

# Early Action Compact

# Ozone Action Plan

**Proposed Revision to the State Implementation Plan**

**Approved by:**  
**Colorado Air Quality Control Commission**  
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## INTRODUCTION

State and regional agencies in the Denver metropolitan area entered into a voluntary agreement with the U.S. Environmental Protection Agency in December 2002 that lays out a process for achieving attainment with EPA's new 8-hour ozone standard in an expeditious manner. Called an Early Action Compact for Ozone ("the EAC"), the agreement sets forth a schedule for the development of technical information and the adoption and implementation of the necessary control measures into the state implementation plan (SIP) in order to comply with the 8-hour standard by December 31, 2007 and maintain the standard beyond that date.

This document, the Early Action Compact Ozone Action Plan ("EAC Ozone Action Plan") contains the enforceable plan required by the Early Action Compact for bringing the Front Range 8-hour ozone control area into attainment with the 8-hour standard.

### A. NATIONAL AMBIENT AIR QUALITY STANDARDS FOR OZONE

The Federal Clean Air Act (CAA) is the comprehensive law that regulates airborne emissions from area, mobile, and stationary sources nationwide. This law authorizes the EPA to establish NAAQS to protect public health and the environment. The EPA currently has two NAAQS for ozone, the 1-hour peak standard and the 8-hour standard.

#### **1-Hour Standard and the Denver Metropolitan Area**

An area must have a monitored hourly peak ozone concentration below 0.125 parts per million (ppm) to meet the 1-hour ozone standard. If an area exceeds the standard more than three times in three years, it is subject to a nonattainment designation.

The Denver metro area has not violated the 1-hour standard since 1988, and the area was redesignated to attainment for the 1-hour ozone NAAQS on September 11, 2001 (effective October 11, 2001).

#### **8-Hour Standard and the Front Range Area**

In 1997 EPA established a new, more stringent standard for ozone. The new 8-hour standard is set at a level of 0.08 ppm (or 80 parts per billion) averaged over an eight-hour period. To take into account extreme and variable meteorological conditions that can influence ozone formation, a violation of the standard occurs when the three-year average of the fourth maximum values at a monitor exceeds the federal standard. Due

to rounding of monitoring values, a violation occurs when the three-year average is equal to or greater than 0.085 ppm.

During the past several years, public education, outreach and voluntary measures have been implemented in the front range area as ozone concentrations have approached and occasionally exceeded the value permitted by the 8-hour ozone NAAQS. Based on the 2000-2002, 3-year average, the Denver metro region demonstrated compliance with the 8-hour ozone NAAQS. However, in summer 2003, elevated values of 8-hour ozone caused the Denver metro region 3-year average to violate the 8-hour ozone NAAQS in 2001-2003.

In April 2004, EPA will designate and classify areas of the country that violate the 8-hour standard. Based on the most recent three years of data (2001-03), the Front Range 8-hour ozone control area is slated to be designated non-attainment by EPA. However, by implementing the Early Action Compact, EPA will defer the non-attainment designation as long as region continues to meet the terms of the agreement and demonstrates attainment by December 31, 2007. Failure to meet the obligations of the agreement will result in immediate reversion to the traditional nonattainment process.

## **B. EARLY ACTION COMPACT FOR OZONE**

### **EPA Early Action Compact Protocol**

EPA developed the Protocol for Early Action Compacts (EAC Protocol) on June 19, 2002, supplemented on October 18, 2002. In exchange for relief from certain provisions of the nonattainment area requirements, the protocol establishes a two-step process that offers a more expeditious time line for achieving the 8-hour ozone standard than expected under EPA's 8-hour ozone standard implementation rulemaking.

The principles of the EAC Protocol to be executed by Local, State and EPA officials are:

- Early planning, implementation, and emission reductions leading to expeditious attainment and maintenance of the 8-hour ozone standard;
- Local area control of the measures to be employed, with broad-based public input;
- State support to ensure technical integrity of the early action plan;
- Formal incorporation of the early action plan into the state implementation plan (SIP);
- Deferral of the effective date of nonattainment designation and related requirements so long as all terms and milestones are met; and
- Safeguards to return areas to traditional nonattainment SIP requirements should terms and/or milestones are unfulfilled, with appropriate credit given for emission reduction measures implemented.

When EPA's 8-hour implementation guidelines call for designations, EPA will defer the effective date of any nonattainment designation and related requirements for participating areas that fail to meet the 8-hour ozone standard as long as all terms and milestones of the compact are being met. If the nonattainment designation is deferred, EPA will move expeditiously to designate the area as attainment and impose no additional requirements, provided that the monitors in the area reflect attainment by December 31, 2007.

If at any time the area does not meet all the terms of the compact, including meeting agreed-upon milestones, then it will forfeit its participation and its attainment or nonattainment designation (or redesignation if necessary) will become effective. The EPA will offer such an area no delays, exemptions or other favorable treatment because of its previous participation in this program.

If the area violates the standard as of December 31, 2007, and the area has had the effective date of any nonattainment designation deferred, such nonattainment designation will become effective. The State must then submit a revised attainment demonstration SIP revision according to the Clean Air Act (CAA) and EPA's 8-hour implementation rule, unless the 8-hour implementation schedule requires SIPs from 8-hour nonattainment areas before December 31, 2008. In that event, a revised attainment demonstration SIP revision for the participating area will be due as soon as possible but no later than December 31, 2008. In no event will EPA extend the attainment date for the area beyond that required by the CAA and/or EPA's 8-hour implementation rule. The region will not be allowed to renew this EAC after December 31, 2007, or to initiate a new compact if it has previously forfeited its participation.

### **Denver Area Early Action Compact**

In December 2002 state and regional agencies with responsibilities for air quality and transportation planning in the Denver metro area entered into a Memorandum of Agreement (MOA) with EPA Region 8 consistent with terms specified in the EPA's EAC Protocol. Signatories to the agreement were:

- Denver Regional Air Quality Council (RAQC)
- Colorado Air Quality Control Commission (AQCC)
- Colorado Department of Public Health and Environment (CDPHE)
- Denver Regional Council of Governments (DRCOG)
- Colorado Department of Transportation (CDOT)
- U.S. Environmental Protection Agency, Region 8
- In December 2003, in a letter to the Governor of the State of Colorado, the EPA proposed including a total of 11 counties in the north Front Range 8-Hour Nonattainment Area, including the 8 counties listed in the

Denver/Boulder/Greeley consolidated statistical metropolitan area (CMSA), plus Larimer, Morgan and Elbert counties. In January and February 2004 the county commissioners of Weld, Larimer, Morgan and Elbert counties agreed to join the EAC and sign the MOA.

The Compact agreement established several planning milestones that must be met for the Compact to remain in effect. These milestones are:

- June 16, 2003 – Potential state, local and other emission reduction strategies identified and described (*milestone met*);
- March 31, 2004 – RAQC must complete a proposed EAC Ozone Action Plan and submit the plan to the AQCC for public rulemaking hearing (*milestone met with proposal to AQCC on December 18, 2003*)
- December 31, 2004 – State must complete public rulemaking hearings, adopt the EAC Ozone Action Plan as part of the SIP, and submit the plan to EPA for approval
- September 30, 2005 – EPA must take final action on the SIP submittal
- December 31, 2005 – Additional emission reduction strategies implemented no later than this date
- December 31, 2007 – Attainment of the 8-hour standard demonstrated

The Compact agreement also establishes several other requirements that must be included in the early action SIP and planning process:

### **Reporting**

The RAQC and the AQCC will assess and report progress towards milestones in a regular, public process, at least every six months, beginning in June 2003 and concluding on December 31, 2007.

### **Emissions Inventories**

Emission inventories used in this EAC Ozone Action Plan were developed for summer episode day for the years 2002, 2007, and 2012 using EPA's MOBILE6 emissions model and the latest transportation information; area sources using a combination of EPA's NONROAD model data, latest demographics information, local equipment populations and usage rates, area source data, and local survey and information data, and the latest stationary sources emissions information, as required by the EAC. Future year inventories will sufficiently account for projected future growth in ozone precursor emissions through 2007, particularly from stationary, area, and mobile sources. Emissions inventories were compared and analyzed for trends in emission sources over time.

