

**APPENDIX I**

**EFFECTIVENESS CALCULATIONS  
FOR THE TOWN OF MAMMOTH LAKES  
PARTICULATE EMISSIONS REGULATIONS**

**- ADOPTED ORDINANCE -**

**EFFECTIVENESS CALCULATIONS FOR THE  
TOWN OF MAMMOTH LAKES  
PARTICULATE EMISSIONS REGULATIONS**

Adopted November 7, 1990

The effect of the Particulate Emissions Regulations on the future ambient PM-10 concentrations for each section of the regulation was determined by following 3 steps;

Step 1 - Estimate the uncontrolled emissions from the affected sources for each year.

Step 2 - Estimate the controlled emissions from the affected sources for each year, and

Step 3 - Estimate the ambient PM-10 contribution resulting from the controlled emissions using the proportional roll-back method in Section 5.4. For all ambient contribution estimates in this appendix, the road dust and cinders dominated day is used for the  $C_{di}$  values.

$$C_T = \Sigma C_i + C_b = \Sigma [C_{di} (E_i/E_{di})] + C_b$$

$C_T$  = Total PM-10 Concentration  
 $C_b$  = Background PM-10 Concentration,  $5 \mu\text{g}/\text{m}^3$   
 $C_i$  = PM-10 Concentration Due to the Source  $i$   
 $C_{di}$  = Design Day Source Contribution for Source  $i$   
 $E_i$  = PM-10 Emissions from Source  $i$   
 $E_{di}$  = Peak PM-10 Emissions from Source  $i$

To determine the ambient source contributions for either design day scenario, use the following emissions for  $E_{di}$ :

$E_{di}$  = 882 kg/day for fireplaces  
= 957 kg/day for wood stoves  
= 2,390 kg/day for road dust & cinders  
= 23 kg/day for vehicle tailpipes

For the Wood Burning Dominate Design Day use the source contributions estimated using the Chemical Mass Balance model in Section 4:

$$\begin{aligned}
C_{di} &= 94 \mu\text{g}/\text{m}^3 && \text{for fireplaces} \\
&= 101 \mu\text{g}/\text{m}^3 && \text{for wood stoves} \\
&= 5 \mu\text{g}/\text{m}^3 && \text{for road dust and cinders} \\
&= 5 \mu\text{g}/\text{m}^3 && \text{for vehicle tailpipes}
\end{aligned}$$

For the Road Dust and Cinders Dominated Design Day:

$$\begin{aligned}
C_{di} &= 54 \mu\text{g}/\text{m}^3 && \text{for fireplaces} \\
&= 58 \mu\text{g}/\text{m}^3 && \text{for wood stoves} \\
&= 93 \mu\text{g}/\text{m}^3 && \text{for road dust and cinders} \\
&= \text{negligible} && \text{for vehicle tailpipes}
\end{aligned}$$

### Section 8.30.110, Road Dust Reduction Measures

#### Step 1 - Emissions Growth

Two emissions growth calculations will be determined; 1) for no controls, and 2) for VMT growth limited through the adoption of Control Measure number 2.

#### No Controls - Uncontrolled Growth

This growth estimate was calculated for Section 5.1 and displayed in Table 5.2. A summary of the VMT and emission estimates is shown below for an emission rate of 36.064 grams/VMT (22.4 grams/VKT) for road dust and cinders. The VMT projections can be found in Appendix E.

#### Example Calculation

$$\begin{aligned}
\text{Emissions} &= \text{VMT/day} \times 36.064 \text{ grams/VMT} \times \text{kg}/1000 \text{ grams} \\
&= 82,403 \times 36.064 = 2,972 \text{ kg/day}
\end{aligned}$$

#### Road Dust & Cinders Emission Growth

##### No Controls - Uncontrolled Growth

| <u>Year</u> | <u>VMT</u> | <u>Emissions<br/>(kg/day)</u> |
|-------------|------------|-------------------------------|
| 1990        | 66,275     | 2,390                         |
| 1993        | 82,403     | 2,972                         |
| 1995        | 93,155     | 3,360                         |
| 2000        | 120,035    | 4,329                         |
| 2005        | 146,915    | 5,298                         |

Future VMT is limited to 106,600 VMT. It is assumed that the peak VMT will be reached in 15 years. From section 3.2, the emissions factor for road dust and cinders is 36 grams/VMT and the 1990 peak VMT is 66,300. A straight line interpolation of the VMT from 1990 to 2005 will yield the following VMT's and emission estimates:

Road Dust & Cinders Emission Growth  
VMT Growth Limited by Control  
Measure 2 - Vehicle Traffic Reduction

| <u>Year</u> | <u>VMT</u> | <u>Emissions<br/>(kg/day)</u> |
|-------------|------------|-------------------------------|
| 1990        | 66,275     | 2,390                         |
| 1993        | 74,339     | 2,681                         |
| 1995        | 79,715     | 2,875                         |
| 2000        | 93,155     | 3,360                         |
| 2005        | 106,600    | 3,844                         |

Step 2 - Controlled Emissions

Vacuum sweeping is credited with a 34% reduction in emissions from roadways. Using the emissions from Step 1 for the uncontrolled growth emissions and for the case with vehicle traffic reductions resulting from the adoption of control measure 2, the effect of street sweeping is shown below.

Example Calculation

$$\begin{aligned} \text{Controlled Emissions} &= \text{emissions (kg/day)} \times (1 - 0.34) \\ &= 2,972 \times (1 - 0.34) = 1,961.5 \text{ kg/day} \end{aligned}$$

| <u>Year</u> | <u>Street Sweeping Only</u>   |                                | <u>Street Sweeping &amp;<br/>Vehicle Traffic Reductions</u> |                                |
|-------------|-------------------------------|--------------------------------|---|--------------------------------|
|             | <u>Emissions<br/>(kg/day)</u> | <u>Controlled<br/>(kg/day)</u> | <u>Emissions<br/>(kg/day)</u>                               | <u>Controlled<br/>(kg/day)</u> |
| 1990        | 2,390                         | 1,577                          | 2,390   | 1,577                          |
| 1993        | 2,972                         | 1,962                          | 2,681   | 1,769                          |
| 1995        | 3,360                         | 2,218                          | 2,875   | 1,898                          |
| 2000        | 4,329                         | 2,857                          | 3,360   | 2,218                          |
| 2005        | 5,298                         | 3,497                          | 3,844   | 2,537                          |

Step 3 - Ambient PM-10 Contribution

The ambient contribution from road dust can be estimated from the roll-back equation for road dust dominated days,

$$\text{Ambient Contribution} = (93 \mu\text{g}/\text{m}^3) \times (\text{Ctrl Emissions}/2,390 \text{ kg/day})$$

For convenience the summary table for the ambient contributions is shown as a function of the VMT's. To perform the calculations the

controlled emissions from the previous table must be used. A summary of the VMT's and the ambient PM-10 contributions from roadway emissions are shown below for the uncontrolled contributions and the contributions with street sweeping alone and with vehicle traffic reductions.

