

# Portola 2019 Quantitative Milestone Report



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## BACKGROUND

On January 15, 2015, the United States Environmental Protection Agency (U.S. EPA) designated and classified a portion of Plumas County as a Moderate PM<sub>2.5</sub> nonattainment area (Portola Nonattainment Area) for the 2012 annual PM<sub>2.5</sub> standard. This was based on ambient monitoring data that showed the area was above 12.0 µg/m<sup>3</sup> for the 2011–2013 monitoring period.<sup>1</sup> On February 28, 2017, the California Air Resources Board (CARB) submitted to U.S. EPA the Portola Fine Particulate Matter (PM<sub>2.5</sub>) Attainment Plan (Portola Plan) developed by the Northern Sierra Air Quality Management District (District). The Portola Plan demonstrates that the Portola Nonattainment Area will reach attainment by the Moderate area attainment date, December 31, 2021.

Section 189(c) of the Clean Air Act (CAA) requires that attainment plans for all PM<sub>2.5</sub> nonattainment areas contain quantitative milestones that are achieved every three years and demonstrate reasonable further progress (RFP) until the area is redesignated to attainment. These milestones are set to ensure that the nonattainment area is making generally linear progress towards attainment and is on track to attain the National Ambient Air Quality Standards (NAAQS) by the applicable attainment date. In the case of the Portola Nonattainment Area, the first quantitative milestone date is October 2019. Section 189(c)(2) of the CAA requires each state containing a PM<sub>2.5</sub> nonattainment area to submit, no later than 90 days after the applicable milestone date, a quantitative milestone report demonstrating that all State Implementation Plan (SIP) measures have been implemented and that the milestone has been met. The first quantitative milestone report for the Portola Nonattainment Area is due January 2020. Each quantitative milestone report must include, at a minimum:

- A certification by the Governor or Governor's designee that the SIP control strategy is being implemented consistent with RFP;
- Technical support, including calculations, sufficient to document completion statistics for appropriate milestones and to demonstrate that the quantitative milestones have been satisfied and how the emission reductions achieved to date compare to those required or scheduled to meet RFP; and
- A discussion of whether the area will attain the applicable PM<sub>2.5</sub> NAAQS by the projected attainment date.<sup>2</sup>

The U.S. EPA requires that the RFP demonstration for milestone years includes direct PM<sub>2.5</sub>, as well as any PM precursors that have been determined to be significant. As demonstrated in Section V.C of the Portola Plan, PM precursors were determined to be insignificant for attainment. Therefore, this report only addresses direct PM<sub>2.5</sub> emissions.

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<sup>1</sup> 40 CFR 81 (Jan 15, 2015)

<sup>2</sup> 40 CFR 51.1013(b)

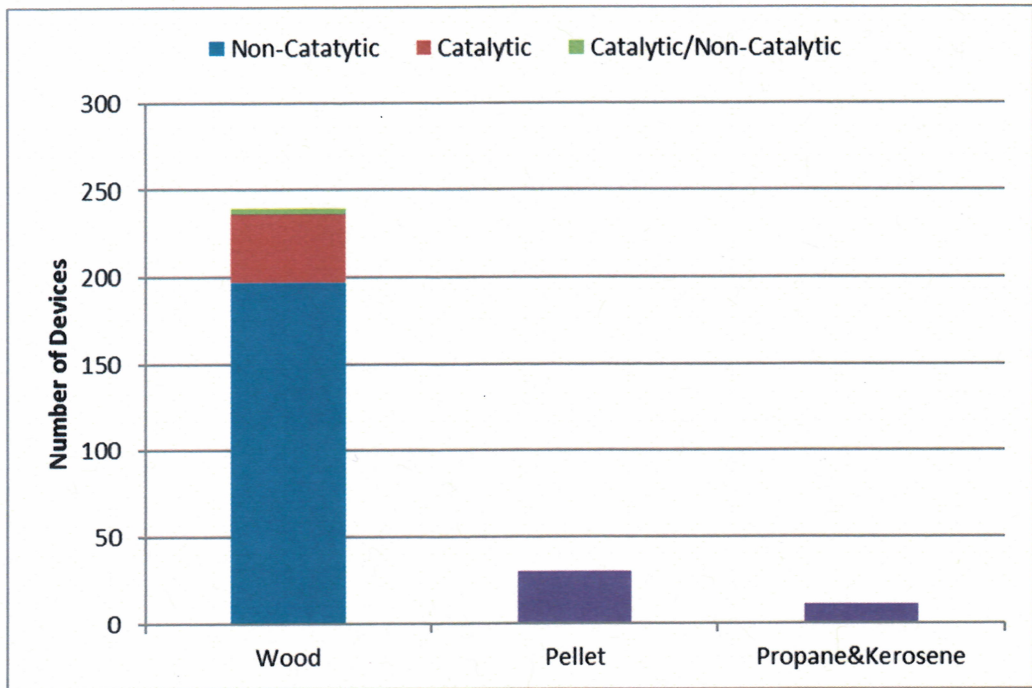
The objective of this quantitative milestone report is to demonstrate that the District has reviewed its commitments in the Portola Plan, has verified that the emission reductions needed to demonstrate RFP have been achieved, and that ongoing progress is being made to meet the December 31, 2021 attainment deadline.

## I. CONTROL STRATEGY IMPLEMENTATION

PM2.5 concentrations in the Portola Nonattainment Area are dominated by direct PM2.5 emissions from residential wood heaters. Having a single emission source category that's located in people's homes and used as a primary source of heat makes the Portola PM2.5 problem very challenging. Therefore, the District and CARB have chosen to implement a Greater Portola Woodstove Change-out Program (Change-out Program) as the primary control strategy for the Portola Nonattainment Area. The District and CARB have committed to implementing the Change-out Program and continuing the ongoing reductions in the mobile sector in order to achieve milestone and attainment obligations. These commitments have been satisfied. The District made additional commitments listed in Table 4 of the Portola Plan referred to as 'Other Commitments'. Any potential emission reductions achieved from the 'Other Commitments' were not part of the attainment demonstration. All of these commitments have been met, except for prohibiting open burning during winter which the District now plans to take it to the Plumas County Board of Directors and the City of Portola Council in 2019.

