**DRAFT September 8, 2008**

## Denver Metro Area & North Front Range

# Ozone Action Plan

### Including
### A Proposed Revision to the State Implementation Plan

**Approved by:**
**Colorado Air Quality Control Commission**
*(Public Hearing and SIP approval scheduled for December 11, 2008)*

**Regional Air Quality Council**
*Proposed plan and SIP revision*
*approved September 8, 2008*

**North Front Range Transportation and**
**Air Quality Planning Council**
*Proposed plan and SIP revision*
*endorsed September 4, 2008 (with modifications)*

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Colorado Department of Public Health and Environment

Regional Air Quality Council

NFRMPO North Front Range Metropolitan Planning Organization

*This document is currently undergoing review by the public, stakeholder groups, and the respective air quality policy boards. Reference to participating air quality agencies does not necessarily represent endorsement of the plan while it is undergoing public review.*

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Attachments are separate documents on the electronic version.

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# OVERVIEW
# 2008 OZONE ACTION PLAN

*This Overview section is provided for information only and shall not be construed to be part of the federally-enforceable State Implementation Plan.*

On November 20, 2007, the U.S. Environmental Protection Agency (EPA) designated the Denver/North Front Range region as nonattainment for the 8-hour ozone standard of 0.08 parts per million (ppm) adopted in 1997. The State of Colorado must submit an attainment plan (referred to as a revision to the State Implementation Plan, or SIP) to EPA by July 1, 2009 that will bring the region back into attainment by November 2010 (based on data from 2008-2010 ozone seasons).

## BACKGROUND

In 1997 EPA adopted a new, more stringent National Ambient Air Quality Standard (NAAQS) for ozone based on the latest ozone health effects information. The standard was set as a level of .08 ppm averaged over an 8-hour period. Attainment of the standard is based on the 4$^{th}$ maximum 8-hour ozone concentration recorded at each monitoring location each year, averaged over a three-year period.

State and regional agencies in the Denver metropolitan area entered into a voluntary agreement with EPA in December 2002 that laid out a process for achieving attainment with EPA's 1997 8-hour for ozone standard in an expeditious manner, but no later than December 31, 2007. Called the Early Action Compact for Ozone ("the EAC"), the agreement set 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. The EAC Ozone Action Plan (SIP) was adopted by the Colorado Air Quality Control Commission (AQCC) in March 2004 and submitted to EPA in the summer 2004. EPA promulgated approval of the Ozone Action Plan in the Federal Register (Vol. 70 , Number 94, May 17, 2005). A revision to the Ozone Action Plan to preserve the reductions estimated in the original plan was approved by the Air Quality Control Commission on December 17, 2006 and the Colorado State Legislature in spring 2007, and submitted to the EPA by the Governor in August 2007. EPA approved this revision in February 2008.

In April 2004, EPA designated and classified areas of the country that violated the 8-hour standard. Based on the 2001-2003 design values, the Denver Metro Area/North Front Range (DMA/NFR) area violated the 8-hour ozone standard at three monitors and was included on EPA's 2004 list of non-attainment areas. However, based on terms in the Early Action Compact, EPA deferred the non-attainment area designation pending the area continuing to meet the deadlines in the EAC and achieving the 8-hour standard by December 31, 2007 (based on data from the 2005-2007 ozone seasons).

Despite efforts in the EAC Ozone Action Plan that reduced ozone-causing emissions in the DMA/NFR, the area failed to achieve the standard due to high readings in July 2007, resulting in a three-year (2005-2007) design value of 0.085 ppm at one monitor (Rocky Flats North) which violated the 8-hour ozone NAAQS.

On November 20, 2007 the EPA did not continue the deferral of the effective date for non-attainment in the DMA/NFR 8-hour non-attainment area and the official non-attainment designation became effective at that time.

## OZONE HEALTH EFFECTS

Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. People with chronic lung and heart diseases, children, older adults, and even healthy people who are active outdoors can be affected when ozone levels are unhealthy. Ozone can worsen symptoms for those who have pre-existing conditions such as bronchitis, emphysema, asthma, chronic obstructive pulmonary disease, and heart disease. Ozone can also reduce lung function and inflame the linings of the lungs, while repeated exposure may permanently scar lung tissue. Ozone exposure can also increase the mortality risk for susceptible individuals, including the elderly and those with pre-existing conditions.

Numerous scientific studies have linked ground-level ozone exposure to a variety of problems, including:

- airway irritation, coughing, and pain when taking a deep breath;
- wheezing and breathing difficulties during exercise or outdoor activities;
- inflammation of the respiratory tract tissues;
- aggravation of asthma and increased susceptibility to respiratory illnesses like pneumonia and bronchitis;
- permanent lung damage with repeated exposures; and
- cardiac impacts.

The Clean Air Act requires EPA to set air quality standards to protect both public health and the public welfare (e.g. crops and vegetation) and states and local areas must develop plans to achieve these health-based standards as expeditiously as practical.

## HOW OZONE IS FORMED

Ground-level ozone is not emitted directly into the air, but is created by complex chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC), and to a lesser extent carbon monoxide (CO), in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NOx and VOC.

In the Denver/North Front Range area, ozone is principally a summertime problem associated with high temperatures, intense sunlight, little cloud cover, little moisture, light winds, and persistent high pressure systems. The State of Colorado monitors ambient ozone concentrations at 15 sites in the Denver/North Front Range. High ozone levels are most likely recorded at monitors along the foothills from Fort Collins south to Chatfield Reservoir in Douglas County. Typically, light, westerly winds pick up VOC and NOx pollutants throughout the metro area and intense sunlight “bakes” the pollutants, resulting in highest concentrations along the foothills during prime ozone meteorological conditions.

## AIR QUALITY AGENCIES IN COLORADO

### Regional Air Quality Council

The Regional Air Quality Council (RAQC) is designated by Governor Ritter as the lead air quality planning agency for the Denver metropolitan area. In this capacity, the mission of the RAQC is to develop effective and cost-efficient air quality initiatives with input from state and local government, the private sector, stakeholder groups, and private citizens. The RAQC primary task is to prepare state implementation plans (SIPs) for compliance with federal air quality standards. The RAQC consists of an 11-member board appointed by the Governor.

In July 2007, when it was clear that the region was in violation of the 8-hour ozone standard, Governor Bill Ritter directed the RAQC to develop an effective plan (SIP) to reduce ozone in the Denver/North Front Range area by September 2008. The Governor also urged the RAQC to propose measures that would further reduce ozone concentrations during the 2008 summer season and set as its immediate goal the reduction or elimination of ozone levels measured above 0.08 ppm. In addition, the

Governor directed the RAQC to begin the process for considering additional measures that may be necessary to meet an anticipated lower federal standard for ozone.

**North Front Range Transportation and Air Quality Planning Council**

The North Front Range Transportation and Air Quality Planning Council is designated by the Governor as the lead air quality planning organization for the North Front Range region. The North Front Range Transportation and Air Quality Planning Council is a nonprofit public organization of 15 local and county governments in Larimer and Weld counties and is funded through federal and state grants, and local funds. The goal of the North Front Range Transportation and Air Quality Planning Council is to enhance air quality and mobility among northern Colorado communities, and between the North Front Range and the Denver Metro area, by developing cooperative working relationships and financial partnerships among its member governments, the Colorado Department of Transportation (CDOT), Federal Highway Administration (FHA), the Federal Transit Administration (FTA), and the private sector.

The North Front Range Transportation and Air Quality Planning Council is responsible for proposing air quality measures affecting the North Front Range and performing conformity determinations to ensure its transportation plans and programs comply with the state implementation plan.

**Colorado Air Quality Control Commission**

The Colorado Air Quality Control Commission (AQCC) is the regulatory body with responsibility for adopting air quality regulations consistent with state statute. This includes the responsibility and the authority to adopt state implementation plans (SIPs) and implementing regulations. The AQCC takes action on SIPs and regulations through a public rule-making process. The AQCC has nine members who are appointed by the Governor and confirmed by the State Senate.

## DENVER METRO AREA/NORTH FRONT RANGE NON-ATTAINMENT AREA

The boundary of the DMA/NFR 8-hour ozone nonattainment area was established in EPA's April 2004 designation of nonattainment areas, as follows:

> *All of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson Counties and portions of Larimer and Weld Counties.*

A map describing the current non-attainment area boundaries is included in the Figure at the end of this section.

## NEW 8-HOUR OZONE STANDARD

In March 2008 EPA established a new, more stringent standard for ozone based on a review of the most recent health effects information. The new 8-hour standard is set at a level of 0.075 ppm (or 75 parts per billion) averaged over an eight-hour period. As with the 1997 standard, 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 will occur when the three-year average is equal to or greater than 0.076 ppm (or 76 ppb).

Under EPA's rule establishing the new standard, the Governor is required to make recommendations for areas of nonattainment by March 2009. EPA will review the Governor's recommendations and make final nonattainment determinations in March 2010. States will have to submit revised state implementation plans for the new ozone standard by March 2013. EPA will later establish attainment dates for areas, which will range between 2013 to 2030 depending on the severity and classification of the area.

In the meantime, all the 1997 8-hour ozone standards and all the associated regulatory requirements remain in place. States and nonattainment areas should continue their plans for implementing the 1997 standards. EPA will address transition issues from the 1997 standards to the 2008 standards in a separate future rulemaking.

Currently, through summer 2008, eight monitors along the DMA/North Front Range currently violate of the new 0.075 ppm 8-hour ozone standard. This proposed Attainment SIP is not intended to address attainment of the 0.075 ppm 8-hour ozone standard. However, the Regional Air Quality Council and the Colorado Department of Public Health and Environment (CDPHE) will continue to consider measures that move the region towards attainment of the new 8-hour ozone standard as expeditiously as practical. Provisions in the 2008 Ozone Action Plan are intended to begin moving the region to compliance with the new standard.

## 2008 OZONE ACTION PLAN

After several months of analysis and evaluation and after more than 40 stakeholder and public meetings, the Regional Air Quality Council has proposed an Ozone Action Plan to reduce ozone levels in the Denver/North Front Range area by 2010. The overall plan includes elements that will be included in the federally-enforceable State Implementation Plan (SIP), elements that are include as state-only enforceable measures in state regulation, and elements that need further evaluation for a possible SIP amendment in

the near future. These elements are discussed briefly below and are summarized in the Table at the end of this section.

## Measures proposed for the federally-enforceable SIP

**(see attached SIP document for more details)**

The following measures are proposed for inclusion in the Ozone State Implementation Plan. In addition to being adopted and enforced by the State of Colorado, these measures will also be federally-enforceable upon approval of the State Implementation Plan revisions by EPA.

1. **Adopt more stringent cut-points for inspection/maintenance program in 7-county Denver metro area**

   Lower cut-points will identify more high-emitting vehicles that will result in repairs to reduce emissions. The Air Quality Control Commission approved revisions to Regulation No. 11 implementing these cutpoints in March 2008 and the changes took effect in May 2008. These revisions are expected to reduce mobile source VOC emissions by one ton per day (tpd), NOx emissions by three tpd, and carbon monoxide (CO) emissions by 13 tpd.

2. **Require 7.8 psi RVP (Reid vapor pressure) gasoline in the entire non-attainment area**

   7.8 RVP gasoline is already required in the former one-hour ozone non-attainment area (most of the 7-county Denver area) and will be required in portions of Larimer and Weld counties and eastern portions of Arapahoe and Adams counties under this action. This change requires EPA regulatory action, which hopefully can be implemented no later than May 2010, if not before. This action is expected to provide an additional three tpd SIP emission reduction credit.

3. **Increase control requirements for oil and gas condensate tanks to 95% for all new and modified tanks greater than two tons per year (tpy) (by 2009) and all existing tanks greater than 10 tpy (by 2010)**

   This will replace the current 75% system-wide control requirement in Regulation No. 7 and will be implemented as revisions to Regulation No. 7 adopted by the AQCC in December 2008. The requirements for new and modified tanks will take effect in February 2009 and the requirements for existing tanks greater than 10 tpy will take effect in May 2010. These controls are expected to reduce VOC emissions between 24 and 39 tpd.

***The North Front Range Transportation and Air Quality Planning Council has endorsed an alternative approach suggested by industry that would increase the current system-wide control factor to 90% as a SIP measure. This alternative proposal is likely to be considered by the Air Quality Control Commission during its upcoming rulemaking pre-hearing process.*

**4. Require low-bleed control devices on all new and existing pneumatic valves in oil and gas operations (by 2009)**

The AQCC will adopt revisions to Regulation No. 7 in December 2008 that require low-bleed controllers on valves, effective in May 2009. Exemptions will be granted for operations that require high-bleed controllers on valves for safety reasons. These controls are expected to reduce VOC emissions between 19 and 23 tpd.

**5. Expand current requirements in Regulation No. 7 for Volatile Organic Compound (VOC) controls to the entire nonattainment area**

Control requirements for VOC stationary sources currently pertain only to the former one-hour ozone attainment/maintenance area (most of the 7-county Denver area). These reasonably available control technology (RACT) requirements in Regulation No. 7 will now apply to specific new and existing listed source categories and all new and existing major (greater than 100 tpy) stationary sources of VOCs in portions of Larimer and Weld counties and eastern portions of Adams and Arapahoe counties. These revisions to Regulation No. 7 will be adopted by the AQCC in December 2008 and become effective in February 2009. The impact of these revisions is difficult to quantify since it is unknown how many sources will be affected and the control levels that will be required.

**6. Remove current exemptions contained in Regulation No. 3 for selected small sources required to file air pollution emission notices and obtain permits**

Regulation No. 3 currently contains exemptions for many small source categories. Many of these exemptions pertaining to VOC sources will be removed by the AQCC in revisions to Regulation No. 3 in December 2008 and become effective in February 2009. This will result in the identification of more sources of VOCs and potentially additional control requirements. The impact of these revisions is difficult to quantify since it is unknown how many sources will be affected and the control levels that will be required.

**7. Require general application of permit requirements in Regulation No. 3 and reasonably available control technology (RACT) for all VOC stationary sources greater than two tons per year and NOx stationary sources greater than five tons per year in the entire nonattainment area.**

Revisions to Regulation No. 3 implementing these changes were adopted by the AQCC in February 2008. The impact of these revisions is difficult to quantify since it is unknown how many sources will be affected and the control levels that will be required.

## Measures proposed as state-only measures in state regulation

The following measures will not be included in the federally-enforceable State Implementation Plan at this time, but will be adopted and enforced exclusively under state authority. These measures will provide additional reductions of ozone-causing emissions, which will give the region an additional margin of safety to maintain compliance with the 1997 8-hour ozone standard and will help the region make further progress towards meeting the new EPA standard.

**1. Implement a motor vehicle inspection/maintenance program in the North Front Range (Larimer and Weld counties)**

The North Front Range Transportation and Air Quality Planning Council has endorsed a proposal to extend the inspection/maintenance program structure that currently exists in the Denver metro area to portions or Larimer and Weld counties. The program includes IM 240 testing, remote-sensing clean screen, gas cap checks, and advisory OBDII checks. Revisions to Regulation No. 11 implementing this change in the former basic I/M program area in Larimer and Weld counties will be proposed to the AQCC in September and adopted in December 2008. The program could become effective between in 2010 or a date determined by the AQCC. Changes to the boundary of the North Front Range program area to include the entire urbanized portion of Larimer and Weld counties will likely be considered by the General Assembly during the 2009 session. Conservatively, this program is expected to reduce mobile source VOC emissions by at least one tpd, NOx emissions by at least one tpd, and CO emissions by at least 17 tpd.

The North Front Range Transportation and Air Quality Planning Council also endorses an evaluation of the I/M program structure by 2013 that includes consideration of expanded OBDII testing and high-emitter identification.

**2. Continue implementing the high-emitter pilot program in the Denver metro area**

A mandatory pilot program using remote sensing technology began January 1, 2008. The pilot program will continue through July 2009, after which the results from the program will be analyzed. This may lead to implementation of a full-scale high-emitter program in the future. Since this is a pilot program that is still underway, the emission reduction potential of this program has not yet been identified. However, it is a well-established fact that high-emitting vehicles contribute disproportionate amount of pollution to our air.

**3. Tighten up collector plate requirements in state law**

Collector plate requirements in current state statute limit emission tests on vehicles more than 25 years old. The RAQC and CDPHE are working with stakeholders to develop legislation that will limit collector plates to true collector vehicles and close the emissions testing loophole for old, non-collector vehicles. The impact from these old, non-collector vehicles is difficult to quantify, but it is expected the VOC reduction could be around one tpd and the CO reduction could be around seven tpd.

**4. Increase control requirements for oil and gas condensate tanks to 95% for and all existing tanks greater than 2 tpy**

Regulation No. 7 will be amended by the AQCC in December 2008 to increase the number of tanks controlled in the nonattainment area beyond the 10 tpy threshold included in the SIP. Control requirements for tanks greater than 5 tpy will take effect in May 2011 and tanks greater than 2 tpy will have to meet the requirements by May 2012. These provisions of Regulation No. 7 will be adopted and enforced as a state-only control measure and will not be included in the SIP. These controls are expected to reduce VOC emissions between 39 and 47 tpd.

