UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Emissions, Monitoring, and Analysis Division
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December 12, 2000

TECHNICAL MEMORANDUM

TO: EPA Air Docket A-99-06

FROM: Eric O. Ginsburg, Senior Program Advisor
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SUBJECT: Summary of Modeled Estimates of 1-hour Concentrations of Ozone for Selected Years

This memorandum summarizes the results of analyses of model-adjusted air quality estimates of 1-hour ozone concentrations and the anticipated air quality impact of reductions in emissions expected to result from implementation of the heavy duty engine and vehicle standards and highway diesel fuel sulfur control requirements.

We performed regional modeling for 6 different scenarios (1996 base, 2007 base, 2020 base and control, 2030 base and control) separately for the eastern and western regions of the United States, using the variable-grid Urban Airshed Model (UAM-V) and the meteorological inputs simulated for the Tier 2 rulemaking. UAM-V is a photochemical grid model that numerically simulates the effects of emissions, advection, diffusion, chemistry, and surface removal processes on pollutant concentrations within a three-dimensional grid. Emissions inputs to the model are described in Procedures for Developing Base Year and Future Year Mass and Modeling Inventories for the Heavy-Duty Diesel (HDD) Rulemaking, October, 2000, which was placed in the docket for this rulemaking. Other than the emissions inventory inputs, this ozone modeling followed the same protocol as was used for the final RIA for the Tier 2 Gasoline Sulfur rulemaking applications in 1999.

In our assessment of model performance, comparisons of base year model output data against ambient observations in the western U.S. indicated that the model was significantly underestimating (by 30-50 percent) the observed amounts of ozone. Given that model performance was degraded relative to both the performance of the model in the eastern U.S. (where biases were found to be within plus or minus 10 percent) and what is typically expected from such regional modeling applications, we determined that this application of the model should not be used in assessing future air quality or the impacts of the emissions control strategy in the west.

The attached tables provide the ambient 1997-1999 1-hour design values and projected design values for the 2007 base, 2020 base and control, 2030 base and control scenarios. The projected design values are based on the application of Relative Reduction Factors (RRFs) to the ambient data. RRFs were calculated from the ozone modeling in the East for each monitoring site with a valid design value. The projected design values in the following tables are the highest post-control design value from among sites within the area. The 1997-1999 data in the tables are the ambient design values at the same site as the projected design value. It should be noted that (1) the ambient value may or may not be the highest design value within an area and (2) the monitoring site with the highest projected design value in an area may shift from one scenario to another. Finally, the information for each scenario is broken out into two groups: (a) those areas with projected design values >=125 ppb and (b) those areas with design values < 125 ppb, but within 10% of 125 ppb (i.e., >=113 ppb and < 125 ppb).

Table 1 provides a summary of results, based on U.S. Bureau of Census county-based estimated population in 1999 (http://www.census.gov/population/estimates/metro-city/ma99-02.txt) and model-adjusted 1-hour ozone design values for the 2007 base case (i.e., before the application of emission reductions to be achieved by the rule). Based on this table, a total of 8 areas were projected to have design values in excess of the standard in the 2007 base case. In addition, 20 areas were projected to have design values within 10% of the standard in the 2007 base case.

Table 2 provides a summary of results, based on U.S. Bureau of Census county-based estimated population in 1999 and model-adjusted 1-hour ozone design values for the 2020 base case (i.e., before the application of emission reductions to be achieved by the rule). Based on this table, a total of 6 areas were projected to have design values in excess of the standard in the 2020 base case. In addition, 14 areas were projected to have design values within 10% of the standard in the 2020 base case.

Table 3 provides a summary of results, based on U.S. Bureau of Census county-based estimated population in 1999 and model-adjusted 1-hour ozone design values for the 2020 control case (i.e., after the application of emission reductions to be achieved by the rule). Based on this table, a total of 3 areas were projected to have design values in excess of the standard in the 2020 control case. In addition, 13 areas were projected to have design values within 10% of the standard in the 2020 control case.

Table 4 provides a summary of results, based on U.S. Bureau of Census county-based estimated population in 1999 and model-adjusted 1-hour ozone design values for the 2030 base case (i.e., before the application of emission reductions to be achieved by the rule). Based on this table, a total of 7 areas were projected to have design values in excess of the standard in the 2030 base case. In addition, 19 areas were projected to have design values within 10% of the standard in the 2030 base case.

