Achieving Attainment Through Wood Smoke Reduction

Jason Mandly, Senior Air Quality Planner
Butte County Air Quality Management District
Challenges in Meeting the 2006 24-hr PM2.5 NAAQS

PM2.5 Daily AQI Values, 2000 to 2008
Butte County, CA

PM2.5 24-hr Design Value – Chico, CA

2003-2005: 47ug/m³
2004-2006: 56ug/m³
2005-2007: 55ug/m³
Identifying the Problem

2007 Daily Maximum PM2.5 BAMM Chico and Gridley

Micro Grams Per Cubic Meter

Chico BAMM PM2.5  Gridley BAMM PM2.5  Federal Standard

Chico 2011-2013 Exceedance Day Composition

- Ammonium Nitrate 24%
- Ammonium Sulfate 3%
- Organic Carbon 63%
- Elements 2%
- Geologic 1%
- EC 7%

Residential Wood Smoke Workshop  March 11, 2020
Voluntary Measures: Don’t Light Tonight & Check Before You Light

FOR IMMEDIATE RELEASE

CHECK BEFORE YOU LIGHT ADVISORY IS IN EFFECT

ON DECEMBER 17, 2013

The Butte County Air Quality Management District (District) is requesting residents of Chico from using their woodstoves and fireplaces from 12:01 am on Tuesday, December 17. Voluntary curtailment has been prompted by an air quality forecast of Unhealthy for Sensitive Groups for the Gridley areas.
Adopting Rules to Contribute Towards Attainment

Table 2—BCAQMD SIP-Approved Control Measures and Programs Contributing Towards Attainment and Maintenance of the 2006 24-Hour PM$_{2.5}$ NAAQS

<table>
<thead>
<tr>
<th>Rule</th>
<th>Title</th>
<th>Adoption or amendment date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>207</td>
<td>Wood Burning Devices</td>
<td>Amended December 11, 2008</td>
<td>EPA approved—78 FR 21540.</td>
</tr>
<tr>
<td>400</td>
<td>Permit Requirements</td>
<td>Amended May 28, 2011 and April 24, 2014.</td>
<td>EPA approved—81 FR 93820.</td>
</tr>
<tr>
<td>433</td>
<td>Rice Straw Emission Reduction Credits</td>
<td>Amended April 24, 2014</td>
<td></td>
</tr>
<tr>
<td>1107</td>
<td>Prevention of Significant Deterioration</td>
<td>Adopted June 28, 2012</td>
<td></td>
</tr>
</tbody>
</table>

rendered permanently inoperable, or is either EPA-Certified, Oregon-Certified, a Pellet-Fueled Wood Heater, or other DISTRICT-approved device as defined in Section 6.1.

3.4 Fuel Types

3.4.1 No person shall cause or allow the burning of any materials other than firewood or other wood or plant products designed and marketed specifically for use as a fuel in wood burning devices.

3.4.2 Prohibited fuel types include but are not limited to:

3.4.2.1 Garbage;
3.4.2.2 Treated wood or wood composition products;
3.4.2.3 Plastic products;
3.4.2.4 Rubber products;
3.4.2.5 Petroleum products, including tar or tar paper;
3.4.2.6 Paints and paint solvents;
3.4.2.7 Coal;
3.4.2.8 Other material which may produce noxious or harmful emissions.
MANDATORY VS. VOLUNTARY MEASURES

ORDINANCE OF THE CITY COUNCIL OF THE CITY OF CHICO
ADJUSTING CHAPTER 8.32 TO TITLE 4 OF THE CHICO MUNICIPAL CODE
REGARDING WOOD BURNING

BE IT ORDAINED by the Council of the City of Chico:

SECTION 1. Chapter 8.32 entitled “Wood Burning Regulations,” is added to the Chico Municipal Code to read as follows:

Chapter 8.32
WOOD BURNING REGULATIONS

8.32.010 Applicability.
8.32.020 Definitions.
8.32.030 Wood burning prohibited.
8.32.040 Exemptions.
8.32.050 Waiver.
8.32.060 Notification of curtailment periods.