## **Dispersion Modeling**

Base and future case dispersion modeling is required, and was performed for the EAC Ozone Action Plan. All modeling is SIP quality and performed within EPA's accepted margin of accuracy; is carefully documented; sufficiently accounts for projected future growth in ozone precursor emissions; will be concurrently reviewed by EPA; and was used to determine the effectiveness of NO<sub>x</sub> and/or VOC reductions. The control case was used to determine the relative effectiveness of different emission reduction strategies and to aid in the selection of appropriate emission reduction strategies. Modeling is based on the "Draft Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS" (EPA-454/R-99-004, May 1999). The modeling follows the guidance as facilitated by EPA Region 8.

## **Emission Reduction Strategies**

All adopted Federal and State emission reduction strategies that have been or will be implemented by the December 31, 2007 attainment date are included in all emission inventories. The selected strategies will be implemented as soon as practical, but no later than December 31, 2005. The emission reduction strategies will be specific, quantified, permanent and enforceable. The strategies will also include specific implementation dates and detailed documentation and reporting processes.

## **Maintenance for Growth**

The plan includes a component to address emissions growth at least 5 years beyond December 31, 2007, ensuring that the area will remain in attainment of the 8-hour standard during that period.

## **Public Involvement**

Public involvement was conducted in all stages of planning by the signatory parties. Several stakeholder meetings were held, and public comment on the EAC Ozone Action Plan complies with the normal SIP revision and public hearing process.

## **AREA ENCOMPASSED BY THE EAC OZONE ACTION PLAN**

At the time of the adoption of this plan by the Air Quality Control Commission, the EPA had proposed, but had not yet finalized, the boundaries of 8-hour ozone nonattainment area in Colorado. See, *EPA Responses to State and Tribal 8-Hour Ozone Air Quality Designation Recommendations*, 68 Federal register 68805 (December 10, 2003). This EAC Ozone Action Plan shall not apply outside the boundaries for the 8-hour ozone non-attainment area finally designated by the EPA.

The area of applicability of the plan should not be confused with the geographic area of the supporting air quality analysis. The air quality analysis includes emissions inventories from most of the western United States. The area of applicability includes county inventories that may ultimately be excluded from the nonattainment boundaries and, therefore, from the scope of this EAC Ozone Action Plan. Such inventories merely are a part of the technical basis for the attainment demonstration, and should not be construed to describe the scope of the plan. As indicated above, the geographic scope of the plan shall be determined by the final boundaries set by the U.S. EPA.

#### **INTRODUCTION IS NOT PART OF THE SIP**

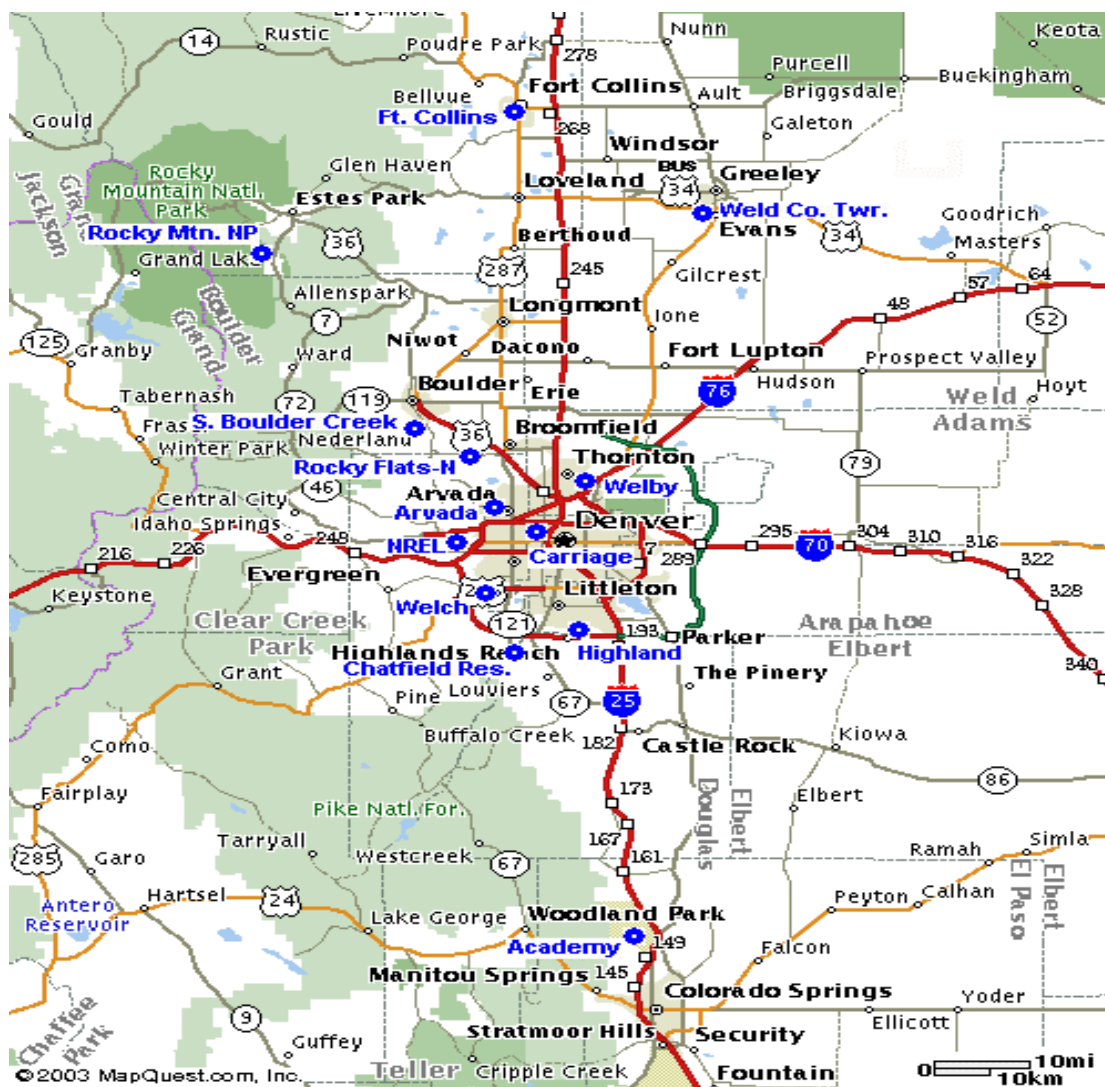
This Introduction section shall not be construed to be a federally-enforceable SIP, or incorporate the quoted provisions of the EAC into the SIP; except; however, the requirements of this plan shall not be applicable in any county or portion thereof excluded from the 8-hour ozone non-attainment area boundary by EPA as described above.

# OZONE MONITORING INFORMATION

## A. Ozone Monitoring Network

The current ozone ambient air monitoring network in the Denver area and along the Front Range consists of 12 stations operated by the Colorado Air Pollution Control Division (APCD) and one station operated by the National Park Service (NPS) in Rocky Mountain National Park. There have been other stations that have operated in the past. The geographical distribution of the Denver area monitors is presented in Figure 1.

Figure 1



This section shall not be construed to establish a monitoring network in the federally-enforceable SIP. EPA has already approved a monitoring SIP for the State of Colorado and this description of the ozone monitoring network shall not be construed to amend such monitoring SIP.

**B. Quality Assurance Program**

Ozone monitoring data for the Denver area have been collected and quality-assured in accordance with 40 CFR, Part 58, Appendix A, EPA’s “Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. 11; Ambient Air Specific Methods”, the APCD’s Standard Operating Procedures Manual, and Colorado’s Monitoring SIP which EPA approved in 1993. The data are recorded in EPA’s Aerometric Information Retrieval System (AIRS) and are available for public review at the APCD and through EPA’s AIRS database. Table 1 presents the data recovery rates for each monitoring site in the Denver and northern Front Range area. Percent data recovery is the number of valid sampling days occurring within the "ozone season", divided by the total number of days encompassing the "ozone season". A valid sampling day is one in which at least 75% of the hourly maxima are recorded.

