EXECUTIVE SUMMARY

Based on 2005-2007 air quality monitoring data the Denver Metropolitan Area (DMA) violated the 0.08 parts per million (ppm) 8-hour ozone National Ambient Air Quality Standard (NAAQS). Thus, in November 2007 the DMA reverted to an 8-hour ozone nonattainment area. This requires the DMA to develop an 8-hour ozone State Implementation Plan (SIP) that demonstrates the area will achieve the 1997 8-hour ozone NAAQS (0.08 ppm) by 2010. The Denver Regional Air Quality Council (RAQC), in consultation with the Colorado Department of Health and Environment (CDPHE) Air Pollution Control Division (APCD), contracted with ENVIRON International Corporation, and their subcontractor Alpine Geophysics, LLC, to develop the photochemical modeling databases necessary to demonstrate that the DMA will achieve the 0.08 ppm 8-hour ozone NAAQS by 2010.

OVERVIEW OF APPROACH

The Comprehensive Air-quality Model with extensions (CAMx; www.camx.com) was set up for a June-July 2006 episode on a 36/12/4 km grid with the 4 km domain focused on Colorado. Meteorological inputs were prepared using the MM5 meteorological model whose results and evaluation are discussed by McNally and co-workers (2008a). An initial emissions inventory was prepared using the SMOKE emissions modeling system and a preliminary 2006 base case was performed. A preliminary model performance evaluation was conducted and diagnostic sensitivity tests performed to identify an optimal model configuration for simulating ozone formation in the DMA (Morris et al., 2008b). A revised final CAMx 2006 base case simulation was performed and a comprehensive model performance evaluation was conducted (Morris et al., 2008c). Although there were some model performance issues on some of the modeling days during the June-July 2006 episode, a vast majority of the modeling days achieved EPA's model performance goals and looking at many model performance displays and metrics we concluded that the model was simulating the observed ozone sufficiently well for use in making ozone projections. Furthermore, on most days the model reproduced the observed VOC/NOx ratios in Denver quite well suggesting that the model is simulating the same chemical regimes as observed as well.

2010 BASE CASE OZONE PROJECTIONS

The procedures given in EPA's 8-hour ozone modeling guidance were used to project current year 8-hour ozone Design Values (DVC) to obtain projected future year 2010 8-hour ozone Design Values (DVF) at each of the DMA monitoring sites (EPA, 2007). These procedures use the 2006 and 2010 base case modeling results in a relative fashion whereby modeled relative response factors (RRFs) are used to scale the current year 8-hour ozone Design Value (DVC) to obtain the projected future year 8-hour ozone Design Value (DVF):

$$DVF = DVC \times RRF$$

The 2010 ozone projections were made using EPA's Modeled Attainment Test Software (MATS) tool (http://www.epa.gov/scram001/modelingapps_mats.htm).

For the Denver 2010 ozone projections, with one exception, the DVCs were based on the 8-hour ozone Design Values from the 2005-2007 period (i.e., the three year average of the fourth highest daily maximum 8-hour ozone concentration at each monitor). The exception to this was for the Fort Collins West (FTCW) monitor that started monitoring in 2006 so a two year average of the fourth highest daily maximum 8-hour ozone concentrations was used from 2006-2007 for the FTCW DVC.

Table ES-1 summarizes the projected 8-hour ozone Design Values (DVF) at the DMA monitoring sites for the 2010 base case simulation using the CAMx 2006 and 2010 base case modeling results and EPA recommended default ozone projection procedures (EPA, 2007). The maximum projected 8-hour ozone Design Value is 84 ppb and occurs at both the Rocky Flats North (RFNO) and Fort Collins West (FCTW) monitoring sites (see column 5 in Table ES-1). As this value is 84 ppb or lower, then the 2010 base case modeling results pass the model attainment demonstration test. EPA's guidance for making 8-hour ozone projections recommends truncating the final projected DVF for comparisons with the 85 ppb NAAQS. In column 6 of Table ES-1 the DVFs are presented to the nearest tenth of a ppb before truncation, in which case we see that the projected 2010 base case DVFs at RFNO and FTCW are both 84.9 ppb. Also shown in Table ES-1 are the RRFs and the cut-off thresholds used in selecting days and number of days used in calculating the RRF. The EPA desire to use at least 10 modeling days and a cutoff threshold of 70 ppb or higher is satisfied using the Denver June-July 2006 modeling period at all monitoring sites. Modeling days are selected based on whether the 2006 base case model estimated maximum daily maximum 8-hour ozone concentration near a monitor (i.e., within 7 x 7 array of 4 km grid cells centered on the monitor) are above the cut-off threshold. In order to achieve at least 10 model days for developing the RRFs, the cut-off thresholds of 74 ppb to 78 ppb were used depending on the monitor (the key RFNO and FTCW monitors using a 78 and 76 ppb cut-off thresholds, respectively).

