Final Report

AIR QUALITY MODELING ANALYSIS FOR THE DENVER EARLY ACTION OZONE COMPACT:

2007 Control Strategy Modeling for the Denver EAC

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1. INTRODUCTION

This report describes 2007 control strategy attainment demonstration modeling carried out as part of the Denver-Northern Front Range 8-hour ozone Early Action Compact Study (Denver EAC Study).

The procedures used in the Denver EAC photochemical modeling are described in detail in the modeling protocol (Tesche et al., 2003a). Meteorological modeling performed to develop meteorological inputs for the Comprehensive Air-quality Model with extensions (CAMx) photochemical grid model and the June-July 2002 modeling period is described by McNally and co-workers (2003). The preparation of the emissions inputs for the Denver EAC modeling is described in Mansell and Dinh (2003a,b,c). The 2002 Base Case modeling and model performance evaluation is described by Morris and co-workers (2003), the preliminary 2007 modeling analysis performed in December 2003 is given in Morris et al., (2004a) and the revised 2007 emissions reductions sensitivity modeling is provided in Morris et al., (2004b).

2. REVISED 2007 BASE CASE AND CONTROL STRATEGY SCENARIOS

The Colorado Department of Health and the Environment (CDPHE) provided revised 2007 Base Case emissions for Colorado and emissions data and control factors for two 2007 Control Strategy scenarios. The revisions to the 2007 Base Case emissions included changes to the Stage I and II emissions and use of a 25% ethanol market penetration instead of the 40% market penetration assumed previously (Morris et al, 2004b). A base 9 psi RVP gasoline is still assumed in the 2007 Base Case.

This new round of photochemical modeling corrected an error in the RVP control factors used in the previous 2007 Base Case and Control Strategy modeling (i.e., Morris et al., 2004a,b). The proper RVP control factors were used for the 2007 Base Case and two Control Strategies described in this report.

The new round of photochemical modeling also updated the Stage I and II VOC emissions to account for their changes due to changes in RVP, which was not done in the previous rounds of modeling. Stage I VOC emissions refer to emissions from headspace displacement due to filling gasoline tanker trucks at the terminals and then pumping the gas out of the trucks to the underground storage tanks at gas stations. Stage II VOC emissions are headspace displacement from gasoline tanks in vehicles when refueling them. When the new Stage I/II emissions were first implemented in the emissions modeling an error occurred that switched the VOC and NOx emissions. This error resulted in an erroneous revised 2007 base case and control simulation that was quickly corrected. The results described in this report use the corrected Stage I/II emissions.

The two 2007 emission control scenarios included the following control measures:

- Low RVP: Lower RVP gasoline for on-road mobile sources in the DMA. Two different levels of RVP were analyzed, 8.1 psi and 7.8 psi RVP, both with a 25% ethanol market penetration.
- Flash VOC: 37.5% control on Flash VOC emissions from oil and gas production.
- RICE: NOx, VOC and CO emission controls on Reciprocating Internal Combustion Engines (RICE) of greater than 250 HP.
- Dehydrators: Emission controls on glycol dehydrators.

REVISED 2007 BASE CASE

Table 2-1 displays the 8-hour ozone Design Value scaling results for the revised 2007 Base Case simulation. Shown in this table are upper and lower panels of maximum estimated daily maximum 8-hour ozone concentrations near (i.e., within approximately 15 km) each monitor for the 2002 Base Case (upper panel) and 2007 Base Case (lower panel) simulations. The 2001-2003 observed 8-hour ozone Design Value (DV) is shown in the first column to the right of the monitor name. During 2001-2003 there were three ozone monitors in the Denver area that violated the 8-hour ozone standard: Rocky Flats (87 ppb), NREL (85 ppb) and Chatfield (85

ppb). To project the 2007 8-hour ozone Design Values, Relative Reduction Factors (RRFs) are developed for each ozone monitor as the ratio of the average daily maximum 8-hour ozone concentrations near each monitor for the 2007 Base Case to the 2002 Base Case simulation for all days in which the estimated 8-hour ozone concentration in the 2002 Base Case simulation was greater than 70 ppb. The projected 8-hour ozone Design Value for the 2007 Base Case and the Rocky Flats, NREL and Chatfield monitors are, respectively, 86.5, 84.5 and 83.4 ppb. The values at Rocky Flats and NREL are 0.1 ppb lower than the previous 2007 Base Case reported by Morris and co-workers (2004b), whereas the value at Chatfield is 0.3 ppb lower. Modeled attainment is demonstrated when the projected 8-hour ozone Design Value is 84.9 ppb or lower, which is satisfied under 2007 Base Case conditions for the NREL and Chatfield monitors, but not the Rocky Flats monitor.