**Table 1  
Ozone Data Recovery Rates for Each Monitoring Site**

Years	Welby Data Recovery	Highland Data Recovery	S. Boulder Creek Data Recovery	Boulder Marine St. Data Recovery	Carriage Data Recovery
1998	99%	99%	99%	99%	98%
1999	99%	98%	99%	no data	94%
2000	99%	99%	98%	no data	89%
2001	95%	90%	98%	no data	94%
2002	94%	96%	96%	no data	96%
2003	95%	96%	98%	no data	99%

Years	Chatfield Data Recovery	Arvada Data Recovery	Welch Data Recovery	R. Flats North Data Recovery
1998	84%	98%	99%	97%
1999	72%	93%	99%	97%
2000	93%	98%	94%	99%
2001	90%	99%	97%	97%
2002	94%	98%	98%	95%
2003	93%	97%	97%	99%

**Table 1 (continued)  
Ozone Data Recovery Rates for Each Monitoring Site**

Years	NREL Data Recovery	RMNP Data Recovery	Ft. Collins Data Recovery	Greeley/Weld County Data Recovery*
1998	100%	85%	99%	97%
1999	63%	98%	93%	97%
2000	98%	94%	98%	96%
2001	96%	100%	90%	99%
2002	99%	99%	85%	99%
2003	99%	100%	97%	96%

\* The Greeley monitor was moved from 811 15th St. to the Weld County site at 3101 35th Ave. in 2002.

**C. Monitoring Network/Verification of Continued Attainment**

The APCD has and will continue to operate an appropriate air quality monitoring network of National Air Monitoring System (NAMS) and State/Local Air Monitoring System (SLAMS) monitors in accordance with 40 CFR Part 58 to verify the attainment of the 8-hour ozone NAAQS. If measured mobile source parameters (e.g., vehicle miles traveled, congestion, fleet mix, etc.) change significantly over time, the APCD will perform the appropriate studies to determine whether additional and/or re-sited monitors are necessary. Annual review of the NAMS/SLAMS air quality surveillance system will be conducted in accordance with 40 CFR 58.20(d) to determine whether the system continues to meet the monitoring objectives presented in Appendix D of 40 CFR Part 58.

**D. Monitoring Data**

Tables 2 and 3 below present the monitoring data for the APCD's Denver and northern Front Range monitoring sites and the NPS Rocky Mountain National Park monitoring site. For each site, the fourth maximum 8-hour ozone concentrations along with the 3-year averages of the 4<sup>th</sup> maximum concentrations at each site are presented.

**Table 2**  
**4th Maximum 8-Hour Ozone Values**

	<b>AIRS #</b>	<b><u>1996</u> 8-hr. O3 4th Max. (ppm)</b>	<b><u>1997</u> 8-hr. O3 4th Max. (ppm)</b>	<b><u>1998</u> 8-hr. O3 4th Max. (ppm)</b>	<b><u>1999</u> 8-hr. O3 4th Max. (ppm)</b>	<b><u>2000</u> 8-hr. O3 4th Max. (ppm)</b>	<b><u>2001</u> 8-hr. O3 4th Max. (ppm)</b>	<b><u>2002</u> 8-hr. O3 4th Max. (ppm)</b>	<b><u>2003</u> 8-hr. O3 4th Max. (ppm)</b>
Welby	08-001-3001	0.074	0.071	0.083	0.071	0.062	0.064	0.068	0.066
Highland	08-005-0002	0.073	0.065	0.084	0.075	0.076	0.077	0.076	0.091
S. Boulder Creek	08-013-0011	0.075	0.072	<b>0.089</b>	0.075	0.072	0.071	0.078	0.082
Carriage	08-031-0014	0.068	0.066	<b>0.085</b>	0.068	0.071	0.072	0.073	<b>0.085</b>
Chatfield Res.	08-035-0002	0.079	0.075	0.081	0.075	0.080	0.077	0.083	<b>0.095</b>
Arvada	08-059-0002	0.073	0.070	<b>0.089</b>	0.072	0.076	0.074	0.073	0.083
Welch	08-059-0005	0.069	0.068	0.080	0.066	0.068	0.064	0.069	0.077
Rocky Flats North	08-059-0006	0.083	0.076	<b>0.092</b>	0.080	0.081	0.082	<b>0.088</b>	<b>0.091</b>
NREL	08-059-0011	0.082	0.075	<b>0.095</b>	0.080	0.083	0.081	0.081	<b>0.095</b>
Fort Collins	08-069-1004	0.066	0.064	0.072	0.063	0.070	0.067	0.072	0.075
Greeley	08-123-0007	0.070	0.069	0.075	0.069	0.069	0.074	(Shut down)	(Shut down)
Weld County Tower	08-123-0009	---	---	---	---	---	---	(0.080)	0.083
Rocky Mountain N.P.	---	0.072	0.069	0.080	0.074	0.078	0.070	<b>0.087</b>	<b>0.086</b>

**Table 3**  
**8-Hour Ozone**  
**4<sup>th</sup> Maximum and Three-Year Average 4th Maximum Ozone Values**

<b>Site Name</b>	<b><u>2000</u></b> 4th Max. Value (ppm)	<b><u>2001</u></b> 4th Max. Value (ppm)	<b><u>2002</u></b> 4th Max. Value (ppm)	<b><u>2003</u></b> 4th Max. Value (ppm)	<b><u>2000-02</u></b> 3-yr. Avg. 4th Max. Value (ppm)	<b><u>2001- 03</u></b> 3-yr. Avg. 4th Max. Value (ppm)
Welby	0.062	0.064	0.068	0.066	0.065	0.066
Highland	0.076	0.077	0.076	0.091	0.076	0.081
S. Boulder Creek	0.072	0.071	0.078	0.082	0.074	0.077
Carriage	0.071	0.072	0.073	0.085	0.072	0.076
Chatfield Res.	0.080	0.077	0.083	0.095	0.080	<b>0.085</b>
Arvada	0.076	0.074	0.073	0.083	0.074	0.076
Welch	0.068	0.064	0.069	0.077	0.067	0.070
Rocky Flats North	0.081	0.082	0.088	0.091	0.084	<b>0.087</b>
NREL	0.083	0.081	0.081	0.095	0.082	<b>0.085</b>
Fort Collins	0.070	0.067	0.072	0.075	0.070	0.071
Greeley	0.069	0.074	(Shut down)	(Shut down)	---	---
Weld County Tower	---	---	(0.080)	(0.083)	(0.080)	(0.081)
Rocky Mtn. N.P.	0.078	0.070	0.087	0.086	0.078	0.081

## CHAPTER I:      **BASE CASE EMISSIONS INVENTORIES**

This section presents emission inventories for this EAC Ozone Action Plan for the 8-hour ozone control area 2002 base case and the 2007 base case used in the modeling scenarios. Inventories for the 8-hour ozone control area 2007 control case modeling will be presented later in this document and will include the additional control measures that are needed to demonstrate attainment of the 8-hour ozone NAAQS. All of the base and control case modeling inventories are for all of the eight counties in the Denver/Boulder/Greeley CMSA: Denver, Jefferson, Douglas, Broomfield, Boulder, Adams, Arapahoe and Weld plus Larimer, Morgan and Elbert counties. These inventories represent emissions estimates for an average episode day during the summer ozone season (May through September).

The emission estimates were developed based on the most recent demographic data and vehicle miles traveled (VMT) estimates contained in 1) DRCOG's conformity analysis for the updated fiscally constrained element of the 2025 Regional Transportation Plan, and 2) North Front Range Transportation and Air Quality Planning Council's (NFRTAQPC) 2025 Regional Transportation Plan. Table 4 presents this information.

**Table 4  
Demographic Data**

<b>DRCOG Demographics</b>	<b>2002</b>	<b>2007</b>	<b>2012</b>
Population	2,492,627	2,718,479	2,944,330
Households	1,083,751	1,181,947	1,280,144
Employment	1,492,115	1,636,654	1,781,192
VMT	63,493,136	70,537,153	77,362,474
<b>NFRTAQPC Demographics</b>	<b>2002</b>	<b>2007</b>	<b>2012</b>
Population	332,030	403,534	463,121
Households	144,360	175,450	201,366
Employment	177,880	204,951	238,791
VMT	12,433,458	14,903,717	17,052,833

The 2002 and 2007 base case modeling inventories incorporate the control measures in place at that time. Control measures in place in 2002 and assumed for 2007 include:

1. Federal tailpipe standards and regulations, including those for small engines and non-road mobile sources. Credit is taken for these federal requirements but they

are not part of the Colorado SIP. The credits change from 2002 to 2007 as EPA Tier II and low sulfur gasoline standards become effective.

