefits of plugging-in and using the transit program called Metropolitan Area Commuter System (MACS)
- Expanded transit service includes improved service frequency on high ridership routes, new routes and better bus stop facilities; ridership increased 61% between 2008 & 2013
- Commuter Van Pool program, includes Van Tran program for elderly and disabled
- Anti-idling program for heavy-duty diesel vehicles started as a ADOT&PF program focused on dump trucks and tractors and has been expanded to a CMAQ-funded pilot

program focused on the purchase and installation of auxiliary heaters to reduce idle time in private fleets.
- Federal Motor Vehicle Control Program

The analysis of these measures found:

With the exception of the anti-idling program, the programs listed above have been in place for well over a decade and are working to reduce motor vehicle emissions under extreme winter operating conditions.

Measures focused on reducing traffic congestion offer limited benefits as the Fairbanks road network has few roads operating at Level of Service (LOS) levels D, E, or F.

Community-wide ridesharing programs offer few potential emission reduction benefits because of the low population and employment density in the nonattainment area (employer programs are operated where sufficient density supports participation).

Travel reduction programs have been found to have limited benefits on a national basis, with principal reductions coming from commute trips, which require high density employment to be successful.

EPA's motor vehicle emissions model MOVES, including the most recently released version MOVES2014b, does not provide a PM benefit for either light- or heavy-duty I/M programs. Thus, there is no way to quantify a particulate benefit from I/M, and EPA clearly does not recognize I/M as an appropriate PM control measure.

This resulted in a finding that no additional TCMs appear viable for Fairbanks. Because TCMs are not expected to provide additional reductions, all TCMs are classified as "not technologically feasible."

EPA comments on the moderate SIP findings for this measure were limited to inspection/maintenance (I/M) programs and vehicle idle restrictions (which were addressed separately in Measure 60). With regard to I/M, EPA commented that the finding that I/M is technologically infeasible because MOVES2014b does not provide an I/M benefit is not a valid conclusion. They noted that the Utah Cache Valley has a I/M program for VOC and Fairbanks had previously operated an I/M program for carbon monoxide (CO) and this measure needed to be evaluated. EPA's comments on this measure for the serious SIP, not expressed in writing, suggested the need for additional discussion of this measure.

Analysis

EPA and FHWA have devoted considerable resources to develop tools to analyze the benefits of Transportation Control Measures (TCMs) as they were intended to help reduce mobile source emissions through transportation efficiency improvements and reductions in vehicle miles of travel. Independent analyses by the NCHRP (a division of the Transportation Research Board) and ASHTO (the American Association of State Highway and Transportation Officials), have

documented that the initial enthusiasm for including TCMs in SIPs has diminished as states have gained experience with their benefits and learned that they produce small emission reductions as compared with those produced by technological advancements that produce cleaner vehicles and fuels. Thus, while CMAQ funding is being used to support the implementation of a variety of transportation measures in many communities, less emission reduction credit is being taken for them and they are more frequently being implemented as voluntary measures, for which emission reduction credit is limited.

The Moderate SIP, approved by EPA, identified the measures that have been implemented in Fairbanks and reached the following findings with regard to the implementation of additional measures:

- Measures focused on reducing traffic congestion offer limited benefits as the Fairbanks road network has few roads operating at Level of Service (LOS) levels D, E, or F.
- Community-wide ridesharing programs offer few potential emission reduction benefits because of the low population and employment density in the nonattainment area (employer programs are operated where sufficient density supports participation).
- Travel reduction programs have been found to have limited benefits on a national basis, with principal reductions coming from commute trips, which require high density employment to be successful.

This resulted in the conclusion that no additional TCMs appear viable for Fairbanks. Because TCMs were not expected to provide additional reductions, all TCMs were classified as "not technologically feasible".

The BACM analysis revisited these findings and determined that they had not changed - additional transportation control measures are technologically infeasible and not eligible for the Fairbanks nonattainment area.

That said, independent studies have documented that while states and communities continue to adopt them, where funding is available, growing experience in lower-48 states has demonstrated emissions benefits are limited. As a result, credit for TCMs in SIPs has diminished.

Fairbanks continues to examine the range of transportation control measure alternatives available to reduce emissions in a cost-effective manner. Most recently this has led to the commitment of funds for public reader boards that display information on air quality and air quality alert (i.e., no burn) days. While this measure does not qualify as a TCM under the section 108(f); it represents a cost-effective transportation-based solution for the community. Another example is the recent commitment of CMAQ funds to improve traffic signalization with the nonattainment area.