Table 2-1. 8-hour ozone Design Value projections for the revised (February 2004) 2007 Base Case simulation.

2002 Base Case -- Base Case: run11a										
Site	DV	2176	2177	2178	2179	2180	2181	2182	#Days>70	
Weld County Tow	81	61.0	57.2	65.2	60.6	69.4	66.9	70.9	1	
Rocky Mtn. NP	81	63.1	64.3	67.4	62.0	71.4	76.0	79.1	3	
Fort Collins	71	63.2	62.6	69.5	59.0	65.4	70.7	73.5	2	
USAF Academy	73	56.6	63.5	56.6	66.6	61.0	69.4	70.6	1	
Welch	70	58.9	66.5	69.8	71.7	65.7	73.0	87.2	3	
Rocky Flats Nor	87	62.8	62.7	70.9	62.1	70.5	73.8	84.5	4	
NREL	85	60.4	64.6	70.9	64.9	63.1	73.8	87.2	3	
Arvada	76	59.8	60.0	70.8	63.1	69.1	71.8	85.1	3	
Welby	66	56.6	55.2	62.6	66.5	70.0	66.2	72.7	2	
S. Boulder Cree	77	63.0	62.8	70.9	63.0	70.9	74.1	84.5	4	
Carriage	76	58.4	62.3	68.8	67.9	66.6	71.9	83.8	2	
Highland	81	57.4	66.3	62.7	73.0	69.7	71.9	81.6	3	
Chatfield Res.	85	57.9	66.5	63.4	73.0	69.7	71.9	85.9	3	
2007 Base Case (February 2004) -- Future Year: 07run11a.a2										
Site	DV	2176	2177	2178	2179	2180	2181	2182	RRF DV	Scaled
Weld County Tow	81	60.2	56.6	65.1	59.6	68.0	66.2	69.8	0.9845	79.7
Rocky Mtn. NP	81	63.6	63.5	66.0	61.0	69.7	74.8	76.9	0.9772	79.2
Fort Collins	71	62.8	62.2	68.8	58.3	64.2	71.1	72.0	0.993	70.5
USAF Academy	73	56.4	62.5	55.9	64.1	59.1	68.0	68.1	0.9646	70.4
Welch	70	59.1	67.3	69.2	70.1	64.6	72.8	85.5	0.9848	68.9
Rocky Flats Nor	87	64.2	62.3	70.7	61.6	69.3	74.4	83.4	0.9942	86.5
NREL	85	60.8	66.2	70.7	65.4	62.6	74.4	85.5	0.9946	84.5
Arvada	76	60.5	61.8	70.7	62.5	68.5	72.0	84.5	0.9975	75.8
Welby	66	56.4	55.8	64.7	64.9	69.3	69.0	74.4	1.0072	66.5
S. Boulder Cree	77	64.4	62.6	70.7	62.1	70.0	74.4	83.4	0.9939	76.5
Carriage	76	59.6	64.9	69.5	68.2	66.7	71.3	82.5	0.9881	75.1
Highland	81	57.2	67.0	63.1	70.6	66.9	71.3	81.1	0.9844	79.7
Chatfield Res.	85	58.1	67.1	61.4	70.6	66.9	71.3	84.5	0.9807	83.4

2007 CONTROL STRATEGY RESULTS

Two control strategy packages were modeled with the four control measures listed above. They differ in that one assumed an 8.1 psi RVP gasoline for on-road mobile sources in the link-based DMA network, whereas the other assumed an 7.8 psi RVP gasoline. Note that this report used the corrected RVP control factors so that the results for the RVP control scenarios can not be directly compared with previous reports (Morris et al., 2004a,b). Table 2-2 summarizes the anthropogenic emissions in the DMA plus Weld Counties for the 2007 Base Case (February 2004 a5 version of emissions) and the two control strategies. The two control strategies only differ in terms of VOC and CO emissions from on-road mobile sources and small changes in VOC emissions from point sources due to changes in refueling emissions.

Table 2-2. Summary emissions for the DMA plus Weld Counties for the 2007 Base Case and two 2007 Control Strategy packages.