2. Air Quality Control Commission Regulation No. 11 -- covering the Automobile Inspection and Readjustment (A.I.R.) program in place during the 2002 ozone season, which includes an enhanced Inspection/Maintenance (I/M). For 2007, a maximum of 50% fleet coverage is assumed for the remote sensing clean screen program in the DMA based on a proposed change in Reg. 11. Regulation No. 11 also contains state-only, basic I/M programs in the Colorado Springs and Fort Collins/Greeley areas. The computer modeling does not include any credit for the basic programs in the Colorado Springs and Fort Collins/Greeley areas and such basic programs are not part of, or being submitted for inclusion in, the SIP.
3. Air Quality Control Commission Regulations No. 3, No. 6, No. 7, and Common Provisions – covering gasoline station and industrial source control programs. The Common Provisions, Parts A and B of Regulation No. 3, and the VOC control requirements of Regulation No. 7 are already included in the approved SIP. Regulation No. 6 and Part C of Regulation No. 3 implement the federal standards of performance for new stationary sources and the federal operating permit program. This reference to Regulation No. 6 and Part C of Regulation No. 3 shall not be construed to mean that these regulations are included in the SIP.
4. Since 1991, gasoline sold in the Denver metro area during the summer ozone season (June 1 to September 15) has been subject to a national Reid Vapor Pressure (RVP) limit of 7.8 pounds per square inch (psi) in order to reduce fuel volatility. For ethanol-blended fuels, the RVP limit is 8.8 psi due to the federal 1.0 psi RVP waiver for ethanol. The EPA has granted waivers to allow a 9.0 psi RVP (10.0 psi for ethanol blends) gasoline in the Denver area instead of the more stringent 7.8 psi limit.

For 2002, because of voluntary efforts to reduce the gasoline RVP, the RVP of the base gasoline was measured at 8.2 psi; ethanol (10% blend) market share was measured at 20%. In other words, 80% of the gasoline was at 8.2 psi RVP, and 20% of the gasoline was at 9.2 psi RVP.

For purposes of the base case 2007 mobile source inventory, the RVP of the base gasoline is assumed to be 9.0 psi, as requested in the maintenance plan submitted by the Governor to support redesignation to attainment for the 1-hour ozone standard (Ozone Redesignation Request and Maintenance Plan for the Denver Metropolitan Area). The ethanol (10% blend) market share is assumed to be 25% based on future ethanol market share average projected by the

industry. In other words, 75% of the gasoline is assumed to be 9.0% psi RVP, and 25% of the gasoline is assumed to be 10.0 psi RVP.

All of the inventories were developed using EPA-approved emissions modeling methods, including EPA's MOBILE6 model and local VMT data for on-road mobile source emissions, EPA's non-road model and local demographic information for area and off-road sources, and reported actual emissions for point sources. Estimates for future emissions are based on the above-mentioned tools and the EPA's Economic Growth and Analysis System (EGAS) model for estimating future point sources activity, VMT growth for on-road mobile sources, and 2007 and 2012 demographic data for off-road and area sources. The EAC Ozone Action Plan's technical support document contains detailed information on model assumptions and parameters for each source category.

Summaries of the VOC and NOx base case inventories for the 8 county and the 11 county areas, for 2002 and 2007, are presented in Tables 5a and 5b, respectively, below. Emissions of NOx and VOCs are in tons per average episode day. Additional detail on the categories of emissions can be found in the technical support document.

### **Wildfire Emissions Estimates**

Wildfire emissions, though not included in Tables 5a and 5b, have been considered for the background ozone concentrations in the modeling effort. Wildfire emissions can vary wildly on a day-to-day basis depending on conditions. The average daily wildfire emissions in the modeling episodes are estimated at approximately 15 tpd for VOC, 323 tpd for CO and 7 tpd for NOx.

**Table 5a**  
**2002 and 2007 Base Case Emission Inventories**  
 (tons per average episode day)  
**Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas,**  
**Jefferson and Weld Counties**

Source Category	2002 VOCs (tons/day)	2007 VOCs (tons/day)	2002 NOx (tons/day)	2007 NOx (tons/day)
Flash	133.9	146.1	0	0
Gas Stations	22.3	16.0	0.1	0.1
Oil and Gas Production	4.1	4.5	0.2	0.2
Reciprocating Internal Combustion Engines	7.8	8.7	93.5	94.7
Other Stationary Sources	24.6	28.8	11.4	12.2
<b>Total Point</b>	<b>192.8</b>	<b>204.1</b>	<b>105.2</b>	<b>107.1</b>
Automotive After Market Products	27.2	29.0	0	0
Architectural Coatings	19.5	20.8	0	0
Household and Personal Products	17.0	18.2	0	0
Adhesives and Sealants	14.7	15.7	0	0
Pesticide Application	8.9	10.0	0	0
Other Area Sources	9.6	10.4	25.60	27.6
<b>Total Area</b>	<b>96.9</b>	<b>104.1</b>	<b>25.60</b>	<b>27.6</b>
Lawn & Garden	47.3	31.2	9.31	9.3
Other Off-road	25.8	22.5	78.7	73.2
Total Off-road	<b>73.1</b>	<b>53.7</b>	<b>87.99</b>	<b>82.5</b>
<b>On-road Mobile</b>	<b>152.8</b>	<b>117.5</b>	<b>157.8</b>	<b>119.3</b>
<b>Total Anthropogenic</b>	<b>515.6</b>	<b>479.4</b>	<b>376.6</b>	<b>336.5</b>
Total Biogenic	468.1	468.1	37.1	37.1
<b>Total</b>	<b>983.7</b>	<b>947.5</b>	<b>413.7</b>	<b>373.6</b>

Note: Inventories merely are a part of the technical basis for the attainment demonstration, and should not be construed to describe the scope of the plan. The geographic scope of the plan shall be determined by the final boundaries set by the U.S. EPA.

**Table 5b**  
**2002 and 2007 Base Case Emission Inventories**  
(tons per average episode day)  
**Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas,**  
**Jefferson, Weld, Elbert, Larimer and Morgan Counties**

Source Category	2002 VOCs (tons/day)	2007 VOCs (tons/day)	2002 NOx (tons/day)	2007 NOx (tons/day)
Flash	134.3	147.2	0.0	0.0
Gas Stations	24.5	17.5	0.1	0.1
Oil and Gas Production	4.2	4.6	0.2	0.2
Reciprocating Internal Combustion Engines	9.0	9.9	125.8	129.7
Other Stationary Sources	28.0	30.1	14.1	15.0
<b>Total Point</b>	<b>200.0</b>	<b>209.3</b>	<b>140.1</b>	<b>144.9</b>
Automotive After Market Products	30.0	32.1	0.0	0.0
Architectural Coatings	21.5	23.0	0.0	0.0
Household and Personal Products	18.8	20.1	0.0	0.0
Adhesives and Sealants	16.3	17.4	0.0	0.0
Pesticide Application	11.7	13.1	0.0	0.0
Other Area Sources	12.9	14.0	30.4	32.7
<b>Total Area</b>	<b>111.3</b>	<b>119.6</b>	<b>30.4</b>	<b>32.7</b>
Lawn & Garden	53.0	35.0	10.4	10.4
Other Off-road	31.9	27.6	94.2	82.1
<b>Total Off-road</b>	<b>84.9</b>	<b>62.6</b>	<b>104.6</b>	<b>92.4</b>
<b>On-road Mobile</b>	<b>172.6</b>	<b>135.1</b>	<b>177.6</b>	<b>136.6</b>
<b>Total Anthropogenic</b>	<b>568.8</b>	<b>526.6</b>	<b>452.7</b>	<b>406.6</b>
Total Biogenic	799.46	799.5	52.3	52.3
<b>Total</b>	<b>1368.3</b>	<b>1326.1</b>	<b>505.0</b>	<b>458.9</b>

Note: Inventories merely are a part of the technical basis for the attainment demonstration, and should not be construed to describe the scope of the plan. The geographic scope of the plan shall be determined by the final boundaries set by the U.S. EPA.

## **CHAPTER II: CONTROL MEASURES**

This section of the EAC Ozone Action Plan lists the additional control measures, above and beyond those assumed in the 2007 base case inventory described in Chapter 1 that are incorporated into the SIP to demonstrate attainment of the 8-hour ozone NAAQS by 2007 and maintenance of such standard through 2012. For purposes of this EAC Ozone Action Plan, and for inclusion of such control measures in the state implementation plan, the term "8-hour ozone control area" shall mean the area designated by the EPA as a deferred non-attainment area for the 8-hour ozone standard.