The 2019 quantitative milestone target was based on the assumption that between 2016 and 2018 350 uncertified stoves will be replaced with Phase II certified stoves with an emission rate of 7.5 grams/hour (g/hr). The actual change-outs include 240 wood stoves with average emission rates of 3 g/hr, 30 pellet stoves with an average emission rate of 1.4 g/hr, and 11 propane and kerosene stoves. Figure 1 illustrates the devices replaced through December 31, 2018, grouped by the device type.

Figure 1. Number of Replacement Devices by Type Installed through 12/31/2018



## II. EMISSION REDUCTIONS

The District made a commitment to achieve PM<sub>2.5</sub> emission reductions of 0.045 tpd by the October 2019 milestone and 0.077 tpd by the October 2022 milestone by replacing uncertified wood stoves with cleaner burning and more efficient home heating devices in the Portola Nonattainment Area (Table 1).

Table 1. RFP Projected Emissions for Quantitative Milestone Years (tpd)

Sector	2019	2022
Wood Stove Change-out	0.045	0.077
Total	0.045	0.077

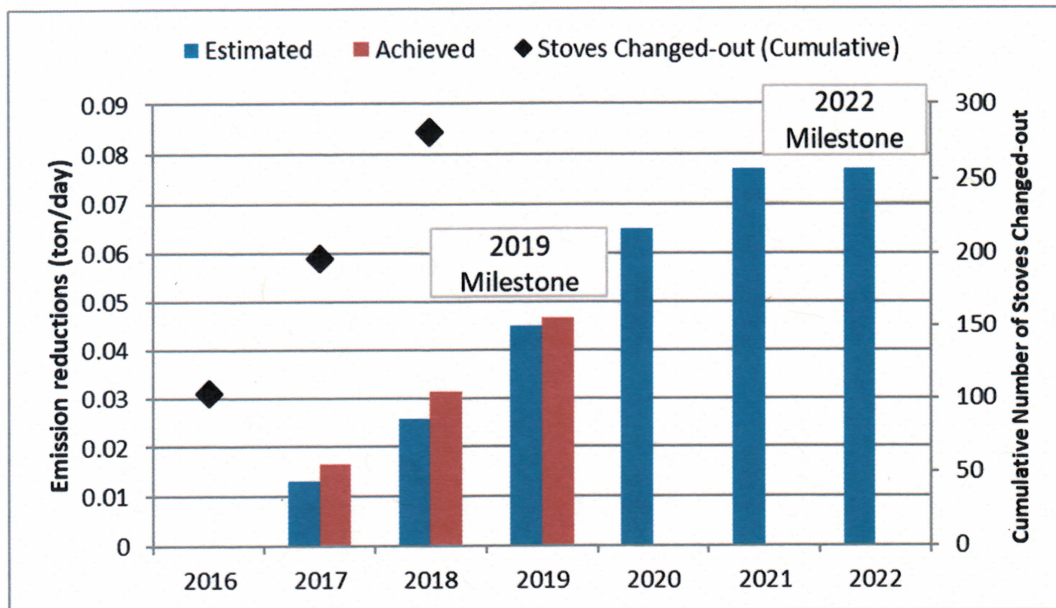
As demonstrated in Table 2 and Appendix A, change-outs completed by December 31, 2018 will reduce PM<sub>2.5</sub> emissions by 0.46 tpd by the October 2019 milestone. The level of emission reductions achieved through December 31, 2018 ensures that the District meets the October 2019 milestone and is on track to meet the October 2022 milestone. The emission reductions needed to demonstrate RFP have been achieved, the October 2019 quantitative milestone have been met, and the ongoing progress is being made to attain the 12 µg/m<sup>3</sup> annual PM<sub>2.5</sub> standard by December 31, 2021.

The 281 devices installed by the end of 2018 provide the emission reductions to meet the 2019 RFP milestone because they have significantly lower PM2.5 emission rates than the initial estimates. In order to have a conservative estimate, the assumption was that each qualified uncertified device will be replaced with a Phase II wood stove with an average certification test emission rate of 7.5 g/hr. The 240 wood burning replacement devices installed between 2016 and 2018 had an average certification test emission rate of 3.0 g/hr. The remaining 41 devices were even cleaner and included 30 pellet stoves with average emission rates of 1.4 g/hr and 11 propane/kerosene stoves with negligible PM2.5 emissions. The change-out statistics through December 31, 2018, including the number of specific devices and associated emission reductions are summarized in Table 2. Figure 2 compares the achieved emission reductions to the 2019 and 2022 quantitative milestones.

Table 2. Summary of Change-outs Completed between 2016 and 2018

<b>Total Installations as of 12/31/18</b>	<b>281</b>
<b>Summary by Replacement Device Type</b>	
Non-catalytic Stoves	197
Catalytic Stoves	39
Catalytic/Non-catalytic Stoves	4
Pellet Stoves	30
Propane/Kerosene Stove	11
<b>Summary of Emission Reductions</b>	
Total PM2.5 Emissions Saved (tons per year)	16.969
Total PM2.5 Emissions Saved (tons per day)	0.046
Initial Estimate (tons per day)	0.045
<b>Additional PM2.5 Reductions Achieved (tons per day)</b>	<b>0.001</b>

Figure 2. Comparison of PM2.5 Emission Reductions Achieved to the 2019 and 2022 Quantitative Milestones.



### III. CALCULATIONS

Initial estimates of emission reductions achieved by replacing uncertified wood stoves with cleaner burning and more energy efficient home heating devices were based on the U.S. EPA Burnwise Emission Calculator (EPA Calculator).<sup>3</sup> The EPA Calculator is designed to calculate the average emission reductions for the entire Program using the default emission factors. In order to come up with device specific emission estimates, CARB staff developed a supplemental calculator, referred to as the CARB Calculator.