Table ES-1. Current-year (DVC) and projected future-year (DVF) 8-hour ozone Design Values using the CAMx 2006 and 2010 base case modeling results.

			2005-07	2010 Base Case				
Site ID	**Monitor Name**	**County**	**DVC**	**DVF**	**DVF**	**RRF**	**Cutoff**	**#days**
80013001	Welby	Adams	70.0	70	70.2	1.0042	77.0	11
80050002	Highland	Arapahoe	78.0	77	77.3	0.9916	78.0	14
80130011	S. Boulder Creek	Boulder	81.0	80	80.8	0.9976	78.0	10
80310002	Denver - CAMP	Denver	56.0	56	56.0	1.0017	78.0	10
80310014	Carriage	Denver	74.0	74	74.1	1.0022	78.0	10
80350004	Chatfield State Park	Douglas	84.0	83	83.4	0.9934	78.0	11
80410013	USAF Academy	El Paso	73.0	72	72.0	0.9873	75.0	10
80410016	Manitou Springs	El Paso	74.0	73	73.7	0.9966	74.0	10
80590002	Arvada	Jefferson	79.0	79	79.2	1.0026	78.0	10
80590005	Welch	Jefferson	75.0	75	75.0	1.0004	78.0	10
80590006	Rocky Flats North	Jefferson	85.0	84	84.9	0.9994	78.0	10
80590011	NREL	Jefferson	82.0	82	82.3	1.0039	78.0	11
80690011	Fort Collins - West	Larimer	86.0	84	84.9	0.9874	76.0	10
80691004	Fort Collins	Larimer	74.0	73	73.0	0.9878	76.0	12
81230009	Greeley - Weld Tower	Weld	78.0	77	77.7	0.9964	75.0	10
GTH161	Gunnison	Gunnison	68.0	67	67.8	0.9984	74.0	10
ROM206	Larimer	Larimer	76.0	75	75.2	0.9903	77.0	10
ROM406	Larimer	Larimer	76.0	75	75.2	0.9903	77.0	10

2010 CONTROL PLAN EMISSION SCENARIOS

2010 ozone projections were made for two 2010 emission control plans: (1) 2010 Control 1 that consists of the federally-enforceable control measures that are proposed for the Denver 8-hour ozone State Implement plan (SIP); and (2) Control 2 that includes the federally-enforceable measures of Control 1 plus additional control measures that are adopted as state-only enforceable. The 2010 ozone projections for the two control plans were made using the same procedures as for the 2010 base case. Table ES-2 summarizes the control measures for the two 2010 control plans.

Table ES-2. Summary of control measures in the 2010 Control 1 and Control 2 emission scenarios.