8.32.010 Applicability.

This chapter shall apply to the use of any wood burning device.

8.32.020 Definitions.

Unless otherwise stated, the following definitions shall govern the words and phrases used in this chapter.

A. “Curtailment period” means any period for which the Butte County Air Quality Management District issues a Check Before You Light advisory applicable to Chico which is based on a forecast of PM2.5 exceeding 35 μg/cm³ which is the federal standard for PM2.5 and is considered unhealthy for sensitive groups.

B. “Director” means the director of the general services department of the city.

C. “Interior Space” means any indoor area which is designed and used for human occupancy.

D. “Manufactured logs” means compressed or extended log shaped products designed for
## Public Education and Media Outreach

### AIR QUALITY

<table>
<thead>
<tr>
<th>Air Quality</th>
<th>Air Quality Index</th>
<th>Health Advisory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0-50</td>
<td>None</td>
</tr>
<tr>
<td>Moderate</td>
<td>51-100</td>
<td>Unusually sensitive people should consider reducing prolonged or heavy exertion.</td>
</tr>
<tr>
<td>Unhealthy for Sensitive Groups</td>
<td>101-150</td>
<td>People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.</td>
</tr>
<tr>
<td>Unhealthy</td>
<td>151-200</td>
<td>People with heart or lung disease, adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.</td>
</tr>
<tr>
<td>Very Unhealthy</td>
<td>201-300</td>
<td>People with heart or lung disease, adults, and children should avoid physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.</td>
</tr>
<tr>
<td>Hazardous</td>
<td>301-500</td>
<td>People with heart or lung disease, adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors.</td>
</tr>
</tbody>
</table>

### TEMPERATURE INVERSIONS AFFECT AIR QUALITY

**What are temperature inversions?**

On most days, the temperature of air in the troposphere is cooler the higher up in altitude you go. This is because most of the sun’s energy is concentrated to the surface of the Earth, which in turn warms the air at the surface. The warmer air rises in the atmosphere, where it expands and cools. Sometimes, however, the temperature of air actually increases with height. The situation of having warmer air at the top of a column of air is referred to as a temperature inversion, because the temperature profile of the atmosphere is “inverted” from usual. These are two types of temperature inversions: surface inversions that occur near the Earth’s surface, and valley inversions that occur higher above the ground. Surface inversions are the most important in the study of air quality.

**How do surface temperature inversions form?**

The most common manner in which surface inversion forms is through the cooling of the air near the ground at night. Once the sun goes down, the ground loses heat very quickly, and this cools the air that is in contact with the ground. However, since air is a very poor conductor of heat, the air just above the surface remains warm. Conditions favor the development of a strong surface inversion at calm, clean days, clear nights, and long nights. Calm winds prevent turbulent mixing of the air above the surface from coming down to the ground, and clear skies increase the rate of cooling of the Earth’s surface. Long nights allow the cooling of the ground to continue over a longer period of time, resulting in a slower temperature decrease of the surface. Since the nights in the winter season are much longer than nights during the summer season, surface inversions are stronger and more common during the winter months. A strong inversion supplies a substantial temperature difference exists between the cool surface air and the warmer air aloft. During the daytime hours, surface inversion normally weakens and disappears as the sun warms the Earth’s surface. However, under certain meteorological conditions, such as strong high pressure over the area, these inversions can persist for long to several days. In addition, local topographical features can enhance the formation of inversions, especially in valley locations.

**How do inversions affect air quality?**

Surface temperature inversions play a major role in air quality, especially during the winter season when these inversions are most severe. The warm air above the cold air acts like a lid, suppressing vertical mixing and trapping the cold air at the surface. As pollutants from vehicles, residents, and industry are emitted into the air, the inversions trap these pollutants near the ground, leading to poor air quality. The Air Quality Index (AQI) is used to describe the current level of air pollution. The strength and duration of the inversions will control AQI levels near the ground. A strong inversion will confine pollutants to a shallow vertical layer, leading to high AQI levels, while a weak inversion will tend to lower AQI levels. A large contributor to poor air quality during the winter is residential wood burning. Wood smoke contains much higher amounts of particulate pollution than smoke from oil or gas-fueled furnaces. The Home County Air Quality Management District issues a “Check Before You Light” Advisory to curb the use of woodstoves and fireplaces under certain weather and pollution conditions during the fall and winter.