With regard to I/M program benefits, the latest MOVES release is MOVES14b and it continues to show no $PM_{2.5}$ benefits for either light- or heavy-duty I/M programs. Available information about upcoming revisions to the model indicate that no I/M based PM benefits are expected. Until EPA approves a methodology for quantifying $PM_{2.5}$ benefits of I/M programs, the state cannot claim a benefit for it in the Serious SIP. With regard to EPA's comment about the need to

assess the VOC benefits of an I/M program, the Moderate precursor analysis[113], the Serious SIP and this amended 2020 Plan have consistently found that neither VOC nor NOx are significant precursor pollutants in the Fairbanks $PM_{2.5}$ nonattainment area. Thus, there is no technical basis to pursue an assessment of the costs and benefits of a I/M program for either VOC or NOx.

Conclusion

Findings for the transportation controls examined in the RACM and BACM analysis have not changed, additional section 108(f) transportation control measures are technologically infeasible and not eligible for the 2020 Amendment to the Serious SIP.

Measure R29: Increase Coverage of the District Heating System

Implementing Jurisdiction(s)

- Fairbanks North Star Borough

Regulation Weblink(s)

- None

Background

Many residential, commercial, and institutional buildings within downtown Fairbanks are connected to a district heating system that supplies low pressure steam or hot water for space heating and domestic hot water use. Use of the district heating systems allows for the widespread use of energy produced by a central steam generating unit with effective emissions controls. These systems essentially eliminate the need for the operation of individual fuel combustion heating units in each of the facilities receiving heat from a central plant.

Even considering transmission losses, a well maintained and operated central heating facility can be much more efficient than individual combustion units, especially those that burn wood, coal, or oil. Emissions from a central facility are released into the atmosphere at a much greater height above grade than those of combustion units in individual buildings and, as a result, disperse more widely.

Aurora Energy operates a coal-fired cogeneration power plant that recycles low pressure steam for district heating use. Aurora Energy provides district heating (in the form of low-pressure steam or hot water) to approximately 180 customers. Customers range in size from small residential to large commercial/institutional loads.

[113] http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip-development

Analysis

Aurora commissioned a study[114] in 2008 to examine the feasibility of expanding the underground network of pipes that deliver steam and hot water. Based on the information presented in that study, the RACM analysis determined this measure to be technologically feasible. Aurora provided updated heating expansion cost information in 2018.[115]

Conclusion

No information has become available to change the RACM analysis conclusion about the technological feasibility of this measure; therefore, this measure is technologically feasible and eligible for consideration as a control measure for the 2020 Amendment to the Serious SIP. The results of a cost effectiveness analysis of this measure, presented in Step 4, show this measure is economically infeasible.

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[114] PDC, Inc. Engineers, *Aurora Energy District Heat Capacity Study, Phase 2*, December 2008
[115] Email from Matt Burdick, PE, Project Engineer, Aurora Energy to Bob Dulla, Trinity Consultants, October 12, 2018

5. Step 4 – Determine Whether an Available Control Technology or Measure is Economically Feasible

EPA guidance[116] on determining the economic feasibility of technically feasible control measures was followed to calculate the cost per ton of pollutant reduced. Key cost information collected to support the preparation of the $/ton calculation included:

- Material/equipment prices (local purchase price, etc.)
- Labor (inspection, installation, maintenance, etc.)
- Program costs associated with implementing new control measures (including staff, software development, overhead, etc.)
- Maintenance costs (local labor and parts)
- Connection fees as appropriate (e.g., trenching, parts, etc.)
- Useful life – ranged between 8 and 30 years depending on the device lifespan
- Capital recovery rate – assumed to be 5.5%
- Existing fuel prices (documented by the Fairbanks Community Planning Department)
- Distillate fuel price forecasts (using EIA Pacific Region forecasts)
- Impact of market shifts on home heating fuel supply costs contained in the Appendix to Chapter 7
- Energy content of heating fuels (based on fuel sold in the Borough and reported by local suppliers)
- Combustion efficiency changes associated with the implementation of selected control measures
- Changes in home heating activity associated with measures addressing curtailment
- Changes in NOASH permits
- Changes in heating systems incorporated into new homes

The above information was used to calculate the annualized cost of operating current heating devices and the annualized cost of implementing individual measures for those devices consistent with the assumptions employed in the 2019 emissions inventory. A summary of the cost per ton of $PM_{2.5}$ reduced for each of the technically feasible measures is presented below in Table 9. The results indicate that a shift from No. 2 to ULS home heating oil is cost effective, the rest of the measures are not cost effective and have not been selected for implementation. As noted earlier, a requirement mandating the shift in home heating oil from No. 2 to No 1 has been incorporated into 18 AAC 50.078(b); subsection (b) mandates that starting September 1, 2022 only fuel oil containing 1000 ppm sulfur may be sold for use in home and commercial heating.