Example Calculation

For street sweeping in 1993

$$\text{Ambient Concentration} = 93 \times (1,962/2,390) = 76.3 \mu\text{g}/\text{m}^3$$

| Year | Uncontrolled |                              | Controlled by Street Sweeping |                              | Controlled by SS & VMT Reduction |                              |
|------|--------------|------------------------------|-------------------------------|------------------------------|----------------------------------|------------------------------|
|      | VMT          | ( $\mu\text{g}/\text{m}^3$ ) | VMT                           | ( $\mu\text{g}/\text{m}^3$ ) | VMT                              | ( $\mu\text{g}/\text{m}^3$ ) |
| 1990 | 66,275       | 93                           | 66,275                        | 61.4                         | 66,275                           | 61.4                         |
| 1993 | 82,403       | 115.6                        | 82,403                        | 76.3                         | 74,339                           | 68.8                         |
| 1995 | 93,155       | 130.7                        | 93,155                        | 86.3                         | 79,715                           | 73.9                         |
| 2000 | 120,035      | 168.5                        | 120,035                       | 111.2                        | 93,155                           | 86.3                         |
| 2005 | 146,915      | 206.2                        | 146,915                       | 136.1                        | 106,600                          | 98.7                         |

**Section 8.30.100, POLLUTION REDUCTION EDUCATION PROGRAMS**

There are no emission reductions associated with this measure. Although it is an essential part of the wood burning program there is no practical method to calculate the affect of the program on emission reductions.

**Section 8.30.030, STANDARDS FOR REGULATION OF SOLID FUEL APPLIANCES**

**Section 8.30.050, REPLACEMENT OF NON-CERTIFIED APPLIANCES UPON SALE OF PROPERTY**

**IMPACT ON WOOD STOVES**

Note: Fireplaces are also regulated under these sections, but will be treated separately to simplify calculations.

Step 1 - Emissions Growth

The uncontrolled emissions growth for emissions from wood stoves is based upon the present number of wood stoves, including fireplace inserts, and the growth rate of the number of residents

and visitors. This emission estimate must also consider that all new stoves that are installed in Mammoth Lakes must meet EPA's Phase I certification, and will meet Phase II certification after January 1, 1991.

The 1990 emission estimates for wood stoves which were discussed in Section 3 and summarized in Table 3.4 are shown below.

Example Calculation

$$\text{Emissions} = \text{emission factor (g/kg)} \times \text{wood usage (kg/day)} \times \text{\# units} \times \text{kg/1000 g}$$

$$= 15.0 \times 19 \times 490/1000 = 139.65 \text{ kg}$$

| <u>Wood Stove</u> | <u>Emission Factor</u><br>g/kg | <u>Condos</u>       |              |                    | <u>Sgl. Family Res.</u> |              |                    | <u>Mobile Homes &amp; Apts</u> |              |                    | <u>Total Emissions</u><br>kg |
|-------------------|--------------------------------|---------------------|--------------|--------------------|-------------------------|--------------|--------------------|--------------------------------|--------------|--------------------|------------------------------|
|                   |                                | <u>Wood</u><br>kg/d | <u>Units</u> | <u>PM-10</u><br>kg | <u>Wood</u><br>kg/d     | <u>Units</u> | <u>PM-10</u><br>kg | <u>Wood</u><br>kg/d            | <u>Units</u> | <u>PM-10</u><br>kg |                              |
| Conventional      | 15.0                           | 19                  | 490          | 140                | 33                      | 861          | 426                | 19                             | 240          | 68                 | 635                          |
| Certified         | 9.0                            | --                  | --           | --                 | 19                      | 55           | 9                  | --                             | --           | --                 | 9                            |
| FP Insert         | 15.0                           | 19                  | 980          | 279                | 41                      | 55           | 34                 | --                             | --           | --                 | 313                          |

The population projections in Table 5.1 for permanent residents and visitors are used to estimate the effect of growth on the number of wood stoves.

| <u>Year</u> | <u>Permanent Residents</u> | <u>Skiers &amp; Visitors</u> |
|-------------|----------------------------|------------------------------|
| 1990        | 5,000                      | 24,000                       |
| 1993        | 5,680                      | 27,280                       |
| 1995        | 6,130                      | 29,470                       |
| 2000        | 7,270                      | 34,930                       |
| 2005        | 8,400                      | 40,400                       |

To project the number of wood stoves from 1990 to 2005, the wood stoves for 1990 must be re-categorized to fit the permanent resident and visitor population groups. To do this, it is assumed that the single family residence and the mobile home and apartments categories can be projected using the permanent resident growth rate and the condominium emissions can be projected using the visitor growth rate. It is also assumed that fireplace inserts and wood stoves can be re-grouped into the wood stove category. Since they have the same emission factor, the emission calculations will not be affected. Because the Town requires that all new stoves be EPA certified, the number of conventional stoves is held constant in the projections and the additional number of stoves due to growth are added to the number of certified stoves. The certified wood stoves can also be broken down into Phase I and Phase II certified stoves by assuming that all new stoves before 1991 are

Phase I certified. The result of the re-categorization and the projection results in the following:

Example Calculation

Projected Total # of Stoves

$$= (\text{Stoves \# in 1990}) \times (\text{Pop. in given year}) / (\text{1990 Pop.})$$

Projected # of Certified stoves

$$= (\text{Total \#}) - (\text{1990 \# of conventional}) + (\text{1990 \# of certified})$$

For Visitors, total number of stoves in 2005

$$= 1,470 \times 40,400 / 24,000 = 2,474.5 \text{ stoves}$$

Number of conventional stoves is held constant at 1,470.

$$\text{Projected number of certified stoves} = 2,474.5 - 1,470 = 1004.5$$

**Projected Number of Wood Stoves**

| <u>Wood Stoves</u> | <u>1990</u>  | <u>1991</u>  | <u>1993</u>  | <u>1995</u>  | <u>2000</u>  | <u>2005</u>  |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| <u>Visitors</u>    |              |              |              |              |              |              |
| Conventional       | 1,470        | 1,470        | 1,470        | 1,470        | 1,470        | 1,470        |
| Certified Ph I     | 0            | 67           | 67           | 67           | 67           | 67           |
| Certified Ph II    | 0            | 0            | 134          | 268          | 602          | 938          |
| <u>Residents</u>   |              |              |              |              |              |              |
| Conventional       | 1,156        | 1,156        | 1,156        | 1,156        | 1,156        | 1,156        |
| Certified Ph I     | 55           | 110          | 110          | 110          | 110          | 110          |
| Certified Ph II    | 0            | 0            | 110          | 218          | 495          | 768          |
|                    | <u>2,681</u> | <u>2,803</u> | <u>3,047</u> | <u>3,289</u> | <u>3,900</u> | <u>4,509</u> |

The emissions from these stoves can be estimated by using the following PM-10 emission factors:

15 grams/kg wood for conventional wood stoves & fireplace inserts  
 9.0 grams/kg wood for Phase I stoves (1990), and  
 7.5 grams/kg wood for Phase II stoves installed after 1990.

