Denver Metro Area & North Front Range

Ozone Action Plan

Including Revisions to the State Implementation Plan

Approved by:
Colorado Air Quality Control Commission
December 12, 2008

Colorado Department of Public Health and Environment

REGIONAL AIR QUALITY COUNCIL

NFRMPO
NORTH FRONT RANGE METROPOLITAN PLANNING ORGANIZATION

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Table of Contents

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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 (SIP).

On November 20, 2007, the United States 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 4th 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 ozone standard in an expeditious manner, but no later than December 31, 2007. Called the Early Action Compact for Ozone (EAC), the agreement sets forth a schedule for the development of technical information and the adoption and implementation of the necessary control measures into the State Implementation Plan (SIP) 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 nonattainment areas. However, based on terms in the Early Action Compact, EPA deferred the nonattainment 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 (OAP) 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 parts per million (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 nonattainment in the DMA/NFR 8-hour nonattainment area and the official nonattainment 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 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 (CAA) 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 nitrogen oxides (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, easterly 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's 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 (NFRTAQCPC) 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 including 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 NONATTAINMENT 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 nonattainment 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 (ppb)) 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 occurs 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 and 2030 depending on the severity and classification of the area.

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

Currently, through summer 2008, eight monitors along the DMA/NFR violate 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 toward 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 proposed an Ozone Action Plan to reduce ozone levels in the Denver/North Front Range area by 2010. In addition, the Air Pollution Control Division proposed a revised Interstate Transport SIP, in response to comments from the Environmental Protection Agency, demonstrating that the State does not contribute significantly or interfere with maintenance by any other state of the 0.08 ppm ozone NAAQS, The overall action plan includes elements that will be included in the federally-enforceable State Implementation Plan (SIP), elements that are included 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 the emissions control strategies for ozone are summarized in the Table at the end of this section.

Measures adopted for the federally-enforceable 8-Hour Ozone Attainment Plan – A Revision to the State Implementation Plan (SIP)

(See attached SIP document for more details)

The following measures were adopted 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. **Increase the system-wide control requirements for all condensate tanks to 85% by May 1, 2010 and 90% by May 1, 2011**

   This SIP measure will increase the condensate tank emission control requirement to 81% system-wide by May 1, 2009, 85% system-wide by May 1, 2010 and 90% by May 1, 2011 from the current 75% system-wide control requirement in Regulation No. 7. The current 30 tpy system-wide exemption will remain in place. Auto-igniters will be required for all condensate tank control devices with uncontrolled VOC emissions greater than 50 tpy by May 1, 2009 and all tanks greater than or equal to 2 tpy by May 1, 2010. These controls are expected to reduce VOC emissions in 2009 by 24 tpd, in 2010 by 34 tpd and 2011 by a total of 49. By February 2009, condensate tanks serving newly drilled, re-completed or stimulated wells must control emissions during the first 90 days of production. After that, the control may be removed if emissions do not exceed/will not exceed 2 tons per year.

2. **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 change 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.

3. **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 adopted 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 (I/M) program structure that currently exists in the Denver metro area to portions of Larimer and Weld counties. The program includes IM240 testing, remote-sensing clean screen, gas cap checks, and advisory On-Board Diagnostics (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 2008 for adoption in December 2008. The program will become effective on July 1, 2010. 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. Implement 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 cut-points 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.

3. 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 analysis may lead to implementation of a full-scale high-emitter program in the future. Since this pilot program 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 a disproportionate amount of pollution to our air.

4. 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.

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 nonattainment area. Revisions to Regulation No. 7 making these requirements apply statewide will be adopted by the AQCC in December 2008 and will become effective by May 1, 2010. The emission reduction impact from these statewide controls has not yet been quantified.

6. 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 effective in May 2009 that require low-bleed controllers on valves. 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.

7. 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 tons per year (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 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.

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 the implementation of these potential strategies will be considered during the stakeholder and regulatory processes.

The additional strategies that will undergo further analysis and evaluation by the RAQC and CDPHE include, but are not limited to, the five below. These strategies are included

in the Ozone Action Plan for information purposes only. The RAQC and CDPHE did not request the AQCC to act on or approve these strategies.

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 non-road 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 nonattainment area.

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

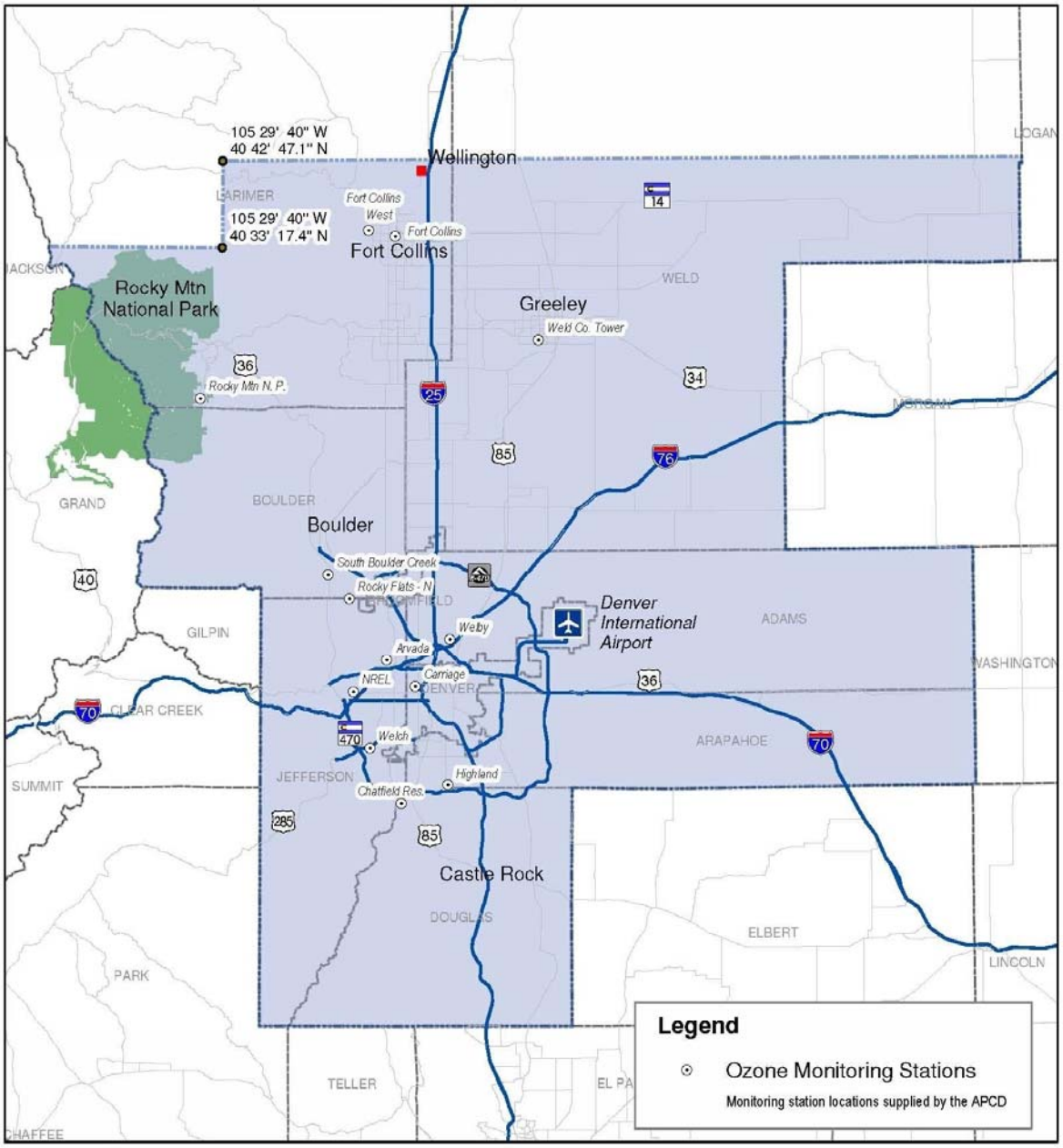
EPA is considering adopting more stringent formulation requirements for a range of paints, solvents, and other household consumer products. Other states and regions have also adopted more stringent regulations for these products than the pending federal rule. RAQC and CDPHE will evaluate the benefits,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

5. Evaluate 95% system-wide controls and surveillance systems for condensate tanks

Industry representatives have raised questions concerning the viability of increasing the required system-wide control to 95% from the 90% system-wide required in 2011. The industry states a 95% system-wide control will nullify any flexibility currently available to meet the requirement, eliminate potential for over-control currently provided, and create an unnecessary burden for the Division and the industry in terms of enforcement actions. The RAQC and the CDPHE will evaluate impacts of 95% system-wide controls for condensate tanks in terms of the added benefit to ozone reduction and the industry's concerns. The anticipated additional VOC reductions are approximately 12 tpd.