[116] Federal Register/Vol. 81, No. 164, August 24, 2016, page 55805

Table 8. Assessment of Economic Feasibility for Technically Feasible Control Measures (Cost Effectiveness Estimate)

Measure #	Measure Description	$/ton of $PM_{2.5}$ Reduced
51b.	No. 2 to ULS home heating oil	-42,500
52	Operation and sale of small "pot burners" prohibited	1,394,334,
53	No sale or exchange of used oil for fuel unless it meets constituent property limits Ban	18,294,422
R15	Ban New Installations – Wood Stoves	34,670
61	EPA – Fuel oil boiler upgrade – burner upgrade/repair	57,086,511
62	EPA – Fuel oil boiler upgrade - replacement	6,319,637
63	Require ESPs on NOASH Pellet Stoves	48,606
68	Charbroilers	$47,786
R29	Increase Coverage of the District Heating System	483,311
Measure #	**Measure Description**	**$/ton of SO_2 Reduced**
51b.	No. 2 to ULS home heating oil	1,819

The above estimates of Measure 51 cost effectiveness reflect revisions prepared to address comments received from EPA and refiners. In summary, those comments addressed:

- Presentation of the impact of regulations on the sulfur emissions from industrial and residential boilers;
- Documentation and spreadsheets supporting the cost per device and cost effectiveness of fuel changes;
- Expansion of the time period analyzed for fuel price differences and related elasticity estimates;
- Assumptions about the transition of JP4 to JP8;
- Assumptions about the Higher Heating Values of heating oils; and
- Assumptions about supply and transportation costs.

The revisions to these assumptions and related documentation are incorporated into the attached cost effectiveness spreadsheets. The results show that changes in fuel use produce an increase in $PM_{2.5}$ emissions, which moot any consideration of their cost effectiveness. The more important impact of this measure is on SO_2 emissions and the results show that while Measure 51 produces a reduction in SO_2, it also produces an increase in cost. This increase in cost, however, is slight and EPA has indicated that higher cost measures must be accepted in the 2020 Amendment relative to the controls adopted in the Serious SIP. For this reason, the shift from No. 2 to ULS is cost effective and should be considered for adoption.

As discussed in the BACM analysis for the Serious SIP, the switch from Diesel #2 to ULSD will require all fuel oil for space heating be imported by truck or rail into the community at a cost premium as described in the analysis and supporting economic assessment. The very large change in the fuel supply chain required to achieve this shift will take time to implement.

6. Step 5 – Determine the Earliest Date by Which a Control Measure or Technology can be Implemented in Whole or in Part

The Step 3 technological feasibility analysis identified 9 measures for Step 4 economic feasibility analysis. The Step 4 analysis identified one measure for implementation – the shift from No. 2 home heating oil to ULS. DEC has requested information from refiners about the time to require the implementation of this rule. The responses to date have focused on issues related to meeting the September 1, 2022 implementation date of the 18 AAC 50.078 1000 ppm requirement. Issues related to the implementation date and other considerations for this measure will be discussed in the Control Measure Chapter of the 2020 Amendment to the Serious Plan.

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7. BACM Findings

The analysis for the 2020 Amendment to the Serious SIP considered 48 separate control measures. The disposition of those measures is as follows:

- 6 – did not meet the definition for BACM and were dismissed,
- 24 – were determined to be technically infeasible and were dismissed,
- 9 - were found to be adopted in different form with no further analysis required
- 9 - measures were determined to be technologically feasible, and
- 9 – of the remaining technologically feasible measures were assessed for economic feasibility; 1 of the 9 was determined to be economically feasible.

The result is that 1 of the 48 measures assessed for technological, economical and timing feasibility was selected for potential implementation as a control measure for the 2020 Amendment to the Serious SIP. That measure will further reduce residential heating based SO_2 emissions, a precursor to $PM_{2.5,}$ and possibly aid community/state efforts to achieve attainment of the ambient 24-hour $PM_{2.5}$ standard.

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Appendices

A copy of the state's report entitled *Residential Fuel Expenditure Assessment of a Transition to Ultra-Low Sulfur and High Sulfur No. 1 Heating Oil for the Fairbanks PM-2.5 Serious Nonattainment Area* is contained in the Appendix III.D.7 Control Strategies of the $PM_{2.5}$ Serious SIP.

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Retrofit Control Devices (RCD) Testing Programs 2020

During development of the Serious Area SIP, FNSB and DEC were engaged in a testing program to evaluate the efficacy of RCDs for various solid fuel appliances. Acknowledging the obstacles presented in Section 7.7.10.1, community interest remained high in determining whether the addition of an RCD would allow wood-burning to continue when burn bans were in effect, specifically Stage 2 Alerts where only those with a NOASH are allowed to operate solid fuel appliances. To address this interest, FNSB commissioned a testing project to measure the effect of two RCDs, an aftermarket catalyst and an ESP, on PM emitted from an EPA Step 2 certified pellet stove and develop an emission factor suitable for use in a SIP. To provide additional information in support of the FNSB study, DEC commissioned a small parallel study to measure the effect of ESPs on two EPA Step 2 cordwood appliances: non-catalytic and catalytic.