***The North Front Range Transportation and Air Quality Planning Council has endorsed an alternative approach suggested by industry that would increase the current system-wide control factor to 90% as a SIP measure. This alternative proposal is likely to be considered by the Air Quality Control Commission during its upcoming rulemaking pre-hearing process.*

**5. Implement control requirements for reciprocating internal combustion engines (RICE) statewide**

The control requirements will mirror requirements currently in place in the Denver/North Front Range non-attainment area. Revisions to Regulation No. 7 making these requirements apply statewide will be adopted by the AQCC in December and will become effective by May 1, 2010. The emission reduction impact from these statewide controls has not yet been quantified.

## Potential strategies requiring additional evaluation for a near-term ozone plan/SIP amendment

During the development of the Ozone Action Plan and SIP revision, the RAQC, CDPHE, and interested stakeholders considered several measures that hold considerable promise for further reducing ozone levels in the future. However, the RAQC and CDPHE concluded these measures need additional evaluation and analysis because of the potential impacts and complexities of the strategies.

The RAQC and CDPHE will initiate additional technical and modeling analysis of these strategies during the fall of 2008 and will conduct a stakeholder involvement process to consider these strategies through the first part of 2009. The RAQC and AQCC will consider these strategies for a possible state-only plan and/or SIP amendment in the latter half of 2009. The timeline for possible implementation of these strategies will be considered during the stakeholder and regulatory processes.

The additional strategies that will undergo additional analysis and evaluation include:

**1. Evaluate potential ozone fuels strategies**

Fuels strategies include 7.0 RVP base gasoline, federal reformulated gasoline, and eliminating the one-pound psi RVP waiver for ethanol blended gasoline. The evaluation will also address any national fuels strategies that may be coming from EPA in the future.

**2. Evaluate emission controls for large industrial sources of NOx**

Recent modeling in the Denver/North Front Range area indicates additional reductions of NOx emissions in the area may be beneficial for ozone reductions. This evaluation will include analysis of control options for power plants, large industrial boilers, cement kilns, and other potential sources. Future modeling analysis will also evaluate the impact of further NOx reductions from motor vehicles and nonroad engines that will result from federal standards already in place.

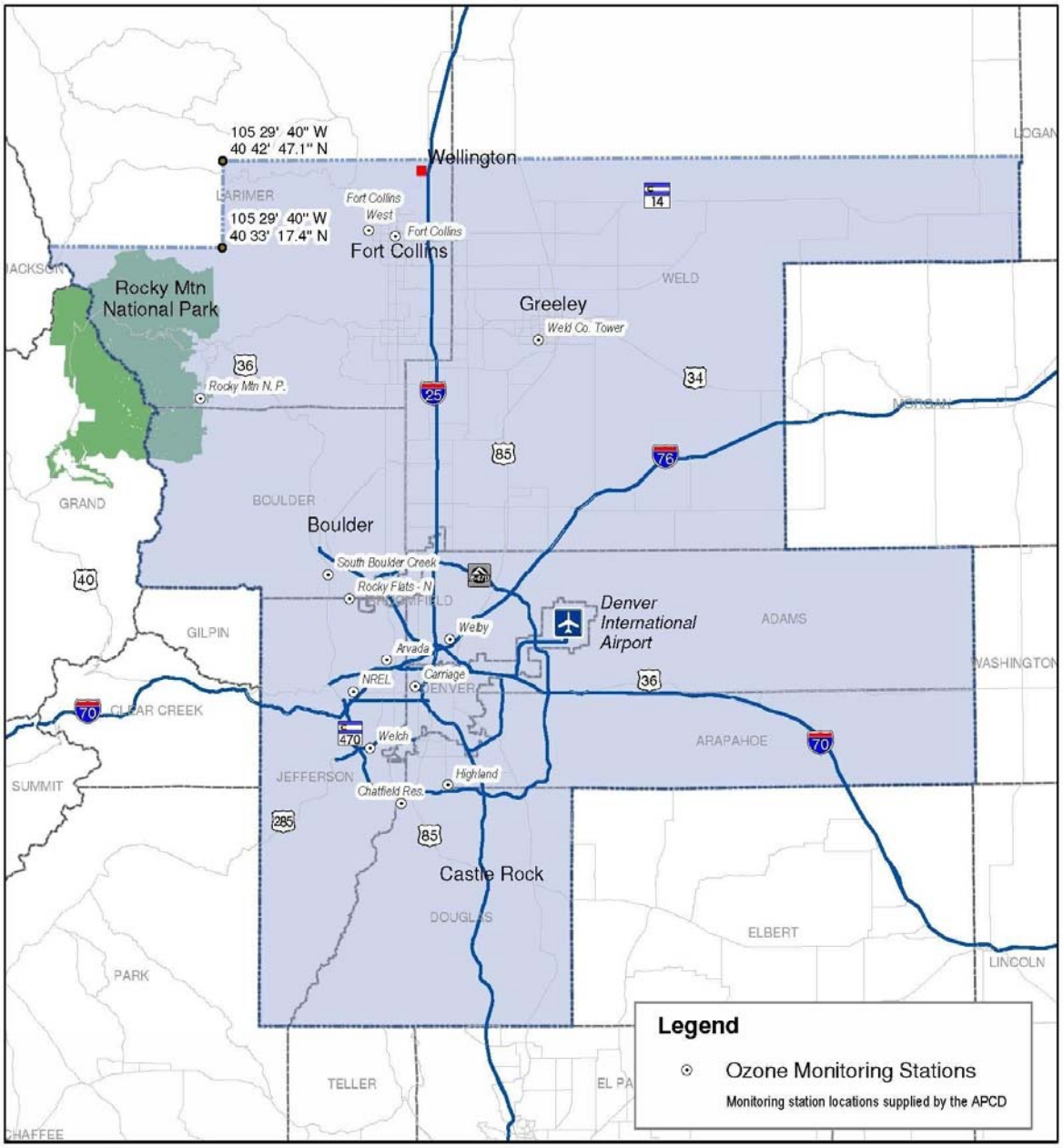
**3. Evaluate statewide control requirements for new oil and gas condensate tanks and pneumatic valves**

Other areas in Colorado also have concerns about the impacts of oil and gas development on air quality in these regions. CDPHE and AQCC will consider statewide control requirements for condensate tanks, pneumatic valves, and other potential oil and gas sources, patterned in part after requirements in effect in the Denver/North Front Range non-attainment area.

**4. Evaluate the feasibility of adopting California requirements for paints, solvents and consumer products**

EPA is considering adopting more stringent formulation requirements for a range of paints, solvents, and other household consumer products. Other states and regions have also adopted more stringent regulations for these products than the pending federal rule. RAQC and CDPHE will evaluate the benefits, impacts, and technical feasibility of adopting more stringent regulations for these products in Colorado.

# Denver Metro Area/North Front Range
# Non-Attainment Area




**Denver Metro Area/Northern Front Range**
**Non-attainment Area**

DRCOG
Denver Regional Council of Governments
Metro Vision Resource Center

June 2004

# Emission Control Strategies for Ozone

| **Strategies Proposed for 2008 Proposed Ozone Action Plan** *(All strategies apply to the entire Denver/North Front Range nonattainment area (NAA) unless otherwise noted)* | | | | | | **Potential Strategies Requiring Additional Evaluation for Near-Term Plan/SIP Amendment** | |
|---|---|---|---|---|---|---|---|
| **Proposed Measures for Federally-Enforceable State Implementation Plan (SIP)** | | *Potential Emission Reduction* | **Proposed Measures That Will Be Adopted and Enforced as State-only Measures** | | *Potential Emission Reduction* | | *Potential Emission Reduction* |
| ➢ More stringent Reg. 11 I/M cutpoints (Denver area) – adopted, effective May 1, 2008 | | *~ 1 tpd VOC, ~3 tpd NOx, ~13 tpd CO* | ➢ Inspection/maintenance program in North Front Range | | *~ 1 tpd VOC, ~1 tpd NOx, ~17 tpd CO* | **Ozone Fuels Strategies**:<br>➢ 7.0 RVP gasoline | *~ 10 tpd VOC* |
| ➢ 7.8 RVP gasoline regulatory requirement in North Front Range (consistent with Denver area) | | *~ 3 tpd VOC* | ➢ Mandatory high-emitter pilot program (Denver area) – began January 1, 2008 | | *Pilot program results are not available* | ➢ Federal Reformulated Gasoline | *~ 18 tpd VOC* |
| | | | ➢ Tighten up collector plate requirements for older vehicles (statewide) | | *< 1 tpd VOC ~ 7 tpd CO* | ➢ Eliminate ethanol waiver | *~ 10 tpd VOC + 360 tpd CO* |
| ➢ Increase condensate tank control (95%)<br>▪ for all new/modified tanks >2 tpy (2009)<br>▪ for all existing tanks >10 tpy (2010) | | *VOC ~ 5-9 tpd ~19-30 tpd* | ➢ Increase condensate tank control (95%)<br>▪ for all existing tanks >5 tpy (2011)<br>▪ for all existing tanks >2 tpy (2012) | | *VOC ~ 30-35 tpd ~9-12 tpd* | ➢ Statewide Oil & Gas regulations – control requirements for new condensate tanks and pneumatic valves | *Scope of the potential controls has not been determined* |
| ➢ Pneumatic valves controls - require low/no bleed valves on all new and existing valves by 2009 | | *~ 23 tpd VOC* | ➢ Statewide Oil & Gas regulations -- Controls on existing reciprocating internal combustion engines | | *7 tpd VOC 16 tpd NOx* | | |
| ➢ Expand Reg. 7 (VOC control requirements) to entire NAA<br>➢ Remove current exemptions in Reg. 3 for selected small sources required to file air pollution emission notices and obtain permits<br>➢ Require Reasonably Available Control Technology (RACT) for minor sources in NAA (Reg. 3) | | *Emission reductions are difficult to quantify at this time, but are expected to be small in the short-term* | | | | ➢ Emission controls on large NOx sources<br>▪ power plants<br>▪ boilers<br>▪ cement kilns | *~ 30-45 tpd NOx* |
| | | | | | | ➢ California Paints/Solvents/ Consumer Products Rule | *~ 8 tpd VOC* |
| **TOTAL EMISSION REDUCTIONS** | **VOC<br>NOx<br>CO** | *~51-66 tpd<br>~ 3 tpd<br>~13 tpd* | | **VOC<br>NOx<br>CO** | *~48-56 tpd<br>~16 tpd<br>>24 tpd* | | |

## Denver Metro Area & North Front Range

# 8-Hour Ozone Attainment Plan

### A Proposed Revision to the State Implementation Plan

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Colorado Department of Public Health and Environment

REGIONAL AIR QUALITY COUNCIL

NFRMPO NORTH FRONT RANGE METROPOLITAN PLANNING ORGANIZATION

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# CHAPTER I
# FEDERAL REQUIREMENTS FOR PREPARING 8-HOUR OZONE ATTAINMENT SIP REVISION

## Clean Air Act Requirements

The Clean Air Act Amendments of 1990 established a classification system for ozone nonattainment areas based the severity of the area's ozone problem as measured by the area's ozone design value. In April 2004 the Environmental Protection Agency (EPA) issued a rule classifying all the areas designated nonattainment for the 8-hour standard. However, this rule was vacated by the U.S. Court of Appeals in December 2007 and EPA has yet issued a new rule consistent with the Court's decision.

EPA has indicated the Denver/North Front Range nonattainment area based on its 2005-2007 design value, will likely be classified as a Marginal area and subject to the provisions of Section 181 and 182(a) of the Clean Air Act Amendments of 1990. In addition, as a former Early Action Compact area, the Denver/North Front Range nonattainment area is subject to 40 CFR 81.300(e)(3)(ii)(D) that requires a new attainment demonstration with photochemical air quality modeling.

The core elements that EPA has indicated as necessary for an approvable revised attainment plan for the Denver/North Front Range nonattainment area under the Marginal classification are as follows:

- Photochemical grid modeling based on the latest EPA modeling guidance
- Emissions inventories for the base and future modeling years
- Modeled attainment demonstration for summer 2010 (3 years after designation)
- Required controls must be effective no later than prior to the beginning of the 2010 summer ozone season (May 1, 2010)
- Mobile vehicle emissions budgets for the attainment year (2010)
- Reasonably Available Control Measures - demonstration that controls needed for attainment have been achieved as expeditiously as possible
- New Source Review applicable to volatile organic compounds (VOC) and nitrogen oxide (NOx) major sources of 100 tpy with offsets of 1.1 to 1
- Construction permits required for new and modified major stationary sources
- Requirements of section 182(a)(3) including:
    - Submission of periodic inventories every three years until the area is redesignated to attainment;
    - Annual submission of a statement of actual VOC and NOx emissions from stationary sources; and,
    - Offset requirements of 1.1 to 1 as noted above.

Additional elements that EPA has indicated are not necessary for an approvable revised state implementation plan for the Denver/North Front Range nonattainment area under the Marginal classification are as follows:

- Contingency measures are not required; however, upon failure to attain the area would be reclassified to a higher classification and additional control requirements may be required (Section 182(a));
- A Reasonably Available Control Technology pre-1990 fix-up is not required because it was achieved with Redesignation of the Denver metro 1-hour ozone area to attainment-maintenance (Section 182(a)(2)(A)); and
- Corrections to the pre-1990 Inspection/Maintenance program are not required because it was achieved with Redesignation of the Denver metro 1-hour ozone area to attainment-maintenance (Section 182(a)(2)(B)).

## Photochemical Grid Modeling

As a former EAC area, an attainment demonstration using photochemical grid dispersion modeling is required, and was performed for the revised 8-hour Ozone Attainment SIP. All modeling is based on “Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, particulate matter ($PM_{2.5}$) and Regional Haze" (EPA-454/B-07-002, April 15, 2007). The modeling follows the guidance as facilitated by EPA Region 8. The modeling 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 NOx and/or VOC reductions. The 2010 base case was tested with 16 sensitivity tests to determine the relative effectiveness of different emission reduction controls and to aid in the selection of appropriate emission reduction strategies.

## Emissions Inventories

Emission inventories used in this revised 8-hour ozone attainment SIP were developed for a typical summer episode day for the years 2006 and 2010 using EPA’s MOBILE6 emissions model and the latest transportation information; area sources using a combination of EPA’s NONROAD model data, and latest demographics information, area source data, and local survey and information data, and the latest stationary sources emissions information, as required. Future year inventories will sufficiently account for projected future growth in ozone precursor emissions through 2010, particularly from stationary, area, and mobile sources. Emissions inventories were compared and analyzed for trends in emission sources over time. Inventories included in the photochemical modeling were also characterized by time of day, day of week, speciation, location, temperature, and other factors.

## Modeled Attainment Demonstration

The EPA Model Attainment Test Software was used with the 2006 and 2010 base case/control case photochemical grid modeling results to project 2010 8-hour ozone attainment. A weight of evidence (WOE) analysis will be required to support the modeled attainment demonstration.

## Emission Reduction Strategies

All adopted Federal and State emission reduction strategies that have been or will be implemented by the November 20, 2010 attainment date are included in all emission inventories. The strategies included in the federally-enforceable SIP will be implemented as soon as practical, but no later than May, 2010. 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.

## Conformity and Motor Vehicle Emissions Budgets

Transportation conformity provisions of section 176 (c)(2)(A) of the CAA require regional transportation plans and transportation improvement programs to demonstrate that "…emissions expected from implementation of plans and programs are consistent with estimates of emissions from motor vehicles and necessary emissions reductions contained in the applicable implementation plan…"

Mobile Source Vehicle Emissions Budgets for VOC and NOx in the 2010 attainment year are established as both subarea and regional budgets for future conformity for the two metropolitan planning organizations (Denver Regional Council of Governments and North Front Range Transportation and Air Quality Planning Council) serving the Denver/North Front Range nonattainment area.

## New Source Review & Construction Permits

The State of Colorado currently performs New Source Review in nonattainment areas applicable to VOC & NOx major sources of 100 tpy with offsets of 1.1 to 1. The State also maintains a Construction Permits program for new and modified major stationary sources.