The industry representatives have raised concerns about requirements for electronic surveillance systems in terms of costs and benefits. The Division will participate with the industry in a pilot program regarding implementation of electronic surveillance systems.

Denver Metro Area/North Front Range Nonattainment 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

2008 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**	
Measures Adopted for Federally-Enforceable State Implementation Plan (SIP)		*Potential Emission Reduction*	**Measures Adopted and Enforced as State-only Measures**		*Potential Emission Reduction*		*Potential Emission Reduction*
			➢ Inspection/maintenance program in North Front Range – eff. July 1, 2010		*~ 1 tpd VOC, ~1 tpd NOx, ~17 tpd CO*	**<u>Ozone Fuels Strategies</u>**: ➢ 7.0 RVP gasoline	*~ 10 tpd VOC*
			➢ More stringent Reg. 11 I/M cut-points (Denver area) – adopted, effective May 1, 2008		*~ 1 tpd VOC, ~3 tpd NOx, ~13 tpd CO*		
			➢ Mandatory high-emitter <u>pilot</u> 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)-legislation being pursued		*~ 1 tpd VOC ~ 7 tpd CO*	➢ Eliminate ethanol waiver	*~ 10 tpd VOC + 360 tpd CO*
➢ Increase system-wide condensate tank control requirements to 85% in 2010 and 90% in 2011 for all tanks greater than or equal to 2 tpy		*Total from 2010 base ~ 34 tpd (2010)/ 49 tpd (2011) VOC*	➢ Statewide Oil & Gas regulations -- Controls on existing reciprocating internal combustion engines		*~4 tpd VOC ~16 tpd NOx*	➢ 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*	➢ Increase system-wide condensate tank control requirements to 95% for all tanks	*Total from 2010 base ~61 tpd VOC*
➢ Remove current exemptions in Reg. 3 for selected small sources required to file air pollution emission notices and obtain permits ➢ 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*	➢ Expand Reg. 7 (VOC control requirements) to entire NAA		*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 ▪ power plants ▪ boilers ▪ cement kilns	*~ 30-45 tpd NOx*
						➢ California Paints/Solvents/ Consumer Products Rule	*~ 8 tpd VOC*
TOTAL EMISSION REDUCTIONS	**VOC NOx CO**	*~34 tpd(2010) 49 tpd (2011)*		**VOC NOx CO**	*~30 tpd ~20 tpd >37 tpd*		

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Denver Metro Area & North Front Range

8-Hour Ozone Attainment Plan

A Revision to the State Implementation Plan

Approved by:
Colorado Air Quality Control Commission
December 12, 2008

Colorado Department of Public Health and Environment

REGIONAL AIR QUALITY COUNCIL

NFRMPO
NORTH FRONT RANGE METROPOLITAN PLANNING ORGANIZATION

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Table of Contents

8-Hour Ozone Attainment Plan

Documents referenced in Attachment A are contained in separate electronic files.

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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 (CAA) of 1990 established a classification system for ozone nonattainment areas based on the severity of the area's ozone problem as measured by the area's ozone design value. In April 2004 the United States 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 not 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 (EAC) 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 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 tons per year (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 State Implementation Plan (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 technical staff. The modeling is within EPA's accepted margin of accuracy; is fully documented; sufficiently accounts for projected future growth in ozone precursor emissions; 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

Emissions 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 non-road model data, and latest demographics information, area source data, and local survey and information data, as well as 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 (MATS) was used with the 2006 and 2010 base case photochemical grid modeling results to project 2010 8-hour ozone attainment. The 2010 base case modeling provides the basis for this SIP's demonstration of attainment. Note that the 2010 base case modeling only takes credit for measures that are "on-the-books or on-the-way"; additional control measures described in this document (see Chapter IV) are not included in the 2010 base case modeling but their emission reduction benefits are instead included as part of a weight of evidence (WOE) analysis (a WOE is required to support the modeled attainment demonstration).

Emission Reduction Strategies

All adopted Federal and SIP emission reduction strategies that have been or will be implemented by the November 20, 2010 attainment date are included in all emissions 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 and Construction Permits

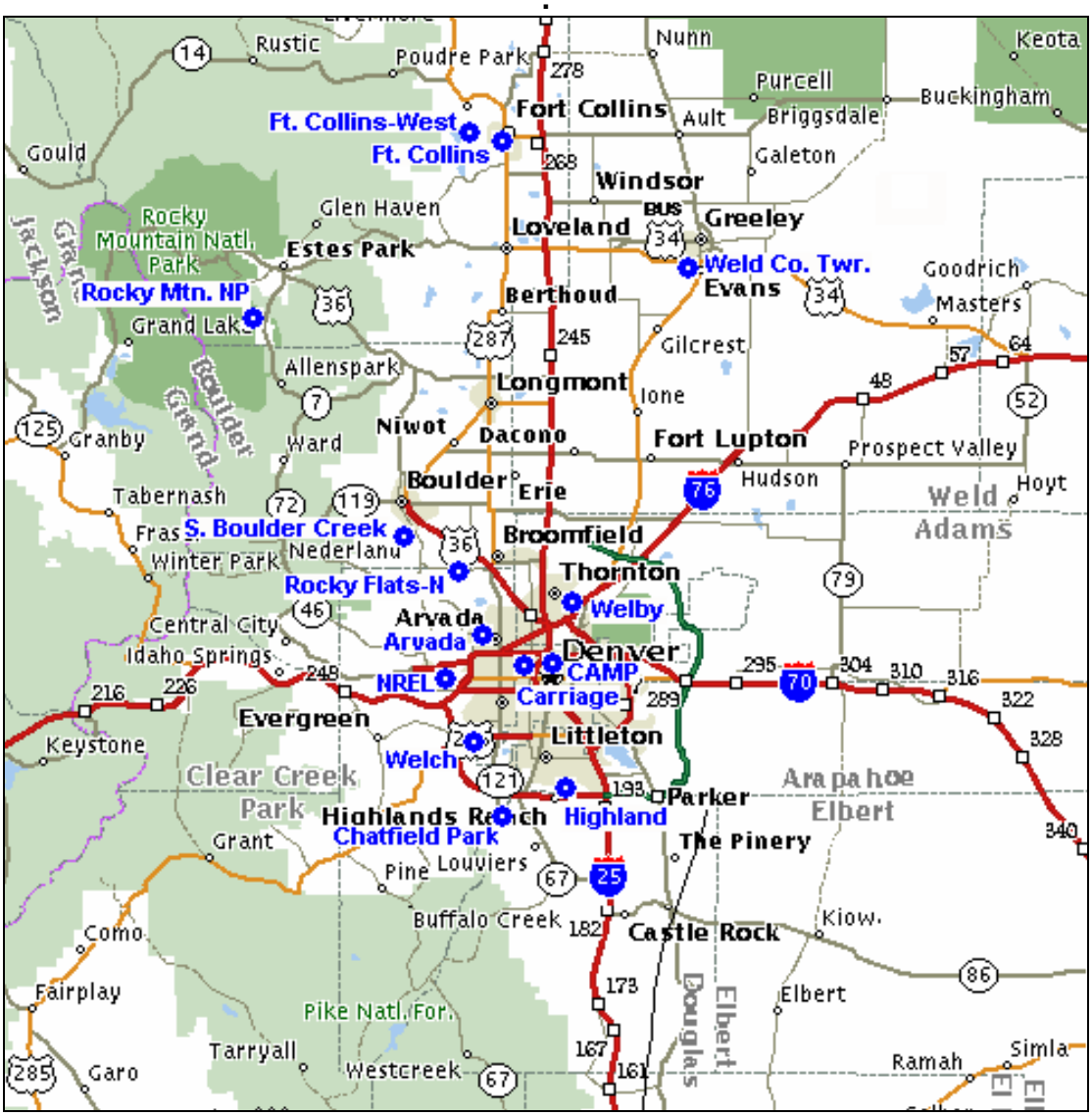
The State of Colorado currently performs New Source Review in nonattainment areas applicable to VOC and NOx major sources of 100 tpy with offsets of 1.1 to 1. The State also maintains a Construction Permits program for new and modified major stationary sources.