<table>
<tr><th colspan="6">Strategies Under Development for 2008 Proposed Ozone Action Plan
(All strategies apply to the entire Denver/North Front Range nonattainment area (NAA) unless otherwise noted)</th></tr>
<tr><th colspan="2">**Control 1**
Recommended Measures
for Federally-Enforceable
State Implementation Plan (SIP)</th><th>*Potential Emission Reduction*</th><th colspan="2">**Control 2**
Recommend Measures
Adopted and Enforced
as State-only Measures</th><th>*Potential Emission Reduction*</th></tr>
<tr><td colspan="2">➢ More stringent Reg. 11 I/M cutpoints (Denver area) – adopted, effective May 1, 2008</td><td>*~ 1 tpd VOC,
~3 tpd NOx,
~13 tpd CO*</td><td colspan="2">➢ Inspection/maintenance program in North Front Range (structure to be determined)</td><td>*~ 1 tpd VOC,
~1 tpd NOx,
~17 tpd CO*</td></tr>
<tr><td colspan="2">➢ 7.8 RVP gasoline regulatory requirement in North Front Range (consistent with Denver area)</td><td>*~ 3 tpd VOC*</td><td colspan="2">➢ Mandatory high-emitter <u>pilot</u> program (Denver area) – began January 1, 2008</td><td>*unknown at this time*</td></tr>
<tr><td colspan="3"></td><td colspan="2">➢ Tighten up collector plate requirements for older vehicles (statewide)</td><td>*< 1 tpd VOC
~ 7 tpd CO*</td></tr>
<tr><td colspan="2">➢ Increase condensate tank control (95%)
▪ for all new/modified tanks >2 tpy (2009)
▪ for all existing tanks >10 tpy (2010)</td><td>*VOC
~ 6-9 tpd
~19-30 tpd*</td><td colspan="2">➢ Increase condensate tank control (95%)
▪ for all existing tanks >5 tpy (2011)
▪ for all existing tanks >2 tpy (2012)</td><td>*VOC
~ 30-35 tpd
~9-12 tpd*</td></tr>
<tr><td colspan="2">➢ Pneumatic valves controls - require low/no bleed valves on all new and existing valves by 2009</td><td>*~ 23 tpd VOC*</td><td colspan="2">➢ Statewide Oil & Gas regulations -- Controls on existing reciprocating internal combustion engines</td><td>*unknown at this time*</td></tr>
<tr><td colspan="2">➢ Expand Reg. 7 (VOC control requirements) to entire NAA</td><td>*unknown at this time*</td><td colspan="3" rowspan="3"></td></tr>
<tr><td colspan="2">➢ Remove current exemptions in Reg. 3 for selected small sources required to file air pollution emission notices and obtain permits</td><td>*unknown at this time*</td></tr>
<tr><td colspan="2">➢ Require Reasonably Available Control Technology (RACT) for minor sources in NAA (Reg. 3)</td><td>*unknown at this time*</td></tr>
<tr><td>TOTAL
EMISSION
REDUCTIONS</td><td>VOC
NOx
CO</td><td>*~52-66 tpd
~ 3 tpd
~13 tpd*</td><td></td><td>VOC
NOx
CO</td><td>*~41-49 tpd
NA
>24 tpd*</td></tr>
</table>

2010 CONTROL PLAN OZONE PROJECTIONS

Table ES-3 displays the projected 8-hour ozone DVFs for the 2010 base case and the two 2010 control plans. The maximum projected 8-hour ozone Design Values for the 2010 Base, Control 1 and Control 2 emissions scenarios are 84 ppb at the Rocky Flats North (RFNO) and Fort Collins West (FTCW) monitoring sites. Thus, the 2010 Base Case and two control scenarios pass the modeled attainment demonstration test. However, since there are four monitoring sites with projected 2010 DVFs of 82 ppb or higher (84 ppb at RFNO and FTCW, 83 ppb at Chatfield and 82 ppb at NREL), an additional weight of evidence (WOE) analysis is required.

When reporting the DVFs to the nearest tenth of a ppb we see that the projected 2010 DVF for the Base Case is 84.9 ppb at both the RFNO and FTCW monitoring sites. The implementation of the federally enforceable SIP control measures in the 2010 Control 1 emissions scenario reduces the DVFs at the RFNO and FTCW by, respectively, 0.1 and 0.2 ppb (to 84.8 and 84.7 ppb, respectively). The addition of the state-enforceable control measures in the 2010 Control 2 scenario reduces the DVFs at RFNO and FRTCW by an additional 0.1 and 0.2 ppb, respectively (to 84.7 and 84.5 ppb, respectively). These results are consistent with the 2010 sensitivity modeling that found ozone to be more responsive to emission controls at the FTCW than RFNO monitoring sites (McNally et al., 2008b).

Table ES-3. Projected 2010 8-hour ozone Design Values (DVFs) for the 2010 Base Case and 2010 Control 1 (Cntl1) and Control 2 (Cntl2) control strategies.

			DVF (EPA Recommended)			DVF (to nearest 0.1 ppb)		
Name	**County**	**DVC**	**Base**	**Cntl1**	**Cntl2**	**Base**	**Cntl1**	**Cntl2**
Welby	Adams	70.0	70	70	70	70.2	70.2	70.2
Highland	Arapahoe	78.0	77	77	77	77.3	77.2	77.1
S. Boulder Creek	Boulder	81.0	80	80	80	80.8	80.7	80.6
Denver - CAMP	Denver	56.0	56	56	55	56.0	56.0	55.9
Carriage	Denver	74.0	74	74	74	74.1	74.1	74.0
Chatfield State Park	Douglas	84.0	83	83	83	83.4	83.3	83.3
USAF Academy	El Paso	73.0	72	71	71	72.0	71.9	71.9
Manitou Springs	El Paso	74.0	73	73	73	73.7	73.7	73.7
Arvada	Jefferson	79.0	79	79	79	79.2	79.1	79.1
Welch	Jefferson	75.0	75	75	74	75.0	75.0	74.9
Rocky Flats North	Jefferson	85.0	84	84	84	84.9	84.8	84.7
NREL	Jefferson	82.0	82	82	82	82.3	82.2	82.1
Fort Collins - West	Larimer	86.0	84	84	84	84.9	84.7	84.5
Fort Collins	Larimer	74.0	73	72	72	73.0	72.9	72.7
Greeley-WeldTower	Weld	78.0	77	77	77	77.7	77.4	77.0
Gunnison	Gunnison	68.0	67	67	67	67.8	67.8	67.9
Larimer	Larimer	76.0	75	75	75	75.2	75.1	75.1
Larimer	Larimer	76.0	75	75	75	75.2	75.1	75.1