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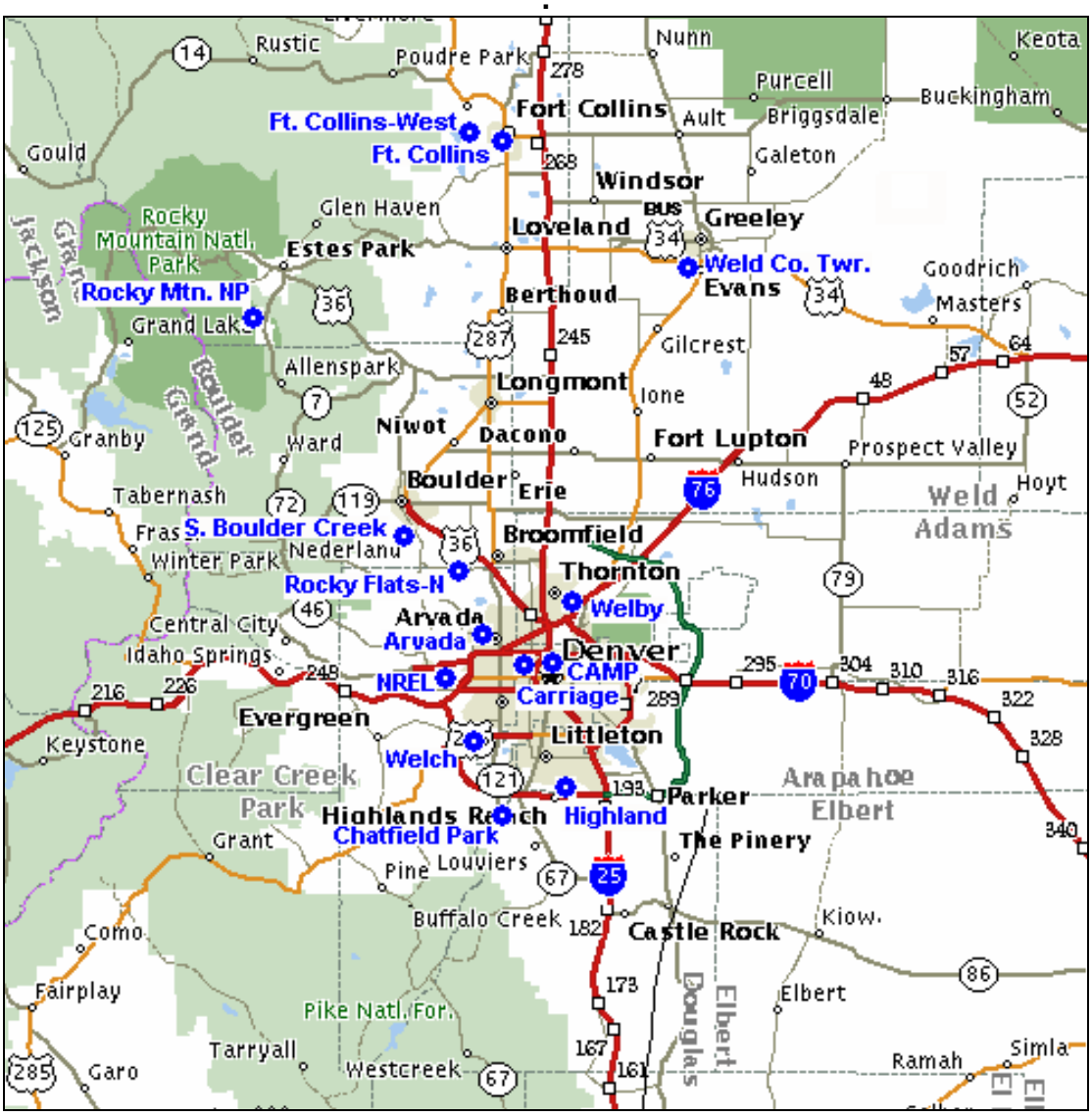
# CHAPTER II
# OZONE MONITORING INFORMATION

## A. Ozone Monitoring Network

The 2007 ozone ambient air monitoring network in the Denver area and along the northern Front Range consisted of 13 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 Front Range 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. II - Ambient Air Quality Monitoring Program", the APCD's Quality Management Plan and Quality Assurance Project Plan documents, and Colorado's Monitoring SIP which EPA approved in 1993. The data are recorded in EPA's Air Quality System (AQS) and are available for public review at the APCD and through EPA's AQS database. Table 1 presents the data recovery rates for each monitoring site in the Denver and North 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". For Colorado, the "ozone monitoring season" has been designated by EPA to be March 01 through September 30. A valid sampling day is one in which at least 75% of the hourly averages are recorded.

**Table 1: Ozone Data Recovery Rates for Each Monitoring Site**
**(Based on EPA designated ozone season of 3/1 – 9/30)**

| Year | **Welby 08-001-3001** Data Recovery | **Highland 08-005-0002** Data Recovery | **S. Boulder Creek 08-013-0011** Data Recovery | **CAMP 08-031-0002** Data Recovery | **Carriage 08-031-0014** Data Recovery | **Chatfield Reservoir * 08-035-0002** Data Recovery |
|---|---|---|---|---|---|---|
| 2000 | 99% | 99% | 99% | --- | 90% | 95% |
| 2001 | 96% | 91% | 98% | --- | 95% | 91% |
| 2002 | 95% | 96% | 97% | --- | 97% | 93% |
| 2003 | 95% | 96% | 99% | --- | 99% | 87% |
| 2004 | 94% | 99% | 96% | --- | 99% | --- |
| 2005 | 99% | 97% | 97% | 98% | 96% | --- |
| 2006 | 97% | 98% | 98% | 99% | 97% | --- |
| 2007 | 99% | 99% | 98% | 98% | 97% | --- |

**Table 1 (continued)**
**Ozone Data Recovery Rates for Each Monitoring Site**
**(Based on EPA designated ozone season of 3/1 – 9/30)**

| Year | **Chatfield Park * 08-035-0004** Data Recovery | **Arvada 08-059-0002** Data Recovery | **Welch 08-059-0005** Data Recovery | **Rocky Flats North 08-059-0006** Data Recovery | **NREL 08-059-0011** Data Recovery | **Rock Mtn. NP 08-069-0007** Data Recovery |
|---|---|---|---|---|---|---|
| 2000 | --- | 98% | 94% | 98% | 99% | 89% |
| 2001 | --- | 99% | 97% | 98% | 98% | 95% |
| 2002 | --- | 99% | 98% | 96% | 99% | 95% |
| 2003 | --- | 98% | 98% | 99% | 99% | 94% |
| 2004 | 92% | 99% | 99% | 99% | 98% | 95% |
| 2005 | 99% | 95% | 98% | 94% | 95% | 90% |
| 2006 | 97% | 97% | 99% | 99% | 99% | 96% |
| 2007 | 97% | 99% | 99% | 96% | 99% | 97% |

| Year | **Fort Collins West 08-069-0011** Data Recovery | **Fort Collins CSU 08-069-1004** Data Recovery | **Greeley ** 08-123-0007** Data Recovery | **Weld County Tower ** 08-123-0009** Data Recovery |
|---|---|---|---|---|
| 2000 | --- | 99% | 98% | --- |
| 2001 | --- | 92% | 99% | --- |
| 2002 | --- | 87% | 96% | 99% |
| 2003 | --- | 97% | --- | 97% |
| 2004 | --- | 98% | --- | 96% |
| 2005 | --- | 91% | --- | 97% |
| 2006 | 99% | 98% | --- | 99% |
| 2007 | 99% | 97% | --- | 99% |

* The Chatfield Reservoir seasonal monitor was moved from the campground registration building to the Chatfield Park office yard as a year-round monitor in 2004.

** The Greeley monitor was moved from 811 15th Street to the Weld County Tower site at 3101 35th Avenue in 2002.

## C. Monitoring Network/Verification of Continued Attainment

The APCD has and will continue to operate an appropriate air quality monitoring network of State/Local Air Monitoring System (SLAMS) monitors in accordance with 40 CFR Part 58 to verify the attainment of the 8-hour-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 SLAMS air quality surveillance system will be conducted in accordance with 40 CFR Part 58.10 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 North 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 4th maximum concentrations at each site are presented.

### Table 2: 4th Maximum 8-Hour Ozone Values

| Site Name | AQS # | 2000 8-hr. 4th Max. (ppm) | 2001 8-hr. 4th Max. (ppm) | 2002 8-hr. 4th Max. (ppm) | 2003 8-hr. 4th Max. (ppm) | 2004 8-hr. 4th Max. (ppm | 2005 8-hr. 4th Max. (ppm | 2006 8-hr. 4th Max. (ppm | 2007 8-hr. 4th Max. (ppm) | 2008* 8-hr. 4th Max. (ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| Welby | 08-001-3001 | 0.062 | 0.064 | 0.068 | 0.066 | 0.066 | 0.073 | 0.069 | 0.070 | **0.077** |
| Highland | 08-005-0002 | 0.076 | 0.077 | 0.076 | **0.091** | 0.072 | 0.080 | 0.081 | 0.075 | ** |
| S. Boulder Creek | 08-013-0011 | 0.072 | 0.071 | 0.078 | 0.082 | 0.068 | 0.076 | 0.082 | **0.085** | **0.076** |
| CAMP | 08-031-0002 | --- | --- | --- | --- | --- | 0.051 | 0.062 | 0.057 | --- |
| Carriage | 08-031-0014 | 0.071 | 0.072 | 0.073 | **0.085** | 0.066 | 0.074 | 0.072 | 0.076 | 0.073 |
| Chatfield Reservoir | 08-035-0002 | 0.080 | 0.077 | 0.083 | **0.095** | --- | --- | --- | --- | --- |
| Chatfield Park | 08-035-0004 | --- | --- | --- | --- | 0.075 | 0.084 | **0.086** | 0.082 | **0.081** |
| Arvada | 08-059-0002 | 0.076 | 0.074 | 0.073 | 0.083 | 0.065 | 0.078 | 0.082 | 0.079 | 0.074 |
| Welch | 08-059-0005 | 0.068 | 0.064 | 0.069 | 0.077 | 0.062 | 0.064 | 0.081 | 0.080 | 0.073 |
| Rocky Flats North | 08-059-0006 | 0.081 | 0.082 | **0.088** | **0.091** | 0.073 | 0.077 | **0.090** | **0.090** | **0.079** |
| NREL | 08-059-0011 | 0.083 | 0.081 | 0.081 | **0.095** | 0.074 | 0.079 | 0.083 | **0.085** | **0.076** |
| Rocky Mountain NP | 08-069-0007 | 0.078 | 0.070 | **0.087** | **0.086** | 0.073 | 0.075 | 0.076 | 0.078 | **0.076** |
| Fort Collins West | 08-069-0011 | --- | --- | --- | --- | --- | --- | **0.087** | **0.085** | **0.077** |
| Fort Collins CSU | 08-069-1004 | 0.069 | 0.067 | 0.072 | 0.075 | 0.064 | 0.076 | 0.078 | 0.069 | 0.067 |
| Greeley | 08-123-0007 | 0.069 | 0.074 | --- | --- | --- | --- | --- | --- | --- |
| Weld Co. Tower | 08-123-0009 | --- | --- | 0.080 | 0.083 | 0.069 | 0.078 | 0.082 | 0.074 | 0.073 |

** 2008 data is currently through August 31, 2008 and the post season quality assurance review has not taken place. Quality Assured data is expected in November 2008 and this and other related tables in this Chapter will be updated with the data at that time.*

*** Highlands monitor was out of service much of the season due to nearby construction.*

## Table 3: 8-Hour Ozone
## Three-Year Average 4th Maximum Ozone Values

| Site Name | 2000-02 3-yr. Avg. 4th Max. Value (ppm) | 2001-03 3-yr. Avg. 4th Max. Value (ppm) | 2002-04 3-yr. Avg. 4th Max. Value (ppm) | 2003-05 3-yr. Avg. 4th Max. Value (ppm) | 2004-06 3-yr. Avg. 4th Max. Value (ppm) | 2005-07 3-yr. Avg. 4th Max. Value (ppm) | 2006-08* 3-yr. Avg. 4th Max. Value (ppm) |
|---|---|---|---|---|---|---|---|
| Welby | 0.064 | 0.066 | 0.066 | 0.068 | 0.069 | 0.070 | 0.072 |
| Highland | 0.076 | 0.081 | 0.079 | 0.081 | 0.077 | 0.078 | 0.071 |
| S. Boulder Creek | 0.073 | 0.077 | 0.076 | 0.075 | 0.075 | 0.081 | **0.081** |
| CAMP | --- | --- | --- | --- | --- | 0.056 | --- |
| Carriage | 0.072 | 0.076 | 0.074 | 0.075 | 0.070 | 0.074 | 0.073 |
| Chatfield Reservoir | 0.080 | **0.085** | --- | --- | --- | --- | --- |
| Chatfield Park | --- | --- | --- | --- | 0.081 | 0.084 | **0.083** |
| Arvada | 0.074 | 0.076 | 0.073 | 0.075 | 0.075 | 0.079 | **0.078** |
| Welch | 0.067 | 0.070 | 0.069 | 0.067 | 0.069 | 0.075 | **0.078** |
| Rocky Flats North | 0.083 | **0.087** | 0.084 | 0.080 | 0.080 | **0.085** | **0.086** |
| NREL | 0.081 | **0.085** | 0.083 | 0.082 | 0.078 | 0.082 | **0.081** |
| Rocky Mountain NP | 0.078 | 0.081 | 0.082 | 0.078 | 0.074 | 0.076 | **0.076** |
| Fort Collins West | --- | --- | --- | --- | --- | --- | **0.083** |
| Fort Collins CSU | 0.069 | 0.071 | 0.070 | 0.071 | 0.072 | 0.074 | 0.071 |
| Greeley | --- | --- | --- | --- | --- | --- | --- |
| Weld Co. Tower | --- | --- | 0.077 | 0.076 | 0.076 | 0.078 | **0.076** |

** 2008 data is currently through August 31, 2008 and the post season quality assurance review has not taken place. Quality assured data are expected in November 2008 and this and other related tables in this Chapter will be updated with the data at that time.*

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# CHAPTER III
# BASE CASE EMISSIONS INVENTORIES

This section presents emission inventories for this Ozone State Implementation Plan (SIP) for the 8-hour ozone Denver Metro Area/North Front Range attainment area, 2006 base case, and the 2010 base case used in the modeling scenarios. Inventories for the 8-hour ozone control area 2010 control case modeling will be presented later in this document and will include the additional control measures that are included in the attainment demonstration for the 8-hour ozone National Ambient Air Quality Standards (NAAQS). All of the base and control case inventories are for the 8-hour ozone nonattainment area (NAA), which includes the counties of Denver, Jefferson, Douglas, Broomfield, Boulder, Adams, Arapahoe, and portions of Weld and Larimer counties. These inventories in tons per summer day (tpsd) represent emissions estimates for an average episode day during the peak summer ozone season (May through September).

The emission estimates were developed based on the most recent vehicle miles traveled (VMT) estimates contained in: 1) Denver Regional Council of Government's (DRCOG) conformity analysis for the updated fiscally constrained element of the 2035 Regional Transportation Plan; 2) North Front Range Transportation and Air Quality Planning Council's (NFRTAQPC) 2035 Regional Transportation Plan; 3) the APCD estimates of VMT derived from data provided by the Colorado Department of Transportation (CDOT); and 4) Population estimates from the State Demographer. Table 4 presents this information.

**Table 4: Demographic Data**

| | 2006 | 2010 |
|---|---|---|
| DRCOG VMT | 69,548,803 | 76,551,505 |
| NFRTAQPC VMT | 10,537,341 | 11,753,832 |
| NON-DRCOG/NFR VMT | 1,715,579 | 1,835,149 |
| TOTAL NAA VMT | 81,801,723 | 90,140,486 |
| NAA Population | 3,118,439 | 3,357,009 |

The 2006 and 2010 base case inventories incorporate the control measures in place at that time. Control measures in place in 2006 and assumed for 2010 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 2006 to 2010 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 2006 ozone season, which includes an enhanced Inspection/Maintenance (I/M). For 2006, a maximum of 10% fleet coverage is assumed, and for 2010, a maximum of 50% fleet coverage is assumed for the remote sensing clean screen program in the DMA based on Regulation No. 11.

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 2004, gasoline sold in the Denver metro area during the summer RVP 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.

   Since 1991, gasoline sold in the Larimer and Weld area during the summer ozone season (June 1 to September 15) has been subject to a national Reid Vapor Pressure (RVP) limit of 9.0 pounds per square inch (psi) in order to reduce fuel volatility. For ethanol-blended fuels, the RVP limit is 10.0 psi due to the federal 1.0 psi RVP waiver for ethanol.

   For 2006, the RVP of gasoline for the Denver metropolitan portion of nonattainment area was determined by survey to be at 8.2 psi, with an ethanol market share of 60%, and for the Larimer and Weld portion of the nonattainment area the RVP was determined to be 8.4 psi with the same ethanol share of 60%. For purposes of the base case 2010 mobile source inventory, the RVP of the base gasoline is assumed to be 7.8 psi for the Denver metropolitan portion of nonattainment area, with an ethanol market share of 85%, and for the Larimer and Weld portion of the nonattainment area the RVP was assumed to be 9.0 psi with an ethanol share of 25%.