Based on the wood use survey, a weighted average of 30.5 kg wood/day for conventional wood stoves is used for the residents and 19 kg/day is used for visitors. From the survey, the wood usage rate for certified wood stoves is 19 kg wood/day for residents and visitors. The number of wood stoves in the previous table is used to project the emissions.

Example Calculation

$$\text{Emissions} = \text{wood use} \times \text{emission factor} \times \# \text{ stoves} \times \text{kg}/1000 \text{ g}$$

For Residents with Phase I stoves in 1990

$$\text{Emissions} = 19 \times 9.0 \times 55 / 1000$$

$$= 9.4 \text{ kg/day}$$

**Projected Wood Stove Emissions Considering Phase II Stoves are Required after January 1, 1991.**

| <u>Wood Stoves</u> | <u>PM-10 Emissions (kg)</u> |             |              |              |              |              |
|--------------------|-----------------------------|-------------|--------------|--------------|--------------|--------------|
|                    | <u>1990</u>                 | <u>1991</u> | <u>1993</u>  | <u>1995</u>  | <u>2000</u>  | <u>2005</u>  |
| <u>Visitors</u>    |                             |             |              |              |              |              |
| Conventional       | 419                         | 419         | 419          | 419          | 419          | 419          |
| Certified Ph I     | 0                           | 11          | 11           | 11           | 11           | 11           |
| Certified Ph II    | 0                           | 0           | 19           | 38           | 86           | 134          |
| <u>Residents</u>   |                             |             |              |              |              |              |
| Conventional       | 529                         | 529         | 529          | 529          | 529          | 529          |
| Certified Ph I     | 9                           | 19          | 19           | 19           | 19           | 19           |
| Certified Ph II    | 0                           | 0           | 16           | 31           | 78           | 109          |
|                    | <u>957</u>                  | <u>978</u>  | <u>1,013</u> | <u>1,047</u> | <u>1,135</u> | <u>1,221</u> |

**Step 2- Controlled Emissions**

Replace Non-certified Wood Stoves Upon Resale of Dwelling, it is assumed that 90% of the dwellings in Mammoth Lakes will be sold over the next 15 years. This will result in 90% of the wood stoves to be switched from conventional stoves to Phase II certified wood stoves after 1990. This change-over, which is proportioned over the next 15 years, will result in the following breakdown for the stoves.

**Projected Number of Wood Stoves Considering Replacement of Non-Certified Wood Stoves Upon Resale of Dwelling and Require Phase II Stoves after January 1, 1991.**

| <u>Wood Stoves</u> | <u>Projected Number of Wood Stoves</u> |              |              |              |              |              |
|--------------------|--|--------------|--------------|--------------|--------------|--------------|
|                    | <u>1990</u>                            | <u>1991</u>  | <u>1993</u>  | <u>1995</u>  | <u>2000</u>  | <u>2005</u>  |
| <u>Visitors</u>    |  |              |              |              |              |              |
| Conventional       | 1,470                                  | 1,470        | 1,205        | 1,029        | 588          | 147          |
| Change - Ph II     | 0                                      | 0            | 265          | 441          | 882          | 1,323        |
| New Cert. Ph I     | 0                                      | 67           | 67           | 67           | 67           | 67           |
| New Cert. Ph II    | 0                                      | 0            | 134          | 268          | 602          | 938          |
| <u>Residents</u>   |  |              |              |              |              |              |
| Conventional       | 1,156                                  | 1,156        | 948          | 809          | 462          | 116          |
| Change - Ph II     | 0                                      | 0            | 208          | 347          | 694          | 1,040        |
| New Cert. Ph I     | 55                                     | 110          | 110          | 110          | 110          | 110          |
| New Cert. Ph II    | 0                                      | 0            | 110          | 218          | 495          | 768          |
|                    | <u>2,681</u>                           | <u>2,803</u> | <u>3,047</u> | <u>3,298</u> | <u>3,900</u> | <u>4,509</u> |

Using the same method that was used in step 1 to calculate the PM-10 emissions, the following table summarizes the effect of replacing conventional wood stoves with certified wood stoves.

**Projected Wood Stove Emissions Considering Replacement of Non-Certified Wood Stove Upon Resale of Dwelling and Require Phase II Certified Stoves After January 1, 1991**

| <u>Wood Stoves</u> | <u>Controlled PM-10 Emissions (kg)</u> |             |             |             |             |             |
|--------------------|--|-------------|-------------|-------------|-------------|-------------|
|                    | <u>1990</u>                            | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| <u>Visitors</u>    |  |             |             |             |             |             |
| Conventional       | 419                                    | 419         | 343         | 293         | 168         | 42          |
| Change - Ph II     | 0                                      | 0           | 38          | 63          | 126         | 189         |
| Certified Ph I     | 0                                      | 11          | 11          | 11          | 11          | 11          |
| Certified Ph II    | 0                                      | 0           | 19          | 38          | 86          | 134         |
| <u>Residents</u>   |  |             |             |             |             |             |
| Conventional       | 529                                    | 529         | 434         | 370         | 211         | 53          |
| Change - Ph II     | 0                                      | 0           | 30          | 49          | 99          | 148         |
| Certified Ph I     | 9                                      | 19          | 19          | 19          | 19          | 19          |
| Certified Ph II    | 0                                      | 0           | 16          | 31          | 71          | 109         |
|                    | <u>957</u>                             | <u>978</u>  | <u>910</u>  | <u>874</u>  | <u>791</u>  | <u>705</u>  |

Step 3 - Ambient PM-10 Contribution

The ambient PM-10 contribution from wood stoves can be estimated from the roll-back equation for road dust dominated days,

$$\text{Ambient conc.} = (58 \mu\text{g}/\text{m}^3) \times (\text{controlled emissions}/957 \text{ kg/day})$$

The ambient contribution for each of the stove types from residents and visitors is shown below.