Source Category	2007 Base	2007 Control Pkg. w/ 8.1 RVP			2007 Control Pkg. w/ 7.8 RVP		
		Control	Reduction		Control	Reduction	
	(tpd)	(tpd)	(tpd)	(%)	(tpd)	(tpd)	(%)
VOC Emissions							
Area	137.70	137.70	0.00	0%	137.70	0.00	0%
On-Road	154.28	138.06	-16.21	-11%	134.82	-19.46	-13%
Off-Road	71.66	71.66	0.00	0%	71.66	0.00	0%
Points	220.42	159.65	-60.77	-28%	159.35	-61.07	-28%
Total	584.06	507.08	-76.98	-13%	503.53	-80.53	-14%
NOx Emissions							
Area	6.92	6.92	0.00	0%	6.92	0.00	0%
On-Road	176.30	175.78	-0.52	0%	175.78	-0.52	0%
Off-Road	104.16	104.16	0.00	0%	104.16	0.00	0%
Points	145.90	129.31	-16.60	-11%	129.31	-16.60	-11%
Total	433.28	416.17	-17.11	-4%	416.17	-17.11	-4%
CO Emissions							
Area	2.10	2.10	0.00	0%	2.10	0.00	0%
On-Road	1276.12	1183.74	-92.38	-7%	1171.11	-105.01	-8%
Off-Road	1586.37	1586.37	0.00	0%	1586.37	0.00	0%
Points	47.55	36.72	-10.83	-23%	36.72	-10.83	-23%
Total	2912.14	2808.93	-103.21	-4%	2796.29	-115.85	-4%

Tables 2-3 and 2-4 display the 8-hour ozone Design Value calculations for the two 2007 Control Strategy emissions scenarios. Modeled attainment of the 8-hour ozone standard is demonstrated for all monitors but Rocky Flats, where an 8-hour ozone Design Value of 86 ppb is projected for both of the 2007 control scenarios.

Table 2-3. 8-hour ozone Design Value projections for the 2007 Control Strategy Pkg. w/ 8.1 RVP simulation.

2002 Base Case -- Base Case: run11a										
Site	DV	2176	2177	2178	2179	2180	2181	2182	#Days>70	
Weld County Tow	81	61	57.2	65.2	60.6	69.4	66.9	70.9	1	
Rocky Mtn. NP	81	63.1	64.3	67.4	62	71.4	76	79.1	3	
Fort Collins	71	63.2	62.6	69.5	59	65.4	70.7	73.5	2	
USAF Academy	73	56.6	63.5	56.6	66.6	61	69.4	70.6	1	
Welch	70	58.9	66.5	69.8	71.7	65.7	73	87.2	3	
Rocky Flats Nor	87	62.8	62.7	70.9	62.1	70.5	73.8	84.5	4	
NREL	85	60.4	64.6	70.9	64.9	63.1	73.8	87.2	3	
Arvada	76	59.8	60	70.8	63.1	69.1	71.8	85.1	3	
Welby	66	56.6	55.2	62.6	66.5	70	66.2	72.7	2	
S. Boulder Cree	77	63	62.8	70.9	63	70.9	74.1	84.5	4	
Carriage	76	58.4	62.3	68.8	67.9	66.6	71.9	83.8	2	
Highland	81	57.4	66.3	62.7	73	69.7	71.9	81.6	3	
Chatfield Res.	85	57.9	66.5	63.4	73	69.7	71.9	85.9	3	
2007 Control Strategy Package w/ 8.1 RVP -- Future Year: 07run11a.a2-attn										
Site	DV	2176	2177	2178	2179	2180	2181	2182	RRF DV	Scaled
Weld County Tow	81	59.3	55.9	64.4	58.7	66.8	66	69.4	0.978	79.2
Rocky Mtn. NP	81	63.7	62.6	65.7	60.6	69.3	74.3	76.4	0.9711	78.7
Fort Collins	71	62.4	61.4	68.2	58	63.6	70.3	71.8	0.9854	70.0
USAF Academy	73	56.3	62.4	55.8	64	59	67.7	67.8	0.9612	70.2
Welch	70	59	66.9	68.8	69.8	64.5	72.4	85	0.9798	68.6
Rocky Flats Nor	87	64.4	61.7	70.3	61.1	69.1	74	82.9	0.9888	86.0
NREL	85	60.7	65.9	70.3	65.2	62.4	74	85	0.9891	84.1
Arvada	76	60.5	61.4	70.3	62.1	68	71.6	84	0.9923	75.4
Welby	66	56.4	55.5	64.3	64.5	68.7	68.6	73.9	0.9993	66.0
S. Boulder Cree	77	64.7	62.1	70.3	61.7	69.5	74	82.9	0.9879	76.1
Carriage	76	59.5	64.6	69.1	67.7	66.2	71	82	0.983	74.7
Highland	81	57.1	66.7	62.9	70.4	66.7	70.9	80.6	0.9795	79.3
Chatfield Res.	85	58	66.8	61.3	70.4	66.7	71	84	0.9761	83.0