2010 UNMONITORED AREA ANALYSIS

EPA's 8-hour ozone projection procedure also includes an unmonitored area analysis (EPA, 2007) that has been codified in MATS. The unmonitored area analysis uses the future-year 8-hour ozone Design Value projection procedure applied to each grid cell in the modeling domain. In this procedure, the current-year Design Values (DVC) are interpolated to each grid cell in the modeling domain. This interpolation scheme uses the modeled concentration gradients. RRFs are then obtained for each grid cell in the modeling domain using essentially the same approach as used for the monitored ozone projections, only using the modeling data within each grid cell rather than near a grid cell as done for the projections at the monitor.

Figure ES-1 displays the interpolated current year 8-hour ozone Design Values (DVC) and projected 8-hour ozone Design Values (DVFs) for the 2010 Base Case using the MATS unmonitored area analysis. Interpolated current year ozone DVCs in excess of 80 ppb are estimated to the south, west and northwest of Denver stretching to Fort Collins and then west of Fort Collins. In fact, the MATS interpolation procedure estimates 12 grid cells of current-year DVCs in excess of the 85 ppb NAAQS occur west of the Fort Collins (Figure ES-1, left). The projected DVFs for the 2010 base case (Figure ES-1, right) have greatly reduced the spatial extent of the DVFs in excess of 80 ppb and the 12 cells with DVCs exceeding the 85 ppb NAAQS have been reduced by half to 6 grid cells in the 2010 base case emissions scenario.

Figure ES-2 displays the unmonitored area analysis projected DVFs for the 2010 Control 1 (left) and 2010 Control 2 (right) emission scenarios. There are slight reductions in the 2010 DVFs over the 2010 Base Case, which can be seen more clearly in the difference plots seen in Figure ES-3. The 6 remaining grid cells with projected DVFs that are 85 ppb or higher in the 2010 Base case are reduced to 4 and 3 grid cells in the, respectively, 2010 Control 1 and Control 2 emission scenarios.

EPA guidance stresses that the unmonitored area test has more uncertainties than the projections at the monitors and it should be treated separately from the monitor based attainment demonstration test (EPA, 2007). EPA further notes that while it is expected that additional emission controls will likely be needed to eliminate predicted exceedances of the ozone NAAQS in the monitor based attainment test, the same requirements may not be appropriate in unmonitored areas. In any event, EPA recommends that areas of predicted violations in the unmonitored area test be scrutinized and understood to determine whether they are likely to really exist in the ambient air, or whether they may be caused by an error or uncertainties in the modeling system. At a minimum, it may be appropriate to deploy additional ozone monitors to such areas. In the case of the Denver ozone modeling, higher ozone concentrations are estimated west of Fort Collins than at the locations of the two monitors in Fort Collins on some days and this does not appear to be due to an error in the modeling system. Whether it may be due to uncertainties in the modeling system can not be determined. However, it does not seem implausible that higher ozone values could exist west of the Fort Collins West monitoring site.