5. The EPA approved the EAC Ozone Action Plan (OAP) on August 19, 2005. The OAP included an amendment to Regulation No. 7 requiring the reduction of flash emissions of volatile organic compounds from condensate collection, storage,

processing and handling operations by May 1, 2005. This initial rule required the installation of air pollution control technology to achieve a system-wide 47.5% reduction from uncontrolled emissions of volatile organic compounds from new and existing oil and gas exploration and production operations located within the 8-hour ozone nonattainment area designated by EPA for operators with total emissions greater than 30 tons per year. The 2006 base case estimate was developed from actual reported emissions based on the system-wide 47.5% reduction requirement.

In February 13, 2008, the EPA approved revisions to Regulation No. 7 to require the system-wide reduction of condensate tank flash VOC emissions of 75% for the 2007 ozone season by May 1, 2007 and 78% reduction for the 2012 ozone season, with technology that achieves a 95% reduction in VOC emissions. The 2010 base case emissions estimate assumes the 75% system-wide reduction requirement.

6. The effect of EPA final locomotive Tier 3 standards were considered and included, where appropriate, in the 2010 area source estimates. Tier 4 locomotive standards do not go into effect until 2015 and therefore were not included in the 2010 inventories.

All of the inventories in this 8-hour Ozone Attainment SIP were developed using EPA-approved emissions modeling methods, including EPA's MOBILE6 model and local vehicle miles traveled (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 2010 and 2012 demographic data for off-road and area sources. The technical support document contains detailed information on model assumptions and parameters for each source category.

Highway mobile source emissions are from the ENVIRON CONCEPT Model inventory, which is based on DRCOG VMT data and MOBILE6 input data provided by APCD and expanded to the entire NAA based on VMT from the North Front Range Transportation and Air Quality Planning Council and the Colorado Department of Transportation (CDOT).

Non-road source emissions are from the EPA Non-Road Model. This model includes the impact of future controls on non-road engines, which is used in equipment such as lawn and garden equipment and construction equipment.

Oil and gas source emissions are from the revised Independent Petroleum Association of Mountain States (IPAMS) inventory, and were projected to 2010 using the methodology in the IPAMS projection methodology document. The IPAMS inventory was sponsored by the IPAMS and is Phase III of a regional oil and gas emission inventory for the Inter-Mountain West jointly with the Western Regional Air Partnership (WRAP).

Non-oil and gas area source (including heating, consumer solvent use, aircraft and railroads, etc.) are from the 2002 EPA National Emissions Inventory, grown to 2006 and 2010 by population growth from data from the State Demographer. Consumer solvent emission reductions based on 75% of the per-person reductions listed in the EPA May 30, 2007 Emission Reduction Credit Memo were applied to the projected 2010 non O&G area source inventory. A check on the non-oil & gas area sources estimates comparing the recently available 2005 NEI emissions data will be shown in the Technical Support Document (TSD). An inventory completed in 2005 for DIA was used for aircraft and airport non-road source emissions from DIA for both 2006 and 2010.

Non-oil and gas point source emissions were grown to 2010 by the EPA EGAS economic model, and by adding sources for which permits have been issued.

Emissions of VOC and NOx from biogenic sources have been generated by the MEGAN Biogenic Emissions Model using land cover data base of biomass type and density and hourly meteorology data. NCAR has produced a global data base of land use data for use with MEGAN, the MEGAN Driving Variable Database Version 1.2. Surface temperatures are provided by the MM5 modeling.

Summaries of the VOC and NOx base case inventories for the nonattainment area for 2006 and 2010 are presented in Table 5. 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, have been considered for the background ozone concentrations in the modeling effort. Wildfire emissions can vary significantly on a day-to-day basis depending on conditions.

**Table 5: 8-Hour Ozone DMA/NFR NAA Base Case Inventories**
**(tons per average episode day)**

| | 2006 | | 2010 | |
|---|---|---|---|---|
| **Source Category** | **NOX** | **VOC** | **NOX** | **VOC** |
| **Point Sources** | | | | |
| Electric Generation Units (EGU) | 55.6 | 0.7 | 58.5 | 1.6 |
| External Combustion Boilers | 9.5 | 0.4 | 10.0 | 0.5 |
| Industrial Processes | 12.5 | 10.2 | 14.0 | 11.0 |
| Petroleum and Solvent Evaporation | 0.3 | 19.0 | 0.3 | 22.0 |
| Other | 3.1 | 1.8 | 3.6 | 2.0 |
| **Point Sources Subtotal** | **81.0** | **32.1** | **86.4** | **37.0** |
| | | | | |
| **Oil & Gas Point & Area Sources** | | | | |
| Condensate Tanks | | 126.5 | | 129.6 |
| Other O&G Point Sources | 22.6 | 6.8 | 23.6 | 8.6 |
| Pneumatic Devices (Area Source) | | 24.8 | | 31.1 |
| Unpermitted Fugitives (Area Source) | | 16.2 | | 20.4 |
| Other Area Sources | 17.1 | 10.8 | 22.5 | 13.7 |
| **O&G Point & Area Sources Subtotal** | **39.7** | **185.2** | **46.2** | **203.3** |
| | | | | |
| **Area Sources** | | | | |
| Personal Care Products | | 7.1 | | 7.0 |
| Household Products | | 21.4 | | 17.9 |
| Automotive Aftermarket Products | | 11.9 | | 13.0 |
| Architectural Coatings | | 20.1 | | 16.8 |
| Aircraft | 7.4 | 1.3 | 8.2 | 1.5 |
| Railroad | 12.8 | 0.5 | 13.8 | 0.6 |
| Other Coatings/Pesticides/Cooking/ Miscellaneous. | | 3.9 | | 4.1 |
| **Area Source Subtotal** | **20.2** | **66.3** | **22.1** | **61.0** |
| | | | | |
| **Non-Road Mobile Sources** | | | | |
| Agricultural Equipment | 7.0 | 0.9 | 6.3 | 0.7 |
| Airport Equipment | 0.7 | 0.1 | 0.6 | 0.1 |
| Commercial Equipment | 5.3 | 6.2 | 5.1 | 7.0 |
| Construction and Mining Equipment | 35.7 | 5.5 | 31.2 | 4.5 |
| Industrial Equipment | 10.5 | 2.4 | 6.9 | 1.4 |
| Lawn and Garden Equipment (Commercial) | 9.4 | 35.9 | 8.9 | 28.1 |
| Lawn and Garden Equipment (Residential) | 1.2 | 7.5 | 1.2 | 11.8 |
| Boats/Recreational Equipment/Miscellaneous | 0.7 | 6.9 | 0.8 | 7.8 |
| **Non-Road Mobile Source Subtotal** | **70.5** | **65.3** | **61.0** | **61.3** |
| | | | | |
| **On-Road Mobile Sources** | | | | |
| On-Road Mobile (including vehicle refueling) | 165.5 | 129.7 | 122.9 | 109.2 |
| **On-Road Mobile Subtotal** | **165.5** | **129.7** | **122.9** | **109.2** |
| | | | | |
| **Anthropogenic Total** | **376.8** | **478.6** | **338.5** | **471.8** |
| **Biogenic Total** | **53.0** | **694.0** | **53.0** | **694.0** |
| **Anthropogenic & Biogenic Total** | **429.8** | **1172.6** | **391.5** | **1165.8** |

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# CHAPTER IV
# SIP CONTROL MEASURES

This section of the 8-Hour Ozone Attainment State Implementation Plan (SIP) lists the additional control measures, above and beyond those assumed in the 2010 base case inventory described in Chapter III, that are incorporated in this attainment demonstration SIP for the 1997 0.08 ppm 8-hour ozone National Ambient Air Quality Standards (NAAQS) by 2010. For purposes of this 8-Hour Ozone Attainment SIP, and for inclusion of such control measures in the State Implementation Plan, the term "8-hour ozone nonattainment area" shall mean the area designated by the EPA as a nonattainment area for the 8-hour ozone standard in 2004 (69 FR 23857, April 30, 2004).

## A. Revisions to Regulation No. 11 - Automobile Inspection and Readjustment (AIR) Program

The SIP includes revisions to Air Quality Control Commission Regulation No. 11 that lowers emission cutpoints that will increase the VOC, $NO_x$, and CO emission reductions achieved from the existing Automobile Inspection and Readjustment (AIR) program in the Denver Metro Area. The AIR program has been in place in the Denver Metro Area since the mid 1990s. Program standards then in place were used for the 2006 base year modeling.

In March 2008, the Air Quality Control Commission (AQCC) approved revisions to Regulation No. 11 that tightened tailpipe emissions standards for VOCs, CO and $NO_x$ used to pass or fail program eligible vehicles in the Denver Metro Area. The revised cutpoints went into effect in May 2008. Vehicles subject to the AIR program are inspected on a two-year cycle; therefore the emission benefits from the more stringent cut-points will be fully achieved by the summer of 2010. The reductions in emissions when fully realized are estimated to be 1 tpd VOC, 3 tpd NOx and 13 tpd CO.

This revision to Regulation No. 11 will be submitted to EPA for inclusion in the State Implementation Plan.

This revised regulation can be found at www.cdphe.state.co.us/regulations/airregs/.

## B. 7.8 Reid Vapor Pressure in North Front Range

The North Front Range area is currently subject to a national Reid Vapor Pressure (RVP) limit of 9.0 pounds per square inch (10.0 psi for ethanol blends).

This revision to the State Implementation Plan requests and anticipates that EPA change the federal regulatory Reid Vapor Pressure requirement to 7.8 psi RVP (8.8 psi for ethanol blends) gasoline for the North Front Range area by May 2009 but no later than May 2010. Once the SIP is approved, a formal request will be made to EPA to revise the federal regulation if EPA has not already taken the necessary action. The estimated reduction is 3 tpd VOC reduction to direct on-road mobile source emissions and in refueling (gas station) emissions.

## C. Condensate Tank Emissions Controls

The approved EAC Ozone Action Plan included 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 initial rule required the installation of air pollution control technology to achieve a system-wide 47.5% reduction from uncontrolled emissions of volatile organic compounds from new and existing oil and gas exploration and production operations located within the 8-hour ozone nonattainment area designated by EPA. The rule includes an exemption if total emissions from an operator are less 30 tons per year.

In 2006 the AQCC approved to Regulation No. 7 to require the system-wide reduction of condensate tank flash VOC emissions of 75% for the 2007 ozone season, and 78% reduction for the 2012 ozone season, with technology that achieves a 95% reduction in VOC emissions.

This revision to the State Implementation Plan further amends Regulation No. 7 *(See Attachment A SIP Rule Language, Regulation No.7 Section XII and for specific reference to the two control strategies below see Section XII.D.1 & Section XII.D.2. B (ii))* to phase out the system-wide approach and replace it with a threshold approach to achieve additional reduction of condensate tank flash volatile organic compound (VOC) emissions as follows:

- Control new and modified condensate tanks ≥ 2 tpy in the nonattainment area by 95% and install and operate auto igniters and electronic surveillance, effective February 1, 2009
- Retrofit existing condensate tanks ≥ 10 tpy in the nonattainment area to 95% control and install and operate auto igniters and electronic surveillance by May 1, 2010

The reduction from these strategies is estimated at 24 tpd reduction in VOC based on an assumed Rule Effectiveness *(See Chapter V.D.)* adjustment of 0.83 applied to the estimated potential emissions reduction.

***The North Front Range Transportation and Air Quality Planning Council has endorsed an alternative approach suggested by industry that would increase the current system-wide control factor to 90% as a SIP measure. This alternative proposal is likely to be considered by the Air Quality Control Commission during its upcoming rulemaking pre-hearing process.*

## D. Pneumatic Control Devices

Pneumatic devices powered by pressurized natural gas are used widely in the natural gas industry as liquid level controllers, pressure regulators and valve controllers. As a part of normal operation pneumatic devices release or bleed natural gas to the atmosphere.

A revision to Regulation No. 7 *(See Attachment A SIP Rule Language, Regulation No.7 Section XIII.I)* requires that natural gas actuated pneumatic control devices in the nonattainment area shall be low bleed devices unless granted an exception for safety purposes from the Air Pollution Control Division (APCD) as follows:

- New pneumatic control devices shall be low-bleed devices effective February 1, 2009
- Existing high-bleed pneumatic control devices shall be retrofitted to low-bleed devices effective May 1, 2009
- Existing and new high-bleed devices may receive an exemption for safety reasons, but must receive enhanced maintenance on a monthly basis

Approximately 19 tpd VOC reduction is estimated for this control strategy based on an assumed Rule Effectiveness *(See Chapter V.D.)* adjustment of 0.83.

## E. Additional Revisions to Regulation Nos. 3 & 7

**Regulation No. 7 Expansion to all NAA in Colorado**

The current Regulation No. 7 is specific to the former Denver one-hour ozone attainment-maintenance area. This revision to Regulation No. 7 expands the source-category VOC emission control requirements to include all ozone nonattainment areas in the state, which will now include the entire Denver/North Front Range nonattainment area.

All ozone nonattainment areas in the state (existing and future designations) shall be subject to Regulation 7 Reasonably Available Control Technology (RACT) requirements.

**Regulation No. 3 Exemptions**

Regulation No. 3 currently defines a wide variety of sources that are exempt from providing Air Pollutant Emission Notices (APEN) and/or permitting because by themselves or cumulatively as a category they are deemed to have a negligible air quality impact.

APEN and permitting exemptions will be removed or revised to develop an inventory of emissions from source categories where actual emissions are anticipated to exceed reporting thresholds or there are equity issues, and in the case of condensate tanks, to exclude categorical exemptions over the new 1 ton per year APEN threshold in the nonattainment area. Proposed exemptions for removal/revision are as follows:

- Removal of APEN and permit exemptions for O &G condensate storage tanks, but may make use of the generic APEN exemption when actual emissions fall below defined de minimis levels.
- Remove APEN exemptions but retain permit exemptions for the following:
    - petroleum industry flares
    - crude oil truck loading
    - oil production wastewater
    - crude oil storage tanks
- Revise APEN/permitting exemptions for surface water impoundments and chemical storage tanks to exclude the exemption for the following:
    - oil and gas production wastewater
    - commercial facilities' operations
- Revise APEN/permitting exemptions for fuel storage dispensing to expand the applicability all nonattainment areas for equity purposes.

**Regulation Nos. 3 & 7 RACT Clarification**

Clarifies how both Regulation No. 3 minor source RACT requirements and Regulation No. 7 RACT requirements apply in an ozone nonattainment area as follows:

- All new and modified sources having VOC ≥ 2 tpy or NOx ≥ 5 tpy emissions are required to complete a RACT analysis unless subject to a general RACT (based on adopted control technique guidelines (CTGs)) in Regulation No. 7, and implement RACT.
- All existing sources having VOC emissions greater than 100 tons per year in a nonattainment area are required to complete a RACT analysis and implement RACT.

*(For Rule Language on Regulations No. 3 & 7 see Attachment A - SIP Rule Language, Regulation No.7and Regulation No.3)*

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# CHAPTER V
# PHOTOCHEMICAL MODELING & OTHER WEIGHT OF EVIDENCE ANALYSES FOR ATTAINMENT DEMONSTRATION

## A. Photochemical Modeling for the 2006 and 2010 Base Case Scenarios

As a former Early Action Compact (EAC) area, the Environmental Protection Agency (EPA) regulation requires a photochemical grid modeling attainment demonstration as part of the revised 8-Hour Ozone Attainment State Implementation Plan (SIP). The goal of the attainment plan's 8-hour ozone modeling analysis is to conduct a comprehensive photochemical modeling study for the Denver Metro Area/North Front Range nonattainment area that can be used as the technical basis for demonstrating attainment with the 8-hour ozone National Ambient Air Quality Standard (NAAQS).

The photochemical model "Comprehensive Air Quality Model with Extensions" (CAMx) (as applied by 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 2006 and 2010 base case were processed through the emissions processing systems, CONCEPT for the DMA on-road mobile, MEGAN for biogenic emissions and SMOKE for the other emissions categories. The photochemical modeling study was conducted in accordance with EPA modeling guidance for ozone ("Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze" (EPA-454/B-07-002, April 15, 2007) 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 (TSD) for this plan. Technical support documentation for modeling includes:

- Modeling Protocol, Episode Selection, and Domain Definition
- Evaluation of MM5 Simulations of the June-July 2006 Denver Ozone Season
- Development of the 2002 base case Modeling Inventory
- Model Performance Evaluation June-July 2006 Denver Ozone Season, Diagnostic Testing and Analysis
- Development of the 2010 base case modeling inventory

- Air Quality Modeling for the 2006 & 2010 base case, 2010 base case ozone projections, and sensitivity analysis
- Additional Air Quality Modeling Analysis to address 8-Hour ozone Attainment for the DMA/NFR nonattainment area

It should be noted that the suite of mathematical models used to evaluate current and future air quality possess inherent limitations owing to the necessary simplifications and approximations made in formulating the governing equations, implementing them for numerical solution on fast computers, and in supplying them with input data sets and parameters that are themselves approximations of the full state of the atmosphere and emission processes. To put the air quality model results in full perspective, the technical support document contains model performance evaluations for the meteorological and photochemical model.