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 consists 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 State Implementation Plan (SIP). The United States Environmental Protection Agency (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 tested for quality assurance 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 monitors (SLAMS) in accordance with 40 CFR Part 58 to verify the attainment of the 8-hour-hour ozone National Ambient Air Quality Standard (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	**0.076**
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	0.072
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	**0.080**
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**	**0.076**
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 current through September 30, 2008. The post season quality assurance review has taken place for all monitors except Rocky Mountain National Park.*

*** The Highland 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	0.071
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	**0.082**
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	---	---	---	---	---	---	**0.082**
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 current through September 30, 2008. The post season quality assurance review has taken place for all monitors except Rocky Mountain National Park.*

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CHAPTER III
BASE CASE EMISSIONS INVENTORIES

This section presents emissions inventories for this Ozone State Implementation Plan (SIP) for the 8-hour ozone Denver Metro Area/North Front Range (DMA/NFR) 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 are presented later in this document and include the additional control measures that are included in the attainment demonstration for the 8-hour ozone National Ambient Air Quality Standard (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). Details of the inventories can be found in the Technical Support Documents (TSD) Appendix C at www.colorado.gov/airquality/documents/deno308/.

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 Air Pollution Control Division (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 the United States Environmental Protection Agency (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 Denver metro area (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 volatile organic compounds (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 Reid Vapor Pressure (RVP) ozone season (June 1 to September 15) has been subject to a national RVP limit of 7.8 pounds per square inch (psi) 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 RVP limit of 9.0 psi 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%. Explanation of assumptions found in the Emissions Inventory TSD, Section 5.1.

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 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 Consolidated Community Emissions Processing Tool (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 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 emissions (including heating, consumer solvent use, aircraft and railroads, etc.) are from the 2002 EPA National Emissions Inventory (NEI), 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-oil and gas area source inventory. A check on the non-oil and gas area sources estimates comparing the recently available 2005 NEI emissions data is shown in the Emissions Inventory TSD, Section 7.1. An inventory completed in 2005 for Denver International Airport (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 nitrogen oxides (NOx) from biogenic sources have been generated by the Model of Emissions of Gases and Aerosols from Nature (MEGAN) Biogenic Emissions Model using land cover data base of biomass type and density and hourly meteorology data. The National Center of Atmospheric Research (NCAR) has produced a global data base of land use data, the MEGAN Driving Variable Database Version 1.2, for use with MEGAN. Surface temperatures are provided by the Mesoscale Meteorological Model (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 TSD.

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**

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 parts per million (ppm) 8-hour Ozone National Ambient Air Quality Standard (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 United States Environmental Protection Agency (EPA) as a nonattainment area for the 8-hour ozone standard in 2004 (69 FR 23857, April 30, 2004).

A. Condensate Tank Emissions Controls

The approved EAC Ozone Action Plan (OAP) 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 changes 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. These two system-wide thresholds are proposed to remain as part of the Federal State Implementation plan.

This revision to the State Implementation Plan further amends Regulation No. 7 *(See Attachment A SIP Rule Language, Regulation No.7 Section XII)* requiring the system-wide reduction of condensate tank flash VOC emissions of 81% for tanks ≥ 2 tons per year (tpy) for the 2009 ozone season, 85% for tanks ≥ 2 tpy for the 2010 ozone season and 90% for tanks ≥ 2 tpy for the 2011 ozone season with technology that achieves a 95% reduction in VOC emissions and installation and operation of auto igniters on all tanks ≥ 2 tpy effective May 1, 2010. By February 2009, condensate tanks serving newly drilled, re-completed or stimulated wells must control emissions during the first 90 days of production. After that, the control may be removed if emissions do not exceed/will not exceed 2 tpy.

The reduction from these strategies is estimated at 34 tons per day (tpd) reduction in VOC for 2010 and 49 tpd reduction in VOC for 2011 based on an assumed Rule Effectiveness adjustment of 0.83 applied to the estimated potential emissions reduction. Justification of the rule effectiveness for Condensate Tanks is presented in the Rule Effectiveness document as part of TSD Appendix C.

B. Additional Revisions to Regulation No. 3 and No. 7

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 where 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 oil and gas 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 No. 3 and No. 7 RACT Clarification

This revision 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

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

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CHAPTER V
PHOTOCHEMICAL MODELING AND 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 United States 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 (DMA/NFR) 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, Consolidated Community Emissions Processing Tool (CONCEPT) for the DMA on-road mobile, Model of Emissions of Gases and Aerosols from Nature (MEGAN) for biogenic emissions and Sparse Matrix Operating Kernel Emissions (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 Appendices for this plan at www.colorado.gov/airquality/documents/deno308/. Technical support documentation for modeling includes:

- Modeling Protocol, Episode Selection, and Domain Definition (Appendix A)
- Evaluation of MM5 Simulations of the June-July 2006 Denver Ozone Season (Appendix B)
- Development of the 2006 & 2010 base case Modeling Inventory (Appendix C)

- Model Performance Evaluation June-July 2006 Denver Ozone Season, Diagnostic Testing and Analysis (Appendix D)
- Air Quality Modeling for the 2006 & 2010 base case, ozone projections, sensitivity analysis, and source attribution (Appendix E)
- 2010 Ozone Attainment Demonstration Modeling for the Denver 8-Hour Ozone State Implementation Plan Control Strategy (Appendix F)
- Weight of Evidence Analysis to Support the Modeled Attainment Demonstration (Appendix G)
- Ambient Data (Appendix H)
- Final 2010 Ozone SIP Control Measure Modeling for the Denver 8-Hour Ozone State Implementation Plan (Appendix I)

It should be noted that the suite of mathematical models used to evaluate current and future air quality possesses 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 agreement between the modeled and measured volatile organic compounds/nitrogen oxides (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 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 a relative sense as discussed in the next section. In addition, EPA modeling guidance requires a Weight of Evidence (WOE) 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 2010 base case modeled 8-hour ozone concentration divided by the mean 2006 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 parts per million (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 parts per billion (ppb)), then attainment is demonstrated. However, when there are DVFs in the range of 82-87 ppb EPA guidance requires a WOE analysis to supplement the attainment demonstration.

EPA guidance indicates that base design values, which are the three year average of the 4th maximum values at each monitor, are to be presented to three places in ppm, truncating the 4th place right of the decimal point. When projecting future design values in ppm, similarly rounding to the 4th place and ultimately truncating the 4th place for comparison with the NAAQS is required. In Table 6, the future design values have been calculated to the 4th place in ppm and presented with the 4th 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 and 2007

As can be noted attainment at all of the monitors is demonstrated (design values less than 85 ppb) for the 2010 base case for the 8-hour ozone nonattainment area 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. Weight of Evidence (WOE) Analysis

EPA's 8-hour ozone modeling guidance suggests a weight of evidence analysis (a set of supplemental analyses) be provided 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.

The supplemental analyses used in a weight of evidence will help to determine whether attainment is likely when modeled attainment test results indicate future air quality levels are near the NAAQS. Additional detail has been provided in the TSD Appendices F and G. As previously noted the TSD Appendices F, 2010 Attainment Demonstration Modeling and G, Weight of Evidence Analysis to Support the Modeled Attainment Demonstration are found at www.colorado.gov/airquality/documents/deno308/.

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 downward emissions trend in on-road mobile source emissions between 2006 and 2010 is consistent with the expected changes in emissions due to mobile source fleet turnover and federal tailpipe regulations. Similarly, downward trends in non-road mobile source emissions are consistent with expected changes in emissions from the Tier 2 and Tier 3 non-road regulations. The correlation between the expected emission reductions from existing regulatory programs and the calculated emissions reductions from the emissions modeling systems suggest that the emissions reductions are providing directionally correct emissions projections for 2010.