The CARB Calculator was used to estimate PM2.5 emission reductions achieved by replacing 281 wood stoves between 2016 and 2018 with cleaner-burning and more energy efficient alternatives. The individual calculations for each device, along with the device tracking number and new equipment type, are presented in Appendix A. Listed below are the step-by-step instructions and formulas.

The first step in calculating emission reductions required converting certification test emission rates in grams per hour (g/hr) to emission factors in pounds per ton (lb/ton), as described below:

1. The certification test emission rate was scaled upward by 50 percent to reflect real-world in-home performance;<sup>4</sup>

<sup>3</sup> Available at <https://www.epa.gov/burnwise/burn-wise-additional-resources>

<sup>4</sup> <https://www3.epa.gov/ttnchie1/conference/ei17/session4/houck.pdf>



2. The scaled emission rate was divided by the average burn rate of 1.5 kilograms per hour (kg/hr) to calculate grams of PM2.5 emissions per kilogram of wood (g/kg);<sup>5</sup> and
3. The result was multiplied by 2 to convert g/kg to lb/ton.

The average certification test emission rate for the 240 devices between 2016 and 2018 was 3.0 g/hr. Table 3 provides additional information about the emission limits of the wood burning devices installed in between 2016 and 2018.

Table 3. Breakdown of Wood Burning Devices Installed between 2016 and 2018 by the Emission Rate

Certification Test Emission Rate	Number of Devices
Not exceeding 3.0 g/hr	89
Between 3.0 g/hr and 4.0 g/hr	119
Greater than 4.0 g/hr	32
<b>Total</b>	<b>240</b>

The following equation was used to calculate emission factor in pounds per ton:

$$\text{Equation 1: } EF = (ER \times 1.5) / BR \times 2$$

Where:

- EF* Emission factor in pounds per ton
- ER* Emission rate in grams per hour
- BR* Average burn rate in kilograms per hour of operation
- 1.5 Factor used to scale certification test emission rate to reflect real world emissions
- 2 Factor used to convert grams per kilogram to pounds per ton

The average emission factor of 6.05 lb/ton calculated using Equation 1 is close to the emission factor of 8.76 lb/ton estimated in the Regulatory Impact Analysis for Residential Wood Heaters NSPS Review Table 4.3 (NSPS Review).<sup>6</sup> Considering that the average replacement device had an approximate 1/3 lower certification test emission rate than the 4.5 g/hr assumed in the NSPS Review, the calculated emission factors seem appropriate.

<sup>5</sup> Based on information received from Gary Blais of U.S. EPA Burnwise Program on August 2, 2016, titled "Conversion Factor TB." The spreadsheet was prepared by Tom Butcher, Research Engineer; Brookhaven National Laboratory.

<sup>6</sup> [https://www3.epa.gov/ttnecas1/docs/ria/wood-heaters\\_ria\\_final-nsps-revision\\_2015-02.pdf](https://www3.epa.gov/ttnecas1/docs/ria/wood-heaters_ria_final-nsps-revision_2015-02.pdf)

The following formulas were used to calculate PM2.5 emissions of the old device, the new device, and the difference between them.

$$\text{Equation 2: } E_{old} = (EF_{old} \times WU \times WD)/2000$$

$$\text{Equation 3: } E_{new} = (EF_{new} \times WU \times WD \times (EFC_{old}/EFC_{new}))/2000$$

$$\text{Equation 4: } E_{benefit} = E_{old} - E_{new}$$

Where:

$E_{old}$	Emissions of old device (ton/year)
$E_{new}$	Emissions of new device (ton/year)
$EF_{old}$	Emission factor for the old device (lb/ton)
$EF_{new}$	Emission factor for the new device (lb/ton)
$WU$	Wood usage (cords/year)
$WD$	Wood density (ton/cord)
$EFC_{old}$	Device efficiency for the old device (%)
$EFC_{new}$	Device efficiency for the new device (%)
$E_{benefit}$	Emission reductions from change-out (ton/year)

Since emission factors for pellet stoves are considered to be more representative of an actual in-home usage,<sup>7</sup> a default emission factor of 3.06 lb/ton, consistent with the NSPS Review, was used for all pellet stoves.<sup>8</sup> Portola households using a pellet stove as a main source of heat use two to three tons of pellet fuel per year.<sup>9</sup> In order to ensure a conservative estimate for emission reductions, three tons was assumed. Consistent with California's Short-Lived Climate Pollutant Reduction Strategy<sup>10</sup>, propane and kerosene fueled heating devices were assumed to have negligible PM2.5 emissions.

#### IV. SUMMARY AND CONCLUSIONS

The Portola Nonattainment Area is classified as Moderate nonattainment for the 2012 annual PM2.5 standard, with an attainment date of December 31, 2021. The District has reviewed its commitments in the Portola Plan, has provided updates on the implementation of the control measures, and has verified that the emission reductions needed to satisfy the 2019 milestone have been achieved. The emission reductions needed to demonstrate RFP have been achieved, the 2019 quantitative milestone have been met, and ongoing progress is being made to attain the 2012 annual PM2.5 standard by December 31, 2021.

<sup>7</sup> <https://www3.epa.gov/ttnchie1/ap42/ch01/related/woodstove.pdf>

<sup>8</sup> [https://www3.epa.gov/ttnecas1/docs/ria/wood-heaters\\_ria\\_final-nsps-revision\\_2015-02.pdf](https://www3.epa.gov/ttnecas1/docs/ria/wood-heaters_ria_final-nsps-revision_2015-02.pdf).