Summaries of the test results are presented in this appendix document, however significant insight into the operational performance of the RCDs evaluated are contained in the test reports, which are incorporated by reference, but not discussed here. The test reports are available on DEC's and FNSB's websites at:
http://www.fnsb.us/transportation/Pages/Retrofit-Emission-Control-Device-Testing.aspx
https://dec.alaska.gov/air/anpms/communities/adec-esp-cordwood-test-report/
https://dec.alaska.gov/air/anpms/communities/fnsb-esp-pellet-test-report/

Test result summaries are presented first followed by additional information regarding a community pilot project then concluded with an evaluation of the control technologies.

FNSB Testing:

The FNSB-commissioned test program was conducted to measure the effect of aftermarket emission control devices on PM (particulate matter) emitted from a Step 2 pellet stove, selected to be representative of that category of solid fuel burning appliances operated in the FNSB. The testing program, conducted by ClearStak, in collaboration with Northeast States for Coordinated Air Use Management (NESCAUM) and Air Tox Environmental, evaluated the performance of two aftermarket RCDs: an OekoTube ESP and a Grace Fire StoveCAT catalyst.

The program collected data on PM emitted upstream and downstream from the ESP unit simultaneously to allow a calculation of the efficiency of the unit in reducing emissions. The manufacturer's recommended placement of the StoveCAT catalyst did not allow sufficient space for the measurement of upstream emissions. Therefore, non-simultaneous measurements were collected from baseline (no catalyst) and controlled (catalyst installed) tests; average differences between the baseline and controlled tests provide the basis to calculate the efficiency in reducing emissions.

Two different methods of PM measurement were employed in the program: the primary method used a modified ASTM E2515 protocol with dual train filters to collect the total PM emitted over the course of the test; and a secondary method, not yet certified by EPA, that used a tapered element oscillating microbalance (TEOM) to collect time-resolved measurements of PM emitted during the test. Data collected by the TEOM method provides insight into the performance of controls during different phases of operation (i.e., startup, low, medium, and high burn) as well as total operation, while the ASTM

E2515 method only provides a single data point—the average of all phases. Multiple replicate tests were conducted to assess variance in the performance of the retrofit controls.

FNSB Test, Pellet Appliance, ESP Performance:

A total of 6 controlled tests were conducted. Particulate control efficiency varied between test runs and the method used to measure emissions. As shown in Table 1 the overall reduction in emissions measured by the primary filter method was 72%; the average TEOM measured reduction was 47%. Large differences in PM emissions measured downstream occur between the TEOM and filter trains of ASTM E2515 and are likely related to the limitations of the filter-based instrumentation's ability to measure small filter catches (i.e., 0.2 mg and less) with precision and accuracy. This led to unusually large uncertainties in measured PM and the calculated control efficiency. Although ASTM E2515 is the primary method for PM measurement, the TEOM measurements may provide a more accurate representation of ESP performance.

Table 1
ESP PM Control Efficiency (% reduction)

Test Run	ESP 2**	ESP 3	ESP 7	ESP 8	ESP 9	ESP 10	Average
Filter	90	38	51	70	94	86	72
TEOM	69	60	37	49	41	24	47

** Missing 10 min. of stack flow; used average minute data from the interval prior to and after the missing interval.

Table 2 below presents TEOM-measured average emission rates and removal efficiencies over the entire test cycle and by test phase to summarize ESP performance over different phases of operation.

Table 2
Average TEOM Measurements

	Entire Cycle	Startup	High Burn	Medium Burn	Low Burn
Average Emissions (g/hr)					
Pre ESP	1.0	1.3	1.1	0.8	0.9
Post ESP	0.5	0.9	0.3	0.6	0.4
Average Efficiency (% reduction)					
Mean Value	47	30	74	25	55
Std. Deviation	16	24	12	36	15

On average, the ESP removes 47% of the pellet stove's emissions over the test cycle, reducing its average emission rate from 0.97 g/h before the device to 0.51 g/h after the device. However, its overall performance varies from 24% to 69% across the six test runs. Particulate removal is consistently high only in the High Burn Phase where it averages 74%. It is low (30%) in the Startup phase largely because the ESP does not begin to operate until it senses a sufficient temperature rise to indicate the presence of smoke. Thus, it offers no control for up to 15 minutes after the stove is first fired. Particulate removal is

lowest (25%) and highly variable in the Medium Burn phase due to the occurrence of arcing events that reduce the availability of control and re-entrain particulate matter (previously captured within the ESP) which is then emitted to the atmosphere[1]. Particulate removal in the Low Burn Phase (55%) is intermediate between the High and Medium Burn phases but is consistent across test runs.