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 adopted 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 below demonstrate an overall reduction in emissions between the 2006 base case and the 2010 base case and additional SIP and state-only measures case. The 2010 additional SIP and state only measures modeled in this analysis include:

- State–only revisions to Regulation No. 11 (March 2008) that tighten tailpipe emissions standards,
- State-only revisions to Regulation No. 7 (December 2008) requiring low-bleed devices for new and existing pneumatic controllers.
- Revisions to Regulation No. 7 requiring increased system-wide control of condensate emissions from 75% to 81% in 2010 which reduced condensate tank emissions by 24 tpd from the 2010 base case, and
- An estimate of the impact of 7.8 psi RVP in the NFR area considering local survey data of ethanol penetration

AQCC action on December 12, 2008 adopted a federally enforceable SIP control measure revising Regulation No. 7, noted above, requiring increased system-wide control of condensate VOC emissions from 75% to 85% in 2010 which reduced condensate tank emissions by 34 tpd from the 2010 base case. The analysis in Table 9 below is therefore considered conservative since the adopted SIP control measure provides 10 tpd more reduction than originally modeled.

In Table 7, the reduction in total anthropogenic VOC from 2006 base case to 2010 base case is about 7 tpd. The 2010 additional control case will net 46 tpd in reductions. The total VOC reduction from 2006 base case to 2010 additional control case is around 53 tpd, which is about an 11% reduction. Including the emissions from the adopted SIP control measures results in a 63 tpd reduction from the 2006 base case, this is about a 13% reduction. In Table 8, the reduction in total anthropogenic NOx from 2006 base case to 2010 base case is about 38 tpd. The 2010 additional control case will net 4 more tons per day. The total NOx reduction from 2006 base case to 2010 additional control case is around 42 tpd, which is about an 11% reduction. Table 9 reflects the ozone benefits of the emission reductions presented in Tables 7 & 8.

For an analysis of the ozone benefits of the adopted SIP control measures (34 tpd of VOC emissions) alone see Final 2010 Ozone SIP Control Measure Modeling for the Denver 8-Hour Ozone State Implementation Plan in Appendix I of the TSD.

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

	2006 Base	2010 Base	2010 Additional 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 and Control Case Emission Inventory (tons per average episode day)

	2006 Base	2010 Base	2010 Additional 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**

***** *The 2010 additional control measures modeled in this analysis include:*

- *State–only revisions to Regulation No. 11 (March 2008) that tighten tailpipe emissions standards,*
- *State-only revisions to Regulation No. 7 (December 2008) requiring low-bleed devices for new and existing pneumatic controllers.*
- *Revisions to Regulation No. 7 requiring increased system-wide control of condensate emissions from 75% to 81% in 2010 which reduced condensate tank emissions by 24 tpd from the 2010 base case, and*
- *An estimate of the impact of 7.8 psi RVP in the NFR area considering local survey data of ethanol penetration.*

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 additional 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 RRFs.

Table 9: 2010 Additional 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 and 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 (SIP and state-only measures discussed above in this Section D.. This analysis of ozone benefit is conservative since the final SIP measures add 10 more tpd of VOC reduction than was estimated in the above analysis.

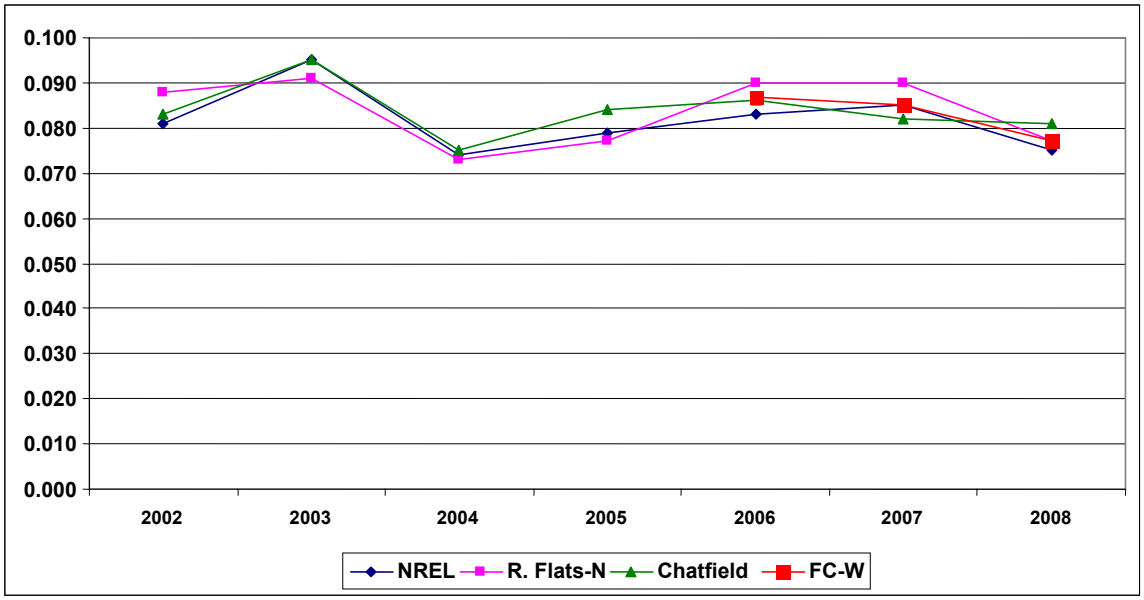
Ozone Trends

Time Series of Monitored 4th 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 Denver Metro Area (DMA) 1-hour ozone attainment maintenance area prior to the 2004 ozone season.

The chart below presents data from 2002 prior to application of controls by the region through the end of August 2008. The 4th maximum 8-hour ozone value time series 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: Time Series of Monitored 4th Maximum 8-Hour Ozone Values (ppm)

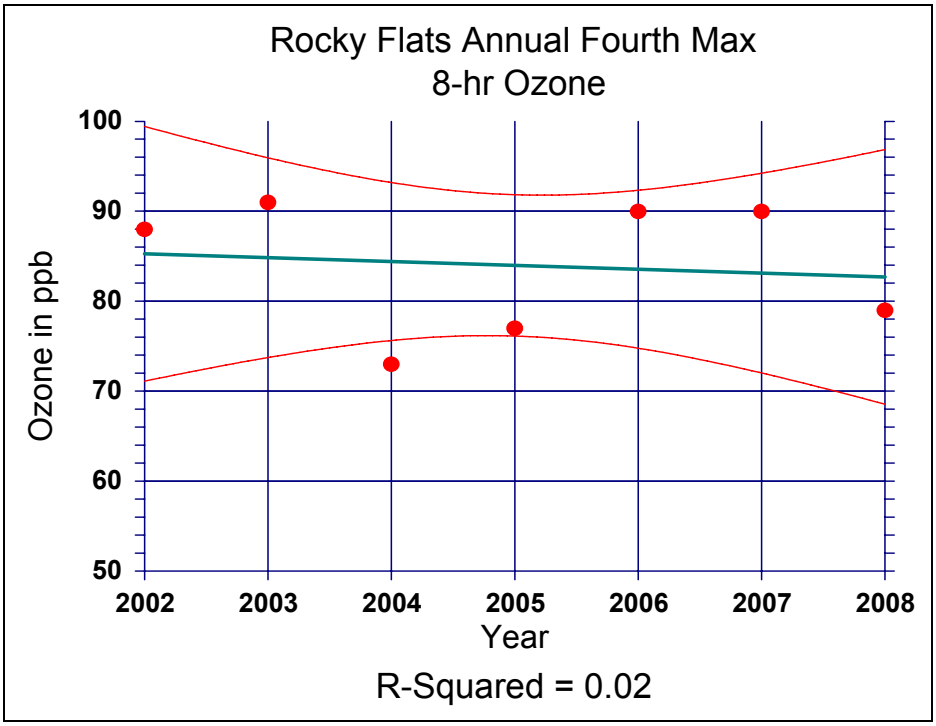


Linear Regression of Monitored 4th Maximum Ozone Values

A linear regression analysis of the 4th high ozone concentration values between 2002 and 2008 for the Rocky Flats North monitor shown in Chart 2, shows what appears to be a downward trend. However, the coefficient of determination (R^2) of the regression is very small and additional analysis shows that this trend does not pass the standard test for statistical significance. Therefore, there is not a statistically significant linear trend at Rocky Flats North during this period for 4th high values. There is too much inter-annual variation in the 4th high values at Rocky Flats North to conclude from the observations

that the 4th high value in the future years will be above or below current levels. In addition, analyses for the monitors at Chatfield, NREL and Fort Collins West show that there are no statistically significant trends in 4th high values at these sites. Similarly, an analysis of all four sites together does not show significant or discernible trends during this period.