<sup>9</sup> Quincy Hot Spot personal communication

<sup>10</sup> [https://www.arb.ca.gov/cc/shortlived/meetings/03142017/final\\_slcp\\_report.pdf](https://www.arb.ca.gov/cc/shortlived/meetings/03142017/final_slcp_report.pdf)

# Appendix A

**Greater Portola Wood Stove Change-out Program  
Emission Benefit Calculator**

Constants & Conversions	Value	Unit	Source
<b>PM2.5 Emission Factors</b>			
Uncertified Stove	30.60	lb PM2.5/ton wood	AP-42, Table 1.10.-1 <sup>11</sup>
Fireplace	34.60	lb PM2.5/ton wood	AP-42, Table 1.9.-1 <sup>12</sup>
Pellet Stove	3.06	lb PM2.5/ton wood	2015 NSPS - Regulatory Impact Analysis for Residential Wood Heaters NSPS Review Table 4.3 <sup>13</sup>
2015 NSPS Stove	8.76	lb PM2.5/ton wood	2015 NSPS - Regulatory Impact Analysis for Residential Wood Heaters NSPS Review Table 4.3 <sup>14</sup>
Propane, Electric, or Kerosene	0.00		California Short-Lived Pollutant Reduction Strategy <sup>15</sup>
<b>Efficiency</b>			
Uncertified Stove Efficiency	54	%	AP-42, Table 1.10-5 <sup>16</sup>
Certified Stove Efficiency	68	%	AP-42, Table 1.10-5 <sup>17</sup>
Pellet Stove Efficiency	68	%	AP-42, Table 1.10-5 <sup>18</sup>
Fireplace	7	%	Review of Fireplace Use and Technology, OMNI Environmental <sup>19</sup>
<b>Other Constants &amp; Conversions</b>			
Wood Use	4.3	cord/year	District Survey
Wood Density	1.04	ton/cord	U.S. EPA Burnwise Emission Calculator
Average Burn Rate	1.5	kg/hour	Gary Blais Personal Communications
Emission Rate Scaling Factor	1.5		
Conversion from lb to ton	2000		
Conversion from g/kg to lb/ton	2		

<sup>11</sup> <https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s10.pdf>

<sup>12</sup> <https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s09.pdf>

<sup>13</sup> [https://www3.epa.gov/ttnecas1/docs/ria/wood-heaters\\_ria\\_final-nsps-revision\\_2015-02.pdf](https://www3.epa.gov/ttnecas1/docs/ria/wood-heaters_ria_final-nsps-revision_2015-02.pdf)

<sup>14</sup> Ibid

<sup>15</sup> [https://www.arb.ca.gov/cc/shortlived/meetings/03142017/final\\_slcp\\_report.pdf](https://www.arb.ca.gov/cc/shortlived/meetings/03142017/final_slcp_report.pdf)

<sup>16</sup> <https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s10.pdf>

<sup>17</sup> Ibid

<sup>18</sup> Ibid

<sup>19</sup> <http://www.omni-test.com/publications/firepl.pdf>

Program Tracking # (YYYY-XXX)	New Fuel	Install Date	Emission Rate (g/hr)	Device Type	Emission Factor (lb/ton)	Emissions (ton/year)		
						Before	After	Difference
2016-001	wood	5/23/16	2.9	NC	5.8	0.0684	0.0103	0.0581
2016-003	wood	8/9/16	1.9	NC	3.8	0.0684	0.0067	0.0617
2016-006	wood	5/11/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-007	wood	8/5/16	3.3	NC	6.6	0.0684	0.0117	0.0567
2016-008	wood	6/24/16	0.58	NC	1.16	0.0684	0.0021	0.0664
2016-009	wood	5/10/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-011	wood	5/27/16	3.8	NC	7.6	0.0684	0.0135	0.0549
2016-012	wood	5/19/16	3.09	NC	6.18	0.0684	0.0110	0.0574
2016-015	wood	5/11/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-016	wood	8/4/16	3	NC	6	0.0684	0.0107	0.0578
2016-017	wood	7/14/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-019	wood	6/13/16	2.3	NC	4.6	0.0684	0.0082	0.0603
2016-020	wood	6/23/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-021	wood	5/25/16	3.8	NC	7.6	0.0684	0.0135	0.0549
2016-022	wood	8/18/16	3.6	NC	7.2	0.0684	0.0128	0.0556
2016-023	wood	6/28/16	2.77	NC	5.54	0.0684	0.0098	0.0586
2016-024	wood	5/19/16	2.4	NC	4.8	0.0684	0.0085	0.0599
2016-025	wood	7/14/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-026	wood	9/1/16	0.08	NC	0.16	0.0684	0.0003	0.0681
2016-028	wood	5/16/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-029	wood	6/21/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-030	wood	10/19/16	3.9	NC	7.8	0.0684	0.0139	0.0546
2016-032	wood	7/25/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-033	wood	8/2/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-035	wood	7/8/16	2.9	NC	5.8	0.0684	0.0103	0.0581
2016-036	wood	6/22/16	3.8	NC	7.6	0.0684	0.0135	0.0549
2016-037	wood	10/11/16	4.2	NC	8.4	0.0684	0.0149	0.0535
2016-038	wood	6/23/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-039	wood	7/26/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-040	wood	7/19/16	3.6	NC	7.2	0.0684	0.0128	0.0556
2016-041	wood	7/8/16	4.1	NC	8.2	0.0684	0.0146	0.0539
2016-042	wood	6/14/16	2.7	NC	5.4	0.0684	0.0096	0.0588
2016-044	wood	7/14/16	3.8	NC	7.6	0.0684	0.0135	0.0549