Table 3 lists the emission factors[2] calculated by ClearStak for the Step 2 EPA-certified pellet stove without control and for the same stove equipped with an ESP based on TEOM measurements and filter measurements, which produced removal efficiencies of 47% and 72% respectively. Below this, emission factors are listed for a residential fuel oil furnace, which is the chief alternative for home heating during burn bans, and for a natural gas furnace.

Table 3
Comparison of Pellet Stove Emission Factors to Other Residential Heating Sources

	$PM_{2.5}$ Emission Factor[a] (lb/MMBtu)	**Source**
Pellet Stove (EPA Certified)		
No Control	0.090	ClearStak
with ESP Control (TEOM removal efficiency)	0.047	ClearStak
With ESP Control (Filter removal efficiency)	0.031	ClearStak
Other Residual Heating Sources		
#1 / #2 Fuel Oil Furnace (weighted 31.8% #1, 68.2%, #2)	0.0034	OMNI run #17[b]
Natural Gas Furnace	0.0000488	Brookhaven Report[c]

[a] All particulate matter for all sources is assumed to be less than 2.5 micrometer in diameter. Therefore, the PM emission factors presented here may be used to represent PM_{10}, $PM_{2.5}$, or total PM.
[b] "Measurement of Space Heating Emissions," OMNI-Test Laboratories, Inc., May 23, 2013.
[c] R. McDonald, "Evaluation of Gas, Oil and Wood Pellet Fueled Residential Heating System Emissions Characteristics," Brookhaven National Laboratory, BNL-91286-2009-IR, December 2009. Average of natural gas furnace, conventional and condensing boiler tests.

FNSB Test, Pellet Appliance, StoveCAT Performance:

All emission testing was done downstream of the catalyst. When it was observed that the catalyst did not operate during more than 94% of the conditioning period, the decision was made to reduce the replicates of baseline and catalyst test runs. Two baseline tests, without the catalyst installed, were performed. After one test with the catalyst installed, it was determined that that the catalyst never activated and, therefore, had no effect on PM emissions as evidenced by the catalyst temperature data showing that

1 Arcing and re-entrainment is a normal phenomenon that occurs in ESP devices across many applications. An arcing event occurs when conditions within the device discharge the high-voltage electrode and cause the electric field responsible for trapping particulates to collapse. In the testing and analysis reported here, emissions of re-entrained particulates are counted against the removal efficiency following the precedent set by EPA regulation for ESPs in the industrial sector.
2 Emission *factors* in lbs/MMBtu should not be confused with the emission *rates* in g/hr from which derived.

post-catalyst temperatures were always cooler than pre-catalyst temperatures for the entire test run. This finding is not surprising since catalyst operation requires a combination of fuel in the form of hydrocarbons (HC), oxygen and a sufficiently high temperature to light off and continue operation. The pellet stove emission levels are low to begin with, which limits the HC needed to support combustion, and the placement of the catalyst outside of the stove (rather than within) reduces the flue gas temperature to less than is needed for catalyst light-off and continued combustion.

DEC Testing:

A limited testing program was conducted to measure the effect of a commercially available ESP on PM emitted from cordwood stoves in support of the FNSB testing project. The study focus was to collect initial measurements with an ESP to assist in providing additional information to the decision-making processes within the Borough related to consideration of retrofit controls and potential needs for further testing by the Borough. The testing program, conducted by ClearStak and Air Tox Environmental, evaluated the performance of an OekoTube ESP.

Two EPA Step 2 appliances[3] were tested: a non-catalytic stove and catalytic stove, designated in this report as Stoves 9 and 19, respectively. Both were selected to be representative of their categories operated in FNSB. The test fuel used was seasoned silver maple, sourced in Connecticut with 19-25% moisture content. The test protocol used for operating the cordwood stoves was the Integrated Duty Cycle Method for Cordwood Stoves (IDC), developed by New York State Energy Research & Development Agency (NYSERDA) and NESCAUM. It specifies four phases of operation at two different heat output settings, high and low, designed to represent realistic stove operation: Startup, High Fire, Maintenance Fire and Overnight Fire.

Given the limited scope of the program, insufficient resources were available to support the collection of simultaneous measurements of PM up and downstream of the ESP unit. Instead, non-simultaneous measurements were collected from baseline (no ESP) and controlled (ESP installed) tests; average differences between the baseline and controlled tests were used to calculate the estimated efficiency in reducing emissions. Care must be taken in interpreting these values as test to test variability is imbedded in the average values used to calculate efficiency. For this reason, the findings are limited and preliminary. Additional and more robust testing with simultaneous measurements and larger sample sizes would need to be conducted to produce more complete findings on cordwood stoves.