Chart 2: Linear Regression of Monitored 4th Maximum Ozone Values



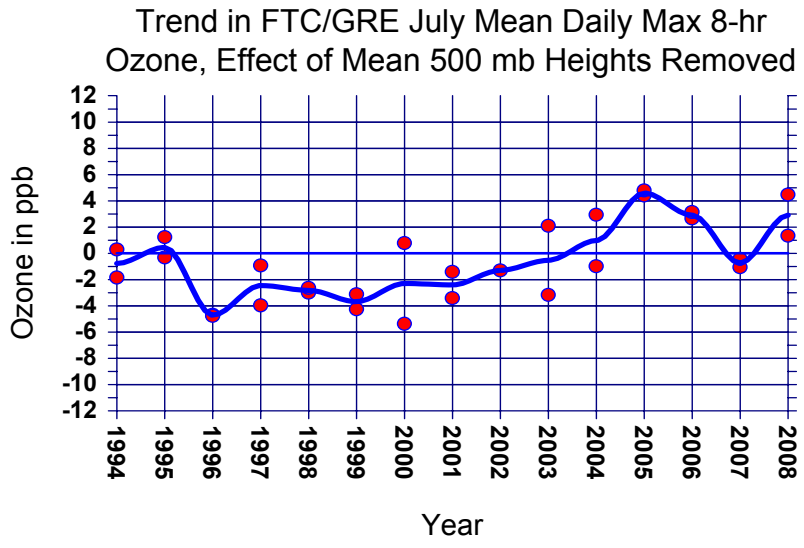
Weather-Corrected Ozone Time Series

The correspondence between 500-millibar heights and ozone, noted later in this section, can be used to correct ozone time series for the effects of weather. These corrected trends or time series are much more likely to show the effects of changes in emissions than the uncorrected time series.

The trend in weather-corrected July mean daily maximum 8-hour ozone for Fort Collins and Greeley is shown in Chart 3. A continuous increase in ozone from the late 1990s through 2005 may be the result of local growth and increases in oil and gas emissions. A sudden drop from 2005 through 2007 may be the result of reductions in area oil and gas emissions. A similar analysis for Rocky Flats, NREL, Chatfield, Carriage, South Boulder Creek, and Arvada is shown in Chart 4. Gradual decreases through 2004 are replaced by apparent steep increases in 2005 and 2008. The increases in 2008 in both plots suggest that there may have been an increase in background concentrations across all of the Front Range, with a magnitude of about 4 ppb. While many factors may

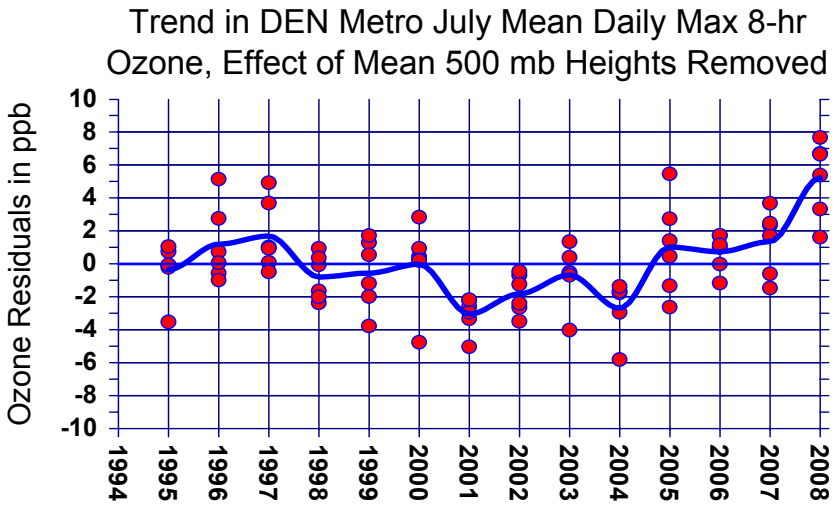
have contributed to this increase, it is outside the scope of this process to complete a thorough analysis of the causes.

Chart 3: Trend in Weather-Corrected July Mean Daily Max 8-Hour Ozone for Fort Collins and Greeley



(Residuals are differences between actual and weather predicted ozone.)

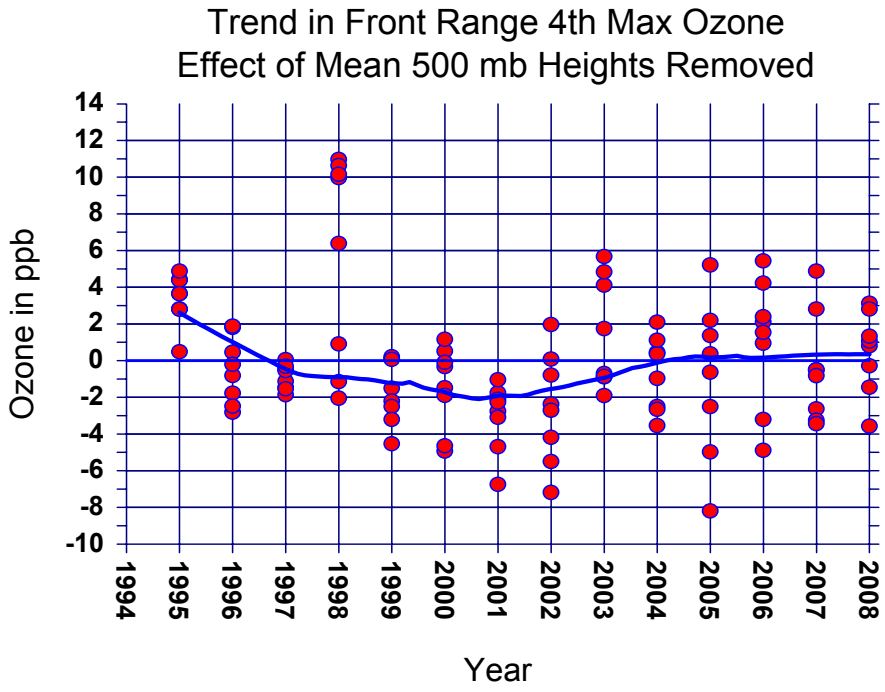
Chart 4: Trend in Weather-Corrected July Mean Daily Max 8-Hour Ozone for Denver Metro Area Sites



(Residuals are differences between actual and weather predicted ozone.)

Correcting all eight of the Front Range annual fourth maximum time series for weather leads to the pattern shown in Chart 5. The corrected time series shows a period of decline followed by a rise and ending in a level line from 2004 through 2008. This is consistent with the idea that ozone is difficult to control but increases have ceased since 2004. In addition, the possible increase in regional background in 2008 seen in earlier plots does not appear to have had an impact on these worst-case concentrations.

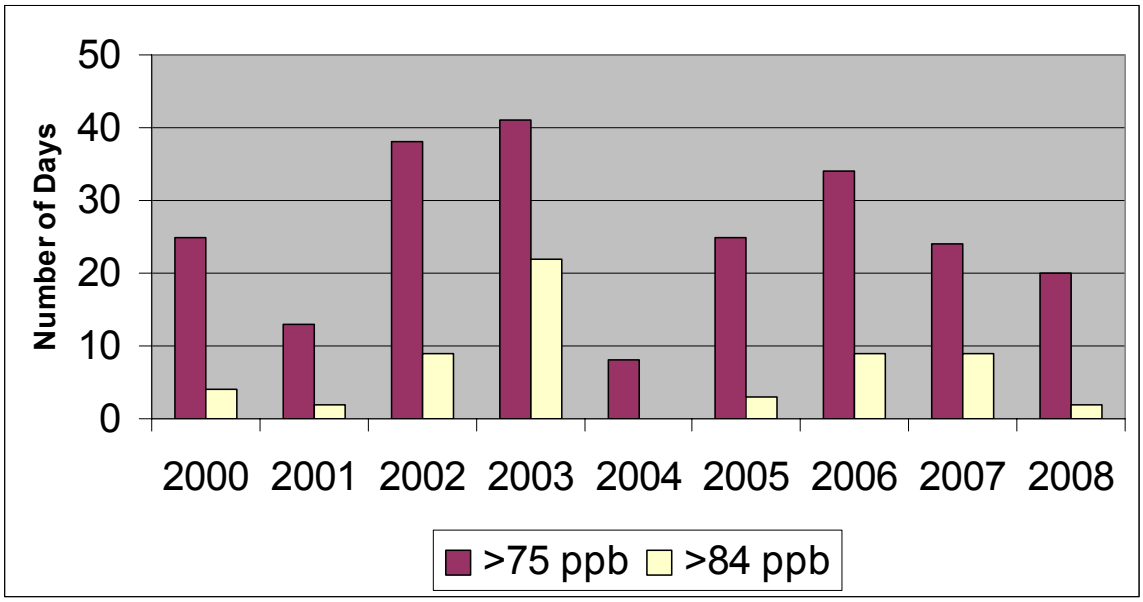
Chart 5: Trend in Weather-Corrected Annual Fourth Max 8-Hour Ozone for Front Range Sites