Table 5 provides a summary of results, based on U.S. Bureau of Census county-based estimated population in 1999 and model-adjusted 1-hour ozone design values for the 2030 control case (i.e., after the application of emission reductions to be achieved by the rule). Based on this table, a total of 6 areas were projected to have design values in excess of the standard in the 2030 control case. In addition, 12 areas were projected to have design values within 10% of the standard in the 2030 control case.

These analyses of future air quality are based on projected population growth and projected changes in emissions over time, taking into account federal controls currently in place or scheduled for implementation, such as Tier 2 standards on light-duty vehicles and 2004 standards on heavy duty vehicle. Additional reductions may be achieved by further actions taken at the Federal, State, or local level.

cc:
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Attachments

Table 1a. Areas with projected 2007 Base Case 1-hour design values (DVs) >=125 ppb

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2007 Base 1-Hr DVs (ppb)	1999 Population (million)
Atlanta	156	139	3.9
Baltimore/ Washington, DC[1]	152	134	7.4
Beaumont/ Port Arthur	130	126	0.4
Hartford	147	134	1.1
Houston	203	192	4.5
New London	137	125	0.3
New York City	145	135	20.2
Philadelphia[2]	139	128	6

1. These design values were determined from among the monitoring sites in the Baltimore MSA. The corresponding values for the Washington, DC MSA are 128 ppb (ambient) and 118 ppb (projected).

2. These data were determined from a monitoring site in Bucks County, PA. Another site in the Philadelphia CMSA located in Cecil County, MD had a higher projected design value (132 ppb projected and 153 ambient), but it is not clear to what extent the ambient design value at this site reflects ozone from the vicinity of Philadelphia versus the vicinity of Baltimore.

Table 1b. Areas with projected 2007 Base Case 1-hour design values (DVs) within 10% of the NAAQS

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2007 Base 1-Hr DVs (ppb)	1999 Population (million)
Baton Rouge	126	120	0.6
Charlotte	132	117	1.4
Chicago	126	116	8.9
Dallas[1]	135	124	4.9
Detroit	126	117	5.5
Grand Rapids	123	113	1.1
Kansas City	122	114	1.8

Knoxville	138	116	0.7
Lake Charles	124	121	0.2
Lancaster Co, PA	128	114	0.5
Longview, TX	134	124	0.2
Louisville	130	113	1.0
Manitowoc Co, WI	128	116	0.1
Memphis	126	116	1.1
Milwaukee	134	122	1.6
Pittsburgh	128	114	2.3
Richmond	134	114	1
Sheboygan, WI	134	122	0.1
Springfield, MA	128	119	0.6
St. Louis	131	118	2.6

1. This design value was determined from data at a site which was moved to a nearby location between 1997 and 1998

Table 2a. Areas with projected 2020 Base Case 1-hour design values (DVs) >=125 ppb

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2020 Base 1-Hr DVs (ppb)	1999 Population (Million)
Atlanta	156	132	3.9
Baltimore/ Washington, DC[1]	152	130	7.4
Hartford	147	132	1.1
Houston	203	199	4.5
New York City	145	133	20.2
Philadelphia[2]	139	126	6

1. These design values were determined from among the monitoring sites in the Baltimore MSA. The corresponding values for the Washington, DC MSA are 128 ppb (ambient) and 117 ppb (projected).

2. These data were determined from a montoring site in Bucks County, PA. Another site in the Philadelphia CMSA located in Cecil County, MD had a higher projected design value (128 ppb projected and 153 ambient), but it is not clear to what extent the ambient design value at this site reflects ozone from the vicinity of Philadelphia versus the vicinity of Baltimore

Table 2b. Areas with projected 2020 Base Case 1-hour design values (DVs) within 10% of the NAAQS

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2020 Base 1-Hr DVs (ppb)	1999 Population (Million)
Baton Rouge	123	116	0.6
Beaumont- Port Arthur	130	121	0.4
Charlotte	132	113	1.4
Chicago	126	117	8.9
Dallas[1]	135	116	4.9
Detroit	126	118	5.5
Lake Charles	124	116	0.2
Longview, TX	134	117	0.2
Manitowoc Co, WI	128	114	0.1