**The information provided by EPA courtesy of Home County Air Quality Management District 2301 National Drive, Suite H Chico, CA 95928**

**tribal.gov**  
**takata.gov**  
**March 11, 2020**
### Table 1—2009–2012 24-Hour PM$_{2.5}$ Monitoring Site and Design Values for the Chico Nonattainment Area.

<table>
<thead>
<tr>
<th>Monitoring site</th>
<th>AQS site identification No.</th>
<th>98th percentile ($\mu g/m^2$)</th>
<th>Design values ($\mu g/m^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chico-Manzanita</td>
<td>06-007-0002</td>
<td>30.0</td>
<td>29.0</td>
</tr>
<tr>
<td>Chico-East</td>
<td>06-007-0008</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$ The Chico monitoring site was moved in 2012 to address siting issues, and EPA has approved this network modification request. See August 22, 2013 letter from Meredith Kurpus, Manager, Air Quality Analysis Office, EPA Region IX, to Michael Benjamin, Chief, Monitoring and Laboratory Division, CAFB.

$^b$ The 2012 98th percentile and design value are calculated using January 1 through June 30, 2012 data from the Chico-Manzanita site and July 1 through December 31, 2012 data from the new Chico-East site.

Source: AQS Design Value and Raw Data Reports, August 9, 2013.
Butte County Participates as Third Party Agency in Consent Decree

TARGET: 1,511 tons of CO & 51 tons of Hydrocarbons + Oxides of Nitrogen per year for 3 years.

Three Year Summary

- Year 1:
  - 159 vouchers issued (83 wood, 24 pellet, 52 gas)
  - $248,250 paid out to vouchers
  - Total emissions reductions: 388 tons HC+NOx, 1511 tons CO, 210 tons PM

- Year 2:
  - 160 vouchers issued (86 wood, 23 pellet, 51 gas)
  - $247,862 paid out to vouchers
  - Total emissions reductions: 390 tons HC+NOx, 1511 tons CO, 211 tons PM

- Year 3:
  - 161 vouchers issued (85 wood, 29 pellet, 47 gas)
  - $250,103 paid out to vouchers
  - Total emissions reductions: 389 tons HC+NOx, 1517 tons CO, 212 tons PM
Implementing the Wood-Burning Device Change-out Program

For better breathing. Local agency to offer program to swap out polluting heating following string of air-quality...
# PM2.5 Reductions from Woodstove Replacement Projects (2005 – 2015)

Table 4. Emission reductions achieved from a wood stove change-out program

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Wood Stove</td>
<td>16</td>
<td>33</td>
<td>63</td>
<td>21</td>
<td>244</td>
<td>377</td>
</tr>
<tr>
<td>Pellet Stove</td>
<td>7</td>
<td>7</td>
<td>10</td>
<td></td>
<td>76</td>
<td>100</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>29</td>
<td>31</td>
<td>47</td>
<td>6</td>
<td>149</td>
<td>262</td>
</tr>
<tr>
<td>Emissions Before (t/y)</td>
<td>3.544</td>
<td>4.838</td>
<td>8.177</td>
<td>1.840</td>
<td>31.960</td>
<td>50.359</td>
</tr>
<tr>
<td>Emissions After (t/y)</td>
<td>0.421</td>
<td>0.861</td>
<td>1.640</td>
<td>0.543</td>
<td>6.387</td>
<td>9.851</td>
</tr>
<tr>
<td>Savings (t/y)</td>
<td>3.123</td>
<td>3.978</td>
<td>6.538</td>
<td>1.297</td>
<td>25.573</td>
<td>40.508</td>
</tr>
<tr>
<td>Savings (t/d)</td>
<td>0.018</td>
<td>0.023</td>
<td>0.038</td>
<td>0.008</td>
<td>0.150</td>
<td>0.238</td>
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</tbody>
</table>