Table 2-4. 8-hour ozone Design Value projections for the 2007 Control Strategy Pkg. w/ 7.8 RVP simulation.

2002 Base Case -- Base Case: run11a										
Site	DV	2176	2177	2178	2179	2180	2181	2182	#Days>70	
Weld County Tow	81	61	57.2	65.2	60.6	69.4	66.9	70.9	1	
Rocky Mtn. NP	81	63.1	64.3	67.4	62	71.4	76	79.1	3	
Fort Collins	71	63.2	62.6	69.5	59	65.4	70.7	73.5	2	
USAF Academy	73	56.6	63.5	56.6	66.6	61	69.4	70.6	1	
Welch	70	58.9	66.5	69.8	71.7	65.7	73	87.2	3	
Rocky Flats Nor	87	62.8	62.7	70.9	62.1	70.5	73.8	84.5	4	
NREL	85	60.4	64.6	70.9	64.9	63.1	73.8	87.2	3	
Arvada	76	59.8	60	70.8	63.1	69.1	71.8	85.1	3	
Welby	66	56.6	55.2	62.6	66.5	70	66.2	72.7	2	
S. Boulder Cree	77	63	62.8	70.9	63	70.9	74.1	84.5	4	
Carriage	76	58.4	62.3	68.8	67.9	66.6	71.9	83.8	2	
Highland	81	57.4	66.3	62.7	73	69.7	71.9	81.6	3	
Chatfield Res.	85	57.9	66.5	63.4	73	69.7	71.9	85.9	3	
2007 Control Strategy Package w/7.8 RVP -- Future Year: 07run11a.a2-cntl19a										
Site	DV	2176	2177	2178	2179	2180	2181	2182	RRF DV	Scaled
Weld County Tow	81	59.3	55.9	64.4	58.7	66.8	66	69.3	0.9777	79.2
Rocky Mtn. NP	81	63.6	62.6	65.6	60.6	69.3	74.3	76.4	0.9709	78.6
Fort Collins	71	62.4	61.4	68.1	58	63.6	70.3	71.8	0.9853	70.0
USAF Academy	73	56.3	62.4	55.8	64	59	67.7	67.8	0.9611	70.2
Welch	70	59	66.9	68.8	69.8	64.5	72.4	85	0.9794	68.6
Rocky Flats Nor	87	64.4	61.7	70.3	61.1	69.1	74	82.8	0.9884	86.0
NREL	85	60.7	65.8	70.3	65.1	62.4	74	85	0.9887	84.0
Arvada	76	60.4	61.4	70.3	62.1	68	71.6	84	0.9918	75.4
Welby	66	56.4	55.5	64.3	64.5	68.7	68.6	73.8	0.9987	65.9
S. Boulder Cree	77	64.7	62.1	70.3	61.7	69.5	74	82.8	0.9874	76.0
Carriage	76	59.5	64.5	69.1	67.7	66.2	70.9	82	0.9826	74.7
Highland	81	57.1	66.7	62.9	70.3	66.7	70.9	80.5	0.9792	79.3
Chatfield Res.	85	58	66.7	61.3	70.3	66.7	70.9	84	0.9757	82.9

ADDITIONAL ANALYSIS OF MODELING RESULTS

The projected 8-hour ozone Design Value at the Rocky Flats monitor for the 2007 Base Case and two Control Strategy packages are greater than 84.9 ppb so therefore do not satisfy EPA's deterministic modeled attainment test (EPA, 1999). However, as shown by Morris and co-workers (2004a,b), the modeling results appear to be very stiff; that is the estimated 8-hour ozone Design Values are not very sensitive to local emission controls. The reasons for this are several fold and include:

- The projected 8-hour ozone Design Values are based, in part, on 2003 ozone observations that occurred during more adverse ozone formation conducive meteorological conditions than occurred in 2002 producing ozone concentrations that are much higher than previous years, including the June - July 2002 episode. Thus the contributions of local emissions to the June 2002 episode ozone is not as great as for the observed 2001-2003 Design Values that are being scaled.