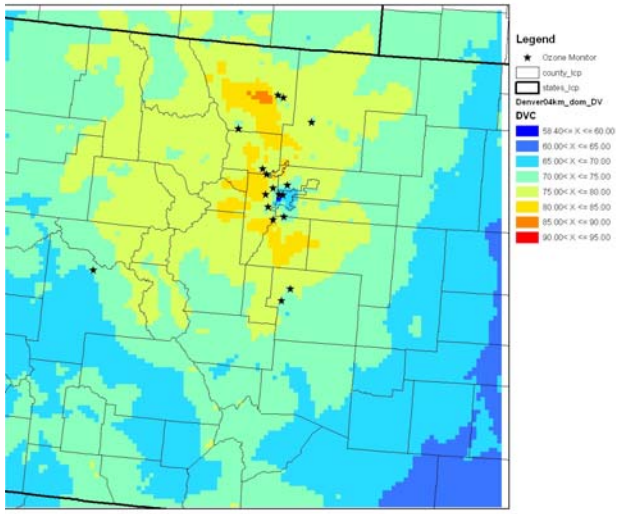
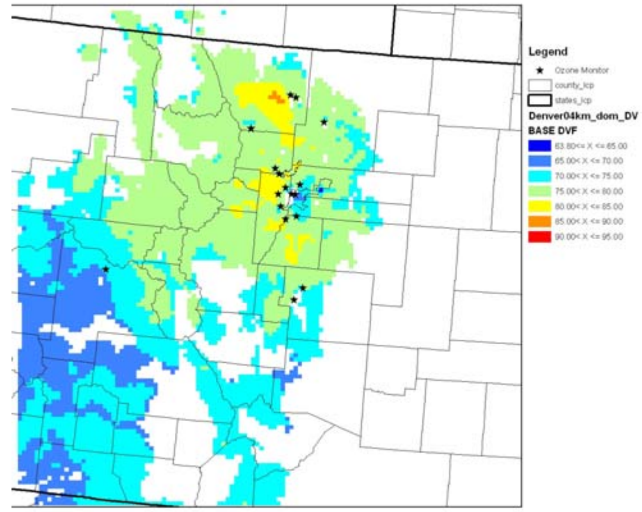



Figure ES-1. Interpolated current year 8-hour ozone Design Values (DVC; left) and projected 2010 Base Case 8-hour ozone Design Values (DVF; right).

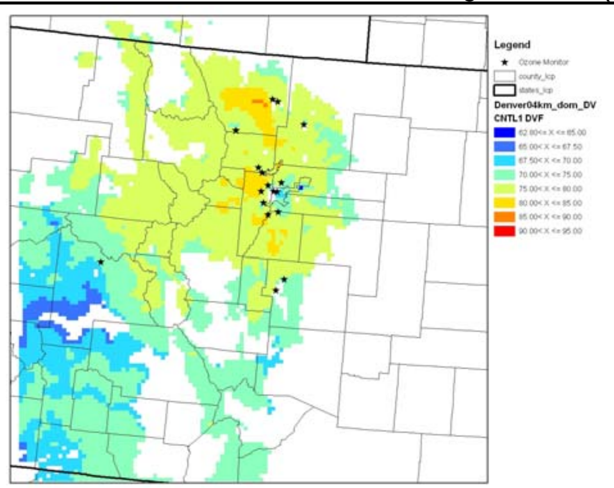
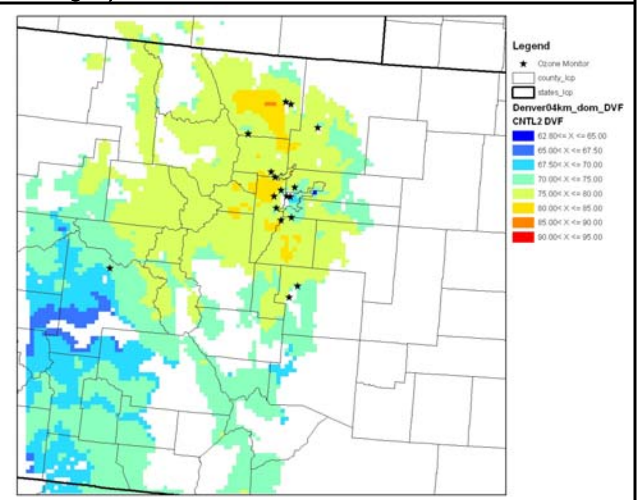



Figure ES-2. Projected 2010 8-hour ozone Design Values (DVF) for the 2010 Control 1 (left) and Control 2 (right) emission scenarios.