**Projected Ambient Contributions for Wood Stove Emissions Considering Replacement of Non-certified Wood Stoves Upon Resale of Dwelling and Requirement for EPA Phase II Certified Wood Stoves After January 1, 1991.**

| <u>Wood Stoves</u> | <u>Ambient PM-10 Contribution (<math>\mu\text{g}/\text{m}^3</math>)</u> |             |             |             |             |             |
|--------------------|---|-------------|-------------|-------------|-------------|-------------|
|                    | <u>1990</u>   | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| <u>Visitors</u>    |   |             |             |             |             |             |
| Conventional       | 25.3  | 25.3        | 20.8        | 17.7        | 10.2        | 2.5         |
| Change - Ph II     | 0   | 0           | 2.3         | 3.8         | 7.6         | 11.9        |
| New Cert. Ph I     | 0   | 0           | 0.6         | 0.6         | 0.6         | 0.6         |
| New Cert. Ph II    | 0   | 0           | 1.2         | 2.3         | 5.2         | 8.1         |
| <u>Residents</u>   |   |             |             |             |             |             |
| Conventional       | 32.1  | 32.1        | 26.3        | 22.4        | 12.8        | 3.2         |
| Change - Ph II     | 0   | 0           | 1.8         | 3.0         | 6.0         | 9.0         |
| New Cert. Ph I     | 0.5   | 1.2         | 1.2         | 1.2         | 1.2         | 1.2         |
| New Cert. Ph II    | 0   | 0           | 0.9         | 1.9         | 4.3         | 6.6         |
|                    | <u>57.9</u>   | <u>58.6</u> | <u>55.1</u> | <u>52.9</u> | <u>47.9</u> | <u>43.1</u> |

**IMPACT ON FIREPLACES**

Step 1 - Emissions Growth

The uncontrolled emissions growth from fireplaces is based upon the present number of fireplaces, not including fireplace inserts, and the growth rate of the number of residents and visitors. The 1990 emission estimates for fireplaces which were discussed in Section 3 are summarized in Table 3.4 and shown below.

Example Calculation

$$\text{Emissions} = \text{emissions factor (g/kg wood)} \times \text{wood usage (kg wood/day)} \times \# \text{ of fireplaces} \times \text{kg}/1000 \text{ g}$$

For Fireplaces the emissions factor is 14 g/kg wood  
 For residents,  
 Emissions = 14 x 22 x 324/1000 = 99.8 kg

**1990 Fireplace Emissions**

|           | <u>Wood Use</u> | <u>Number</u> | <u>Emissions</u> |
|-----------|-----------------|---------------|------------------|
| Condos    | 19 kg/d         | 2,941         | 782 kg/d         |
| Residents | 22 kg/d         | 324           | 100 kg/d         |

Using the same population projection figures and method that was used for the wood stove measures, the effect of growth on the number of fireplaces and the emissions is shown below.

**Projected Number of Fireplaces and Emissions**

| <u>Year</u> | <u>Condominiums</u> |                           | <u>Residents</u> |                           | <u>Total Emissions</u> |
|-------------|---------------------|---------------------------|------------------|---------------------------|------------------------|
|             | <u>Number</u>       | <u>Emissions (kg/day)</u> | <u>Number</u>    | <u>Emissions (kg/day)</u> |                        |
| 1990        | 2,941               | 782                       | 324              | 100                       | 882                    |
| 1991        | 3,075               | 818                       | 353              | 109                       | 927                    |
| 1993        | 3,343               | 889                       | 412              | 127                       | 1,016                  |
| 1995        | 3,611               | 961                       | 434              | 134                       | 1,095                  |
| 2000        | 4,280               | 1,138                     | 471              | 145                       | 1,283                  |
| 2005        | 4,951               | 1,317                     | 544              | 168                       | 1,485                  |

Step 2 - Controlled Emissions

Regulations that affect fireplaces will institute a ban on new fireplaces except in common areas of lodges and condominiums. In addition, fireplaces must be replaced with Phase II certified wood stoves or cleaner burning appliances before sale of a dwelling.

Note: New fireplaces in common areas of lodges and condominiums is assumed to be negligible as compared to the total wood burning emissions. These fireplaces are not included in the calculations. It is also assumed that fireplaces that would have been installed in new dwellings will be gas logs.

The strategy assumes that 90% of the dwellings will be sold over the next 15 years. This will result in 90% of the open wood burning fireplaces to be rendered inoperable or to be replaced with a cleaner burning device. The control efficiency for the affected dwellings is conservatively assumed to be 46%, based on the replacement of the fireplace with a Phase II certified wood stove. Although it is likely that many fireplaces will be rendered inoperable, or be replaced with gas logs or pellet stoves, there is no data to support consideration of these variables.

The projected number of fireplaces that are replaced for the next 15 years is shown below.

| <u>Projected Number of Fireplaces and Those That Are Replaced</u> |             |             |             |             |             |             |
|---|-------------|-------------|-------------|-------------|-------------|-------------|
|   | <u>1990</u> | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| Visitors  |             |             |             |             |             |             |
| Fireplaces  | 2,941       | 3,075       | 2,706       | 2,337       | 1,415       | 492         |
| FP to Phase II  | 0           | 0           | 369         | 738         | 1,661       | 2,583       |
| Residents   |             |             |             |             |             |             |
| Fireplaces  | 324         | 353         | 311         | 268         | 162         | 56          |
| FP to Phase II  | 0           | 0           | 42          | 85          | 191         | 297         |

From the number of fireplaces and Phase II wood stoves an estimate of the controlled emissions can be made using the emissions equation in Step 1 for the fireplaces emissions and step 1 from the Phase II wood stove emissions. The fireplace wood usage rate for visitors is 19 kg/day and for residents it is 22 kg/day. The wood usage rate in Phase II stoves is 19 kg/day for both visitors and residents. The emissions factor for fireplaces is 14 g/kg of wood and the emission factor for phase II wood stoves is 7.5 g/kg of wood.

| <u>Projected Emissions (kg/day)</u> |             |             |             |             |             |             |
|-------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                     | <u>1990</u> | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| Visitors                            |             |             |             |             |             |             |
| Fireplaces                          | 782         | 818         | 720         | 622         | 376         | 131         |
| FP to Phase II                      | 0           | 0           | 53          | 105         | 237         | 368         |
| Residents                           |             |             |             |             |             |             |
| Fireplaces                          | 100         | 109         | 96          | 83          | 50          | 17          |
| FP to Phase II                      | 0           | 0           | 6           | 12          | 27          | 42          |
| <b>Total</b>                        | <b>882</b>  | <b>927</b>  | <b>875</b>  | <b>822</b>  | <b>690</b>  | <b>558</b>  |

### Step 3 - Ambient PM-10 Contribution

The ambient PM-10 contribution can be estimated from the roll-back equation for road dust dominated days,

$$\text{Ambient Contribution} = 54 \mu\text{g}/\text{m}^3 \times (\text{Ctrl Emissions}/882 \text{ kg/day})$$

A summary of the ambient contributions is shown in the table below.