A very brief summary of photochemical model performance is offered as follows:

- The model has a tendency to under predict the observed peaks in ozone concentration that is believed to be due in part to
    - inability of the meteorology model to push the ozone concentrations far enough into the foothills;
    - inability to replicate retention of ozone aloft for a sustained period of days; and,
    - some days possibly understating the contributions of transport and the amount of ozone generated in the Denver urban plume.
- The model meets EPA's peak, bias and error ozone performance goals for ozone modeling on a vast majority of the modeled days.
- There is good agreement between the modeled and measured VOC/NOx ratios in Denver on most days suggesting that the mobile sources inventory is representative and the model is simulating the correct chemical regimes.
- The model meets EPA guidance performance requirements which require that most of the matched pairs near the monitor should be within ± 20% of the observed value. This model's performance for the matched pairs is as follows:
    - Maximum modeled daily maximum = 76% within ± 20% of the observed value;
    - Closest modeled daily maximum = 91% within ± 20% observed value; and
    - Spatial paired modeled daily maximum = 82% within ± 20% observed value.

Even though all models and modeling protocols have inherent limitations, photochemical grid modeling is the best tool available to assess progress in reducing ozone concentrations and to integrate the hourly variable inputs of emissions, meteorology and chemistry data over a two-month modeled ozone season. To mitigate the limitations of the modeling platform, the results are not used in an absolute sense, but rather are used

in relative sense as discussed in the next section. In addition, EPA modeling guidance requires a Weight of Evidence analysis that uses other objective air quality measures and modeling parameters to supplement the modeling results.

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

The modeling produces base case relative response 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 2006 base case modeled 8-hour ozone concentration divided by the mean 2010 base case modeled 8-hour concentration. The RRF is essentially the percentage change in modeled ozone concentrations between 2006 and 2010. Specifically, each RRF is the mean of at least 10 daily 8-hour predicted maximum concentrations in 2006 greater than 0.075 ppm "nearby" (within 15 kilometers) a monitor during a given episode divided by the mean of similar 2010 daily 8-hour predicted maximum concentrations during a given episode as shown below. (Based on EPA's "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze" (EPA-454/B-07-002, April 15, 2007).

$$\text{Relative Response Factor (RRF)} = \frac{\text{Mean 2010 Base Case Modeled 8-hour Ozone Concentrations (ppm)}}{\text{Mean 2006 Base Case Modeled 8-hour Ozone Concentrations (ppm)}}$$

An RRF for each monitoring site for modeled (predicted) days greater than 0.075 ppm is presented in Table 6.

## C. Estimated Future (2010) 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.

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

Table 6 presents the current (2005-2007) base case design values (DVC) for each monitoring site, the modeled base case RRFs for modeled days greater than 0.075 ppm, and the future base case design values (DVF) for each site. If the future (2010) base case design values are less than 0.085 ppm (85 ppb), then attainment is demonstrated.

However, when there are DVFs in the range of 82-87 ppb EPA guidance requires a Weight of Evidence (WOE) analysis to supplement the attainment demonstration.

EPA guidance indicates that base design values, which are the three year average of the 4$^{th}$ maximum values at each monitor and which is the case here, are to be presented to 3 places in ppm, truncating the 4$^{th}$ place right of the decimal point. When projecting future design values in ppm, similarly rounding to the 4$^{th}$ place and ultimately truncating the 4$^{th}$ place for comparison with the NAAQS is required. In Table 6 below, the future design values have been calculated to the 4$^{th}$ place in ppm and presented with the 4$^{th}$ place truncated for comparison with the 1997 8-hour standard of 0.084 ppm.

**Table 6: 2010 Base Case Design Values for Each Monitoring Site for Modeled Days greater than 0.075 ppm**

| Site Name | 8-Hour Ozone Current (2005-2007) Base Case Design Values (ppm) | Modeled Base Case Relative Response Factors | Calculated 8-Hour Ozone Future (2010) Base Case Design Values (ppm) | Truncated 8-Hour Ozone Future (2010) Base Case Design Values (ppm) |
|---|---|---|---|---|
| Welby | 0.070 | 1.0042 | 0.0702 | 0.070 |
| Arvada | 0.079 | 1.0026 | 0.0792 | 0.079 |
| NREL | 0.082 | 1.0039 | 0.0823 | **0.082** |
| Rocky Flats North | **0.085** | 0.9994 | 0.0849 | **0.084** |
| S. Boulder Creek | 0.081 | 0.9976 | 0.0808 | 0.080 |
| Fort Collins | 0.074 | 0.9878 | 0.0730 | 0.073 |
| Fort Collins West* | **0.086** | 0.9874 | 0.0849 | **0.084** |
| Carriage | 0.074 | 1.0022 | 0.0741 | 0.074 |
| Welch | 0.075 | 1.0004 | 0.0750 | 0.075 |
| CAMP | 0.056 | 1.0017 | 0.0560 | 0.056 |
| Weld County Tower | 0.078 | 0.9964 | 0.0777 | 0.077 |
| Highland | 0.078 | 0.9916 | 0.0773 | 0.077 |
| Chatfield Res. | 0.084 | 0.9934 | 0.0834 | **0.083** |
| Rocky Mtn. N.P. | 0.076 | 0.9903 | 0.0752 | 0.075 |

* FCW has only 2 years of complete data available, 2006 & 2007

As can be noted attainment at all of the monitors is achieved (design values less than 85 ppb) in 2010 for the 8-hour ozone nonattainment as a result of the reductions expected from existing programs and regulations. However, since there are four monitors with design values between 82-87 ppb a WOE analysis is required.

## D. 2010 Control Case Emission Inventories

Reductions from the SIP control measures described in Chapter III have been applied to the 2010 base case emissions inventories to provide an additional safety margin as follows:

- Reid Vapor Pressure of base gasoline to be 7.8 psi (maintains 1.0 psi waiver for ethanol-blended gasoline at 85% market share) in North Front Range – estimated 3 tpd VOC reduction to direct on-road mobile source emissions and in refueling (gas station) emissions.
- Controls on new condensate tanks ≥ 2 tpy and existing tanks ≥10 tpy – estimated 24 tpd reduction in VOC based on an assumed Rule Effectiveness adjustment of 0.83 applied to the calculated actual emissions reduction.
- New and existing pneumatic control devices required to be low-bleed devices – approximately 19 tpd VOC reduction based on an assumed Rule Effectiveness adjustment of 0.83.
- Tighten Regulation No. 11 I/M cut points - 1 tpd VOC, 3 tpd NOx and 13 tpd CO.
- Additional Regulation No. 3 & 7 changes – no additional credit assumed.

Rule Effectiveness (RE) reflects the actual ability of a regulatory program for controlled point sources or source categories to achieve the emissions reductions required by regulation. During the AQCC 2006 rule making on Regulation No. 7 revisions related to controls on condensate tank emissions, new EPA guidance on RE was reviewed. In consultation with EPA Region 8 staff, an RE of 0.83 was established for the oil and gas industry facilities. This essentially discounts the calculated reduction estimates by 17%. The previously agreed upon RE of 0.83 was assumed for condensate tank controls and pneumatic devices for the purposes of facilitating the 2010 base case and control case modeling.

The APCD has recently analyzed both the weekly compliance rate through reporting and compliance rate of random inspections on condensate controls for the 2007 peak ozone season for each of the companies with total system wide VOC emissions of 30 tons per year. The analysis indicates an 83% compliance rate based on weekly reporting and a 91% compliance rate based on random inspections. Based on this analysis and the proposed revisions to strengthen Regulation No. 7, the State believes a rule effectiveness factor of at least .83 is still valid. Analysis supporting the final RE used in modeling is found in the TSD, Section --.

The total emission reduction, compared to the 2006, for these control strategies (together with the federal and existing state controls assumed for the 2010 base case) is approximately 47 tons per day VOC and 3 tons per day NOx in the 8-nonattainment area (however the total VOC reduction could be as great as 70 tons per day without the rule effectiveness reduction) The resulting 2010 control inventory based on the total control

package noted above is presented below in Tables 7 (VOC) & 8 (NOx) for the 8-hour nonattainment area. All inventories presented as tons per summer day (tpsd) in this chapter represent a typical average episode day. In the photochemical modeling, all anthropogenic source categories are varied by day of the week, time of day, temperature, location, speciation and other factors. Biogenic sources are varied by differing meteorological conditions and diurnally varied by temperature.

## Table 7: VOC Base Case & Control Case Emission Inventory
**(tons per average episode day)**

| | 2006 Base | 2010 Base | 2010 Control |
|---|---|---|---|
| **Source Category** | **VOC** | **VOC** | **VOC** |
| **Point Sources** | | | |
| Electric Generation Units (EGU) | 0.7 | 1.6 | 1.6 |
| External Combustion Boilers | 0.4 | 0.5 | 0.5 |
| Industrial Processes | 10.2 | 11.0 | 11.0 |
| Petroleum and Solvent Evaporation | 19.0 | 22.0 | 22.0 |
| Other | 1.8 | 2.0 | 2.0 |
| **Point Sources Subtotal** | **32.1** | **37.0** | **37.0** |
| | | | |
| **Oil & Gas Point & Area Sources** | | | |
| Condensate Tanks | 126.5 | 129.6 | 105.6 |
| Other O&G Point Sources | 6.8 | 8.6 | 8.6 |
| Pneumatic Devices (Area Source) | 24.8 | 31.1 | 12.0 |
| Unpermitted Fugitives (Area Source) | 16.2 | 20.4 | 20.4 |
| Other Area Sources | 10.8 | 13.7 | 13.7 |
| **O&G Point & Area Sources Subtotal** | **185.2** | **203.3** | **160.1** |
| | | | |
| **Area Sources** | | | |
| Personal Care Products | 7.1 | 7.0 | 7.0 |
| Household Products | 21.4 | 17.9 | 17.9 |
| Automotive Aftermarket Products | 11.9 | 13.0 | 13.0 |
| Architectural Coatings | 20.1 | 16.8 | 16.8 |
| Aircraft | 1.3 | 1.5 | 1.5 |
| Railroad | 0.5 | 0.6 | 0.6 |
| Other Coatings/Pesticides/Cooking/Miscellaneous | 3.9 | 4.1 | 4.1 |
| **Area Source Subtotal** | **66.3** | **61.0** | **61.0** |
| | | | |
| **Non-Road Mobile Sources** | | | |
| Agricultural Equipment | 0.9 | 0.7 | 0.7 |
| Airport Equipment | 0.1 | 0.1 | 0.1 |
| Commercial Equipment | 6.2 | 7.0 | 7.0 |
| Construction and Mining Equipment | 5.5 | 4.5 | 4.5 |
| Industrial Equipment | 2.4 | 1.4 | 1.4 |
| Lawn and Garden Equipment (Commercial) | 35.9 | 28.1 | 28.1 |
| Lawn and Garden Equipment (Residential) | 7.5 | 11.8 | 11.8 |
| Boats/Recreational Equipment/Miscellaneous | 6.9 | 7.8 | 7.8 |
| **Non-Road Mobile Source Subtotal** | **65.3** | **61.3** | **61.3** |
| | | | |
| **On-Road Mobile Sources** | | | |
| On-Road Mobile (including vehicle refueling) | 129.7 | 109.2 | 106.0 |
| **On-Road Mobile Subtotal** | **129.7** | **109.2** | **106.0** |
| | | | |
| **Anthropogenic Total** | **478.6** | **471.8** | **425.4** |
| **Biogenic Total** | **694.0** | **694.0** | **694.0** |
| **Anthropogenic & Biogenic Total** | **1172.6** | **1165.8** | **1119.4** |

## Table 8: NOx Base Case & Control Case Emission Inventory
**(tons per average episode day)**

| | 2006 Base | 2010 Base | 2010 Control |
|---|---|---|---|
| **Source Category** | **NOX** | **NOX** | **NOX** |
| **Point Sources** | | | |
| Electric Generation Units (EGU) | 55.6 | 58.5 | 58.5 |
| External Combustion Boilers | 9.5 | 10.0 | 10.0 |
| Industrial Processes | 12.5 | 14.0 | 14.0 |
| Petroleum and Solvent Evaporation | 0.3 | 0.3 | 0.3 |
| Other | 3.1 | 3.6 | 3.6 |
| **Point Sources Subtotal** | **81.0** | **86.4** | **86.4** |
| | | | |
| **Oil & Gas Point & Area Sources** | | | |
| Condensate Tanks | | | |
| Other O&G Point Sources | 22.6 | 23.6 | 23.6 |
| Pneumatic Devices (Area Source) | | | |
| Unpermitted Fugitives (Area Source) | | | |
| Other Area Sources | 17.1 | 22.5 | 22.5 |
| **O&G Point & Area Sources Subtotal** | **39.7** | **46.2** | **46.2** |
| | | | |
| **Area Sources** | | | |
| Personal Care Products | | | |
| Household Products | | | |
| Automotive Aftermarket Products | | | |
| Architectural Coatings | | | |
| Aircraft | 7.4 | 8.2 | 8.2 |
| Railroad | 12.8 | 13.8 | 13.8 |
| Other Coatings/Pesticides/Cooking/Miscellaneous | | | |
| **Area Source Subtotal** | **20.2** | **22.1** | **22.1** |
| | | | |
| **Non-Road Mobile Sources** | | | |
| Agricultural Equipment | 7.0 | 6.3 | 6.3 |
| Airport Equipment | 0.7 | 0.6 | 0.6 |
| Commercial Equipment | 5.3 | 5.1 | 5.1 |
| Construction and Mining Equipment | 35.7 | 31.2 | 31.2 |
| Industrial Equipment | 10.5 | 6.9 | 6.9 |
| Lawn and Garden Equipment (Commercial) | 9.4 | 8.9 | 8.9 |
| Lawn and Garden Equipment (Residential) | 1.2 | 1.2 | 1.2 |
| Boats/Recreational Equipment/Miscellaneous | 0.7 | 0.8 | 0.8 |
| **Non-Road Mobile Source Subtotal** | **70.5** | **61.0** | **61.0** |
| | | | |
| **On-Road Mobile Sources** | | | |
| On-Road Mobile (including vehicle refueling) | 165.5 | 122.9 | 118.9 |
| **On-Road Mobile Subtotal** | **165.5** | **122.9** | **118.9** |
| | | | |
| **Anthropogenic Total** | **376.8** | **338.5** | **334.6** |
| **Biogenic Total** | **53.0** | **53.0** | **53.0** |
| **Anthropogenic & Biogenic Total** | **429.8** | **391.5** | **387.6** |

## E. Estimated Future (2010) Control Case Design Value

Table 9 presents the current (2005-2007) base case design values (DVC) for each monitoring site, the 2010 modeled control case RRFs for modeled days greater than 0.075 ppm, and the 2010 control case design values (DVF) for each site calculated per EPA Guidance with the 2005-2007 base case design values and the modeled control case RRF's.

**Table 9: 2010 Control Case Design Values for Each Monitoring Site for Modeled Days greater than 0.075 ppm**

| Site Name | 8-Hour Ozone Current (2005-2007) Base Case Design Values (ppm) | Modeled Control Case Relative Reduction Factors | Calculated 8-Hour Ozone Future (2010) Control Case Design Values (ppm) | Truncated 8-Hour Ozone Future (2010) Control Case Design Values (ppm) |
|---|---|---|---|---|
| Welby | 0.070 | 1.0039 | 0.0702 | 0.070 |
| Arvada | 0.079 | 1.0022 | 0.0791 | 0.079 |
| NREL | 0.082 | 1.0027 | 0.0822 | **0.082** |
| Rocky Flats North | **0.085** | 0.9981 | 0.0848 | **0.084** |
| S. Boulder Creek | 0.081 | 0.9963 | 0.0807 | 0.080 |
| Fort Collins | 0.074 | 0.9853 | 0.0729 | 0.072 |
| Fort Collins West* | **0.086** | 0.9852 | 0.0847 | **0.084** |
| Carriage | 0.074 | 1.0015 | 0.0741 | 0.074 |
| Welch | 0.075 | 1.0002 | 0.0750 | 0.075 |
| CAMP | 0.056 | 1.0009 | 0.0560 | 0.056 |
| Weld County Tower | 0.078 | 0.9925 | 0.0774 | 0.077 |
| Highland | 0.078 | 0.9900 | 0.0772 | 0.077 |
| Chatfield Res. | 0.084 | 0.9921 | 0.0833 | **0.083** |
| Rocky Mtn. N.P. | 0.076 | 0.9892 | 0.0751 | 0.075 |

* FCW has only 2 years of complete data available, 2006 & 2007

Attainment at all of the monitors continues to be achieved (design values less than 85 ppb) in 2010 for the 8-hour ozone nonattainment area with an additional (0.1 to 0.2 ppb) margin of safety as a result of the additional control measures discussed in Section D. of this Chapter. However, since there are still four monitor sites with design values between 0.082-0.087 ppm, a Weight of Evidence analysis is still necessary.