Program Tracking # (YYYY-XXX)	New Fuel	Install Date	Emission Rate (g/hr)	Device Type	Emission Factor (lb/ton)	Emissions (ton/year)		
						Before	After	Difference
2016-045	wood	7/12/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-046	wood	7/28/16	2.1	NC	4.2	0.0684	0.0075	0.0610
2016-047	wood	7/22/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-048	wood	12/5/16	3.6	NC	7.2	0.0684	0.0128	0.0556
2016-049	wood	8/3/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-050	wood	7/11/17	2.1	NC	4.2	0.0684	0.0075	0.0610
2016-051	wood	7/26/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-054	wood	8/17/16	2.3	NC	4.6	0.0684	0.0082	0.0603
2016-055	wood	9/14/16	3.6	NC	7.2	0.0684	0.0128	0.0556
2016-056	wood	8/26/16	3.1	NC	6.2	0.0684	0.0110	0.0574
2016-057	wood	12/16/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-058	wood	7/29/16	3	NC	6	0.0684	0.0107	0.0578
2016-059	wood	8/19/16	2.3	NC	4.6	0.0684	0.0082	0.0603
2016-061	wood	8/12/16	3.9	NC	7.8	0.0684	0.0139	0.0546
2016-062	wood	8/9/16	3.8	NC	7.6	0.0684	0.0135	0.0549
2016-064	wood	8/2/16	3	NC	6	0.0684	0.0107	0.0578
2016-065	wood	8/17/16	3.6	NC	7.2	0.0684	0.0128	0.0556
2016-066	wood	12/20/16	3.9	NC	7.8	0.0684	0.0139	0.0546
2016-068	wood	9/15/16	2.3	NC	4.6	0.0684	0.0082	0.0603
2016-069	wood	9/14/16	3.7	NC	7.4	0.0684	0.0131	0.0553
2016-070	wood	11/18/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-072	wood	9/9/16	3.9	NC	7.8	0.0684	0.0139	0.0546
2016-073	wood	4/19/18	3.29	NC	6.58	0.0684	0.0117	0.0567
2016-074	wood	8/9/16	2.1	NC	4.2	0.0684	0.0075	0.0610
2016-075	wood	11/3/16	4.47	NC	8.94	0.0684	0.0159	0.0525
2016-076	wood	9/7/16	3.8	NC	7.6	0.0684	0.0135	0.0549
2016-078	wood	10/13/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-079	wood	8/18/16	3.8	NC	7.6	0.0684	0.0135	0.0549
2016-080	wood	6/27/17	1.9	NC	3.8	0.0684	0.0067	0.0617
2016-082	wood	9/9/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-083	wood	10/11/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-084	wood	9/13/16	3.7	NC	7.4	0.0684	0.0131	0.0553
2016-085	wood	10/19/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-089	wood	9/8/16	3	NC	6	0.0684	0.0107	0.0578
2016-091	wood	10/6/16	3	NC	6	0.0684	0.0107	0.0578
2016-093	wood	12/1/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-096	wood	10/18/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-098	wood	11/18/16	3.2	NC	6.4	0.0684	0.0114	0.0571

Program Tracking # (YYYY-XXX)	New Fuel	Install Date	Emission Rate (g/hr)	Device Type	Emission Factor (lb/ton)	Emissions (ton/year)		
						Before	After	Difference
2016-099	wood	5/17/17	4.2	NC	8.4	0.0684	0.0149	0.0535
2016-101	wood	10/10/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-103	wood	10/12/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-104	wood	11/22/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-106	wood	10/21/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-107	wood	2/24/17	1.9	NC	3.8	0.0684	0.0067	0.0617
2016-108	wood	8/18/17	3.5	NC	7	0.0684	0.0124	0.0560
2016-109	wood	12/7/16	3.1	NC	6.2	0.0684	0.0110	0.0574
2016-111	wood	11/3/16	4.2	NC	8.4	0.0684	0.0149	0.0535
2016-112	wood	11/21/16	3.9	NC	7.8	0.0684	0.0139	0.0546
2016-113	wood	11/17/16	3	NC	6	0.0684	0.0107	0.0578
2016-115	wood	10/17/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-118	wood	10/31/16	3.89	NC	7.78	0.0684	0.0138	0.0546
2016-120	wood	12/20/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-121	wood	11/8/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-122	wood	11/16/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-123	wood	12/16/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-126	wood	1/27/17	3.5	NC	7	0.0684	0.0124	0.0560
2016-127	wood	9/6/18	3.3	NC	6.6	0.0684	0.0117	0.0567
2016-128	wood	12/19/16	4.47	NC	8.94	0.0684	0.0159	0.0525
2016-129	wood	6/14/17	3.8	NC	7.6	0.0684	0.0135	0.0549
2016-131	wood	11/7/17	3.5	NC	7	0.0684	0.0124	0.0560
2016-132	wood	12/12/16	4.4	NC	8.8	0.0684	0.0156	0.0528
2016-133	wood	12/7/16	3.5	NC	7	0.0684	0.0124	0.0560
2016-134	wood	12/7/16	4	NC	8	0.0684	0.0142	0.0542
2016-135	wood	7/14/17	3.8	NC	7.6	0.0684	0.0135	0.0549
2016-136	wood	12/15/16	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-137	wood	12/20/16	2.3	NC	4.6	0.0684	0.0082	0.0603
2016-138	wood	1/27/17	3.6	NC	7.2	0.0684	0.0128	0.0556
2016-139	wood	1/24/17	3.2	NC	6.4	0.0684	0.0114	0.0571
2016-145	wood	3/16/17	3.5	NC	7	0.0684	0.0124	0.0560
2016-146	wood	6/20/17	3.5	NC	7	0.0684	0.0124	0.0560
2016-147	wood	3/30/17	3.5	NC	7	0.0684	0.0124	0.0560
2016-148	wood	12/28/16	2.8	NC	5.6	0.0684	0.0099	0.0585
2016-149	wood	1/31/17	3.5	NC	7	0.0684	0.0124	0.0560
2016-150	wood	8/3/17	3.5	NC	7	0.0684	0.0124	0.0560
2016-151	wood	7/6/17	3.59	NC	7.18	0.0684	0.0127	0.0557
2017-001	wood	5/21/17	3.2	NC	6.4	0.0684	0.0114	0.0571