**Projected Ambient Contributions With Sections 8.30.030 and 8.30.050  
Ban New Fireplaces and Remove Fireplaces Upon Sale of Dwelling**

|                  | Ambient Contributions ( $\mu\text{g}/\text{m}^3$ ) |             |             |              |             |             |
|------------------|--|-------------|-------------|--------------|-------------|-------------|
|                  | 1990   | 1991        | 1993        | 1995         | 2000        | 2005        |
| <b>Visitors</b>  |  |             |             |              |             |             |
| Fireplaces       | 47.9   | 50.1        | 44.1        | 38.1         | 23.0        | 8.0         |
| FP to Phase II   | 0  | 0           | 3.2         | 6.4          | 14.5        | 22.5        |
| <b>Residents</b> |  |             |             |              |             |             |
| Fireplaces       | 6.1  | 6.7         | 5.9         | 5.1          | 3.1         | 1.0         |
| FP to Phase II   | 0  | 0           | 0.4         | 0.7          | 1.7         | 2.6         |
| <b>Total</b>     | <b>54.0</b>  | <b>56.8</b> | <b>53.6</b> | <b>50.30</b> | <b>42.3</b> | <b>34.1</b> |

**Section 8.30.040, DENSITY LIMITATIONS**

This section of the ordinance limits the number of wood burning appliances to one certified wood stove in new units, or two appliances if one is a pellet stove. The previous calculations assume one appliance per dwelling unit. It is anticipated that the emissions from the additional pellet stoves will be insignificant. This section also requires an inspection of new installations by a certified inspector. This is credited with a 5% reduction from new units.

Step 1 - Emissions Growth

The emissions growth calculation for new wood stoves can be taken from the new wood stove estimates that have been completed in previous sections.

**Projected Wood Stove Emissions with Replacement of Non-certified appliance Upon Resale, Change-over of Fireplaces, Require Phase II Wood Stoves**

| New Wood Stoves  | PM-10 Emissions (kg) |          |            |            |            |            |
|------------------|----------------------|----------|------------|------------|------------|------------|
|                  | 1990                 | 1991     | 1993       | 1995       | 2000       | 2005       |
| <b>Visitors</b>  |                      |          |            |            |            |            |
| Conv WS to Ph II | 0                    | 0        | 38         | 63         | 126        | 189        |
| New Ph II        | 0                    | 0        | 19         | 38         | 86         | 134        |
| FP to Phase II   | 0                    | 0        | 53         | 105        | 237        | 368        |
| <b>Residents</b> |                      |          |            |            |            |            |
| Conv WS to Ph II | 0                    | 0        | 30         | 49         | 99         | 148        |
| New Ph II        | 0                    | 0        | 16         | 31         | 71         | 109        |
| FP to Phase II   | 0                    | 0        | 6          | 12         | 27         | 42         |
|                  | <b>0</b>             | <b>0</b> | <b>162</b> | <b>298</b> | <b>646</b> | <b>990</b> |

## Step 2 - Controlled Emissions

Wood Stove Installer Certification is credited with a 5% reduction in emissions from new stoves that are installed.

### Example Calculation

For 1993,

$$\begin{aligned} \text{Controlled emissions} &= 162 \text{ kg/day} \times (1 - 0.05) \\ &= 154 \text{ kg/day} \end{aligned}$$

### Controlled PM-10 Emissions (kg)

| <u>New Wood Stoves</u> | <u>1990</u> | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
|------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                        | 0           | 0           | 154         | 283         | 614         | 941         |

## Step 3 - Ambient PM-10 Contribution

The ambient PM-10 contribution from the previous wood stove ordinances can be estimated from the roll-back equation for road dust dominated days,

$$\text{Ambient Concentration} = (58 \mu\text{g}/\text{m}^3) \times (\text{ctrl emissions}/957 \text{ kg/day})$$

Using the controlled emissions estimates from the previous table, the ambient contributions are shown below.

### Ambient Contributions from the Wood Stove Certification and All Previous Wood Stove Ordinances for New Wood Stoves

| <u>New Wood Stoves</u> | <u>Ambient PM-10 Contribution (<math>\mu\text{g}/\text{m}^3</math>)</u> |             |             |             |             |             |
|------------------------|---|-------------|-------------|-------------|-------------|-------------|
|                        | <u>1990</u>   | <u>1992</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
|                        | 0   | 0           | 9.3         | 17.2        | 37.2        | 57.0        |

## **Section 8.30.080, PROHIBITED FUELS**

There are no emission reductions associated with this measure. It is intended to give the regulating agencies a tool to prevent the general public from burning materials that may cause odors or excessive smoke.

## **Section 8.30.070, OPACITY LIMITS**

There are no emission reductions associated with this measure. It is included as a possible enforcement tool for individuals that may cause repeated complaints of smoke or odor.

**Section 8.30.090, MANDATORY CURTAILMENT**

Initially the mandatory wood burning curtailment will exempt certified wood burning appliances. If more reductions are needed this exemption may be dropped and the curtailment will affect all wood burning. The following calculations will consider the affect of the curtailment with and without exemptions for certified wood stoves.

Step 1 - Emissions Growth

The total emissions growth estimate for mandatory wood burning bans can be estimated from the previous estimates for emissions from new and existing wood stoves and fireplaces. These emission estimates assume that the previous controls were implemented.

|                                  | <u>Projected Emissions (kg/day)</u> |              |              |              |              |              |
|----------------------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                                  | <u>1990</u>                         | <u>1991</u>  | <u>1993</u>  | <u>1995</u>  | <u>2000</u>  | <u>2005</u>  |
| <u>Fireplaces</u>                |                                     |              |              |              |              |              |
| Visitors                         | 782                                 | 818          | 720          | 622          | 376          | 131          |
| Residents                        | 100                                 | 109          | 96           | 83           | 50           | 17           |
| Sub-total                        | <u>882</u>                          | <u>927</u>   | <u>816</u>   | <u>705</u>   | <u>426</u>   | <u>148</u>   |
| <u>Non-Certified Wood Stoves</u> |                                     |              |              |              |              |              |
| Vis Conv WS                      | 419                                 | 419          | 343          | 293          | 168          | 42           |
| Res Conv WS                      | 529                                 | 529          | 434          | 370          | 211          | 53           |
| Sub-total                        | <u>948</u>                          | <u>948</u>   | <u>777</u>   | <u>663</u>   | <u>379</u>   | <u>95</u>    |
| Non-Certified Total              | 1,830                               | 1,875        | 1,593        | 1,368        | 805          | 243          |
| <u>Certified Wood Stoves</u>     |                                     |              |              |              |              |              |
| Visitor Ph I                     | 0                                   | 11           | 11           | 11           | 11           | 11           |
| Resident Ph I                    | 9                                   | 19           | 19           | 19           | 19           | 19           |
| Vis/Res Phase II                 | 0                                   | 0            | 154          | 283          | 614          | 941          |
| Certified Total                  | <u>9</u>                            | <u>30</u>    | <u>184</u>   | <u>313</u>   | <u>644</u>   | <u>971</u>   |
| All Wood Burning Total           | <u>1,839</u>                        | <u>1,905</u> | <u>1,777</u> | <u>1,681</u> | <u>1,449</u> | <u>1,214</u> |

## Step 2 - Controlled Emissions

A mandatory wood burning ban is credited with a 50% reduction from the uncontrolled emissions. The summary of the controlled emissions is shown below.