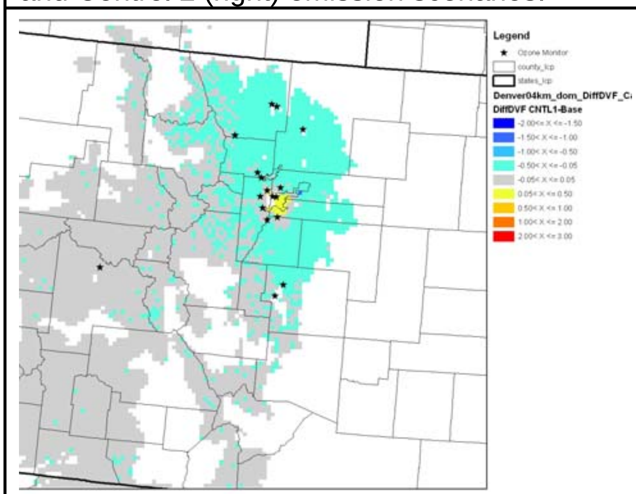
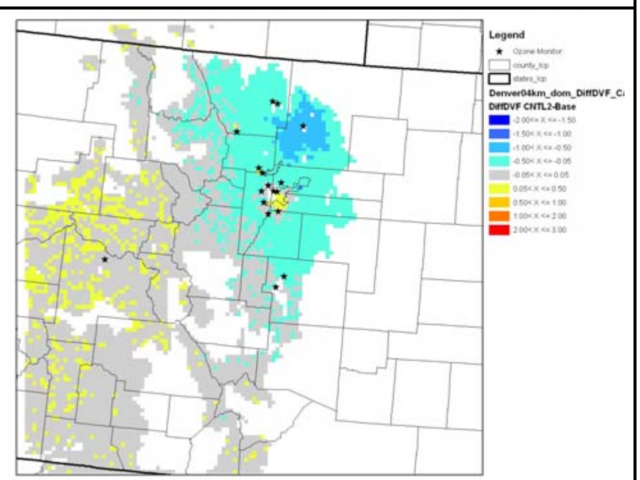



Figure ES-3. Differences in projected 2010 8-hour ozone Design Values (DVF) between the 2010 Control 1 (left) and 2010 Control 2 (right) and the 2010 Base Case.

ALTERNATIVE 2010 OZONE PROJECTION RESULTS

Several alternative 2010 ozone projection procedures were analyzed for the 2010 Base Case, Control 1 and Control 2 emission scenarios to estimate the uncertainties in the projection procedures and provide confidence that passing the modeled attainment demonstration test does indicate attainment will likely be achieved in 2010 under either the 2010 Base Case, Control 1 or Control 2 emission scenarios. These alternative ozone projection procedures differ in the days used and how modeled ozone near the monitor is selected to construct the RRFs. Six additional ozone projection procedures were analyzed, in addition to the EPA guidance default approach discussed previously:

> Minimum 5 Days to Develop RRF using 85-70 ppb Sliding Threshold (5dth): In the EPA default approach, days are selected for use RRFs based on whether the maximum daily maximum 8-hour ozone concentration near the monitor (with 7 x 7 array of grid cells) in the 2006 Base Case is greater than a threshold, with the threshold determined when at least 10 days are obtained for the RRF. In this alternative projection approach, we require a minimum of 5 modeled days to construct the RRFs.
>
> Use of 80 ppb Cutoff Threshold and Minimum of 1 Day (1dth80): The second alternative ozone projection approach uses an 80 ppb cutoff threshold and RRFs are allowed to be calculated with as few as one modeling day.
>
> Use of 75 ppb (1dth75) and 70 ppb (1dth70) Cutoff Thresholds: In those two alternative projection approaches the cutoff threshold is reduced to 75 and 70 ppb.
>
> Use of 5 x 5 and 3 x 3 Array of Grid Cells: Select the maximum daily maximum 8-hour ozone concentration from a 5 x 5 or 3 x 3 array of grid cells centered on the monitor, instead of using a 7 x 7 array as used in the EPA default procedure

Table ES-4 lists the projected 2010 DVFs at the key RFNO and FTCW monitoring sites for the EPA guidance default and the six alternative ozone projection procedures discussed above. Also shown in Table ES-4 are the ozone cutoff thresholds and number of days used in calculating the RRFs for each alternative 2010 ozone project methods and the RFNO and FTCW monitoring sites. It should be noted that there is really no one "correct" method for projecting future year ozone concentrations that has been proven the most reliable. Methods based on just a few number of days have been shown to be less robust than ones based on more days. And it is logical that methods based on modeled concentrations closer to the observed 8-hour ozone Design Values would be more representative of the conditions that produced those Design Values than methods based on days much higher or lower than the Design Values.

2010 Base Case: For the 2010 Base Case, the projected 2010 DVF using the EPA guidance default approach was 84.9 ppb at both the RFNO and FTCW monitoring sites. Some of the six alternative projection approaches result in increases, whereas others in decreases in the projected 2010 DVFs at these two sites relative to the EPA guidance default approach. The projected DVFs at RFNO for the 2010 Base Case range from 84.5 to 85.2 with an average value of 84.9 ppb. A similar range for the FTCW monitor is 84.6 to 85.2 ppb with an average of 84.9 ppb. At the RFNO monitoring site, 3 of the 7 projection methods pass the modeled attainment demonstration test (43%), while at the FTCW 5 of the 7 methods pass the test (71%).