Program Tracking # (YYYY-XXX)	New Fuel	Install Date	Emission Rate (g/hr)	Device Type	Emission Factor (lb/ton)	Emissions (ton/year)		
						Before	After	Difference
2017-002	wood	8/9/18	3.4	NC	6.8	0.0684	0.0121	0.0563
2017-003	wood	3/9/17	3.9	NC	7.8	0.0684	0.0139	0.0546
2017-155	wood	5/26/17	4.4	NC	8.8	0.0684	0.0156	0.0528
2017-156	wood	5/10/17	3.2	NC	6.4	0.0684	0.0114	0.0571
2017-157	wood	3/27/17	3.2	NC	6.4	0.0684	0.0114	0.0571
2017-159	wood	3/31/17	3.2	NC	6.4	0.0684	0.0114	0.0571
2017-161	wood	4/12/17	1.9	NC	3.8	0.0684	0.0067	0.0617
2017-163	wood	9/5/17	4.2	NC	8.4	0.0684	0.0149	0.0535
2017-164	wood	5/25/17	3	NC	6	0.0684	0.0107	0.0578
2017-165	wood	5/20/17	3.2	NC	6.4	0.0684	0.0114	0.0571
2017-166	wood	6/30/17	0.8	NC	1.6	0.0684	0.0028	0.0656
2017-168	wood	5/19/17	2.3	NC	4.6	0.0684	0.0082	0.0603
2017-169	wood	6/28/17	3.09	NC	6.18	0.0684	0.0110	0.0574
2017-170	wood	9/12/18	3.29	NC	6.58	0.0684	0.0117	0.0567
2017-171	wood	6/7/17	3.8	NC	7.6	0.0684	0.0135	0.0549
2017-172	wood	6/13/17	3.8	NC	7.6	0.0684	0.0135	0.0549
2017-173	wood	7/14/17	3.59	NC	7.18	0.0684	0.0127	0.0557
2017-174	wood	8/22/17	3	NC	6	0.0684	0.0107	0.0578
2017-177	wood	7/17/17	3.4	NC	6.8	0.0684	0.0121	0.0563
2017-179	wood	9/4/18	3.8	NC	7.6	0.0684	0.0135	0.0549
2017-182	wood	8/7/17	2.9	NC	5.8	0.0684	0.0103	0.0581
2017-183	wood	8/24/17	4.29	NC	8.58	0.0684	0.0152	0.0532
2017-184	wood	10/12/17	4.4	NC	8.8	0.0684	0.0156	0.0528
2017-187	wood	7/25/17	3.89	NC	7.78	0.0684	0.0138	0.0546
2017-188	wood	8/23/17	1.9	NC	3.8	0.0684	0.0067	0.0617
2017-190	wood	9/6/17	3.89	NC	7.78	0.0684	0.0138	0.0546
2017-191	wood	8/17/17	3.1	NC	6.2	0.0684	0.0110	0.0574
2017-192	wood	8/16/17	3.99	NC	7.98	0.0684	0.0142	0.0543
2017-193	wood	11/30/17	3.89	NC	7.78	0.0684	0.0138	0.0546
2017-194	wood	7/27/17	4.4	NC	8.8	0.0684	0.0156	0.0528
2017-195	wood	11/30/17	3.5	NC	7	0.0684	0.0124	0.0560
2017-197	wood	12/5/17	3.89	NC	7.78	0.0684	0.0138	0.0546
2017-199	wood	12/5/17	3.59	NC	7.18	0.0684	0.0127	0.0557
2017-200	wood	11/20/17	3.86	NC	7.72	0.0684	0.0137	0.0547
2017-203	wood	11/15/17	2.1	NC	4.2	0.0684	0.0075	0.0610
2017-205	wood	9/7/17	2.5	NC	5	0.0684	0.0089	0.0595
2017-207	wood	8/30/17	3.5	NC	7	0.0684	0.0124	0.0560

Program Tracking # (YYYY-XXX)	New Fuel	Install Date	Emission Rate (g/hr)	Device Type	Emission Factor (lb/ton)	Emissions (ton/year)		
						Before	After	Difference
2017-208	wood	12/21/17	3.39	NC	6.78	0.0684	0.0120	0.0564
2017-210	wood	2/7/18	4.4	NC	8.8	0.0684	0.0156	0.0528
2017-211	wood	11/21/17	3.89	NC	7.78	0.0684	0.0138	0.0546
2017-212	wood	11/20/17	3.89	NC	7.78	0.0684	0.0138	0.0546
2017-213	wood	12/1/17	3.8	NC	7.6	0.0684	0.0135	0.0549
2017-216	wood	12/26/17	4.2	NC	8.4	0.0684	0.0149	0.0535
2017-217	wood	12/6/17	3.29	NC	6.58	0.0684	0.0117	0.0567
2017-221	wood	11/9/17	4.4	NC	8.8	0.0684	0.0156	0.0528
2017-223	wood	1/26/18	3.5	NC	7	0.0684	0.0124	0.0560
2017-225	wood	8/2/18	4.2	NC	8.4	0.0684	0.0149	0.0535
2017-228	wood	2/6/18	3.3	NC	6.6	0.0684	0.0117	0.0567
2017-229	wood	1/31/18	3.39	NC	6.78	0.0684	0.0120	0.0564
2017-231	wood	2/21/18	3.69	NC	7.38	0.0684	0.0131	0.0553
2017-232	wood	1/10/18	1.9	NC	3.8	0.0684	0.0067	0.0617
2017-234	wood	12/8/17	4.4	NC	8.8	0.0684	0.0156	0.0528
2017-236	wood	3/6/18	1.9	NC	3.8	0.0684	0.0067	0.0617
2018-239	wood	9/21/18	1.54	NC	3.08	0.0684	0.0055	0.0630
2018-241	wood	4/26/18	3.89	NC	7.78	0.0684	0.0138	0.0546
2018-242	wood	10/4/18	1.9	NC	3.8	0.1080	0.0067	0.1012
2018-244	wood	2/6/18	3.89	NC	7.78	0.0684	0.0138	0.0546
2018-245	wood	2/7/18	3.89	NC	7.78	0.0684	0.0138	0.0546
2018-246	wood	9/20/18	1.54	NC	3.08	0.0684	0.0055	0.0630
2018-250	wood	5/13/18	3.5	NC	7	0.0684	0.0124	0.0560
2018-251	wood	6/6/18	3.5	NC	7	0.0684	0.0124	0.0560
2018-254	wood	4/4/18	4.29	NC	8.58	0.1080	0.0152	0.0927
2018-256	wood	4/30/18	3.9	NC	7.8	0.1080	0.0139	0.0941
2018-260	wood	5/9/18	3.29	NC	6.58	0.0684	0.0117	0.0567
2018-261	wood	6/26/18	3.29	NC	6.58	0.0684	0.0117	0.0567
2018-263	wood	5/24/18	4.2	NC	8.4	0.1080	0.0149	0.0930
2018-265	wood	3/28/18	0.58	NC	1.16	0.1080	0.0021	0.1059
2018-266	wood	3/14/18	2.84	NC	5.68	0.0684	0.0101	0.0583
2018-267	wood	5/1/18	3.9	NC	7.8	0.0684	0.0139	0.0546
2018-270	wood	3/19/18	3.9	NC	7.8	0.0684	0.0139	0.0546
2018-271	wood	6/4/18	3.89	NC	7.78	0.0684	0.0138	0.0546
2018-272	wood	8/31/18	3.5	NC	7	0.1080	0.0124	0.0955
2018-273	wood	5/18/18	3.29	NC	6.58	0.0684	0.0117	0.0567
2018-276	wood	9/12/18	1.1	NC	2.2	0.0684	0.0039	0.0645
2018-278	wood	5/8/18	4.29	NC	8.58	0.0684	0.0152	0.0532