### Example Calculation

Controlled Emissions = Emissions (kg/day) x (1 - 0.5)

For all wood burning in 1993,

Controlled emissions = 1,777 x (0.5) = 889 kg/day

|                    | <u>Controlled Emissions (kg/day)</u> |             |             |             |             |             |
|--------------------|--------------------------------------|-------------|-------------|-------------|-------------|-------------|
|                    | <u>1990</u>                          | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| Non-certified      | 915                                  | 938         | 797         | 684         | 403         | 122         |
| Certified (exempt) | 9                                    | 30          | 184         | 313         | 644         | 971         |
| All Wood Burning   | 920                                  | 953         | 889         | 841         | 725         | 607         |

## Step 3 - Ambient PM-10 Contribution

The ambient PM-10 contribution from wood burning can be estimated from the roll-back equation for road dust dominated days. Although the ambient contribution estimates for wood stoves and fireplaces can be calculated separately, it can also be calculated for wood burning in general by using the following equation:

For all wood burning,

Ambient Conc. =  $(58 + 54 \mu\text{g}/\text{m}^3) \times$   
 $(\text{wood burning emissions}) / (957 + 882 \text{ kg/day})$

|                                     | <u>Ambient PM-10 Contribution (<math>\mu\text{g}/\text{m}^3</math>)</u> |             |             |             |             |             |
|-------------------------------------|---|-------------|-------------|-------------|-------------|-------------|
|                                     | <u>1990</u>   | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| Non-certified                       | 55.7  | 57.1        | 48.5        | 41.7        | 24.5        | 7.4         |
| Certified (exempt)                  | 0.5   | 1.8         | 11.2        | 19.1        | 39.2        | 59.1        |
| Total w/exemption                   | 56.2  | 58.9        | 59.7        | 60.8        | 63.7        | 66.5        |
| All Wood Burning<br>(no exemptions) | 56.0  | 58.0        | 54.1        | 51.2        | 44.2        | 37.0        |

## **Section 8.30.060, SOLID FUEL BURNING APPLIANCE REPLACEMENT SCHEDULE**

If the National Ambient Air Quality Standard for PM-10 is not attained by January 1, 1993, all non-certified solid fuel

appliances must be replaced by November 1, 1994. The following section will include an analysis of the impact of this schedule.

Step 1 - Emissions Growth

The emissions growth for wood burning can be calculated from the number of wood stoves and fireplaces. This has been determined in previous calculations. It is important to assume the wood burning regulations that affect the number of devices is in effect.

**Projected Number of Wood Stoves & Fireplaces Considering Replacement of Non-Certified Wood Stoves and Fireplaces Upon Resale of Dwelling and Require Phase II Stoves after January 1, 1991.**

| <u>Wood Stoves</u> | <u>Projected Number of Wood Stoves</u> |              |              |              |              |              |
|--------------------|--|--------------|--------------|--------------|--------------|--------------|
|                    | <u>1990</u>                            | <u>1991</u>  | <u>1993</u>  | <u>1995</u>  | <u>2000</u>  | <u>2005</u>  |
| <u>Visitors</u>    |  |              |              |              |              |              |
| Conventional       | 1,470                                  | 1,470        | 1,205        | 1,029        | 588          | 147          |
| Change - Ph II     | 0                                      | 0            | 265          | 441          | 882          | 1,323        |
| New Cert. Ph I     | 0                                      | 67           | 67           | 67           | 67           | 67           |
| New Cert. Ph II    | 0                                      | 0            | 134          | 268          | 602          | 938          |
| <u>Residents</u>   |  |              |              |              |              |              |
| Conventional       | 1,156                                  | 1,156        | 948          | 809          | 462          | 116          |
| Change - Ph II     | 0                                      | 0            | 208          | 347          | 694          | 1,040        |
| New Cert. Ph I     | 55                                     | 110          | 110          | 110          | 110          | 110          |
| New Cert. Ph II    | 0                                      | 0            | 110          | 218          | 495          | 768          |
|                    | <u>2,681</u>                           | <u>2,803</u> | <u>3,047</u> | <u>3,298</u> | <u>3,900</u> | <u>4,509</u> |

Projected Number of Fireplaces and Those That Are Replaced

|                  | <u>1990</u> | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
|------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>Visitors</u>  |             |             |             |             |             |             |
| Fireplaces       | 2,941       | 3,075       | 2,706       | 2,337       | 1,415       | 492         |
| FP to Phase II   | 0           | 0           | 369         | 738         | 1,661       | 2,583       |
| <u>Residents</u> |             |             |             |             |             |             |
| Fireplaces       | 324         | 353         | 311         | 268         | 162         | 56          |
| FP to Phase II   | 0           | 0           | 42          | 85          | 191         | 297         |

## Step 2 - Controlled Emissions

If all wood burning appliances are required to be changed to certified wood stoves by November 1994, then after 1995 there should be zero non-certified appliances. An accelerated change over of appliance should begin in 1993. It is assumed that it will be a straight line linear reduction from the expected number of non-certified devices, to zero devices in 1995. The reduction of non-certified devices is assumed to match the increase of certified devices over that 2 year period.

**Projected Number of Wood Stoves & Fireplaces Considering Replacement of Non-Certified Wood Stoves and Fireplaces Upon Resale of Dwelling and Require Phase II Stoves after January 1, 1991 and Accelerated Change-over from 1993 to 1995.**

| <u>Wood Stoves</u> | <u>Projected Number of Wood Stoves</u> |              |              |              |              |              |
|--------------------|--|--------------|--------------|--------------|--------------|--------------|
|                    | <u>1990</u>                            | <u>1991</u>  | <u>1993</u>  | <u>1995</u>  | <u>2000</u>  | <u>2005</u>  |
| <u>Visitors</u>    |  |              |              |              |              |              |
| Conventional       | 1,470                                  | 1,470        | 1,205        | 0            | 0            | 0            |
| Change - Ph II     | 0                                      | 0            | 265          | 1,470        | 1,470        | 1,470        |
| New Cert. Ph I     | 0                                      | 67           | 67           | 67           | 67           | 67           |
| New Cert. Ph II    | 0                                      | 0            | 134          | 268          | 602          | 938          |
| <u>Residents</u>   |  |              |              |              |              |              |
| Conventional       | 1,156                                  | 1,156        | 948          | 0            | 0            | 0            |
| Change - Ph II     | 0                                      | 0            | 208          | 1,156        | 1,156        | 1,156        |
| New Cert. Ph I     | 55                                     | 110          | 110          | 110          | 110          | 110          |
| New Cert. Ph II    | 0                                      | 0            | 110          | 218          | 495          | 768          |
|                    | <u>2,681</u>                           | <u>2,803</u> | <u>3,047</u> | <u>3,298</u> | <u>3,900</u> | <u>4,509</u> |