### **A. Reid Vapor Pressure**

Since 1991, gasoline sold in the Denver area during the summer ozone season (June 1 to September 15 for gasoline RVP) has been subject to a national Reid Vapor Pressure (RVP) limit of 7.8 pounds per square inch (psi) in order to reduce fuel volatility. For ethanol blends the limit has been 8.8 psi. Since the Denver area has not violated the 1-hour ozone standard since the late 1980's, the state has requested, and EPA has granted, waivers to allow 9.0 psi RVP (10.0 psi for ethanol blends) gasoline in the Denver area instead of the more stringent 7.8 RVP limit.

Photochemical modeling analyses performed during this EAC process indicates little to no improvement (TSD Appendix L) in predicted ozone levels between a 7.8 and 8.1 RVP. APCD cost estimates indicate a doubling of costs to industry to provide 7.8 RVP over 8.1 RVP fuel. Because of these two considerations this EAC Ozone Action Plan proposes an 8.1 RVP fuel.

Therefore, since this EAC ozone action plan for the 8-hour ozone standard relies on an RVP level of 8.1 psi (9.1 psi for ethanol blends) in the 2007 control case inventory for the existing Denver 1-hour ozone attainment/maintenance area, the State of Colorado requests a three year waiver establishing an 8.1 psi (9.1 psi for ethanol blends) RVP level for the existing Denver 1-hour ozone attainment/maintenance area through the 2007 summer ozone season.

### **B. Condensate Tank Emissions Controls**

The EAC Ozone Action Plan includes an amendment to Regulation No. 7 to require the reduction of flash emissions of volatile organic compounds from condensate collection, storage, processing and handling operations. The rule requires the installation of air pollution control technology to achieve at least a 47.5% reduction from uncontrolled emissions of volatile organic compounds from new and existing oil and gas exploration and production operations, natural gas compressor stations, and natural gas drip stations located within the 8-hour ozone control area designated by EPA. The rule includes an exemption if total emissions are less 30 tons per year.

### **C. Controls for Stationary Engines**

The EAC Ozone Action Plan includes an amendment to Regulation No. 7 to require the installation of controls on new and existing rich burn and lean burn natural gas fired stationary reciprocating internal combustion engines (RICE) larger than 500 horsepower located in the 8-hour ozone control area. In this case, controls installed for uncontrolled rich burn RICE shall be non-selective catalyst reduction and an air fuel ratio controller or other equally effective air pollution control technology, and for uncontrolled lean burn RICE shall be oxidation catalyst reduction, or other equally effective air pollution control technology. Existing lean burn RICE may obtain an exemption upon demonstration that cost of emissions control will exceed \$5000/ton of VOC reduced.

### **D. Controls for Dehydrators**

The EAC Ozone Action Plan includes an amendment to Regulation No. 7 to require the reduction of emissions of volatile organic compounds from new and existing dehydration towers at oil and gas operations with emissions in excess of 15 tons per year.

### **E. Revisions to Regulation No. 11 - Automobile Inspection and Readjustment Program**

The EAC Ozone Action plan includes an amendment to Regulation No. 11 to reduce the coverage of the remote sensing clean screen area in order to reduce the disbenefit of the program and to reflect the practical reality of potential coverage. No more than 50 percent of the fleet of gasoline vehicles in the enhanced program area will be evaluated with remote sensing during any twelve-month period after December 31, 2005.

Previously adopted state-only regulations establishing hydrocarbon limits and requiring gas cap pressure checks are hereby included.

## **CHAPTER III: PHOTOCHEMICAL MODELING & OTHER WEIGHT OF EVIDENCE ANALYSES FOR ATTAINMENT DEMONSTRATION**

### **A. Photochemical Modeling for the 2002 and 2007 Base Case Scenarios**

Photochemical grid modeling was required and performed under the EAC Ozone Action Plan for the 8-Hour Ozone Control Area. The goal of the EAC's 8-hour ozone modeling analysis was to conduct a comprehensive photochemical modeling study for the Denver-north front range region that can be used as the technical basis for demonstrating attainment with the 8-hour ozone NAAQS.

The photochemical model "Comprehensive Air Quality Model with Extensions" (CAMx) from the consultants ENVIRON International Corporation and Alpine Geophysics Atmospheric Sciences Group was used for this study. Meteorological fields for input into CAMx were produced using the Mesoscale Meteorological Model (MM5). Model ready emissions data for the 2002 and 2007 base case were processed through the Emissions Processing System (EPS2x). The photochemical modeling study was conducted in accordance with EPA modeling guidance for ozone and a prepared modeling protocol. The modeling protocol was specifically designed to identify the processes responsible for 8-hour ozone exceedances in the region and to develop realistic emissions reduction strategies for the ozone exceedances.

Several technical documents are available that detail the meteorological, emissions, and photochemical modeling and are included in the Technical Support Document for this plan. Technical support documentation for modeling include:

- Modeling Protocol, Episode Selection, and Domain Definition
- Episode Selection for the Denver Early Action Ozone Compact
- Evaluation of MM5 Simulations of the Summer '02 Denver Ozone Season and Embedded High 8-hr Ozone Episodes
- Development of the 2002 Base Case Modeling Inventory
- Development of the 2007 Base Case Modeling Inventory
- Preliminary Photochemical Base Case Modeling and Model Performance Evaluation for the Summer '02 Denver Ozone Season and Embedded High 8-hour Ozone Episodes
- Draft Final Air Quality Modeling for the Denver EAC Ozone Compact, 2007 Base Case, Control Strategy and Sensitivity Analysis Modeling
- Draft Additional Air Quality Modeling Analysis to address 8-Hour ozone Attainment for the Denver EAC

## B. Base Case Relative Reduction Factors (RRF)

The modeling produces base case relative reduction factors (RRF) for receptors in the modeling domain where ozone monitors are located. In general, the RRF for each monitor is equal to the mean 2007 base case modeled 8-hour ozone concentration divided by the mean 2002 base case modeled 8-hour concentration. Specifically, each RRF is the summation of all 2007 daily 8-hour predicted maximum concentrations greater than 0.070 ppm "nearby" (within 15 kilometers) a monitor during a given episode divided by the summation of all 2002 daily 8-hour predicted maximum concentrations greater than 0.070 ppm within 15 kilometers of the monitor during a given episode as shown below. (Based on EPA's May 1999 "Draft Guidance On the Use of Models and Other Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS.")

$$\text{Relative Reduction Factor (RRF)} = \frac{\text{Mean 2007 Base Case Modeled 8-hour Ozone Conc. (ppm)}}{\text{Mean 2002 Base Case Modeled 8-hour Ozone Conc. (ppm)}}$$

An RRF for each monitoring site for modeled (predicted) days greater than 0.070 ppm is presented in Table 6.

## C. Estimated Future (2007) Base Case Design Value

Once the RRFs are developed, the RRF for each monitoring site is multiplied by the monitoring site's base case design value to determine a future case design value for each site, as shown below, indicating if attainment is demonstrated at each site.

$$\text{Estimated Future Design Value (ppm)} = \text{RRF} * \text{Current Design Value (ppm)}$$

The modeling, though it has met EPA guidelines for use in the EAC process, under predicts actual monitored values by approximately 20%. This results in predicted values in the 8-hour ozone control area, for the 2002 base case less than or very close to 0.070 ppm, which approaches the levels of background ozone, which is estimated to be approximately 0.055 to 0.065 ppm. When expected emission reductions are applied in the 2007 base case or control case and modeled, the resultant predicted values are

similarly very close to 0.070 ppm for many of the days. The resultant RRF calculation offers very slight incremental changes in future ozone design values due to reductions in emissions. This condition is referred to as “stiffness” in the model.

Table 6 presents the current (2001-2003) base case design values for each monitoring site, the base case RRFs for modeled days greater than 0.070 ppm, and the future base case design values for each site. If the future (2007) base case design values are less than 0.085 ppm, then attainment is demonstrated and no additional control measures are needed.