- Although the model achieved most of EPA's performance goals, it exhibited a general underprediction tendency so that less ozone is likely attributable to the local emissions in the model than occurred in reality.

Both of these factors lead to the modeled ozone being less responsive to local emissions controls than it should be. EPA's approach toward scaling ozone Design Values using Relative Reduction Factors (RRFs) has some safeguards against using too low modeled ozone concentration in the Design Value scaling by screening out any days in which the maximum 8-hour ozone value near the monitor is less than 70 ppb. In the case of the 8-hour ozone Design Value projections, the RRFs are based, in part, on estimated daily maximum 8-hour ozone concentrations that are just over 70 ppb, which explains in part why the modeling results are so stiff. For example, if the contribution of ozone transport into the DMA is 60 ppb and local DMA emissions contribute the rest, then a control measure that results in a 0.5 ppb reduction in modeled ozone at 70 ppb (where local emissions contribute 10 ppb) may result in over twice the ozone reduction under the conditions of the 87 ppb observed Design Value that is being scaled (where local emissions are contributing 27 ppb).

EPA's guidance for demonstrating attainment of the 8-hour ozone has provisions for performing an attainment demonstration based on a Weight of Evidence (WOE) provided the projected 8-hour ozone Design Value using the RRFs is less than 90 ppb, which is satisfied for the Denver EAC modeling. Below we discuss three modeling elements that could be used in an WOE attainment demonstration:

- Design Value scaling using alternative year observed 8-hour ozone Design Values;

- Design Value scaling using modeled ozone concentrations closer to the observed ozone Design Values; and

- Trends in additional modeled ozone air quality metrics for the 2002 Base Case and 2007 emissions scenarios.

2007 Projected 8-Hour Ozone Design Values using 2000-2002 Observations

The summer of 2003 produced the highest ozone concentrations that the Denver area has recorded in several years. This was likely due to the unusual meteorological conditions of the summer of 2003. During the summer of 2003 the Denver area experienced record-breaking temperature levels. The National Weather Service (NWS) rates the mean temperature of July 2003 as the fourth warmest in Denver's recorded history. In addition to unusually high temperatures, the high ozone days during the summer of 2003 were also characterized by unusually low mixing heights. It is believed that the unusually high temperatures, which increase VOC evaporative emissions and result in increased photochemical reactions rates, and the unusually low mixing heights, which trapped the pollutants resulting in higher than normal concentrations, produced the unusually high ozone measurements during 2003.

To determine whether the anomalous meteorological conditions of the summer of 2003 affected the 2007 attainment demonstration modeling, we projected 2007 8-hour ozone Design Values using the observed 8-hour ozone Design Values from the 2000-2002 period. Table 2-5 summarizes the projected 8-hour ozone Design Values at the Rocky Flats, NREL and Chatfield monitors for the 2007 Base Case and two 2007 Control Strategies using the observed 2000-2002 8-hour ozone Design Values. The projected 8-hour ozone Design Values are below 84.9 ppb so using the observed 2000-2002 Design Values would demonstrate attainment of the 8-hour ozone standard in the Denver area.

Table 2-5. Projected 8-hour ozone Design Values for the 2007 Base Case and Two 2007 Control Strategy packages using the observed 2000-2002 8-hour ozone Design Values.

Monitor	2007 Base Case	2007 Control Pkg. w/8.1 RVP	2007 Control Pkg. w/7.8 RVP
Rocky Flats	83.7	83.1	83.0
NREL	81.7	81.1	81.1
Chatfield	78.8	78.1	78.1

8-Hour Ozone Projections using More Representative Modeling Ozone Concentrations

2007 8-hour ozone Design Value projections were made increasing the base year modeled ozone cutoff value from 70 ppb to 80 ppb so that the RRFs were based on ozone concentrations more representative of the 8-hour ozone exceedances and are closer to the 87 ppb ozone Design Value at Rocky Flats. The projected 8-hour ozone Design Value at the Rocky Flats monitor for the 2007 Base Case, 2007 Control Strategy package w/ 8.1 RVP and 2007 Control Strategy package w/7.8 RVP are, respectively, 85.9, 85.4 and 85.2 ppb as shown in Table 2-6 below.