|                  | <u>Projected Number of Fireplaces and Those That Are Replaced</u> |             |             |             |             |             |
|------------------|---|-------------|-------------|-------------|-------------|-------------|
|                  | <u>1990</u>   | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| <u>Visitors</u>  |   |             |             |             |             |             |
| Fireplaces       | 2,941   | 3,075       | 2,706       | 0           | 0           | 0           |
| FP to Phase II   | 0   | 0           | 369         | 3,075       | 3,075       | 3,075       |
| <u>Residents</u> |   |             |             |             |             |             |
| Fireplaces       | 324   | 353         | 311         | 0           | 0           | 0           |
| FP to Phase II   | 0   | 0           | 42          | 353         | 353         | 353         |

Projected Wood Stove and Fireplace Emissions Considering Replacement of Non-Certified Wood Stove Upon Resale of Dwelling, Require Phase II Certified Stoves After January 1, 1991, 5% Reduction for Certified Installer of Phase II Stoves and Accelerated Change-over from 1993 to 1995.

| <u>Wood Stoves</u>      | <u>Controlled PM-10 Emissions (kg)</u> |             |             |             |             |             |
|-------------------------|--|-------------|-------------|-------------|-------------|-------------|
|                         | <u>1990</u>                            | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| <u>Visitors</u>         |  |             |             |             |             |             |
| Conventional            | 419                                    | 419         | 343         | 0           | 0           | 0           |
| <b>Certified Stoves</b> |  |             |             |             |             |             |
| Change - Ph II          | 0                                      | 0           | 36          | 199         | 199         | 199         |
| Certified Ph I          | 0                                      | 11          | 11          | 11          | 11          | 11          |
| Certified Ph II         | 0                                      | 0           | 18          | 36          | 82          | 127         |
| <u>Residents</u>        |  |             |             |             |             |             |
| Conventional            | 529                                    | 529         | 434         | 0           | 0           | 0           |
| <b>Certified Stoves</b> |  |             |             |             |             |             |
| Change - Ph II          | 0                                      | 0           | 29          | 157         | 157         | 157         |
| Certified Ph I          | 9                                      | 19          | 19          | 19          | 19          | 19          |
| Certified Ph II         | 0                                      | 0           | 15          | 29          | 67          | 104         |
| Sub-total               | <u>957</u>                             | <u>978</u>  | <u>905</u>  | <u>451</u>  | <u>535</u>  | <u>617</u>  |

|                         | <u>Projected Emissions (kg/day)</u> |             |             |             |             |             |
|-------------------------|-------------------------------------|-------------|-------------|-------------|-------------|-------------|
|                         | <u>1990</u>                         | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| <u>Visitors</u>         |                                     |             |             |             |             |             |
| Fireplaces              | 782                                 | 818         | 720         | 0           | 0           | 0           |
| <b>Certified Stoves</b> |                                     |             |             |             |             |             |
| FP to Phase II          | 0                                   | 0           | 50          | 416         | 416         | 416         |
| <u>Residents</u>        |                                     |             |             |             |             |             |
| Fireplaces              | 100                                 | 109         | 96          | 0           | 0           | 0           |
| <b>Certified Stoves</b> |                                     |             |             |             |             |             |
| FP to Phase II          | 0                                   | 0           | 6           | 48          | 48          | 48          |
| Sub-total               | <u>882</u>                          | <u>927</u>  | <u>872</u>  | <u>464</u>  | <u>464</u>  | <u>464</u>  |

|                         | <u>Projected Emissions (kg/day)</u> |             |             |             |             |             |
|-------------------------|-------------------------------------|-------------|-------------|-------------|-------------|-------------|
|                         | <u>1990</u>                         | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| <b>Certified Stoves</b> |                                     |             |             |             |             |             |
| <b>Visitors</b>         |                                     |             |             |             |             |             |
| Change - Ph II          | 0                                   | 0           | 36          | 199         | 199         | 199         |
| Certified Ph I          | 0                                   | 11          | 11          | 11          | 11          | 11          |
| Certified Ph II         | 0                                   | 0           | 18          | 36          | 82          | 127         |
| FP to Phase II          | 0                                   | 0           | 50          | 416         | 416         | 416         |
| <b>Residents</b>        |                                     |             |             |             |             |             |
| Change - Ph II          | 0                                   | 0           | 29          | 157         | 157         | 157         |
| Certified Ph I          | 9                                   | 19          | 19          | 19          | 19          | 19          |
| Certified Ph II         | 0                                   | 0           | 15          | 29          | 67          | 104         |
| FP to Phase II          | 0                                   | 0           | 6           | 48          | 48          | 48          |
| <b>Certified</b>        |                                     |             |             |             |             |             |
| Sub-total               | 9                                   | 30          | 184         | 915         | 999         | 1,081       |
| <b>Non-Certified</b>    |                                     |             |             |             |             |             |
| <b>Visitors</b>         |                                     |             |             |             |             |             |
| Conventional            | 419                                 | 419         | 343         | 0           | 0           | 0           |
| Fireplaces              | 782                                 | 818         | 720         | 0           | 0           | 0           |
| <b>Residents</b>        |                                     |             |             |             |             |             |
| Conventional            | 529                                 | 529         | 434         | 0           | 0           | 0           |
| Fireplaces              | 100                                 | 109         | 96          | 0           | 0           | 0           |
| <b>Non-Certified</b>    | 1,830                               | 1,875       | 1,593       | 0           | 0           | 0           |
| Sub-total               |                                     |             |             |             |             |             |
| <b>All Wood Burning</b> |                                     |             |             |             |             |             |
| Total                   | 1,839                               | 1,905       | 1,777       | 915         | 999         | 1,081       |

### Step 3 - Ambient PM-10 Contribution

The ambient PM-10 contribution from wood burning can be estimated from the roll-back equation for road dust dominated days. Although the ambient contribution estimates for wood stoves and fireplaces can be calculated separately, it can also be calculated for wood burning in general by using the following equation:

For all wood burning,  
 Ambient Conc. =  $(58 + 54 \mu\text{g}/\text{m}^3) \times$   
 $(\text{wood burning emissions}) / (957 + 882 \text{ kg/day})$

Without the Mandatory Curtailment

|                  | <u>Ambient PM-10 Contribution (<math>\mu\text{g}/\text{m}^3</math>)</u> |             |             |             |             |             |
|------------------|---|-------------|-------------|-------------|-------------|-------------|
|                  | <u>1990</u>   | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| All Wood Burning | 112.0   | 116.0       | 108.2       | 55.7        | 60.8        | 65.8        |

For the mandatory curtailment program a 50% reduction in the ambient contribution from wood burning is expected. The mandatory wood burning curtailment will initially exempt certified wood stoves. If more reductions are needed the mandatory curtailment may instituted without the exemptions. The impact of both cases is estimated.