**Table 6  
2007 Base Case Design Values for Each Monitoring Site  
for Modeled Days greater than 0.070 ppm**

Site Name	8-Hour Ozone Current (2001-2003) Base Case Design Values (ppm)	Base Case Relative Reduction Factors	8-Hour Ozone Future (2007) Base Case Design Values (ppm)
Welby	0.066	1.0072	0.0665
Arvada	0.077	0.9975	0.0758
NREL	<b>0.085</b>	0.9946	0.0845
Rocky Flats North	<b>0.087</b>	0.9942	<b>0.0865</b>
S. Boulder Creek	0.077	0.9939	0.0765
Fort Collins	0.071	0.9930	0.0705
Carriage	0.076	0.9881	0.0751
Welch	0.070	0.9848	0.0689
Weld County Tower	(0.082)	0.9845	0.0797
Highland	0.081	0.9844	0.0797
Chatfield Res.	<b>0.085</b>	0.9807	0.0834
Rocky Mtn. N.P.	0.081	0.9772	0.0792

As can be noted attainment at all of the monitors is achieved (design values less than 0.085 ppm) in 2007 for the 8-hour ozone control area with the exception of Rocky Flats North (design value 0.0865 ppm), as a result of the reductions expected from existing programs and regulations. Additional control measures discussed in Chapter II have been applied to bring the Rocky Flats North monitor into attainment.

**D. Weight of Evidence Analysis**

EPA’s 8-hour ozone modeling guidance suggests a weight of evidence attainment determination if the maximum modeled 8-hour ozone Design Value is between 0.084 ppm and 0.089 ppm at more than one monitor. EPA also allows for an attainment

determination based on weight of evidence if the maximum, modeled 8-hour ozone Design Value is less than 90 ppb (0.090 ppm).

Results of corroboratory analyses may be used in a weight of evidence determination to conclude that attainment is likely despite modeled results, which do not quite pass the attainment and/or screening tests. Such corroboratory analyses could include further analysis of modeling detail, emissions trends related to air quality, observation based models (NOx/VOC ratios), other corroborative evidence such as quantifying model uncertainties, considering other design value years, additional data collection, and possibly excluding episode days with ozone concentrations close to 0.070 ppm.

## **E. 2007 Control Case Emission Inventories**

Reductions from control measures described in Chapter II have been applied to the 2007 base case emissions inventories as follows:

- Reid Vapor Pressure of base gasoline assumed to be 8.1 psi (maintains 1.0 psi waiver for ethanol-blended gasoline at 25% market share) – estimated 9 tpd VOC reduction to direct on-road mobile source emissions and 1 tpd VOC reduction in refueling (gas station) emissions.
- Flash emissions controls – estimated 55 tpd reduction in VOC
- Reciprocating internal combustion engine (RICE) controls – approximately 5.5 tpd VOC and 19 tpd NOx reduction
- Dehydrator controls – approximately 0.5 tpd VOC

The total emission reduction, compared to the 2002 base case, for these four control strategies (together with the federal and existing state controls assumed for the 2007 base case) is approximately 106 tons per day VOC and 58 tons per day NOx in the 8-county area (Denver metropolitan area plus Weld County). Emissions reductions associated with the application of these strategies to in Elbert, Larimer and Morgan counties have not been quantified and have not been included in the modeling. The resultant 2007 inventory based on the total RVP reduction plus Flash, RICE and Dehydrator control package noted above is presented in Tables 7a & 8a (VOC) for the 8-county area and 7b & 8b (NOx) for the 11-county area below. As previously noted in Chapter I all of the inventories presented represent a typical average episode day. In the modeling, all anthropogenic source categories can be varied by weekday, weekend day and/or hour of the day, and on-road mobile and biogenic sources are varied by differing meteorological conditions and diurnally varied by temperature.

**Table 7a**  
**VOC Emission Inventories**  
(tons per average episode day)  
Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and Weld Counties

Source Category	2002 Base (tons/day)	2007 Base (tons/day)	2007 Control (tons/day)	2012 Control (tons/day)
Flash	133.9	146.1	91.3	100.9
Gas Stations	22.3	16.0	14.8	10.2
Oil and Gas Production	4.1	4.5	3.7	4.1
Reciprocating Internal Combustion Engines	7.8	8.7	4.8	5.4
Other Stationary Sources	24.6	28.8	28.7	32.3
<b>Total Point</b>	<b>192.8</b>	<b>204.1</b>	<b>143.3</b>	<b>152.9</b>
Automotive After Market Products	27.2	29.0	29.0	31.5
Architectural Coatings	19.5	20.8	20.8	22.6
Household and Personal Products	17.0	18.2	18.2	19.8
Adhesives and Sealants	14.7	15.7	15.7	17.1
Pesticide Application	8.9	10.0	10.0	11.5
Other Area Sources	9.6	10.4	10.4	11.6
<b>Total Area</b>	<b>96.9</b>	<b>104.1</b>	<b>104.1</b>	<b>114.0</b>
Lawn & Garden	47.3	31.2	31.0	26.7
Other Off-road	25.8	22.5	22.6	21.0
<b>Total Off-road</b>	<b>73.1</b>	<b>53.7</b>	<b>53.5</b>	<b>47.7</b>
<b>Total On-road Mobile</b>	<b>152.8</b>	<b>117.5</b>	<b>108.4</b>	<b>76.0</b>
<b>Total Anthropogenic</b>	<b>515.6</b>	<b>479.4</b>	<b>409.3</b>	<b>390.6</b>
Total Biogenic	468.1	468.1	468.1	468.1
<b>Total</b>	<b>983.7</b>	<b>947.5</b>	<b>877.4</b>	<b>858.7</b>

Note: Inventories merely are a part of the technical basis for the attainment demonstration, and should not be construed to describe the scope of the plan. The geographic scope of the plan shall be determined by the final boundaries set by the U.S. EPA.

**Table 7b**  
**VOC Emission Inventories**  
(tons per average episode day)  
Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and Weld Counties  
plus Larimer, Morgan and Elbert Counties

Source Category	2002 Base (tons/day)	2007 Base (tons/day)	2007 Control (tons/day)	2012 Control (tons/day)
Flash	134.3	147.2	92.0	101.7
Gas Stations	24.5	17.5	16.3	11.3
Oil and Gas Production	4.2	4.6	3.7	4.2
Reciprocating Internal Combustion Engines	9.0	9.9	6.0	6.7
Other Stationary Sources	28.0	30.1	30.1	35.4
<b>Total Point</b>	<b>200.0</b>	<b>209.3</b>	<b>148.1</b>	<b>159.2</b>
Automotive After Market Products	30.0	32.1	32.1	34.9
Architectural Coatings	21.5	23.0	23.0	25.0
Household and Personal Products	18.8	20.1	20.1	21.9
Adhesives and Sealants	16.3	17.4	17.4	18.9
Pesticide Application	11.7	13.1	13.1	15.0
Other Area Sources	12.9	14.0	14.0	15.6
<b>Total Area</b>	<b>111.3</b>	<b>119.6</b>	<b>119.6</b>	<b>131.3</b>
Lawn & Garden	53.0	35.0	34.7	30.0
Other Off-road	31.9	27.6	27.9	26.2
<b>Total Off-road</b>	<b>84.9</b>	<b>62.6</b>	<b>62.6</b>	<b>56.2</b>
<b>Total On-road Mobile</b>	<b>172.6</b>	<b>135.1</b>	<b>126.0</b>	<b>89.0</b>
<b>Total Anthropogenic</b>	<b>568.8</b>	<b>526.6</b>	<b>456.4</b>	<b>435.7</b>
Total Biogenic	799.46	799.5	799.5	799.5
<b>Total</b>	<b>1368.3</b>	<b>1326.1</b>	<b>1255.8</b>	<b>1235.2</b>

Note: Inventories merely are a part of the technical basis for the attainment demonstration, and should not be construed to describe the scope of the plan. The geographic scope of the plan shall be determined by the final boundaries set by the U.S. EPA.