2010 Control 1 Case: A majority of the 2010 ozone projection procedures pass the modeled attainment demonstration test at both the RFNO (4 out of 7, 57%) and FTCW (6 out of 7, 86%) monitoring sites. At the RFNO monitoring site, the projected DVFs for the 2010 Control 1 scenario range from 84.3 to 85.1 ppb with an average of 84.8 ppb. And at the FTCW monitoring site the projected DVFs range from 84.4 to 85.0 ppb with an average of 84.7 ppb.

2010 Control 2 Case: The 2010 projected DVFs at RFNO for the 2010 Control 2 case are similar to the 2010 Control 1 case ranging from 84.3 to 85.1 ppb, with an average of 84.8 ppb. More benefits are seen at FTCW where the 2010 projected DVFs range from 84.3 to 84.8 ppb with an average of 84.5 ppb.

An examination of the different 2010 ozone projection methods across monitoring sites shows no method is tending toward estimating higher or lower DVFs than the EPA default method across all monitoring sites. This is clearly shown in Table ES-4 for the RFNO and FTCW monitoring sites where, in most cases, a method in which the projected DVF at RFNO is greater than the EPA default method is below the EPA default method at FTCW and vice versa.

In conclusion, the alternative ozone projection approaches support the findings using the EPA default approach that the 2010 Base Case will likely achieve attainment in the Denver region of the 0.08 ppm 8-hour ozone NAAQS. The ozone projection methods indicate that there will be more certainty that the Denver region will achieve 8-hour ozone attainment in 2010 under the 2010 Control 1 and Control 2 emission scenarios.

Table ES-4. Projected 2010 8-hour ozone Design Values (DVFs) at the Rocky Flats North (RFNO) and Fort Collins West (FTCW) monitoring sites using the EPA guidance default approach, the six alternative projection approaches and the 2010 Base, Control 1 and Control 2 modeling results.

Alternative 2010 Ozone Projection Procedures									
Name	**DVC**	**EPA**	**5dth**	**1dth80**	**1dth75**	**1dth70**	**5x5**	**3x3**	**Avg**
2010 Base Case (Base) DVFs (ppb)									
Rocky Flats North	85.0	84.9	85.2	85.1	84.9	85.0	85.0	84.5	84.9
Fort Collins - West	86.0	84.9	84.6	84.6	84.9	85.1	84.8	85.2	84.9
2010 Control Strategy No. 1 (Cntl1) DVFs (ppb)									
Rocky Flats North	85.0	84.8	85.1	85.0	84.8	85.0	84.9	84.3	84.8
Fort Collins - West	86.0	84.7	84.4	84.4	84.7	84.9	84.6	85.0	84.7
2010 Control Strategy No. 2 (Cntl2) DVFs (ppb)									
Rocky Flats North	85.0	84.7	85.1	84.9	84.8	84.9	84.8	84.3	84.8
Fort Collins - West	86.0	84.5	84.3	84.3	84.5	84.7	84.5	84.8	84.5
Cut-Off Concentration (ppb)									
Rocky Flats North		78	81	80	75	70	76	75	
Fort Collins - West		76	81	80	75	70	75	73	
Number of Days Used									
Rocky Flats North		10	6	7	19	27	11	10	
Fort Collins - West		10	5	5	13	22	10	10	

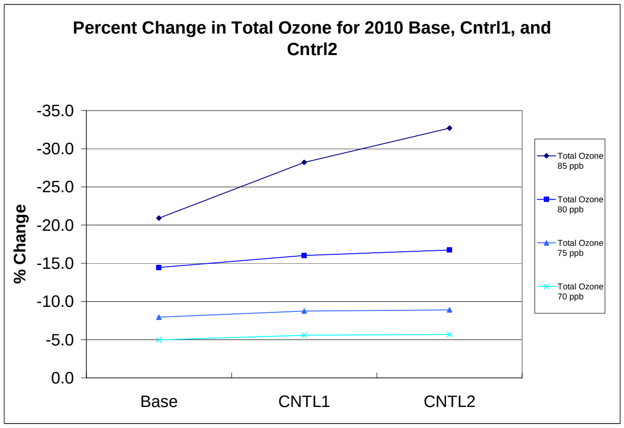
ADDITIONAL MODELING METRICS

EPA's 8-hour ozone modeling guidance recommends calculating additional modeling metrics from the current year base case to future year control scenario to assure that they indicate the modeled ozone concentrations are going down. These additional modeling metrics examine the ozone differences between the current year base case and future year emission scenarios in the modeling domain to assure that ozone is going down, on average, across the entire nonattainment area (NAA) rather than just limited to a few key monitoring sites.