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. Excluding the year, 2004, the years 2005 through 2008 show a modest reduction in number of total days of elevated ozone when compared with the years 2000 through 2003.

Chart 6: Days Greater than 75 ppb and 84 ppb 8-Hour Ozone



Trends Analysis Summary

Monitored data time series and weather corrected monitored data time series indicate that ozone levels have been relative flat. This suggests that without additional emissions reductions, the region will remain at or near the level of the standard. Emissions reductions are provided in the 2010 base case inventory, the attainment case. Additional emissions reductions are provided for in SIP/State-only controls. Various sensitivity analyses of precursor reductions have noted that VOC and NOx reductions will reduce ozone levels. The modeling for the base (attainment) case and the controls cases with the emissions reduction noted indicate attainment, and attainment with a slight margin.

Review of Ozone Conceptual Models for the 8-Hour Nonattainment Area (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 and emission inventory data becomes available, along with a better understanding of the chemical processing that takes place in the nonattainment area,

there will be an opportunity to review the current understanding of local ozone formation in the DMA/NFR region as it presents itself.

Generally, ozone is formed by a complex series of chemical reactions involving photochemical reactive volatile organic compounds (VOCs) and nitrogen oxides (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 and Synoptic Scale 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 recirculation 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.

Pollutants emitted during the day mix upwards and accumulate in that portion of the atmosphere that eventually becomes isolated from 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 strong insolation, surface temperatures rise rapidly, forming a mixed layer that brings pollutants, transported or stored aloft during the night, to the surface.

High ozone levels along the Front Range are significantly affected by upper air transport and the 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.

A key synoptic factor is the multi-day mean 500-millibar height in the area,which is the mean strength of the synoptic-scale regional upper level high-pressure system. Since the 500-millibar height is directly related to the mean temperature of the column of air below about 18,000 feet, it can have a direct effect on the magnitude of regional

background concentrations. Warm temperatures throughout this layer are a typical prerequisite for high ozone concentrations. Higher 500-millibar heights are also associated with weaker westerlies and a lower incidence of thunderstorms and can lead to the stagnation and re-circulating of ozone and its precursors 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, can lead to a regional build up an ozone base or background.

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. 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 the single best predictor for this value at sites along the Front Range urban corridor.

Back Trajectory Analysis

Back trajectory calculations for 8-hour ozone exceedance events at worst-case monitors are recommended as part of the WOE attainment demonstration and to support the understanding of an area's conceptual model. Back trajectories can also provide additional evidence that the behavior of the photochemical dispersion model is reasonable and are useful tools for understanding the relative influence of source areas within the region.

Back trajectories were estimated for each episode by using the NOAA Air Resources Laboratory (ARL) Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT, See http://www.arl.noaa.gov/ss/models/hysplit.html). HYSPLIT uses meteorological model data from the National Centers for Environmental Prediction (NCEP). Trajectories for the June-July 2006 period were modeled using the three-dimensional wind fields provided by the Eta Data Assimilation System (EDAS). The EDAS datasets archived by ARL are based on 3-hour data over a 40-km horizontal grid (EDAS40). EDAS40 is a reanalysis system based on Eta model simulations heavily weighted by a very large collection of surface and upper air observations. HYSPLIT further resolves EDAS40 output into a much finer grid space. Although subject to wind field estimation errors in complex terrain, HYSPLIT with EDAS40 input has been observed to perform well in a variety Air Pollution Control Division analyses. HYSPLIT windfields will sometimes miss the thermally-driven upslope flows along the Front Range, but catch these flows surprisingly well for many episodes.

Back trajectories were calculated for the Rocky Flat North (RFN) and Fort Collins West (FTCW) sites. RFN and FTCW are both high-concentration monitors. Back trajectories

for RFN can show the influence of sources within the Denver metro area and the Platte Valley. Back trajectories for FTCW can show the influence of sources within the Platte Valley, local emissions, and the Denver metro area. FTCW trajectories can vary significantly from those calculated for RFN. Taken together, these sites are fairly representative of the temporal and spatial variability of windfields and source region influences across the Front Range for a given episode.

Composite 48-hour back trajectories were generated for each day of three ozone episodes during the photochemical model base year of 2006. These episodes coincide with periods modeled with the CAMx photochemical model. These three episodes represent three distinct meteorological regimes when high ozone concentrations were modeled in the DMA//NFR. The EPA recommends that various meteorological conditions be modeled for the attainment demonstration in order to estimate the benefit of the various control strategies. The back trajectory analysis demonstrates that the two-month period of June-July 2006 contains a variety of meteorological regimes with elevated ozone ensuring a more representative analysis of the control strategy packages in this SIP.

Back trajectories were developed for three ozone episodes in 2006:

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

Substantial transport of regional background ozone and precursor compounds contributes to elevated ozone levels along the northern Front Range during most high ozone episodes. The potential effects of long-range transport and local sources were investigated by calculating 48-hour HYSPLIT back-trajectories for each of the days in the three high ozone episodes in 2006. Trajectories arrived at each monitor location at 4:00 PM Mountain Daylight Time (MDT), a time that approximates the midpoint for periods of elevated concentrations on most episode days. Composite back trajectories were generated and these include three arrival heights: 10 meters, 100 meters and 1000 meters. Analysis for a variety of arrival height levels makes it possible to assess the transport of low-level air parcels into the area as well as air parcels aloft. It also provides an indication of the level of wind shear in the atmosphere as well as the presence of absence of decoupled air masses.

Day-specific trajectories for each episode were also estimated for the 5:00 AM through 5:00 PM MDT period. Daily back trajectories were calculated using 10 meters as the arrival height. The day specific trajectory analyses consist of four trajectories, each starting at 5 AM and arriving at 8 AM, 11 AM, 2 PM and 5 PM with 1-hour interval markers. Please see Appendix G for greater detail of these analyses.

Conceptual Model Summary

A review of the Conceptual model for the Front Range reveals the complexity of the meteorological, emissions inventory, and photochemical modeling challenges that exist in the formation and subsequent control of ozone formation along the northern Front Range. Several diagnostic tests with subsequent changes to the science options and other input were made to the meteorological model to achieve the best performing meteorological model of the Front Range. The trajectory analyses for three key episodes show that they represent a variety of meteorological and transport conditions. In particular they show gradations between long-distance transport from the west and more localized upslope flows within eastern Colorado. In the conceptual model, the roles of upper level transport and storage and surface upslope transport from local sources have been highlighted. While June 17 and 18 and July 13 were dominated by long-range transport from the west and the impacts of ozone aloft, the remaining episode days show a combination of influences. In particular, the meteorology of these days favored contributions from ozone within the residual layer and short-range transport from local sources on the eastern plains. The range of conditions supports the conceptual models and demonstrates that the modeling period includes a representative variety of meteorological conditions.

In addition, the climatological analysis of back trajectories for FTCW, RMNP, RFN, and HLD and the moving spatial analysis of source areas based on these trajectories demonstrate that local sources along the Platte Valley, in the Denver metro area, and within Weld County play a key role in ozone formation during thermally-driven upslope conditions. This is consistent with the conceptual model. While MM5 does not always reproduce these thermally-driven upslope flows, it does so often enough to insure some confidence in the overall performance of the photochemical modeling.