## F. Weight of Evidence (WOE) Analysis

EPA's 8-hour ozone modeling guidance suggests a weight of evidence analysis (a set of supplemental analyses) to support the attainment determination if the maximum modeled 8-hour ozone design value is between 0.082 ppm and 0.087 ppm at more than one monitor. Although all monitoring locations in this SIP attainment demonstration

indicate modeled attainment of the 8-hour ozone standard, four monitors (Rocky Flats North, Fort Collins West, Chatfield and NREL) have modeled concentrations that fall into the 0.082-0.087 ppm range. Therefore, a set of supplemental analyses are required to determine if these monitors are expected to demonstrate compliance with the ozone standard.

Supplemental analyses used in a weight of evidence will help determine whether attainment is likely where modeled attainment test results indicate future air quality levels are near the NAAQS.

*(The full WOE analysis is currently incomplete, though a large portion of the basic WOE analyses has been included in this document. The WOE analysis will continue to be refined through the AQCC Public Hearing process.)*

## Recent Air Quality Related Trends

### Emission Trends

Impacts of federal tailpipe regulations have continued to reduce mobile source emissions of VOC and NOx over time. The Tier 2 & 3 non-road mobile regulations have been reducing emissions in that source category. Reformulation of paints and consumer products are reducing emissions in the area source category. Point source growth has been modest. Therefore despite continued growth in vehicle miles traveled, population and housing in the Denver/North Front Range area, the region has seen declining emissions of VOC and NOx in mobile, non-road and area sources.

The one area of significant emissions growth in the region since 2002 has been in the oil and gas industry. Controls were first applied to the industry prior to the 2005 peak ozone season and tightened prior to the 2007 peak ozone season to regulate previously uncontrolled facilities (condensate tanks). Due to continued growth, controls applied barely managed to keep pace with the growth in emissions. Additional recommended controls in this SIP and currently proposed state-only controls will continue to reduce emissions in the oil and gas industry and mobile sources beyond 2010.

The total estimate of VOC and NOx emissions from all sources in Tables 7 and 8 demonstrate an overall reduction in emissions between the 2006 base case and the 2010 base and control case. In Table 7 the reduction in total anthropogenic VOC from 2006 base case to 2010 base case is about 7 tpd. The 2010 control case will net an additional 46 tpd . The total VOC reduction from 2006 base case to 2010 Control Case is around 53 tpd, which is about an 11% reduction. In Table 8 the reduction in total anthropogenic NOx from 2006 base case to 2010 base case is about 38 tpd. The 2010

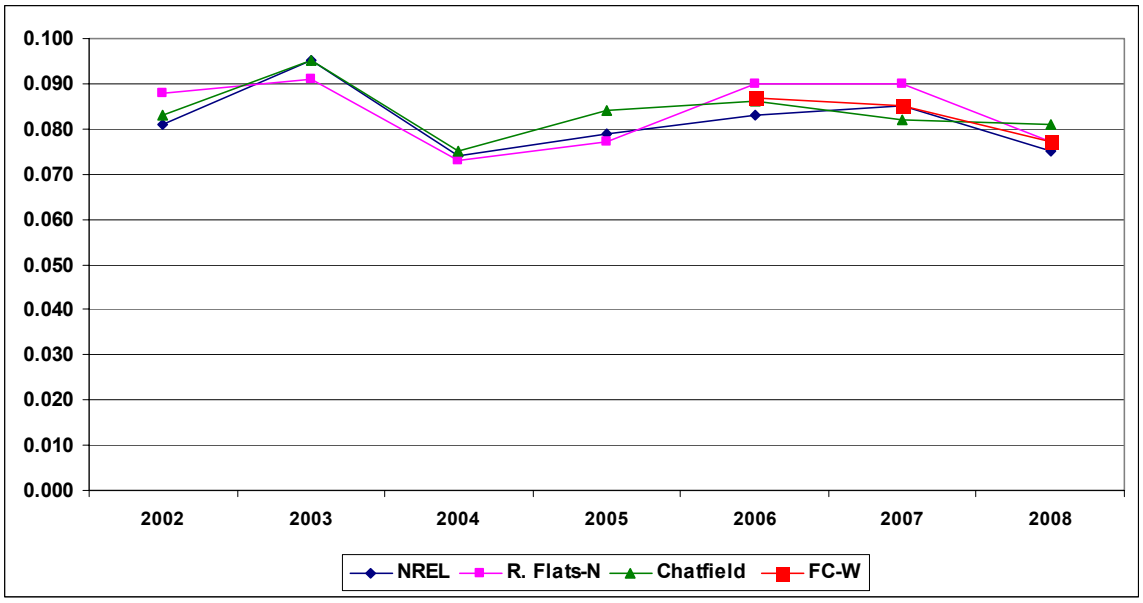
control case will net an additional 4 tpd .The total NOx reduction from 2006 base case to 2010 control case is around 42 tpd, which is about an 11% reduction.

**Trends in monitored 4th & 1st maximum ozone values**

The EAC Ozone Action Plan (OAP) required controls on oil and gas industry condensate VOC emissions prior to the 2005 peak ozone season. Due to recorded growth in condensate flash emissions, Regulation No. 7 was amended in late 2006 to preserve the EAC OAP and additional controls were applied to condensate tanks prior to the 2007 peak ozone season. The EPA required 7.8 RVP fuel in the DMA 1-hour ozone attainment maintenance area prior to the 2004 ozone season.

To bring focus to the 8-hour ozone issue, the chart below presents data from a few years prior to application of controls by the region through the end of August 2008. The 4th maximum 8-hour ozone value trends at monitors still projecting values between 82 and 87 ppb in the modeling exercise, NREL, Rocky Flats-N, Chatfield and Fort Collins West, are shown in the following chart:

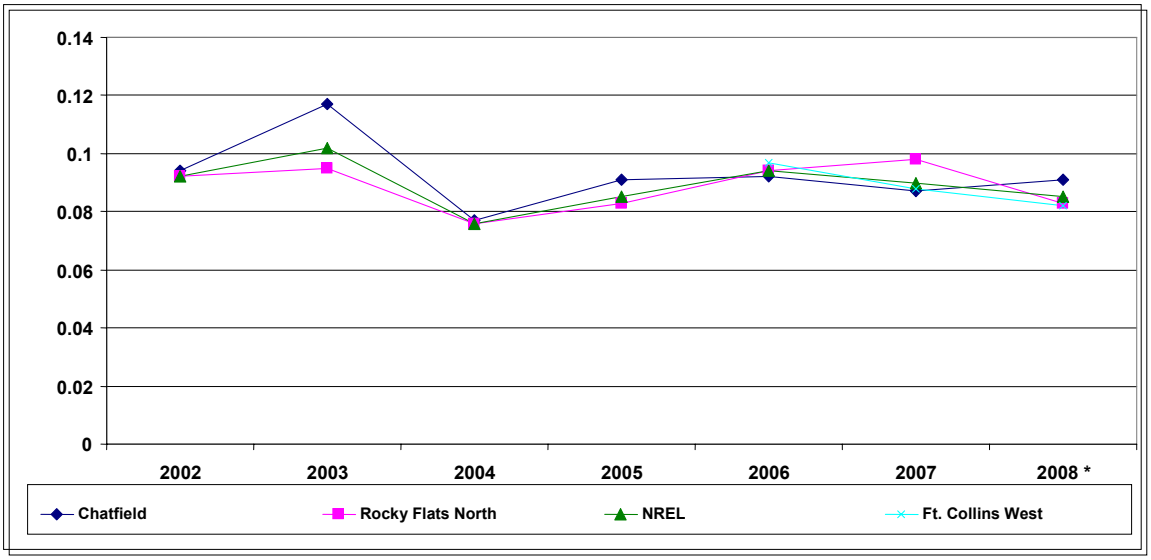
**Chart 1: Trends in 4th Maximum 8-Hour Ozone Values (ppm)**




Despite the variations in meteorology over the years, as can be seen, there is a downward trend in 4th maximum 8-hour ozone values at these “problem” monitors since 2002.

Chart 2 indicates the first maximum value trends for the four monitors. These monitors exhibit a slight, though relatively flat, downward trend since 2002.

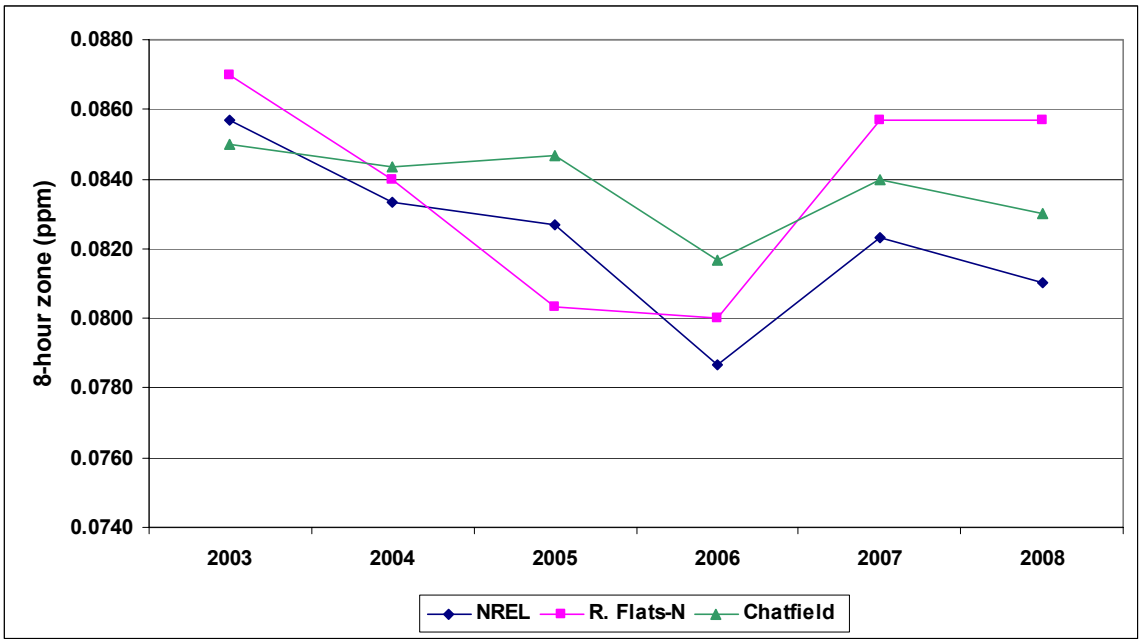
**Chart 2: Trends in 1st Maximum 8-Hour Ozone Values (ppm)**




**Trends in three-year design values**

To continue the focus on the trend in 8-hour ozone since the DMA/NFR began to address the issue, the following chart begins with the 2003 three-year (2001-03) design value to represent the time prior to application of local controls in the region. NREL, Rocky Flats-N and Chatfield data are presented as in the previous chart, while Fort Collins West is not included since in the context of this chart it would provide but one data point. The trend in design values at NREL and Chatfield show a clear downward trend, while the Rocky Flats-N monitor shows much more seasonal variation.

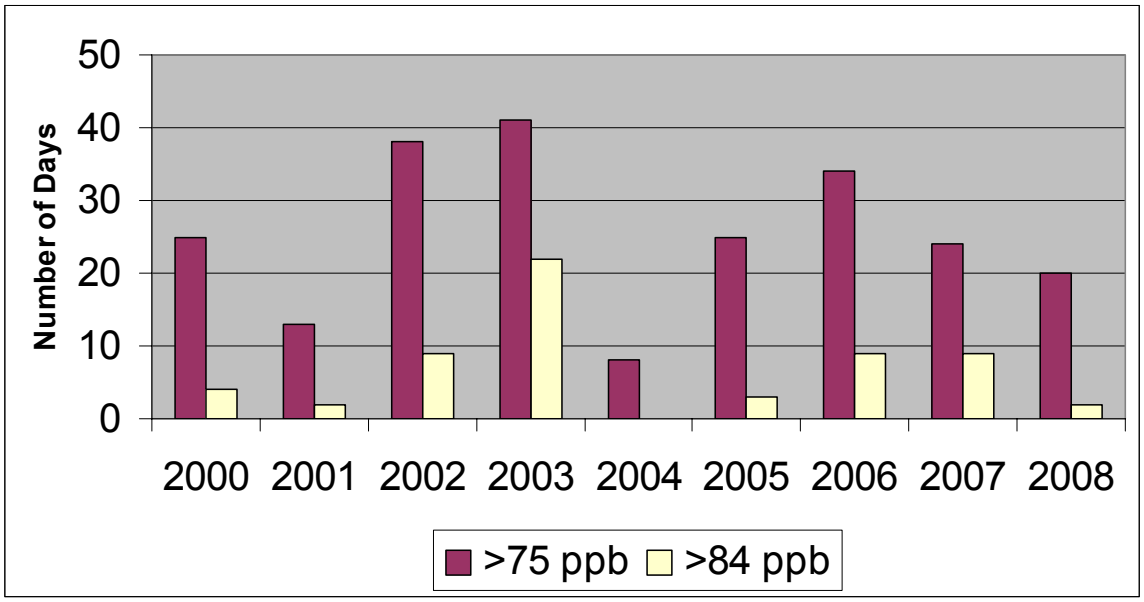
**Chart 3: Trends in 8-hour Ozone Design Values (ppm)**




**Trends in days greater than 75 ppb and 84 ppb**

The following chart presents data from the 2000 ozone season through August 31 of the current 2008 peak ozone season. The data presents days during the ozone seasons when there was a reading at any monitor in the region above 75 ppb and 84 ppb. The years 2004 through 2008 show a reduction in days of elevated ozone when compared to the years 2000 through 2003.

**Chart 4: Days Greater than 75 ppb and 84 ppb 8-hour Ozone**




**Review of Ozone Conceptual Models for the 8-hour NAA**

EPA guidance for the development of a conceptual model defines the meteorological conditions associated with high ozone concentrations. A conceptual model of ozone formation includes the current understanding of the local meteorological conditions and associated large-scale weather patterns typically experienced during periods of elevated ozone. Local understanding of ozone formation is not only important for forecasting elevated ozone levels to protect public health, but, also to gain an understanding of the effectiveness of control strategies.

As part of the conceptual model, supporting analysis includes a review of available ambient air quality data, meteorological data, and photochemical modeling efforts. As new meteorological data and emission inventory data becomes available as well as a better understanding of the chemical processing taking place in the nonattainment area, the opportunity to review the current understanding of local ozone formation in the Denver/NFR region presents itself.

Generally, ozone is formed by a complex series of chemical reactions involving photochemical reactive Volatile Organic Compounds (VOCs) and Oxides of Nitrogen (NOx) in the presence of sunlight. In the DMA/NFR, ambient concentrations of these precursor compounds are sufficient to produce ozone as evident by an occasional exceedance of the 8-hour ozone standard of 85 ppb. However, favorable meteorological conditions are also required before high ozone concentrations are measured.

**Local Meteorology**

Meteorology is the single most important factor affecting mid-summer ozone in the DMA/NFR. Light winds, a deep layer of thermally-driven upslope flow, local vertical re-circulation through the actions of a Front Range Mountain-Valley circulation, cloud-free skies, and warm temperatures are key ingredients for high ozone at the surface. The Mountain Valley circulation consists of thermally-driven surface upslope flow (toward the west) to mountain top level during the afternoon, mixing and transport vertically, and weak transport to the east at higher altitudes. Vertical mixing over Denver closes this loop, keeping ozone in the area. Nighttime surface drainage along valleys allows pooling of morning emissions in lower terrain along the Platte Valley. This phase contributes to the accumulation of emissions that are later processed by the sun and the daytime mountain-valley circulation during the afternoon.

A key feature that results in high ozone levels along the Front Range is upper air transport and retention of ozone aloft during the nighttime hours. This ozone aloft is subsequently incorporated into the surface boundary layer during the day. Research by National Oceanic and Atmospheric Administration (NOAA) scientists and APCD staff indicate a retention and buildup of ozone in the upper portion of the troposphere (the atmosphere below the stratosphere.) Ozone increases in the atmosphere above the nighttime boundary layer can be as large as 20 – 40 ppb.

Pollutants emitted during the day mix upwards and accumulate above the nighttime inversion layer. In addition, elevated point sources release pollutants above the inversion layer at night. These pollutants are transported aloft by mid-level winds. In the morning, under the strong insolation, surface temperature rises rapidly, forming a mixed layer that brings pollutants, transported or stored aloft during the night, to the surface.

**Synoptic Scale Meteorology**

Synoptically, a key factor is the multi-day mean 500-millibar height in the area, that is the mean strength of the synoptic scale regional upper level high-pressure systems. Good vertical mixing to about 18,000 feet above sea level (around 500 millibars in terms of pressure level) is often associated with high ozone along the Front Range Urban Corridor. Warm temperatures throughout this layer are also a typical prerequisite. Since the 500-millibar height is directly related to the mean temperature of the column of air below 18,000 feet, it turns out that it is a useful metric for forecasting high concentrations of ozone and a key factor in the magnitude of regional background concentrations.