The same as the FNSB testing, two different methods of PM measurement were employed in the program: the primary method used a modified ASTM E2515 protocol; and a secondary method that used a TEOM to collect time-resolved measurements of PM emitted during the test. The discussion points regarding PM measurement method under the FNSB testing program are applicable here as well. Both measurement methods, filter based and TEOM were used to measure PM emitted from the higher emitting non-catalytic cordwood stove (Stove 9). Measurements for the lower emitting catalytic cordwood stove (Stove 19) were collected by the TEOM method, as it provides insight into differences in temporal performance; no filter measurements were collected for Stove 19.

3 Certified to 2.5 g/hr when tested with cordwood)

DEC Test, Non-Catalytic Cordwood (Stove 9), ESP Performance:

A total of 9 tests were conducted. Two of the 5 baseline tests (#'s 1 & 2) were invalidated due to test method deviations, leaving 3 valid baseline tests; their measurements along with average values are presented below in Table 4. One of the 4 ESP tests (# 3) had numerous error codes and it was observed that the voltage at the electrode was in the 3,000-voltage range, not at the maximum specified 30,000 voltage, which meant the ESP was not fully functioning to its capacity. At the end of the test, technicians removed the ESP from the test stand and found excessive buildup of creosote on the ESP walls significantly restricting air flow (see photo in test report). The result was a dramatic reduction in control efficiency and concern about operation as testing could not continue without intervention. It also raised a concern about potential safety issues with the use of the device in structures within the community as excessive creosote buildup that is not properly managed can potentially result in increased risk of chimney fire. ESP #3 was considered an anomaly for the purposes of estimating average removal efficiency, but it was a valid test and the results must be considered when assessing ESP as a control device on cordwood appliances.

The ESP was cleaned out with a wire chimney brush[4] and then re-installed back on the test stand. It was then confirmed that the ESP was still operational using ESP data which indicated that no errors existed and maximum voltage at the electrode was present. A thin layer of hard tacky coating of buildup did remain on the ESP walls even after the cleaning. The results for the remaining 3 ESP tests are also presented in Table 4 along average values.

The average baseline values are an order of magnitude higher than the levels to which the stoves were certified. The cause of the discrepancy is the difference between the EPA test protocol and the IDC. Since the IDC is considered more representative of real-world operation, the actual emission rates for these appliances are substantially higher than indicated by the certification levels (this finding parallels motor vehicle owner experience with the difference between EPA and on-road fuel economy – people drive differently from EPA test procedures – people also operate their stoves differently from EPA test procedures). Despite the significant reductions achieved by ESPs (not impeded by creosote buildup), the resulting average values are still multiples of the levels to which the stoves are certified.

4 While the manufacturer's manual recommends the use of a synthetic brush for cleaning, the thickness of the creosote dictated the use of metal brush to remove the restricting material.

Table 4 Non-Catalytic Cordwood Stove Non-Simultaneous PM Test Measurements and Average Efficiency by Test Method (g/hr)				
TEOM				
Test Type/#				Average
Baseline	29.35	18.51	26.74	24.87
ESP	5.59	7.11	7.22	6.64
Control Efficiency				73.3%
Filter				
Test Type/#				Average
Baseline	34.85	22.03	32.40	29.76
ESP	8.21	11.25	10.63	10.03
Control Efficiency				66.3%

The particulate control efficiency is calculated based on the differences between the baseline and ESP tests. Both test methods showed significant PM reductions ranging from 66 percent for the primary filter method to 73 percent for the TEOM method. The cause of the 11 percent control efficiency difference is not known. Regardless of the percent difference between the two PM measuring methods, the TEOM provides more data with regard to ESP performance with 1-minute average values. This is especially helpful when comparing ESP performance during burn phase changes. TEOM results for each burn phase are displayed in Table 5. As can be seen, test run ESP #3 in which the device errored out is an outlier compared to the other three runs (ESP #'s 1, 2, and 4). ESP #3 was a valid test and reflects what can happen to device performance and emissions due to excessive build-up of creosote (discovered after the test).

Table 5 Non-Catalyst Cordwood Stove TEOM Test Measurements and Control Efficiency by IDC Test Phase (g/hr)										
Test Phase	**Baseline**			**ESP**				**Average Baseline**	**Average ESP***	**Control Efficiency**
	#3	#4	#5	#1	#2	#3	#4			
Startup	4.03	10.73	4.83	4.31	3.83	112.03	4.91	6.53	4.35	33.4%
High	23.13	13.07	30.91	5.18	6.30	20.22	9.14	22.37	6.87	69.3%
Maintenance	47.95	43.64	40.57	1.77	5.66	16.58	2.65	44.05	3.36	92.4%
Overnight	26.14	6.18	20.86	9.00	8.70	9.53	9.54	17.83	9.08	48.8%

*Does not include ESP #3, where ESP was not functioning.