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 additional control cases. In the charts that follow, “Cntrl1” represents the SIP and state-only strategies presented in previous Tables 7, 8 & 9, while “Cntrl2” represents additional SIP and state-only strategies adopted or considered that can provide additional reductions in the DMA/NFR area. The additional SIP and state-only strategies adopted or considered in Control 2 include:

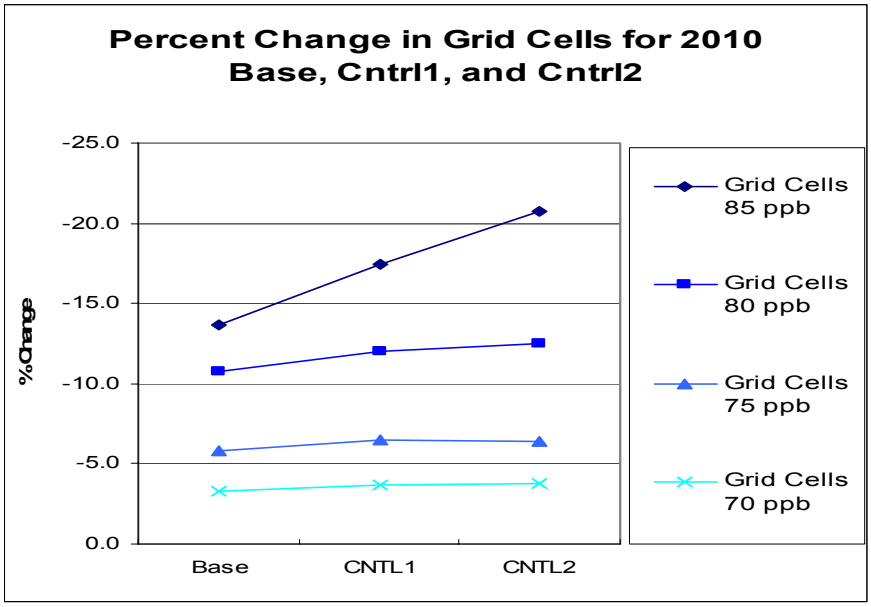
- Inspection/maintenance program in the Forth Front Range
- Tighten up collector plate requirements for older vehicles (statewide)
- Increase condensate control to 90% system-wide by 2011 ozone season
- Increase condensate control to 95% system-wide by 2012 ozone season
- Statewide Oil & Gas regulations – Controls on existing reciprocating internal combustion engines.

The 95% system wide control on condensate tanks was not adopted by the AQCC as SIP or state-only measure. The 90% system-wide control by 2011 was adopted as a SIP strategy. Tightening of collector plates is being pursued but was not adopted as a state-only measure. The remaining strategies were adopted as state-only. 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 7 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. Further 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 7: Relative Change in Grid Cells

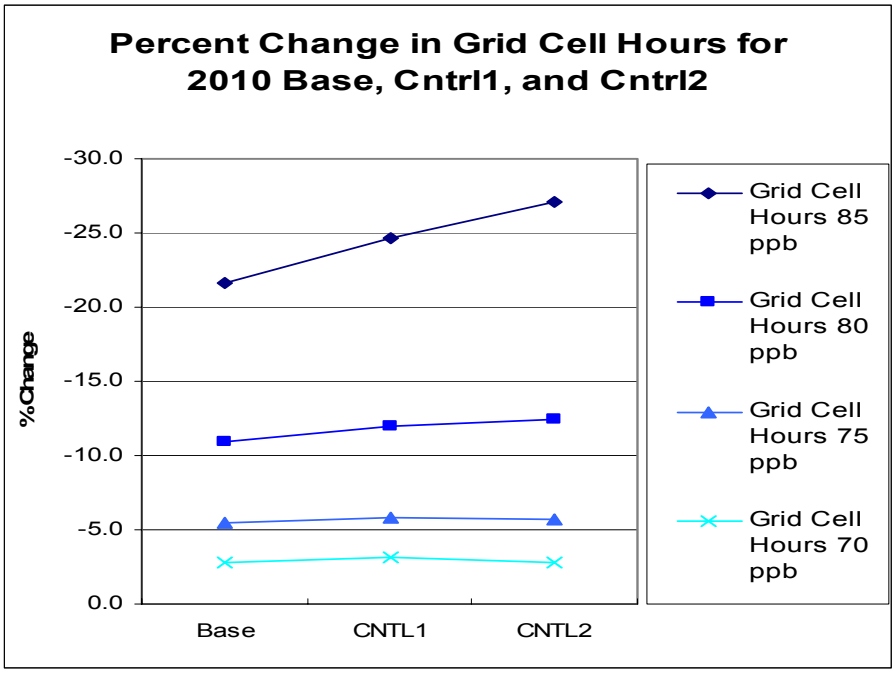


Relative change in grid cells-hours ≥ 85 ppb, ≥ 80 ppb, ≥ 75 ppb and ≥70 ppb

As can be seen in Chart 8 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. Further 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.

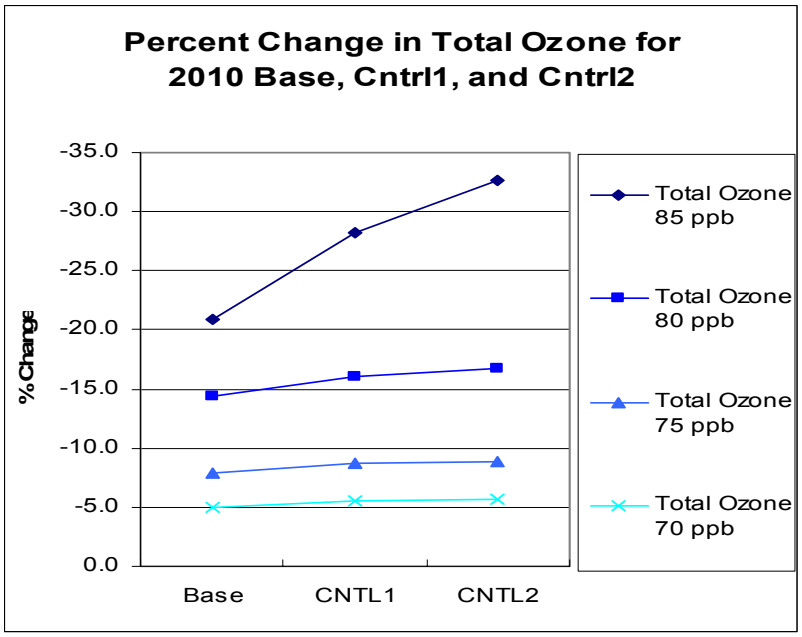
Chart 8: Relative Change in Grid Cell-hours



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

As can be seen in Chart 9 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. Further 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 9: Relative Change in Total 8 hour Ozone



Modeled Metrics Summary

The three additional modeling metrics (grid cells, grid cell hours and total ozone) indicate that the emissions reductions in the base case show decreases of 11% to 22% in peak elevated ozone ≥ 85 ppb and ≥ 80 ppb from emissions reductions due to existing controls and regulations along the Front Range. Continued decreases in emissions due to SIP and state-only controls provide additional decreases in peak elevated ozone ≥ 85 ppb and ≥ 80 ppb of 2% to 11% along the Front Range.

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 (currently formally quality assured by the EPA for all monitors except the Rocky Mountain National Park monitor) is now mostly available and the average of the three design values in the 2004-2008 period can now be calculated.

In this WOE 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	0.0706	1.0042	0.0709	0.070
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**	0.082	0.9874	0.0810	0.081
Carriage	0.0727	1.0022	0.0729	0.072
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.	0.0828	0.9934	0.0823	**0.082**
Rocky Mtn. N.P.	0.0759	0.9903	0.0752	0.075

* thru September 30, 2008. 2008 data have been fully quality assured at this timefor all monitors except Rocky Mountain National Park (Rocky Mtn. N.P).;

** 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 a modeling analysis of the future year design values from the 2010 additional control case (referenced above) 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 Table 9 using the three-year average (2005-07) base case design values.