Monthly mean 500-millibar heights are an excellent predictor of monthly mean daily maximum 8-hour ozone concentrations. July monthly mean daily maximum 8-hour ozone is more strongly correlated with 500-millibar heights than a host of other logical

choices for significant predictors of ozone, including mean surface temperatures, mean temperatures aloft, winds aloft, cloud cover, solar radiation, and number of days with temperatures above 90 degrees. Mean 500-millibar heights are very strongly correlated with monthly mean daily maximum concentrations.

Higher 500-millibar heights are generally synonymous with weaker westerlies and a lower incidence of thunderstorms. The highest mean July millibar heights in the last decade and some of the highest ozone readings since the late 1980's occurred in 2003. The year 2004 was on the opposite end of the scale for both ozone and heights. High heights also suggest that air at mid and upper levels is stagnating and re-circulating in the Four Corners states. This stagnation and re-circulation, and the retention of ozone in the mid levels from one day to the next, leads to a regional build up an ozone base or background. In this case, each day's peak is governed both by the specific details of the day's surface weather features and the regional mid-level base concentration that provides a kind of starting point for ozone.

While annual fourth maximum 8-hour ozone concentrations can occur in any of the months of summer, it turns out the mean July 500-millibar height over Denver is one of the single best predictors for this value at sites along the Front Range Urban Corridor. A full analysis of the synoptic scale including the 500-millibar height analysis can be found in the SIP technical support document.

**Back Trajectory Analysis**

Back trajectory calculations to the monitor at the time of the 8-hour ozone exceedances are recommended as part of the WOE attainment demonstration. The purpose of analyzing back trajectories includes:

- Comparing trajectories derived from different meteorological models to add validity to the local meteorological model (MM5) and to finer grid used for photochemical modeling;
- When the trajectory analysis is limited to daylight hours, the computed trajectory could be compared with observed surface air quality observations. If the timing of high ozone observed along the path of the trajectories is consistent with expectations, given the configuration of sources, this would be an indicator that the meteorological model is performing adequately;
- Daytime surface trajectories using observed wind data. These trajectories could also be compared with air quality patterns. By comparing the two sets of trajectories with observed air quality patterns, it would then be possible to assess whether the meteorological model increases the skill with which ozone plumes are oriented.

Back trajectories were estimated for each episode by using the NOAA HYSPLIT model (http://www.arl.noaa.gov/ss/models/hysplit.html). Back trajectories were calculated for Rocky Flat North (RFN) site and the Fort Collins West site (FTCW). The RFN monitor is representative of those air parcels that end up in the Denver metro area where those arriving at the northern front range sites. Given the distance and the terrain between the two monitors, back trajectories for those two locations can be very different on a day to day basis.

The WOE technical support document presents a back trajectory analysis for three ozone episodes in 2006 that coincides with the photochemical model base year. The three episodes are:

- June 17-19, 2006
- July 13-15, 2006
- July 27-29, 2006

These three episodes present three meteorological regimes when high ozone concentrations were modeled in the DMA//NFR. EPA recommends for the attainment demonstration that various meteorology conditions be modeled in order to estimate the benefit of the various control strategies. The back trajectory analysis demonstrates that by using the two month period of June-July 2006, that various meteorological regimes and resulting ozone were used to analyze the control strategy contain in this SIP.

The June 17-19, 2006 episode demonstrates that the ground-level air mass originated in the far eastern plains of Colorado. In this scenario, a thermally driven upslope condition occurred over Weld County, which is consistent with the conceptual model. In the Denver area, the upper air mass was from west and was directly opposite the low level winds. This would indicate that there was a lot of turbulence in the atmosphere that may have brought any aged air mass down to the surface but is also indicative of the conceptual model where vertical mixing is important in ozone formation in Denver.

The July 13-15, 2006 episode would indicate that there were high background concentrations of ozone and ozone precursors coming into the area from the west. Under this trajectory scenario, local controls would not have much effect on ozone concentrations along the front-range.

The composite trajectory analysis for July 27-29, 2006 indicates that stagnant and recirculation conditions existed over the Front Range that there was a fair amount of turbulence in the atmosphere where upper air and surface air was mixed. Both the stagnant conditions and the interaction between the upper level and surface conditions represent conditions for the conceptual model. This is also one of the best periods for analyzing the effects of local controls on ozone levels along the Front Range.

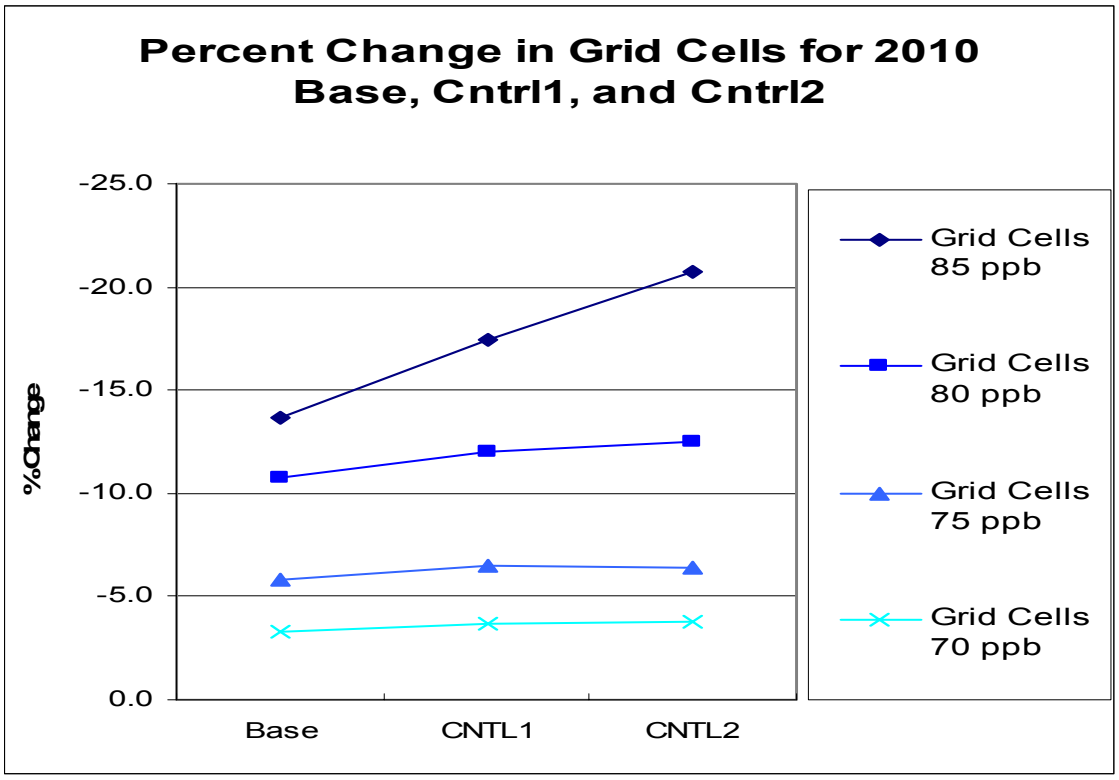
## Review of Modeled Metrics

Modeled metrics assess the changes in ozone levels at grid cells in the NAA from 2006 base case to 2010 base case to 2010 control case. In the charts that follow, “Cntrl1” represents the strategies contained in this SIP, while Cntrl2 represents proposed state-only strategies that are not included in the SIP but will provide additional reductions in the DMA/NFR area. All three of the metrics presented below (grid cells, grid cell hours and total ozone) show decreases in peak elevated ozone ≥ 85 ppb from emissions reductions due to existing controls and regulations and continued decreases due to SIP and state-only controls.

### Relative change in grid cells ≥ 85 ppb, ≥ 80 ppb, ≥ 75 ppb and ≥70 ppb

As can be seen in the Chart 5 below the emissions reductions from the 2006 base case to the 2010 base case achieve a 14% reduction in grid cells ≥ 85 ppb and an additional 3.5% reduction in grid cells due to the SIP strategies. Continued reduction of emissions (through state-only or voluntary measures) continues to demonstrate reduction of cells ≥ 85 ppb. Grid cells ≥ 80 ppb, ≥ 75 ppb and ≥70 ppb show an initial reduction due to existing controls and regulation from the 2006 base case to the 2010 base case and show ≥1% reduction due to the SIP and state-only controls.

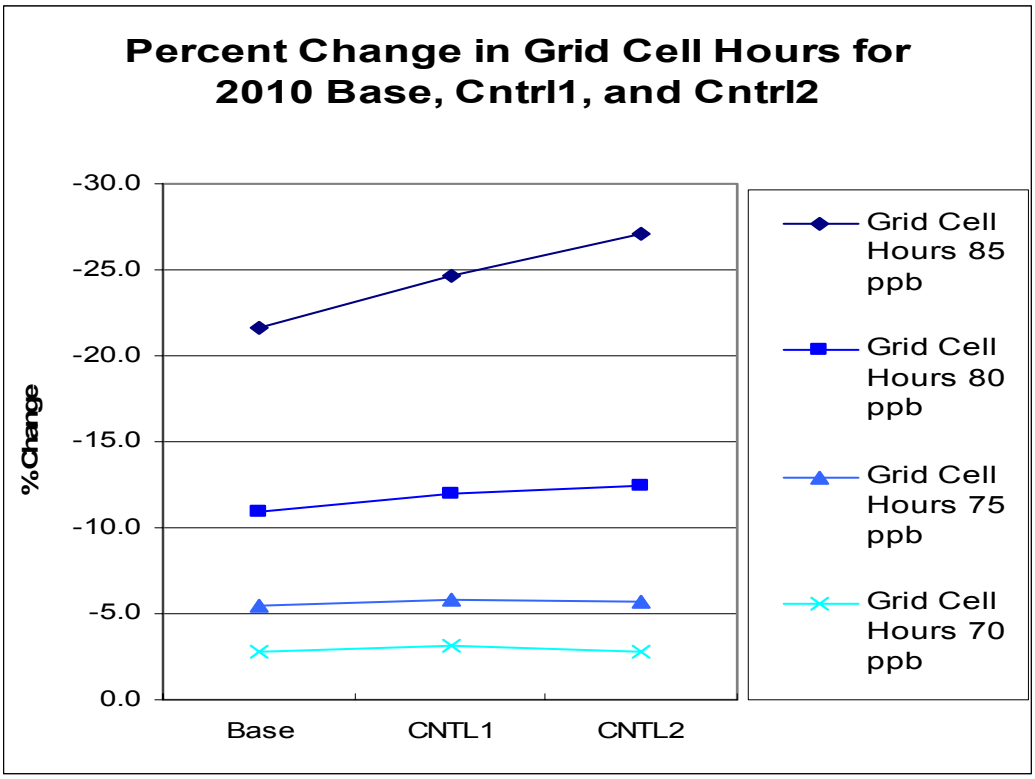
**Chart 5: Relative Change in Grid Cells**




**Relative change in grid cells-hours ≥ 85 ppb, ≥ 80 ppb, ≥ 75 ppb and ≥70 ppb**

As can be seen in Chart 6 below the emissions reductions from the 2006 base case to the 2010 base case achieve a 22% reduction in grid cells-hours ≥ 85 ppb and an additional 3% reduction in grid cells due to the SIP strategies. Continued reduction of emissions (through state-only or voluntary measures) continues to demonstrate reduction of cells-hours ≥ 85 ppb. Grid cell-hours ≥ 80 ppb, ≥ 75 ppb and ≥70 ppb show an initial reduction due to existing controls and regulation from the 2006 base case to the 2010 base case and show ≥ 1% increased reduction in cell-hours due to the SIP and state-only controls.

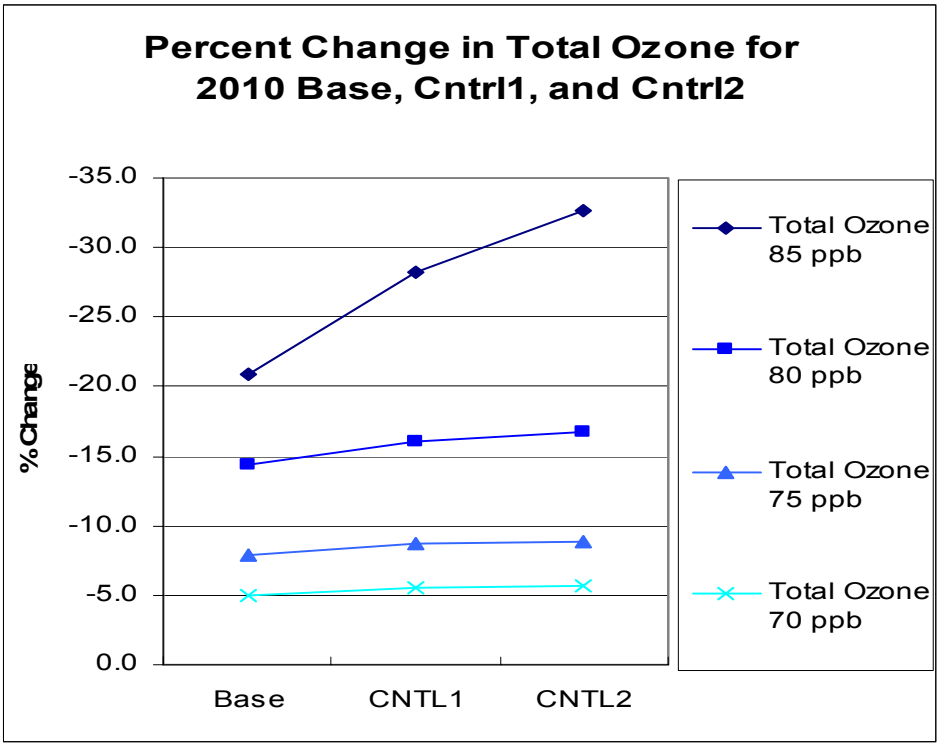
**Chart 6: Relative Change in Grid Cell-hours**




**Relative change in total 8-hour ozone ≥ 85 ppb, ≥ 80 ppb, ≥ 75 ppb and ≥70 ppb**

As can be seen in Chart 7 below the emissions reductions from the 2006 base case to the 2010 base case achieve a 21% reduction in total 8-hour ozone ≥ 85 ppb and an additional 7% reduction in total 8-hour ozone due to the SIP strategies. Continued reduction of emissions (through state-only or voluntary measures) continues to demonstrate reduction of total 8-hour ozone ≥ 85 ppb. Total 8-hour ozone ≥ 80 ppb, ≥ 75 ppb and ≥70 ppb show an initial reduction due to existing controls and regulation from the 2006 base case to the 2010 base case and show ≥1% increased reduction in cell-hours due to the SIP and state-only controls.

**Chart 7: Relative Change in Total 8 hour Ozone**




## Review Alternative Attainment Test Methodology

**EPA's recommended methodology for determining base year Design Value (DVB) for modeling purposes**

While EPA's modeling guidance offers several potential approaches for establishing base year design values, the guidance recommends the preferred methodology for establishing a base year design value as follows:

> "For the modeled attainment tests we recommend using the average of the three design value periods which include the baseline inventory year. Based on the attributes listed above (in the guidance), the average of the three design value periods best represents the baseline concentrations, while taking into account the variability of the meteorology and emissions (over a five year period)."

At the start of the work on the SIP in 2007 and throughout development of the proposed plan, the modeling analysis has used the 2005-2007 three-year design value as representative of the ozone situation facing the region at the time. Data from the 2008 ozone season (though currently not formally quality assured by the State or EPA) is now mostly available and the average of the three Design Values in the 2004-2008 period can now be calculated.

In this Weight of Evidence analysis, the EPA's recommended methodology is applied to establish the base year Design Values and project the 2010 base case Design Value. This methodology requires that the average of the base year Design Value over 2004-2008 be rounded to the 4th place and presented to the 4th place in ppm. After application of the Relative Response Factors, the future year (2010) Design Values are rounded to the 4th place and then truncated for comparison with the NAAQS, all as shown in the following table:

**Table 10**
**2010 Base Case Design Values Utilizing**
**EPA's Recommended DVB Calculation Methodology**

| Site Name | Current (2004-08*) Base Case Design Value (ppm) | Modeled Control Case Relative Response Factors | Calculated 2010 Base Case Design Value (ppm) | Truncated 2010 Base Case Design Value (ppm) |
|---|---|---|---|---|
| Welby | 0.0707 | 1.0042 | 0.0710 | 0.071 |
| Arvada | 0.0777 | 1.0026 | 0.0779 | 0.077 |
| NREL | 0.0808 | 1.0039 | 0.0811 | 0.081 |
| Rocky Flats North | 0.0840 | 0.9994 | 0.0839 | **0.083** |
| S. Boulder Creek | 0.0791 | 0.9976 | 0.0789 | 0.078 |
| Fort Collins | 0.0728 | 0.9878 | 0.0719 | 0.071 |
| Fort Collins West** | 0.083 | 0.9874 | 0.0820 | **0.082** |
| Carriage | 0.0728 | 1.0022 | 0.0730 | 0.073 |
| Welch | 0.0740 | 1.0004 | 0.0740 | 0.074 |
| CAMP | 0.0560 | 1.0017 | 0.0561 | 0.056 |
| Weld County Tower | 0.0769 | 0.9964 | 0.0766 | 0.076 |
| Highland | 0.0760 | 0.9916 | 0.0754 | 0.075 |
| Chatfield Res. | 0.0829 | 0.9934 | 0.0824 | **0.082** |
| Rocky Mtn. N.P. | 0.0759 | 0.9903 | 0.0752 | 0.075 |

* thru August 31, 2008. 2008 data have not been fully quality assured at this time;

** FCW only has three years of data and is presented as a Design Value to three places

As can be seen in Table 10, using EPA's recommended base year Design Value calculation approach results in achieving the standard at all the monitor sites with more safety margin than the results previously presented in Tables 6 using the three-year average (2005-07) base case design values for the 2010 Base Case.