DEC Test, Catalytic Cordwood (Stove 19), ESP Performance:

A total of 7 tests were conducted. One of the 3 baseline tests (#1) was invalidated due to test method deviations, leaving 2 valid baseline tests; their measurements along with average values are presented below in Table 6. One of the 4 ESP tests (#1) was also invalidated due to test method deviations. The results for the 3 remaining tests are also presented in Table 6. For all test runs, the average PM rate was

under 5 g/hr using the IDC protocol. The difference in the average baseline and ESP values is only recorded at the second decimal place and provides an overall control efficiency of 1%.

Table 6
Catalytic Cordwood Stove
TEOM Test Measurements and Control Efficiency
(g/hr)

Baseline		ESP			Average Baseline	Average ESP	Control Efficiency
#2	#3	#2	#3	#4			
2.38	4.17	1.86	3.57	4.29	3.28	3.24	1.13%

When looking at the individual phases presented in Table 7 it is evident that the ESP had the least influence during Startup (8.9%), where PM emissions were higher than the High Fire and Maintenance Fire phases for test runs both with and without an ESP. This can be explained by both the internal catalyst and external ESP being inactive during the beginning portion of this phase. From a cold start, the catalyst has to be heated to activation temperature to become operational; until then, the gases bypass the catalyst through a manual mechanism. The ESP remains inactive until a temperature differential in the stack triggers the powering of the electrode.

Also shown in Table 7, startup emissions account for the large majority (87%) of the overall test emissions. Stove emissions drop off significantly once the catalyst reaches light off temperature after startup. Thus, the later High Fire and Maintenance Fire phases combined account for only 16% of overall emissions. Given the relatively low emission levels compared to start-up, the 50-60% ESP removal efficiency of theses phases does little to further reduce PM emissions and makes a small contribution to overall PM control.

Table 7
Catalytic Cordwood Stove
TEOM Test Measurements and Control Efficiency by IDC Test Phase
(g/hr)

Test Phase	Baseline	ESP	Control Efficiency
Startup	19.21	17.5	8.9%
High Fire	0.32	0.14	56.1%
Maintenance Fire	2.02	0.80	60.4%
Overnight Fire	n/a	n/a	n/a

Additional Information:

During the winter of 2019/2020 Golden Valley Electric Association (GVEA) funded an ESP pilot project. The project was funded at $125,000 for two years with a goal of installing 80 ESPs in the nonattainment area over a 2-year period (40 each year). On December 12, 2019 a meeting was held including multiple stakeholders where homeowner agreements, chimney cleaning, and professional installation issues were resolved. Key takeaways include that prior to each ESP being installed the appliance and chimney would be inspected by a licensed chimney sweep to verify that the appliance was installed correctly and that the chimney would be professionally cleaned prior to ESP installation. In a July 21, 2020 FNSB Air Pollution Control Commission (APCC) meeting GVEA provided a report on

the community pilot project to install ESPs in the North Pole area. Key takeaways from GVEA's report include:

- 17 ESPs were installed in the North Pole area during January – February 2020;
- Upon inspection after the burn season, nearly half the installed ESPs had failed due to excessive creosote buildup;
- The cause (e.g. wet wood, appliance type, appliance operation, or ESP operation) of excessive creosote buildup was not determined; and
- GVEA stopped project funding on a go-forward basis.

Meeting agenda and audio tracks are available on the FNSB website under the July 21, 2020 Meeting Documents are available at:
http://www.fnsb.us/Boards/Pages/Air-Pollution-Control-Commission.aspx

Evaluation of RCDs:

Controls are evaluated on three bases:

1. Addressing community interest, does the addition of an RCD provide sufficient emission reductions to allow wood-burning to continue when burn bans are in effect, specifically Stage 2 Alerts where only those with a NOASH are allowed to operate solid fuel appliances;
2. Within the context of BACM and control measure analysis, is the mandatory addition of an RCD technologically and economically feasible; and,
3. Were any potential safety concerns identified.

An important distinction between evaluation bases 1 and 2 is that basis 1 represents an exemption from a current control measure (the curtailment program) while basis 2 represents a control measure with emission benefits. Regarding basis 1, to ensure compliance with the CAA Section 110(l), PM emitted from solid-fuel burning appliances configured with retrofit devices must not exceed the levels emitted by fuel oil furnaces, the chief alternative heat source that is utilized in lieu of solid fuel appliances during a Stage 2 Alert. Because fuel oil furnaces are currently the primary heat source in most of the area's homes, the residential fuel oil furnace defines the emissions level that must be reached to achieve fuel-oil equivalency.

Basis 2, a control measure requiring the mandatory addition of an ESP, is the only control measure associated with RCDs that identified permanent and enforceable emission reductions and therefore the only control measure addressed in the 2020 Amendment Control Strategy Analysis.