Table 2-6. Projected 8-hour ozone Design Values for the 2007 Base Case and Two 2007 Control Strategy packages using the Modeled Days greater than 80 ppb

	2001-2003	2007					
		Base Case		Control Pkg. w/8.1 RVP		Control Pkg. w/7.8 RVP	
Monitor	DV	RRF DV	Scaled	RRF DV	Scaled	RRF DV	Scaled
Weld County Tow	81	0.9845	79.7	0.9788	79.3	0.9774	79.2
Rocky Mtn. NP	81	0.9722	78.7	0.9659	78.2	0.9659	78.2
Fort Collins	71	0.9796	69.6	0.9769	69.4	0.9769	69.4
USAF Academy	73	0.9646	70.4	0.9603	70.1	0.9603	70.1
Welch	70	0.9805	68.6	0.9748	68.2	0.9748	68.2
Rocky Flats Nor	87	0.9870	85.9	0.9811	85.4	0.9799	85.2
NREL	85	0.9805	83.3	0.9748	82.9	0.9748	82.9
Arvada	76	0.9929	75.5	0.9871	75.0	0.9871	75.0
Welby	66	1.0234	67.5	1.0165	67.1	1.0151	67.0
S. Boulder Cree	77	0.9870	76.0	0.9811	75.5	0.9799	75.5
Carriage	76	0.9845	74.8	0.9785	74.4	0.9785	74.4
Highland	81	0.9939	80.5	0.9877	80.0	0.9865	79.9
Chatfield Res.	85	0.9837	83.6	0.9779	83.1	0.9779	83.1

Additional Ozone Modeling Metrics

EPA recommends that at least 3 additional model outputs be examined in the weight of evidence (WOE) determination to provide assurance that passing or nearly passing the recommended attainment and screening tests indicates attainment (EPA, 1999, pg. 544-60). These tests measure how much estimated elevated 8-hour ozone concentrations are reduced from the current year base case condition to the future-year control strategy. The three recommended metrics are as follows:

Grid-Hours > 84 ppb: Compute the relative change in the number of grid cell – hours during the modeling episode in which the estimated 8-hour ozone concentrations are greater than 84 ppb.

Grid-Cells > 84 ppb: Compute the number of grid-cells in which the daily maximum 8-hour ozone concentrations is greater than 84 ppb.

Relative Difference (RD): The Relative Difference (RD) in 8-Hour ozone concentrations greater than 84 ppb is the ratio of the average of estimated excess 8-hour ozone above 84 ppb of the future-year simulation to the base-year base case.

The first two metrics above represent a type of 8-hour ozone exposure metric. The #Grid-Hours with 8-hour ozone > 84 ppb is the number of grid cell-hours that the model estimated 8-hour ozone concentrations exceeds the health-based standard. The #Grid-cells 8-hour ozone is greater than 84 ppb represents the areal extent of modeled exceedances. The Relative Reduction metric is more of a dosage calculation that is weighted by how much the 8-hour ozone concentration is above 84 ppb.

As part of the WOE, EPA guidance states that "large" reductions in these metrics are desirable (EPA, 1999). By "large" EPA suggests an 80% reduction (EPA, 1999). For the RD metric, an 80% reduction would be equivalent to a 0.20 value.

Table 2-7 below summarizes these metrics for the 2002 Base Case, 2007 Base Case and two 2007 Control Strategy package simulations.

Table 2-7. Summary of additional modeling metrics recommended by EPA in a WOE determination.

	# Grid-Hours 8-hr > 84 ppb		# Grid-Cell > 84ppb		Relative Difference	
	(#)	(%)	(#)	(%)	(ppb-hr)	(%)
2002 Base	33		15			
2007 Base Case	8	76%	6	60%	0.16	84%
2007 Control Stratey Pkg. w/8.1 RVP	4	88%	3	80%	0.08	92%
2007 Control Stratey Pkg. w/7.8 RVP	4	88%	3	80%	0.07	93%

The # Grid-Hours 8-hour ozone > 84 ppb (88%), #Grid-Cell 8-hour ozone > 84 ppb (80%) and the Relative Difference (RD) (92%-93%) metrics all exhibit "large" (> 80%) reductions for the two 2007 Control Strategies thereby satisfying EPA's WOE goal. For the 2007 Base Case, the Relative Difference (RD) (84%) achieves the "large" reduction goal, whereas the #Grid-Hours (76%) and #Grid-Cell (60%) metrics fall a little short.

3. REFERENCES

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