With the Mandatory Curtailment

|                               | <u>Ambient PM-10 Contribution (<math>\mu\text{g}/\text{m}^3</math>)</u> |             |             |             |             |             |
|-------------------------------|---|-------------|-------------|-------------|-------------|-------------|
|                               | <u>1990</u>   | <u>1991</u> | <u>1993</u> | <u>1995</u> | <u>2000</u> | <u>2005</u> |
| Certified (exempt)            | 0.5   | 1.8         | 11.2        | 55.7        | 60.8        | 65.8        |
| Non-Certified<br>(not exempt) | 55.8  | 57.1        | 48.5        | 0           | 0           | 0           |
| Total w/exemption             | <u>56.3</u>   | <u>58.9</u> | <u>59.7</u> | <u>55.7</u> | <u>60.8</u> | <u>65.8</u> |
| All Wood Burning              | 56.0  | 58.0        | 54.1        | 27.9        | 30.4        | 32.9        |

**SUMMARY OF AMBIENT PM-10 CONTRIBUTIONS**  
 Assume NAAQS Attained by January 1, 1993

**Mandatory Burning Curtailment Program**  
 (With an Exemption for Certified Wood Stoves)

|              | Ambient PM-10 Contribution ( $\mu\text{g}/\text{m}^3$ ) |              |              |              |              |              |
|--------------|---|--------------|--------------|--------------|--------------|--------------|
|              | 1990  | 1991         | 1993         | 1995         | 2000         | 2005         |
| Wood Burning | 56.2  | 58.9         | 59.7         | 60.8         | 63.7         | 66.5         |
| Traffic      | 61.4  | 63.9         | 68.8         | 73.9         | 86.3         | 98.7         |
| Background   | 5.0   | 5.0          | 5.0          | 5.0          | 5.0          | 5.0          |
|              | <u>122.6</u>  | <u>127.8</u> | <u>133.5</u> | <u>139.7</u> | <u>155.0</u> | <u>170.2</u> |

**Mandatory Burning Curtailment Program**  
 (No Exemption for Certified Wood Stoves)

|              | Ambient PM-10 Contribution ( $\mu\text{g}/\text{m}^3$ ) |              |              |              |              |              |
|--------------|---|--------------|--------------|--------------|--------------|--------------|
|              | 1990  | 1991         | 1993         | 1995         | 2000         | 2005         |
| Wood Burning | 56.0  | 58.0         | 54.1         | 51.2         | 44.2         | 37.0         |
| Traffic      | 61.4  | 63.9         | 68.8         | 73.9         | 86.3         | 98.7         |
| Background   | 5.0   | 5.0          | 5.0          | 5.0          | 5.0          | 5.0          |
|              | <u>122.4</u>  | <u>126.9</u> | <u>127.9</u> | <u>130.1</u> | <u>135.5</u> | <u>140.7</u> |

**Without the Mandatory Burning Curtailment Program**

|                  | Ambient PM-10 Contribution ( $\mu\text{g}/\text{m}^3$ ) |              |              |              |              |              |
|------------------|---|--------------|--------------|--------------|--------------|--------------|
|                  | 1990  | 1991         | 1993         | 1995         | 2000         | 2005         |
| All Wood Burning | 112.0   | 116.0        | 108.2        | 102.4        | 88.4         | 74.0         |
| Traffic          | 61.4  | 63.9         | 68.8         | 73.9         | 86.3         | 98.7         |
| Background       | 5.0   | 5.0          | 5.0          | 5.0          | 5.0          | 5.0          |
|                  | <u>178.4</u>  | <u>184.9</u> | <u>182.0</u> | <u>181.3</u> | <u>179.7</u> | <u>177.7</u> |

**SUMMARY OF AMBIENT PM-10 CONTRIBUTIONS**  
 Assume NAAQS Not Attained by January 1, 1993

**Mandatory Burning Curtailment Program**  
 (With an Exemption for Certified Wood Stoves)

|              | Ambient PM-10 Contribution ( $\mu\text{g}/\text{m}^3$ ) |              |              |              |              |              |
|--------------|---|--------------|--------------|--------------|--------------|--------------|
|              | 1990  | 1991         | 1993         | 1995         | 2000         | 2005         |
| Wood Burning | 56.3  | 58.9         | 59.7         | 55.7         | 60.8         | 65.8         |
| Traffic      | 61.4  | 63.9         | 68.8         | 73.9         | 86.3         | 98.7         |
| Background   | 5.0   | 5.0          | 5.0          | 5.0          | 5.0          | 5.0          |
|              | <u>122.7</u>  | <u>127.8</u> | <u>133.5</u> | <u>134.6</u> | <u>152.1</u> | <u>169.5</u> |

**Mandatory Burning Curtailment Program**  
 (No Exemption for Certified Wood stoves)

|                  | Ambient PM-10 Contribution ( $\mu\text{g}/\text{m}^3$ ) |              |              |              |              |              |
|------------------|---|--------------|--------------|--------------|--------------|--------------|
|                  | 1990  | 1991         | 1993         | 1995         | 2000         | 2005         |
| All Wood Burning | 56.0  | 58.0         | 54.1         | 27.9         | 30.4         | 32.9         |
| Traffic          | 61.4  | 63.9         | 68.8         | 73.9         | 86.3         | 98.7         |
| Background       | 5.0   | 5.0          | 5.0          | 5.0          | 5.0          | 5.0          |
|                  | <u>122.4</u>  | <u>126.9</u> | <u>127.9</u> | <u>106.8</u> | <u>121.7</u> | <u>136.6</u> |

**Without the Mandatory Burning Curtailment Program**

|                  | Ambient PM-10 Contribution ( $\mu\text{g}/\text{m}^3$ ) |              |              |              |              |              |
|------------------|---|--------------|--------------|--------------|--------------|--------------|
|                  | 1990  | 1991         | 1993         | 1995         | 2000         | 2005         |
| All Wood Burning | 112.0   | 116.0        | 108.2        | 55.7         | 60.8         | 65.8         |
| Traffic          | 61.4  | 63.9         | 68.8         | 73.9         | 86.3         | 98.7         |
| Background       | 5.0   | 5.0          | 5.0          | 5.0          | 5.0          | 5.0          |
|                  | <u>178.4</u>  | <u>184.9</u> | <u>182.0</u> | <u>134.6</u> | <u>152.1</u> | <u>169.5</u> |