Regarding basis 3, potential safety concerns, it is beyond the scope of the SIP to evaluate the safe use of any technology, including RCDs such as an ESP or catalyst. Potential safety concerns that were identified during analysis are characterized as potential because those concerns are identified but not verified. A complete investigation of product safety was not conducted, therefore a conclusion of "no potential safety issues identified" means none were discovered during analysis and should not be construed as no safety issues exist.

EPA Step 2 certified pellet stove equipped with ESP:

1. FNSB test results shows a quantifiable emission benefit for including an ESP as a control on EPA Step 2 certified pellet stoves. As shown in Table 3, the PM reductions achieved with a pellet stove plus ESP are insufficient to achieve equivalency with fuel oil appliances. To do so would require reductions of more than 90% with the ESP. Therefore, a Step 2 certified pellet appliance equipped with an ESP does not qualify for an exemption to the curtailment program.
2. FNSB testing shows a quantifiable emission benefit for including an ESP as a control on EPA Step 2 certified pellet stoves. Technical and economic feasibility is addressed in the 2020 Amendment Control Strategy Analysis. The technology was found to be technically feasible but economically infeasible.
3. No potential safety issues were identified during analysis.

EPA Step 2 certified pellet stove equipped with StoveCAT catalyst:

1. FNSB test results for the StoveCAT demonstrate that it is not designed for the operating conditions of a pellet stove and should not be considered as a control device. Therefore, a Step 2 certified pellet appliance equipped with a StoveCAT does not qualify for an exemption to the curtailment program.
2. Equipping a Step 2 certified pellet stove with a StoveCAT catalyst does not result in emission reductions, was not identified as a potential control measure, and is not addressed in the 2020 Amendment Control Strategy Analysis.
3. No potential safety issues were identified during analysis.

EPA Step 2 certified non-catalytic cordwood appliance equipped with ESP:

1. DEC testing shows a potential emission benefit for including an ESP as a control on a Step 2 certified non-catalytic cordwood stove, additional testing is required to demonstrate a quantifiable emission benefit. Preliminary results indicate that PM reductions achieved with a non-catalytic cordwood appliance plus ESP are insufficient to achieve equivalency with fuel oil appliances. Therefore, a Step 2 certified non-catalytic cordwood stove equipped with an ESP does not qualify for an exemption to the curtailment program.
2. Technical and economic feasibility is addressed in the 2020 Amendment Control Strategy Analysis. Equipping a non-catalytic cordwood appliance with an ESP was found to be technologically infeasible due to potential safety issues.
3. The DEC testing and GVEA pilot project provide a weight of evidence identifying a potential safety issue due to accelerated creosote buildup.

EPA Step 2 certified catalytic cordwood appliance equipped with ESP:

1. DEC testing shows a limited potential emission benefit (less than 1% emission reduction) for including an ESP as a control on a Step 2 certified catalytic cordwood stove, additional testing is required to demonstrate a quantifiable emission benefit. Preliminary results indicate that PM reductions achieved with a catalytic cordwood appliance plus ESP are insufficient to achieve equivalency with fuel oil appliances. Therefore, a Step 2 certified catalytic cordwood stove equipped with an ESP does not qualify for an exemption to the curtailment program.
2. Technical and economic feasibility is addressed in the 2020 Amendment Control Strategy Analysis. Equipping a catalytic cordwood appliance with an ESP was found to be technologically infeasible due to potential safety issues.
3. The DEC testing did not identify a potential safety issue. The GVEA pilot project identified excessive creosote buildup in a catalytic cordwood stove.

All other SFBA and RCD combinations:

1. No testing was completed with any other combination of SFBA and RCD than described in this section. Without quantifiable emission reductions that are equivalent to a fuel oil appliance, any exemption would not comply with CAA Section 110(l). Therefore, no combination of SFBA and RCD would qualify for an exemption to the curtailment program.
2. Technical and economic feasibility is addressed in the 2020 Amendment Control Strategy analysis for all other SFBA equipped with an ESP. Other RCDs were not identified as a control measure and were not included in the 2020 Amendment Control Strategy Analysis. Equipping other SFBAs with an ESP was found to be technologically infeasible due to potential safety issues.
3. The DEC testing and GVEA pilot project provide a weight of evidence identifying a potential safety issue due to accelerated creosote buildup on ESP installations. No potential safety issues were identified with other RCDs during analysis.

Although testing and evaluation do not support a Stage 2 exemption or mandatory installation of an ESP or any other RCD, it does not preclude their use in the FNSB. If determined to be durable in Alaska winters along with professional installation, proper maintenance, cleaning, and monitoring requirements voluntary installation of ESP-equipped pellet stoves, or other RCDs, could provide a quantifiable air quality benefit to the area.

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