Program Tracking # (YYYY-XXX)	New Fuel	Install Date	Emission Rate (g/hr)	Device Type	Emission Factor (lb/ton)	Emissions (ton/year)		
						Before	After	Difference
2018-280	wood	10/10/18	3.5	NC	7	0.0684	0.0124	0.0560
2018-282	wood	8/3/18	2.69	NC	5.38	0.0684	0.0096	0.0589
2018-289	wood	9/5/18	3.59	NC	7.18	0.0684	0.0127	0.0557
2018-290	wood	9/21/18	3.29	NC	6.58	0.0684	0.0117	0.0567
2018-292	wood	10/25/18	1.9	NC	3.8	0.0684	0.0067	0.0617
2018-293	wood	12/7/18	3.29	NC	6.58	0.1080	0.0117	0.0963
2018-297	wood	10/3/18	1.9	NC	3.8	0.0684	0.0067	0.0617
2018-298	wood	11/1/18	3.5	NC	7	0.0684	0.0124	0.0560
2018-299	wood	11/1/18	3.2	NC	6.4	0.0684	0.0114	0.0571
2018-301	wood	10/2/18	3.9	NC	7.8	0.0684	0.0139	0.0546
2018-314	wood	10/12/18	2.3	NC	4.6	0.1080	0.0082	0.0998
2018-315	wood	11/26/18	1.9	NC	3.8	0.1080	0.0067	0.1012
2018-320	wood	12/6/18	1.54	NC	3.08	0.0684	0.0055	0.0630
2016-010	wood	11/1/17	1.76	CAT	3.52	0.0684	0.0063	0.0622
2016-018	wood	7/21/16	1.8	CAT	3.6	0.0684	0.0064	0.0620
2016-043	wood	8/16/16	1.48	CAT	2.96	0.0684	0.0053	0.0632
2016-067	wood	8/18/16	0.45	CAT	0.9	0.0684	0.0016	0.0668
2016-071	wood	8/17/16	0.45	CAT	0.9	0.0684	0.0016	0.0668
2016-087	wood	10/5/16	2.42	CAT	4.84	0.0684	0.0086	0.0598
2016-090	wood	10/19/16	2.42	CAT	4.84	0.0684	0.0086	0.0598
2016-095	wood	9/22/16	1.76	CAT	3.52	0.0684	0.0063	0.0622
2016-102	wood	9/21/16	1.48	CAT	2.96	0.0684	0.0053	0.0632
2016-105	wood	11/16/16	1.3	CAT	2.6	0.0684	0.0046	0.0638
2016-130	wood	1/17/17	1.76	CAT	3.52	0.0684	0.0063	0.0622
2017-176	wood	6/21/17	2.4	CAT	4.8	0.0684	0.0085	0.0599
2017-178	wood	9/20/17	0.97	CAT	1.94	0.0684	0.0034	0.0650
2017-201	wood	8/17/17	3.8	CAT	7.6	0.0684	0.0135	0.0549
2017-209	wood	10/4/17	2.42	CAT	4.84	0.0684	0.0086	0.0598
2017-214	wood	11/14/17	0.045	CAT	0.09	0.0684	0.0002	0.0683
2017-215	wood	10/6/17	0.79	CAT	1.58	0.0684	0.0028	0.0656
2017-220	wood	10/31/17	0.35	CAT	0.7	0.0684	0.0012	0.0672
2017-230	wood	3/13/18	2.42	CAT	4.84	0.0684	0.0086	0.0598
2018-255	wood	4/23/18	0.09	CAT	0.18	0.0684	0.0003	0.0681
2018-258	wood	4/25/18	2.42	CAT	4.84	0.0684	0.0086	0.0598
2018-262	wood	9/25/18	2	CAT	4	0.0684	0.0071	0.0613
2018-264	wood	3/29/18	2.42	CAT	4.84	0.0684	0.0086	0.0598
2018-268	wood	8/16/18	1.76	CAT	3.52	0.0684	0.0063	0.0622
2018-274	wood	8/8/18	1.3	CAT	2.6	0.0684	0.0046	0.0638