The changes in daily maximum 8-hour ozone concentrations between the 2006 Base Case and 2010 emission scenarios was calculated across grid cells in the Denver NAA and across all days in the June-July 2006 modeling episode. The changes 8-hour ozone concentrations are calculated for values above four separate threshold concentrations: 85, 80, 75 and 70 ppb. These modeling metrics consist of the following:

> Total Ozone: Defined as the difference between the modeled daily maximum 8-hour ozone concentrations and the threshold concentration, for modeled values above the threshold, summed across all grid cells in the Denver NAA and modeling days during June-July 2006.
>
> Grid Cells: Number of grid cell-days with modeled daily maximum 8-hour ozone concentrations greater than the threshold for all grid cells in the NAA and days from the June-July 2006 episode.
>
> Grid Cell-Hours: Number of grid cell-hours with modeled running 8-hour ozone concentrations greater than the threshold for all grid cells in the NAA and hours during the June-July 2006 episode.

Figure ES-4 displays the percent change in the Total Ozone and Grid Cells between the 2006 Base Case and the 2010 emission scenarios (the change in Grid-Cell Hours is similar). There are small reductions between 2006 and 2010 in the Total Ozone (~-5%) and Grid Cell (~-3%) modeling metrics greater than the 70 ppb threshold. However, the emission reductions between 2006 and 2010 are having their intended effect in being more effective at reducing the elevated 8-hour ozone concentrations. For example, the changes in Total Ozone and Grid Cells greater than 85 ppb modeling metrics between the 2006 and 2010 Base Cases are -21% and -14% , respectively. These reductions are even greater for the 2010 Control 1 case (-28% and -17%) and even greater still for the 2010 Control 2 scenario.



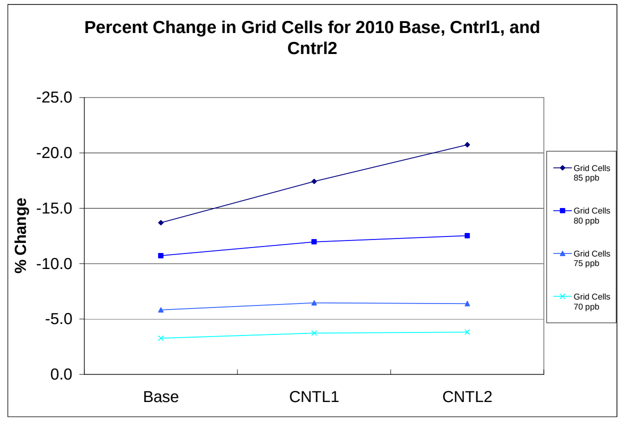


Figure ES-4. Percent change in Total Ozone (left) and Grid Cells (right) greater than 85, 80, 75 and 70 ppb between the 2006 Base Case and the 2010 Base Case (Base), Control 1 (CNTL1) and Control 2 (CNTL2) emission scenarios.

2010 CONTROL PLAN MODELING CONCLUSIONS

The 2010 ozone modeling indicates that the Denver region would achieve attainment of the 1997 8-hour ozone NAAQS (0.08 ppm) by 2010 under any of the three 2010 emission scenarios studied. All three 2010 emission scenarios pass the modeled attainment demonstration test. Examining the unmonitored area test, the alternative ozone projection procedures and additional modeling metrics we conclude that the two 2010 control strategies provide more certainty that ozone attainment will be achieved in 2010 than the 2010 base case.

There are numerous uncertainties in the modeling analysis. By definition, models are simplistic approximations of complex phenomena. The modeling analysis used to asses whether various emission reduction measures will bring the Denver area into attainment of the 8-hour ozone NAAQS contain many elements that are uncertain (e.g., emissions inputs and projections, meteorological inputs, ozone transport, etc.). There are a lot of year-to-year meteorological variations in the Denver area that greatly affect the ozone formation potential of the region. For example, the most ozone formation conducive year for the DMA in recent record was 2003 that was followed by the year with the least ozone formation conducive conditions in 2004. If the ozone formation conditions in the next few years are much more severe than seen in the June-July 2006 modeling period, then that could jeopardize achieving attainment in 2010. However, for 2008 it appears the opposite is true providing further confidence that the DMA will achieve attainment of the 8-hour ozone NAAQS in 2010.