Table 11: 2010 Additional 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	0.0706	1.0039	0.0708	0.070
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**	0.082	0.9852	0.0807	0.080
Carriage	0.0727	1.0015	0.0728	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.	0.0828	0.9921	0.0814	0.081
Rocky Mtn. N.P.	0.0759	0.9892	0.0751	0.075

* thru September 30, 2008. 2008 data have been fully quality assured at this time for all monitors except Rocky Mtn. N.P.;

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

Alternative Attainment Test Summary

The alternative attainment test using the EPA recommended approach for establishing the base case design value design indicates that the 2010 base case will likely achieve

attainment in the Denver region of the 0.08 ppm 8-hour ozone NAAQS. Additionally, there will be more certainty that the Denver region will achieve 8-hour ozone attainment in 2010 under the 2010 additional control case emission scenario.

Assess the Efficacy of SIP, State-Only and Voluntary Control Strategies

The reduction in emissions from the 2006 base case to the 2010 additional control scenarios, 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 Reid Vapor Pressure (RVP) in the North Front Range (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 levels 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 to 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 to prevent emissions of ozone-causing precursors.
- 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.
- The Colorado Department of Transportation's (CDOT) Air Quality Programmatic Agreement is being crafted to identify and commit to a number of proactive measures that will reduce mobile source air toxics and greenhouse gas emissions throughout Colorado, in addition to criteria air pollutants. Due to the inherent nature of air quality, it is more efficient to mitigate these impacts utilizing a programmatic approach rather than negotiating individual mitigation for new environmental documents. It is hoped this agreement will be signed by the participating parties (between CDOT, EPA, Colorado Department of Health and Environment (CDPHE), Federal Highway Authority (FHWA), Federal Transit Administration (FTA), Regional Air Quality Council (RAQC), and Regional Transportation District (RTD) by the end of 2008.

Weight of Evidence - Conclusions

The final WOE combines and weighs the various supplemental analyses with the results of the attainment test resulting in an aggregated, qualitative, and quantitative conclusion as to whether the proposed set of control strategies will result in the Denver Metro Area and North Front Range reaching attainment in 2010. A number of conclusions can be drawn from the weight of evidence as follows:

- Trends in emissions correlate well with surrogate indicators such as fleet turnover.
- Meteorological variability is a key component for ozone formation and is reflected in the year–to-year variability of peak ozone levels. A key metric for upper level high pressure strength has remained steady or trended downward in recent years, suggesting a reasonable likelihood for moderate high pressure strength in the next few years.
- If the emissions trends are correct, then the Relative Response Factors (RRFs) are likely to be directionally correct
- Reductions in VOC emissions are expected to reduce ozone;
- Reductions in NOx emissions are expected to reduce ozone, possibly with greater efficiency than VOC reductions, at troublesome monitors outside of the urban core of metro Denver. Analysis of the weekend-weekday effect for the Front Range shows a strong effect in Central Denver and weaker effect in outlying areas. This points to the possibility for NOx control disbenefits in Central Denver due to the role of NOx quenching there. The spatial pattern of the weekend effect is consistent with the localized NOx disbenefit identified in the photochemical modeling. Increases in ozone concentrations in the urban core of metro Denver due to NOx emissions reductions do not appear to be significant.
- The aggregate trend in weather-corrected 4^{th} maximum time series suggest that ozone levels have been flat from 2004 through 2008, although individual concentrations have been highly variable. This suggests that without additional emission reductions (controls) the region will remain at or near the level of the standard.
- The base case modeling of the June-July 2006 timeframe encompasses the various local meteorological regimes under which elevated ozone levels have and are expected to occur.
- Other modeled metrics indicate that there are reductions in total ozone, grid cells and grid cell-hours of 15-30% for thresholds of 85 ppb and 80 ppb from the 2006 base case through the 2010 base case, the proposed 2010 additional control case (Control 1) and the expected state-only additional control case (Control 2).
- A comparison ambient and modeled data (shown in the TSD Appendix G) indicates that VOC emissions from the oil and gas sector may be underestimated. The consequence of underestimating VOC emissions is that effectiveness of controls is under estimated on a mass basis.

- At this time, the photochemical modeling is considered to be the best predictor of future ozone levels.

In conclusion, the collective supplemental analyses contained in this weight of evidence document support the current photochemical model attainment demonstration for the 0.08 ppm 8-hour ozone NAAQS using the EPA default approaches for the 2010 base case, 2010 additional Control 1(SIP), and the 2010 additional Control 2 (State-only) scenarios. In addition, at this time, the photochemical modeling is considered to be the best predictor of future ozone levels.

The collective supplemental analyses in this weight of evidence analysis support the findings using the EPA methods, as specified in the EPA modeling guidance, that the 2010 base case will likely achieve attainment of the 0.08 ppm 8-hour ozone NAAQS in the Denver Metro Area and North Front Range. As demonstrated using alternative attainment test methodologies, the same WOE indicators demonstrate that there will be more certainty that the Denver region will achieve 8-hour ozone attainment in 2010 under the 2010 base case, 2010 additional Control 1, and 2010 additional Control 2 emissions scenarios. The preponderance of evidence suggests that the region will attain the standard in 2010 under the base case, additional Control 1, and additional Control 2 scenarios, but the safety margin is small.

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 necessary 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.

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 (MPOs) 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 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 (NFRTAQPC) is the metropolitan planning organization responsible for transportation planning in the urbanized portions of Larimer and Weld counties. Finally, the Upper Front Range (UFR) Transportation Planning Region (TPR), not a designated metropolitan planning organization, 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 both VOC and NOx subarea motor vehicle emission budgets, and budgets for VOCs and NOx for the entire nonattainment area for purposes of transportation conformity in the Denver/North Front Range 8-hour ozone nonattainment area. The two subareas are described below. Also described below are the procedures to be followed when switching between using subarea budgets and the nonattainment area-wide budgets.

B. Motor Vehicle Emissions 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. Budgets are specifically established for two sub-regional areas and for the entire nonattainment area 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 area 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 area 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 entire nonattainment area can have from the transportation sector and still lead to attainment of the standard. This SIP expressly allows the MPOs the flexibility to demonstrate conformity with either the established subarea budgets or the nonattainment area-wide Motor Vehicle Emission Budgets. Therefore, 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 the separate Motor Vehicle Emissions Budgets for the ozone precursors VOC and NOx for the two subareas discussed above and the VOC and NOx budgets for the entire nonattainment area.

Table 12: Subarea and Nonattainment Area-wide 2010 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 2010 VMT estimates were used with 2010 emission factors obtained from the EPA MOBILE6.2 Emission Factor Model to calculate emissions. 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 emissions 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 Performance 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 Emissions Budgets in MPO Conformity Determinations

The nonattainment area-wide 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 nonattainment-area wide budgets shall be used for the initial conformity determination; however, consistent with EPA regulations and guidance, the MPOs may use the subarea budgets for subsequent conformity determinations.

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. 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 United States Department of Transportation's (DOT) 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.

Initial Conformity Determination

Once nonattainment area-wide 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 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)). Under provisions of this SIP, the MPOs must make an initial concurrent conformity determination using the nonattainment area-wide Motor Vehicle Emissions Budgets for VOCs and NOx. The MPOs must ensure the sum of their subarea emissions is less than or equal to the established total nonattainment area-wide budgets.

Subsequent Conformity Determinations

Once the initial joint conformity determination using the nonattainment area-wide budgets has been made and approved, the MPOs must continue to make future conformity determinations using the established nonattainment area-wide budgets whenever either MPO is required to make a new conformity determination for a transportation plan or program. However, since this SIP expressly allows the MPOs the flexibility to demonstrate conformity with either the established subarea motor vehicle emissions budgets or the nonattainment area-wide motor vehicle emissions budgets, the MPOs may revert to demonstrating conformity by meeting their respective subarea emission budgets if the MPOs initially make concurrent conformity determinations that demonstrate consistency of their respective plans and programs with their individual subarea budgets. Thereafter, an MPO can make independent conformity determinations for their plans and TIPs as long as the other subarea in the nonattainment area continues to have a conforming transportation plan and TIP in place at the time of the conformity determination.

Likewise, at any time in the future, the MPOs may switch from using subarea budgets to using nonattainment area-wide budgets as long as they once again perform a joint conformity determination and the sum of their subarea motor vehicle emissions is equal to or less than the established nonattainment area-wide budgets, and continue to make joint conformity determinations until they again decide to revert to the subarea 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 Subarea