* Powertrain Change-out

Butte County PM$_{2.5}$ Redesignation Request and Maintenance Plan Attachment C: Emissions Reductions Achieved from the Wood Stove Change-out Programs
Continuing Improvements

Chico PM2.5 24-Hour Design Values (2001-2016)

By Steve Schoonover
sschoonover@chicoer.com
@ER_schoonover on Twitter

Butte County got through the winter pollution season without a single bad air day, for the first time in more than a decade.

The Butte County Air Quality Management District wrapped up its “Check before you light” program Monday without once asking people to forgo wood fires because pollution was forecast to be bad.

County Air Quality Control Officer Jim Wagoner.

PM2.5 Design Value

24-Hr Design Value
Adjusted for 2008 Wildfires
35 ug/m³ 24-hour Standard
Redesignation Request and Maintenance Plan

Figure 3-3: Trends in Three Year Average Winter Composition on Top 10% of Days – Chico, CA

- PM2.5 Mass
- Ammonium Nitrate
- Ammonium Sulfate
- Carbonaceous Aerosols
- Geological
- Elements


Figure 3-4: Change in Diurnal Patterns on Top 10% of Days – Chico, CA

Change in Diurnal Patterns on Top 10% of Days

Hourly Concentrations (µg/m³)

0 10 20 30 40 50 60 70 80

Start Hour

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

2008

2016

Figure 3.5: Comparison of Three-Year Average Trends in Concentrations of Carbonaceous Aerosols and Soluble Potassium on Top 10% of Days.

- Soluble Potassium
- Carbonaceous Aerosols


0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45

Soluble Potassium (µg/m³)

Carbonaceous Aerosols (µg/m³)
In preparing for the Program, the District worked with:

- Neighboring Air Districts
- California Air Resources Board
- CAPCOA
- Local Retailers
- Building Departments

Residential Wood Smoke Workshop

March 11, 2020
Implementing the Woodsmoke Reduction Program

Applications opening Wednesday for wood stove swap-out funds

Vouchers of $1,000 to $3,500 available

Applications will be accepted until funds are depleted. A limited number of applications will be accepted on a first-come, first-served basis. After the first group of applications are processed, the application process will resume on a first-come, first-served basis when new funds are available.

FOR IMMEDIATE RELEASE
May 21, 2018

WOODSMOKE REDUCTION PROGRAM TO BEGIN IN BUTTE COUNTY

The Butte County Air Quality Management District, along with neighboring air districts, will be offering grants to replace woodstoves with cleaner-burning appliances. The Woodsmoke Reduction Pilot Program is funded by California Climate Investments and will be administered by the California Air Resources Board. The program provides an incentive voucher to replace a non-EPA certified woodstove with an EPA-certified woodstove or fireplace, or a renewable energy source.

The program will begin on May 21, 2018, and will continue until funds are depleted.

Replace that stove

Butte County Air Quality Management District offers $1,000-$3,500 vouchers to families

For more information or to apply, please visit the website at [Butte County Air Quality Management District](https://www.bcaqmd.com).
Woodsmoke Reduction Program Results So Far

Year 1 (2018):
- $360,000 in Project Funds
- 89 Vouchers Completed
- 77 Low-Income Qualified Projects

Year 2 (2020):
- $147,000 in Project Funds
- In Progress
EPA Approves Redesignation to Attainment

November 13, 2009 – Most of Butte County Designated Nonattainment

October 10, 2013 – EPA determines that Butte County has attained the 24-hour PM2.5 NAAQS

October 31, 2017 – District Submitted Redesignation Request to CARB

July 11, 2018 – Final Rulemaking by EPA approving Redesignation Request and Maintenance Plan
Thank You!