**Table 8a**  
**NOx Emission Inventories**  
(tons per average episode day)  
Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and Weld Counties

Source Category	2002 Base (tons/day)	2007 Base (tons/day)	2007 Control (tons/day)	2012 Control (tons/day)
Flash	0	0	0	0
Gas Stations	0.1	0.1	0.1	0.1
Oil and Gas Production	0.2	0.2	0.2	0.2
Reciprocating Internal Combustion Engines	93.5	94.7	75.8	82.8
Other Stationary Sources	11.4	12.2	12.2	13.4
<b>Total Point</b>	<b>105.2</b>	<b>107.1</b>	<b>88.3</b>	<b>96.5</b>
Automotive After Market Products	0	0	0	0
Architectural Coatings	0	0	0	0
Household and Personal Products	0	0	0	0
Adhesives and Sealants	0	0	0	0
Pesticide Application	0	0	0	0
Other Area Sources	25.60	27.6	27.6	31.1
<b>Total Area</b>	<b>25.60</b>	<b>27.6</b>	<b>27.6</b>	<b>31.1</b>
Lawn & Garden	9.31	9.3	9.4	9.3
Other Off-road	78.7	73.2	73.2	65.5
<b>Total Off-road</b>	<b>87.99</b>	<b>82.5</b>	<b>82.6</b>	<b>74.8</b>
<b>Total On-road Mobile</b>	<b>157.8</b>	<b>119.3</b>	<b>119</b>	<b>77.7</b>
<b>Total Anthropogenic</b>	<b>376.6</b>	<b>336.5</b>	<b>317.5</b>	<b>280.1</b>
Total Biogenic	37.1	37.1	37.1	37.1
<b>Total</b>	<b>413.7</b>	<b>373.6</b>	<b>354.6</b>	<b>317.2</b>

Note: Inventories merely are a part of the technical basis for the attainment demonstration, and should not be construed to describe the scope of the plan. The geographic scope of the plan shall be determined by the final boundaries set by the U.S. EPA.

**Table 8b**  
**NOx Emission Inventories**  
 (tons per average episode day)  
 Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and Weld Counties  
 plus Larimer, Morgan and Elbert Counties

Source Category	2002 Base (tons/day)	2007 Base (tons/day)	2007 Control (tons/day)	2012 Control (tons/day)
Flash	0.0	0.0	0.0	0.0
Gas Stations	0.1	0.1	0.1	0.1
Oil and Gas Production	0.2	0.2	0.2	0.2
Reciprocating Internal Combustion Engines	125.8	129.7	110.9	121.3
Other Stationary Sources	14.1	15.0	15.0	16.5
<b>Total Point</b>	<b>140.1</b>	<b>144.9</b>	<b>126.1</b>	<b>138.1</b>
Automotive After Market Products	0.0	0.0	0.0	0.0
Architectural Coatings	0.0	0.0	0.0	0.0
Household and Personal Products	0.0	0.0	0.0	0.0
Adhesives and Sealants	0.0	0.0	0.0	0.0
Pesticide Application	0.0	0.0	0.0	0.0
Other Area Sources	30.4	32.7	32.7	36.7
<b>Total Area</b>	<b>30.4</b>	<b>32.7</b>	<b>32.7</b>	<b>36.7</b>
Lawn & Garden	10.4	10.4	10.5	10.4
Other Off-road	94.2	82.1	82.8	74.1
<b>Total Off-road</b>	<b>104.6</b>	<b>92.4</b>	<b>93.3</b>	<b>84.6</b>
<b>Total On-road Mobile</b>	<b>177.6</b>	<b>136.6</b>	<b>136.3</b>	<b>90.1</b>
<b>Total Anthropogenic</b>	<b>452.7</b>	<b>406.6</b>	<b>388.4</b>	<b>349.4</b>
Total Biogenic	52.3	52.3	52.3	52.3
<b>Total</b>	<b>505.0</b>	<b>458.9</b>	<b>440.7</b>	<b>401.8</b>

Note: Inventories merely are a part of the technical basis for the attainment demonstration, and should not be construed to describe the scope of the plan. The geographic scope of the plan shall be determined by the final boundaries set by the U.S. EPA.

#### F. 2007 Control Case Demonstration

The four individual scenarios above have been modeled in CAMx as a SIP control strategy package. As discussed earlier in this Chapter III, the 2007 base case and 2007 SIP control case modeling produces relative reduction factors (RRF) for receptors in the modeling domain where ozone monitors are located.

As noted, the RRF is applied to the base case (2001-2003) design values for each monitor to calculate the 2007 control case design values based on the formula:

$$2007 \text{ Control Case Design Value} = \text{RRF} * \text{Base Case (2001-03 Design Value)}$$

The RRF and the Design Value for each monitor resulting from the 2007 control case analysis are presented for the modeled days greater than 0.070 ppm and the modeled days greater than 0.080 ppm in the following table:

**Table 9**  
**2007 Control Case Design Values for Each Monitoring Site**  
**for Modeled Days greater than 0.070 ppm**  
**and Modeled Days greater than 0.080 ppm at Rocky Flats N.**

Site Name	8-Hour Ozone Base Case Design Values 2001-2003 (ppm)	Days > 0.070 ppm at All Monitor Sites		Days > 0.080 ppm at Rocky Flat N. Site	
		2007 Control Case RRF	2007 Control Case Design Values (ppm)	2007 Control Case RRF	2007 Control Case Design Values (ppm)
Welby	0.066	0.9993	0.0660	1.0165	0.0671
Arvada	0.077	0.9923	0.0754	0.9871	0.0750
NREL	<b>0.085</b>	0.9891	0.0841	0.9748	0.0829
Rocky Flats North	<b>0.087</b>	0.9888	<b>0.0860</b>	0.9811	<b>0.0854</b>
S. Boulder Creek	0.077	0.9879	0.0761	0.9811	0.0755
Fort Collins	0.071	0.9854	0.0700	0.9769	0.0694
Carriage	0.077	0.9830	0.0747	0.9785	0.0744
Welch	0.070	0.9798	0.0686	0.9748	0.0682
Highland	0.081	0.9795	0.0793	0.9877	0.0800
Weld County Tower	(0.082)*	0.9780	0.0792	0.9788	0.0793
Chatfield Res.	<b>0.085</b>	0.9761	0.0830	0.9779	0.0831
Rocky Mtn. N.P.	0.081	0.9711	0.0787	0.9659	0.0782

\* Based on 2002 & 2003 data. Greeley monitor shut down 2001; Weld County Tower monitor started in 2002.

Attainment is demonstrated when the 2007 Control Case Design Value at each monitor is at 0.085 ppm or less.

As can be seen in the above Table 9, for all days greater than 0.070 ppm all of monitors achieve attainment with predicted design values below 0.085 ppm, except the Rocky Flats North monitor. Considering days greater than 0.080 ppm, all monitors achieve greater reduction in design values as a result of the application of control strategies.

However, the Rocky Flats North monitor is still slightly above 0.085 ppm as a result of the 2007 control case analysis. In the next section, the weight of evidence determination provides more corroborating evidence and technical analysis beyond the dispersion modeling to support a conclusion that attainment is likely to occur.

## **G. Weight of Evidence Determination**

EPA modeling guidance indicates that, if a result of the modeling attainment demonstration is between 0.084 ppm and 0.089 ppm at more than one site, a weight of evidence (WOE) determination should be performed. As can be seen in the above Table 9, all other monitors have 2007 control case design values less than 0.084 ppm. Since the design value at the Rocky Flats North monitor is well below 0.090 ppm, the EPA guidance indicates that more corroborating evidence based on other analyses can be sufficiently convincing to support a conclusion that attainment is likely to occur despite the outcome of dispersion modeling tests.

As discussed by the modeling contractor, Environ (2004), the modeling results appear to be very stiff, that is, the estimated 8-hour ozone Design Values are not very sensitive to local emission controls. The reasons for this stiffness are as follows:

- Anomalous Meteorological Conditions in 2003 -The 2003 ozone season was noted for anomalous temperatures and mixing heights causing more conducive ozone forming meteorological conditions than are reflected in the June 2002 modeling episode. Thus the future design value is overestimated using the observed 2001-2003 design value, and the local control strategies applied are not as effective using the June 2002 modeling episode.
- Under Prediction Tendency of Model - Although the model achieved most of EPA's performance goals, it exhibited a general under prediction tendency so that less ozone was likely attributable to the local emissions than likely occurred in actuality.

### **Weight Of Evidence Analyses**

- **Anomalous Meteorological Conditions in 2003**

Meteorological data is provided in the Technical Support Document (TSD) Appendix O - Weight of Evidence – Inter-Office Memorandum, Reddy February 9, 2004 that demonstrates that lower than average mixing heights and record setting maximum temperatures occurred in 2003.

Trend analysis using the 4<sup>th</sup> maximum concentration at Rocky Flats North, and the Zurbenko-Rao Decomposition Method demonstrates that irrespective of

temperature (and all weather effects for which temperature is a good surrogate) ozone concentrations will trend below the 8-hour ozone standard in future years - TSD Appendix O - Weight of Evidence – Inter-Office Memorandum, Reddy, February 9, 2004

- **Under Prediction Tendency of Model**

Under prediction of the model by approximately 20% is well documented in the 2002 model performance evaluation report. TSD Appendix H.