Program Tracking # (YYYY-XXX)	New Fuel	Install Date	Emission Rate (g/hr)	Device Type	Emission Factor (lb/ton)	Emissions (ton/year)		
						Before	After	Difference
2018-277	wood	9/19/18	1.3	CAT	2.6	0.0684	0.0046	0.0638
2018-279	wood	6/18/18	1.3	CAT	2.6	0.0684	0.0046	0.0638
2018-284	wood	7/24/18	1.3	CAT	2.6	0.0684	0.0046	0.0638
2018-294	wood	7/16/18	1.3	CAT	2.6	0.0684	0.0046	0.0638
2018-300	wood	10/11/18	2.4	CAT	4.8	0.0684	0.0085	0.0599
2018-302	wood	9/18/18	2.2	CAT	4.4	0.0684	0.0078	0.0606
2018-304	wood	10/15/18	2.4	CAT	4.8	0.0684	0.0085	0.0599
2018-305	wood	10/22/18	2.42	CAT	4.84	0.0684	0.0086	0.0598
2018-308	wood	11/30/18	0.9	CAT	1.8	0.1080	0.0032	0.1048
2018-309	wood	11/5/18	2.4	CAT	4.8	0.0684	0.0085	0.0599
2018-313	wood	12/4/18	2.42	CAT	4.84	0.0684	0.0086	0.0598
2018-316	wood	12/4/18	1.3	CAT	2.6	0.0684	0.0046	0.0638
2018-318	wood	11/14/18	1.3	CAT	2.6	0.0684	0.0046	0.0638
2018-243	wood	7/19/18	7.5	repair	15	0.0684	0.0266	0.0418
2016-002	wood	5/18/16	0.8	C/NC (both)	1.6	0.0684	0.0028	0.0656
2016-004	wood	5/19/16	0.8	C/NC (both)	1.6	0.0684	0.0028	0.0656
2016-005	wood	5/17/16	0.45	C/NC (both)	0.9	0.0684	0.0016	0.0668
2016-014	wood	5/25/16	0.45	C/NC (both)	0.9	0.0684	0.0016	0.0668
2016-013	pellet	5/25/16	1.3	pellet	3.06	0.0684	0.0046	0.0638
2016-031	pellet	8/2/16	1.5	pellet	3.06	0.0684	0.0046	0.0638
2016-052	pellet	5/17/17	1.3	pellet	3.06	0.0684	0.0046	0.0638
2016-063	pellet	8/1/17	1.3	pellet	3.06	0.0684	0.0046	0.0638
2016-088	pellet	11/15/16	1.3	pellet	3.06	0.0684	0.0046	0.0638
2016-094	pellet	11/4/16	1.3	pellet	3.06	0.0684	0.0046	0.0638
2016-100	pellet	11/1/16	1.3	pellet	3.06	0.0684	0.0046	0.0638
2016-117	pellet	11/17/16	1.7	pellet	3.06	0.0684	0.0046	0.0638
2016-124	pellet	12/13/16	1.3	pellet	3.06	0.0684	0.0046	0.0638
2016-141	pellet	3/14/17	1.8	pellet	3.06	0.0684	0.0046	0.0638
2016-144	pellet	3/10/17	1.3	pellet	3.06	0.0684	0.0046	0.0638
2017-160	pellet	4/13/17	1.3	pellet	3.06	0.0684	0.0046	0.0638
2017-162	pellet	10/10/17	1.8	pellet	3.06	0.0684	0.0046	0.0638
2017-167	pellet	5/12/17	2.1	pellet	3.06	0.0684	0.0046	0.0638
2017-175	pellet	8/8/17	1.3	pellet	3.06	0.0684	0.0046	0.0638
2017-196	pellet	9/8/17	1.5	pellet	3.06	0.0684	0.0046	0.0638
2017-204	pellet	10/13/17	1.35	pellet	3.06	0.0684	0.0046	0.0638

Program Tracking # (YYYY-XXX)	New Fuel	Install Date	Emission Rate (g/hr)	Device Type	Emission Factor (lb/ton)	Emissions (ton/year)		
						Before	After	Difference
2017-218	pellet	1/31/18	1.35	pellet	3.06	0.0684	0.0046	0.0638
2017-222	pellet	12/5/17	0.73	pellet	3.06	0.0684	0.0046	0.0638
2017-233	pellet	12/11/17	1.7	pellet	3.06	0.0684	0.0046	0.0638
2017-235	pellet	1/9/18	1.6	pellet	3.06	0.0684	0.0046	0.0638
2017-237	pellet	6/1/18	1.6	pellet	3.06	0.0684	0.0046	0.0638
2018-238	pellet	4/19/18	1.1	pellet	3.06	0.0684	0.0046	0.0638
2018-275	pellet	8/14/18	1.1	pellet	3.06	0.0684	0.0046	0.0638
2018-281	pellet	5/30/18	1.39	pellet	3.06	0.0684	0.0046	0.0638
2018-285	pellet	9/27/18	1.39	pellet	3.06	0.0684	0.0046	0.0638
2018-286	pellet	7/17/18	1	pellet	3.06	0.0684	0.0046	0.0638
2018-291	pellet	8/31/18	1.3	pellet	3.06	0.0684	0.0046	0.0638
2018-296	pellet	10/24/18	1.3	pellet	3.06	0.0684	0.0046	0.0638
2018-303	pellet	11/21/18	1.75	pellet	3.06	0.0684	0.0046	0.0638
2016-053	propane	9/1/16	0	propane	0	0.0684	0.0000	0.0684
2016-092	propane	10/13/16	0	propane	0	0.0684	0.0000	0.0684
2017-185	propane	8/8/17	0	propane	0	0.0684	0.0000	0.0684
2017-186	propane	10/4/17	0	propane	0	0.0684	0.0000	0.0684
2017-202	propane	10/19/17	0	propane	0	0.0684	0.0000	0.0684
2017-224	propane	2/23/18	0	propane	0	0.0684	0.0000	0.0684
2018-248	propane	5/30/18	0	propane	0	0.1080	0.0000	0.1080
2018-253	propane	7/13/18	0	propane	0	0.1080	0.0000	0.1080
2018-269	propane	11/7/18	0	propane	0	0.0684	0.0000	0.0684
2016-125	kerosene	1/6/17	0	kerosene	0	0.0684	0.0000	0.0684
2018-259	kerosene	3/27/18	0	kerosene	0	0.0684	0.0000	0.0684
<b>Total Installations as of 12/31/18</b>								<b>281</b>
<b>Wood Stoves Total</b>								<b>240</b>
<b>Noncatalytic Stoves</b>								<b>197</b>
<b>Catalytic/Noncatalytic Stoves</b>								<b>4</b>
<b>Catalytic Stoves</b>								<b>39</b>
<b>Pellet Stoves</b>								<b>30</b>
<b>Propane Stoves</b>								<b>9</b>
<b>Kerosene Stoves</b>								<b>2</b>
<b>Total PM2.5 Emissions Saved (tons per year)</b>								<b>16.9688</b>
<b>Total PM2.5 Emissions Saved (tons per day)</b>								<b>0.0465</b>