Table 11 presents the future year Design Values from the 2010 SIP Control Case modeling using EPA's recommended DVB calculation approach. This approach results in achieving the standard at all the monitor sites with more safety margin than the results

previously presented in Tables 9 using the three-year average (2005-07) base case design values.

**Table 11**
**2010 Control Case Design Values Utilizing**
**EPA's Recommended DVB Calculation Methodology**

| Site Name | Current (2004-08*) Base Case Design Value (ppm) | Modeled Control Case Relative Reduction Factors | Calculated 2010 Control Case Design Value (ppm) | Truncated 2010 Control Case Design Value (ppm) |
|---|---|---|---|---|
| Welby | 0.0707 | 1.0039 | 0.0709 | 0.071 |
| Arvada | 0.0777 | 1.0022 | 0.0779 | 0.077 |
| NREL | 0.0808 | 1.0027 | 0.0810 | 0.081 |
| Rocky Flats North | 0.0840 | 0.9981 | 0.0838 | **0.083** |
| S. Boulder Creek | 0.0791 | 0.9963 | 0.0788 | 0.078 |
| Fort Collins | 0.0728 | 0.9853 | 0.0717 | 0.071 |
| Fort Collins West** | 0.083 | 0.9852 | 0.0818 | 0.081 |
| Carriage | 0.0728 | 1.0015 | 0.0729 | 0.072 |
| Welch | 0.0740 | 1.0002 | 0.0740 | 0.074 |
| CAMP | 0.0560 | 1.0009 | 0.0560 | 0.056 |
| Weld County Tower | 0.0769 | 0.9925 | 0.0763 | 0.076 |
| Highland | 0.0760 | 0.9900 | 0.0752 | 0.075 |
| Chatfield Res. | 0.0829 | 0.9921 | 0.0822 | **0.082** |
| Rocky Mtn. N.P. | 0.0759 | 0.9892 | 0.0751 | 0.075 |

* thru August 31, 2008. 2008 data have not been fully quality assured at this time;

** FCW only has three years of data and is presented as a Design Value to three places

**Use of Different Thresholds for Selecting Days for the RRF Calculation**

As required by EPA Guidance each Relative Response Factor (RRF) is based on at least 10 daily 8-hour predicted maximum concentrations in 2006 greater than 0.075 ppm "nearby" (within 15 kilometers) a monitor. The RRF is the mean of these daily predicted maximum concentrations divided by the mean of similar 2010 daily 8-hour predicted maximum concentrations during a given episode. Most of the RRFs in this SIP have been calculated with 10-11 days of data at a minimum threshold of 78 ppb. RRFs calculated with higher thresholds (79 ppb, 80 ppb, 81 ppb etc) are expected to yield greater reductions of peak ozone concentrations in the 2010 base and control cases for the emissions reductions applied. An analysis of the modeling results using high threshold levels is currently under development and will be included as soon as it is available.

**Assess the efficacy of SIP, state-only and voluntary control strategies**

The reduction in emissions from the 2006 base case to the 2010 SIP control case, which include reductions from current state and federal regulations and newly proposed state regulations for inclusion in the SIP, reduce VOC and NOx emissions by 11% from the 2006 base case. Photochemical grid modeling has shown that these reductions will reduce ozone concentrations in the nonattainment area.

The proposed state-only regulations controlling mobile source emissions and oil and gas facilities in the nonattainment area and statewide, plus a request of EPA for a change in RVP in the NFR area, anticipate an approximate additional 50-60 tpd of VOC reduction and 20-21 tpd of NOx reduction state-wide and in the nonattainment area. Photochemical grid modeling has shown that these reductions will provide additional reduction in ozone concentration in the nonattainment area.

In addition in the DMA/NFR there have been and will continue to be a myriad of voluntary measures that are not directly accounted for in the current and projected emissions inventories. Such programs include:

- The summertime Ozone Alert Program where citizens are alerted when elevated ozone levels are predicted and are encouraged to reduce their ozone-causing activities.
- The Regional Air Quality Council's "Let's Take Care of Our Summer Air" public awareness program that includes media advertising and community outreach to encourage citizen action to reduce ozone-causing activities.
- Lawn mower exchange programs in the Denver area and the North Front Range that offers discounts for citizens to replace and recycle old gasoline-powered mowers with electric mowers and lawn equipment.
- Replacement of faulty gas caps on cars and trucks through employer-sponsored activities and fleet testing programs
- Marketing efforts with Colorado Wyoming Petroleum Marketers Association and other gasoline retailers to educate motorists at their stores to "Stop at the Click," refuel in the evening, and maintain their vehicles to reduce ozone-forming emissions.
- Efforts by the Regional Air Quality Council and the Colorado Department of Public Health and Environment repair or salvage high-emitting vehicles that are identified on the road by remote-sensing technology.
- Pollution Prevention programs implemented by local business and industry to reduce their loss of product and prevent emissions of ozone-causing emissions.
- Employer-based travel reduction programs that are implemented by the Denver Regional Council of Governments, area transportation management associations, the Regional Transportation District, local governments, and local

businesses that encourage reduced automobile travel and increased use of alternative transportation and workplace options.

- Efforts by the Regional Air Quality Council, local school districts, and government and private fleets to reduce emissions from diesel vehicles through education and application emission control and anti-idling equipment.
- Car Care Fairs where area motorists can have their cars and trucks evaluated to improve vehicle performance and increase gas mileage.
- Implementation of land use and design policies by local governments to encourage sustainable development practices and mixed-use, transit-oriented development.
- Efforts by the State of Colorado to improve energy efficiency in state government and promote energy efficient practices throughout the state.
- Household chemical recycling events conducted by local governments and local health departments through the Denver area and North Front Range.
- Greenprint Denver, an initiative of the Denver Mayor's Office, promotes energy efficient practices, sustainable development, increased use of alternative fuels and low-emission vehicles, recycling programs, and increased tree planting.

## G. Commitment to Conduct Periodic Assessment of Growth Assumptions

The State of Colorado will periodically evaluate the growth assumptions used to develop this plan and will evaluate the need for additional control measures if needed to remedy unanticipated emission increases. Specifically, the APCD will periodically evaluate the data and growth assumptions used in the SIP’s attainment demonstration for new point source growth and future transportation patterns and their impact on air quality. If the review of growth demonstrates that adopted control measures are inadequate to address growth in emissions, additional measures will be considered and added to the plan.

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# CHAPTER VI
# VOC AND NOx MOTOR VEHICLE EMISSIONS BUDGETS

## A. Transportation Conformity

Transportation conformity provisions of section 176 (c)(2)(A) of the Clean Air Act (CAA) require regional transportation plans and transportation improvement programs to demonstrate that "…emissions expected from implementation of plans and programs are consistent with estimates of emissions from motor vehicles and necessary emissions reductions contained in the applicable implementation plan…"

The Environmental Protection Agency's (EPA) transportation conformity rule requires that control strategy implementation plans, which are defined in 40 CFR 93.101 as reasonable further progress plans and attainment demonstrations, contain motor vehicle emissions budgets. Because this State Implementation Plan (SIP) is an 8-hour ozone attainment demonstration, motor vehicle emissions budgets for volatile organic compounds (VOC) and nitrogen oxides (NOx) are proposed for 2010, which is the area's attainment year. Once these budgets are found adequate or are approved, the metropolitan planning organizations in the nonattainment area will use the budgets to demonstrate that projected emissions that would result from implementation of their transportation plans and transportation improvement programs are less than or equal to the adequate or approved emissions budgets.

The 8-hour ozone nonattainment area encompasses multiple metropolitan planning organizations (MPOs) and transportation planning regions. The Denver Regional Council of Governments (DRCOG) is the metropolitan planning organization responsible for transportation planning in the 7-county Denver metropolitan area and a portion of southwest Weld County. Likewise, the North Front Range Transportation and Air Quality Planning Council is the metropolitan planning organization responsible for transportation planning in the urbanized portions of Larimer and Weld counties. Finally, the Upper Front Range Transportation Planning Region (TPR) not a designated metropolitan planning organization but is responsible for transportation planning in the rural portions of Larimer, Weld, and Morgan counties.

Because of the different institutional arrangements and different schedules and timelines for transportation plans and programs development, this SIP establishes two subarea motor vehicle emission budgets (one each for VOC and NOx) as well as regional motor vehicle emissions budget for purposes of transportation conformity in the Denver/North Front Range 8-hour ozone nonattainment area.

## B. Motor Vehicle Emission Budgets

According to EPA regulations and guidance, the (SIP) may establish a budget or budgets that apply to the entire nonattainment area, and/or subarea budgets for each metropolitan planning organization or subarea within the nonattainment area.

For purposes of this SIP, motor vehicle emissions budgets for VOC and NOx are established for the 2010 attainment year. In addition, budgets are specifically established for two sub-regional areas for purposes of transportation conformity. The two subareas are defined as follows and shown in Figure 2:

- **Southern Subarea** – Area denoted by the ozone nonattainment area south of the Boulder County northern boundary and extended through southern Weld County to the Morgan County line. This includes the nonattainment portion of DRCOG's' regional planning area and the southern Weld County portion of the Upper Front Range TPR.

- **Northern Subarea** -- Area denoted by the ozone nonattainment area north of the Boulder County northern boundary and extended through southern Weld County to the Morgan County line. This includes the North Front Range Transportation and Air Quality Planning Council transportation planning area as well as the northern ozone nonattainment area portion the Upper Front Range TPR in Larimer and Weld counties.

When subarea budgets are created in the SIP, the sum of the subarea budgets must equal the total allowable emissions the area can have from the transportation sector and still lead to attainment of the standard. If each subarea meets its motor vehicle emission budgets or if the total emissions for the entire nonattainment area (the sum of the subareas) are less than or equal to the budget for the entire nonattainment area, then the entire area will meet the total SIP's purpose of attaining the relevant standard.

**Proposed 2010 Emissions Budgets for the Denver Metro and North Front Range 8-Hour Ozone Subareas**

Table 12 indicates both the regional motor vehicle emission budgets and the separate motor vehicle emission budgets for the ozone precursors VOC and NOx for the two subareas discussed above:

**Table 12: Total 8-Hour 2010 and Subarea Motor Vehicle Emissions Budgets**

| Motor Vehicle Emissions Budget Subareas | 2010 | |
|---|---|---|
| | VOC (tpd) | NOx (tpd) |
| **Southern Subarea Budget** (*DRCOG & UFR TPR Subarea*) | **89.7** | **102.4** |
| **Northern Subarea Budget** *(NFRTAQPC & UFR TPR Subarea)* | **19.5** | **20.5** |
| **Total Nonattainment Area Budget** *(Entire Nonattainment Area)* | **109.2** | **122.9** |

The two subarea budgets presented in the table add to the sum of the total 2010 motor vehicle emissions for the entire nonattainment area in the 2010 base case inventory (see Table 5 in Chapter III), which demonstrates attainment of the standard.

For the underlying transportation modeling, the roadway and transit links in DRCOG's 2005 and 2015 Cycle 2 (2007) networks were truncated to include only the portion of the network within the 8-hour ozone nonattainment area. Vehicle miles traveled (VMT) estimates from these networks were interpolated to obtain 2006 and 2010 baseline VMT estimates for purposes of developing the SIP emission inventories. Likewise, the 2005 and 2015 (2007) networks from the North Front Range MPO were truncated to include only the portion of the network within the 8-hour ozone nonattainment area. The VMT estimates were interpolated to obtain 2006 and 2010 baseline VMT estimates. Where there was overlap between the North Front Range (NFR) and DRCOG networks in Weld County, the DRCOG network was used. In areas where there was no MPO network, the Federal Highway Authority (FHWA) Highway Perfomance Management System (HPMS) and Colorado Department of Transportation (CDOT) networks, plus a growth factor, were used to calculate VMT.

The following table summarizes the VMT estimates for each of the budget subareas. The total VMT is identical to the 2010 base case VMT estimates in Table 3 (See Chapter III):

**Table 13: Distribution of VMT between the Budget Subareas (2010)**

| **Southern Subarea** | |
|---|---|
| DRCOG Network VMT | 76,551,505 |
| Upper Front Range VMT | 777,910 |
| Total Southern Area VMT | 77,329,415 |
| **Northern Subarea** | |
| NFR MPO Network VMT | 11,753,832 |
| Upper Front Range VMT | 1,057,239 |
| Total Northern Area VMT | 12,811,071 |
| **Total Nonattainment Area VMT** | 90,140,486 |

The 2006 and 2010 VMT estimates were used with emission factors obtained from the EPA Mobile 6.2 Emission Factor Model to calculate emissions. Emissions were calculated on a link-by-link basis. Speeds were obtained from the MPO transportation networks and the roadway speed limit was used for CDOT links. The ambient temperatures for the regional emissions analysis were derived from the meteorological modeling performed for the attainment demonstration for a typical ozone episode period. The motor vehicle mix was obtained from the CDOT automated traffic counters.

## Process for Considering Subarea Motor Vehicle Emission Budgets in MPO Conformity Determinations

The regional and subarea motor vehicle emission budgets, once approved by the Air Quality Control Commission (AQCC) and determined adequate by the EPA, will be used to measure the conformity of plans and programs for the respective areas. Through an agreement between the affected agencies, DRCOG has agreed to perform transportation forecasts and conformity determinations for the entire Southern Subarea, while the North Front Range Transportation and Air Quality Planning Council has agreed to perform transportation forecasts and conformity determinations for the entire Northern Subarea. The subarea budgets will allow for independent conformity determinations based on the applicable subarea motor vehicle emissions budgets by the two MPOs, whose frequency and timing needs for conformity determinations differ substantially. The regional budgets can be used if the MPOs decide to perform conformity determinations jointly and collectively.

With subarea budgets, the affected MPOs can make independent conformity determinations for their plans and programs as long the other subarea in the nonattainment area has conforming transportation plans and programs in place at the

time of each MPO's and U.S. DOT's plan/transportation improvement program (TIP) determination. If conformity lapses for one subarea (i.e., the conformity determination for a plan or program has expired), the existing plans and TIPs in the other subarea continue to be valid and the MPO can continue to implement transportation projects in its currently conforming plans and programs. However, the MPO cannot make new plan and TIP conformity determinations until the lapse in the other subarea is resolved and conformity is determined in the lapsed subarea.

Once regional and subarea budgets in this plan have been found adequate or approved by EPA, DRCOG and the North Front Range Transportation and Air Quality Planning Council must initially make a joint conformity determination of their respective transportation plans and programs within two years after EPA's adequacy finding and/or SIP approval (40 CFR 93.104(e)). This SIP expressly allows the MPOs the flexibility to demonstrate conformity with either the established subarea motor vehicle emission budgets or the total regional motor vehicle emission budgets.

To use the subarea budgets for the initial conformity determination, the two MPOs must demonstrate conformity jointly at the same time and meet their established motor vehicle emission budgets for their individual subarea. Once this joint conformity determination has been made and approved, the MPOs can then make future conformity determinations for their plans and programs independently as long the other subarea continues to have conforming transportation plans and programs in place.

If the MPOs choose to use the total regional emission budgets for the initial conformity determination, the agencies must agree to demonstrate conformity jointly, and the sum of their subarea emissions must be less than or equal to the established total regional budgets. Once this joint conformity determination using the regional budgets has been made and approved, the MPOs must continue to make joint future conformity determinations and meet the established regional budgets whenever either MPO is required to make a new conformity determination for a transportation plan or program.

However, at any time in the future, the MPOs may revert to demonstrating conformity by meeting their respective subarea emission budgets if the MPOs agree to undertake another joint conformity determination that demonstrates consistency of their respective plans and programs with their individual subarea budgets. Likewise, at any time in the future, the MPOs may switch from using subarea budgets to using regional budgets as long as they once again agree to perform a joint conformity determination and the sum of their subarea motor vehicle emissions are equal to or less than the established regional budgets.

Throughout this process of determining conformity with the budgets in this plan, the MPOs shall consult with federal, state, and local air quality and transportation agencies

through the normal interagency consultation process established by Air Quality Control Commission Regulation No. 10.

**Figure 2: 8-Hour Ozone Emission Budget Sub-Regional Areas**