An analysis of the use of modeled days greater than 70 ppb and modeled days greater than 80 ppb in Table 10 below indicates the stiffness in the modeled data for the days greater than 70 ppb from June 27 through June 30. Only the July 1 episode day has modeled values greater than 70 ppb across the entire monitoring network. Only the July episode day with an estimated 8-hour ozone concentration of 85 ppb is close to both the Design Value (87 ppb) and the observed value on this day (89 ppb). TSD Appendices B, K & L

Analysis of modeled episode days greater than 80 ppb in Table 9 previously presented indicates all monitors for the 2007 control case are below 0.085 ppm, with the exception the Rocky Flat North monitor, which, although slightly above 0.085 ppm demonstrates, through the improved reduction from the observed 2001-2003 design value, that on a day that the modeled performed closer to the Design Value and the observed value, the local control strategies were more effective and sufficient to support the conclusion of attainment. TSD Appendix L

Back Trajectory analyses prepared by the APCD and Environ indicate that local emissions contribute to the high ozone concentrations at the Rocky Flats monitor during this episode. Appendices O

**Table 10**  
**Modeled 2002 Base Case and 2007 Base Case (ppb)**

2002 Base Case: run11a		25-June	26-Jun	27-Jun	28-Jun	29-Jun	30-Jun	1-Jul		
Site	DV	2176	2177	2178	2179	2180	2181	2182	#Days>70	#Days>80
Weld County Tow	81	61	57.2	65.2	60.6	69.4	66.9	<b>70.9</b>	1	
Rocky Mtn. NP	81	63.1	64.3	67.4	62	<b>71.4</b>	<b>76</b>	<b>79.1</b>	3	
Fort Collins	71	63.2	62.6	69.5	59	65.4	<b>70.7</b>	<b>73.5</b>	2	
USAF Academy	73	56.6	63.5	56.6	66.6	61	69.4	<b>70.6</b>	1	
Welch	70	58.9	66.5	69.8	<b>71.7</b>	65.7	<b>73</b>	<b>87.2</b>	3	1
Rocky Flats Nor	87	62.8	62.7	<b>70.9</b>	62.1	<b>70.5</b>	<b>73.8</b>	<b>84.5</b>	4	1
NREL	85	60.4	64.6	<b>70.9</b>	64.9	63.1	<b>73.8</b>	<b>87.2</b>	3	1
Arvada	76	59.8	60	<b>70.8</b>	63.1	69.1	<b>71.8</b>	<b>85.1</b>	3	1
Welby	66	56.6	55.2	62.6	66.5	<b>70</b>	66.2	<b>72.7</b>	2	
S. Boulder Creek	77	63	62.8	<b>70.9</b>	63	<b>70.9</b>	<b>74.1</b>	<b>84.5</b>	4	1
Carriage	76	58.4	62.3	68.8	67.9	66.6	<b>71.9</b>	<b>83.8</b>	2	1
Highland	81	57.4	66.3	62.7	<b>73</b>	69.7	<b>71.9</b>	<b>81.6</b>	3	1
Chatfield Res.	85	57.9	66.5	63.4	<b>73</b>	69.7	<b>71.9</b>	<b>85.9</b>	3	1

**2007 Base Case: 07run11a.a2**

Site	DV	2176	2177	2178	2179	2180	2181	2182
Weld County Tow	81	60.2	56.6	65.1	59.6	68	66.2	<b>69.8</b>
Rocky Mtn. NP	81	63.6	63.5	66	61	<b>69.7</b>	<b>74.8</b>	<b>76.9</b>
Fort Collins	71	62.8	62.2	68.8	58.3	64.2	<b>71.1</b>	<b>72</b>
USAF Academy	73	56.4	62.5	55.9	64.1	59.1	68	<b>68.1</b>
Welch	70	59.1	67.3	69.2	<b>70.1</b>	64.6	<b>72.8</b>	<b>85.5</b>
Rocky Flats Nor	87	64.2	62.3	<b>70.7</b>	61.6	69.3	<b>74.4</b>	<b>83.4</b>
NREL	85	60.8	66.2	<b>70.7</b>	65.4	62.6	<b>74.4</b>	<b>85.5</b>
Arvada	76	60.5	61.8	<b>70.7</b>	62.5	68.5	<b>72</b>	<b>84.5</b>
Welby	66	56.4	55.8	64.7	64.9	<b>69.3</b>	69	<b>74.4</b>
S. Boulder Creek	77	64.4	62.6	<b>70.7</b>	62.1	<b>70</b>	<b>74.4</b>	<b>83.4</b>
Carriage	76	59.6	64.9	69.5	68.2	66.7	<b>71.3</b>	<b>82.5</b>
Highland	81	57.2	67	63.1	<b>70.6</b>	66.9	<b>71.3</b>	<b>81.1</b>
Chatfield Res.	85	58.1	67.1	61.4	<b>70.6</b>	66.9	<b>71.3</b>	<b>84.5</b>

- **Additional Model Metrics**

# Grid-Hours > 84 ppb: The relative change from the 2002 base case to the 2007 control case in the number of grid cell – hours during the modeling episode in which the estimated 8-hour ozone concentrations are greater than 84 ppb is calculated to be 88%, which is over the “large” reduction (80%) suggested by EPA to be consistent with a conclusion that the proposed control strategy package meets the 8-hour standard. TSD Appendix L

# Grid-Cell > 84 ppb: The relative change from the 2002 base case to the 2007 control case in the number of grid cells during the modeling episode in which the

estimated 8-hour ozone concentrations are greater than 84 ppb is calculated to be 80%. This meets the “large” reduction (80%) suggested by EPA to be consistent with a conclusion that the proposed control strategy package meets the 8-hour standard. TSD Appendix L

Relative Difference (RD): The Relative Difference (RD) in 8-Hour ozone concentrations greater than 84 ppb computed as the ratio of the average of estimated excess 8-hour ozone above 84 ppb of the future-year simulation to the base-year base case is calculated at 93% further supporting the conclusion that the proposed control strategy package meets the 8-hour standard. TSD Appendix L

VOC-NOX Sensitivity: Sensitivity model runs looking at reduction of VOC, NOx and VOC and NOx indicate that VOC reductions are more important to reductions in ozone at the critical monitor than NOx reductions confirming the validity of the proposed control package focusing on VOC reductions. TSD Appendix J & K

- **Additional Analyses**

Monitored Speciation Data: Recent ambient monitored precursor data indicates similarity between ambient data and emissions estimates. Very close correlation between flash emissions speciation data and ambient measurements in Weld County the source of almost all of the Flash emission in the inventory. TSD Appendix C & N

Ambient Monitoring & Emissions Trends: Monitored trends and emissions trends of CO and PM10 and emissions trends are declining supporting the concept that over all air quality is improving due to controls in place in the region. TSD Appendix C

Design Value and Emissions Trends: Analysis of 3-year period design values for 8-hour ozone and precursor emissions indicates that both are trending down. TSD Appendix C

PBL Height and Boundary Condition Analysis: Modeling of the 2002 base case investigated the impacts of changes in PBL Heights and Boundary conditions to maximize appropriate assumptions in future modeling. TSD Appendix G & H

## **H. 2012 Maintenance Year Emission Inventory and Maintenance Demonstration**

EPA's Early Action Compact Protocol guidance requires that areas demonstrate long-term maintenance of the 8-hour ozone NAAQS through the year 2012. Although photochemical modeling analysis is required for the 2007 attainment demonstration, a simple comparison of emission inventories is sufficient to demonstrate maintenance. For this plan, the 2007 control case emission inventory, which is supported by a weight of evidence determination of attainment, is compared with the 2012 inventory. When total emissions in 2012 are less than total emissions in 2007 that are supported by a determination of attainment, continued maintenance is demonstrated. The 2012 inventories assume that the 2007 control measures remain in place throughout the maintenance period through 2012. The 2012 inventory also accounts for federal emission control measures taking effect from 2007 through 2012.

The 2007 control case inventories for the 8 county area and the 11 county area and the 2012 maintenance inventories are presented previously in Tables 7a & 7b and 8a & 8b.