Memphis	126	115	1.1
Milwaukee	134	121	1.6
New London	137	124	0.3
Sheboygan, WI	134	121	0.1
Springfield, MA	128	117	0.6

1. This design value was determined from data at a site which was moved to a nearby location between 1997 and 1998

Table 3a. Areas with projected 2020 Control Case 1-hour design values (DVs) >=125 ppb

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2020 Control 1-Hr DVs (ppb)	1999 Population (Million)
Hartford	147	127	1.1
Houston	203	199	4.5
New York City	142	132	20.2

Table 3b. Areas with projected 2020 Control Case 1-hour design values (DVs) within 10% of the NAAQS

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2020 Control 1-Hr DVs (ppb)	1999 Population (Million)
Atlanta	156	123	3.9
Baltimore/ Washington, DC[1]	152	124	7.4
Baton Rouge	123	114	0.6
Beaumont- Port Arthur	130	118	0.4
Chicago	126	118	8.9
Detroit	126	117	5.5
Lake Charles	124	114	0.2
Memphis	126	113	1.5
Milwaukee	134	119	1.6
New London	137	120	0.3
Philadelphia	139	123	6
Sheboygan, WI	134	118	0.1
Springfield, MA	128	113	0.6

1. These design values were determined from among the monitoring sites in the Baltimore MSA. The corresponding values for the Washington, DC MSA are 128 ppb (ambient) and 113 ppb (projected).

Table 4a. Areas with projected 2030 Base Case 1-hour design values (DVs) >=125 ppb

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2030 Base 1-Hr DVs (ppb)	1999 Population (Million)
Atlanta	156	137	3.9
Baltimore/ Washington, DC[1]	152	134	7.4
Hartford	147	135	1.1
Houston	203	202	4.5
New London	137	127	0.3
New York City	142	136	20.2
Philadelphia[2]	139	129	6

1. These design values were determined from among the monitoring sites in the Baltimore MSA. The corresponding values for the Washington, DC MSA are 128 ppb (ambient) and 120 ppb (projected).

2. These data were determined from a montoring site in Bucks County, PA. Another site in the Philadelphia CMSA located in Cecil County, MD had a higher projected design value (131 ppb projected and 153 ambient), but it is not clear to what extent the ambient design value at this site reflects ozone from the vicinity of Philadelphia versus the vicinity of Baltimore.

Table 4b. Areas with projected 2030 Base Case 1-hour design values (DVs) within 10% of the NAAQS

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2030 Base 1-Hr DVs (ppb)	1999 Population (million)
Baton Rouge	123	119	0.6
Beaumont- Port Arthur	130	123	0.4
Charlotte	132	117	1.4
Chicago	126	119	8.9
Dallas[1]	135	120	4.9
Detroit	126	120	5.5
Grand Rapids	123	113	1.1

Kansas City	122	113	1.8
Lake Charles	124	119	0.2
Lancaster Co, PA	128	113	0.5
Longview, TX	134	119	0.2
Louisville	130	114	1.0
Manitowoc, WI	128	116	0.1
Memphis	126	118	1.1
Milwaukee	134	124	1.6
Pittsburgh	128	113	2.3
Sheboygan, WI	134	124	0.1
Springfield, MA	128	120	0.6
St Louis	131	115	2.6

1. This design value was determined from data at a site which was moved to a nearby location between 1997 and 1998

Table 5a. Areas with projected 2030 Control Case 1-hour design values (DVs) >=125 ppb

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2030 Control 1-Hr DVs (ppb)	1999 Population (Million)
Atlanta	156	126	3.9
Baltimore/ Washington, DC[1]	152	125	7.4
Hartford	147	129	1.1
Houston	203	203	4.5
New York City	142	135	20.2
Philadelphia	139	125	6

1. These design values were determined from among the monitoring sites in the Baltimore MSA. The corresponding values for the Washington, DC MSA are 128 ppb (ambient) and 115 ppb (projected).

Table 5b. Areas with projected 2030 Control Case 1-hour design values (DVs) within 10% of the NAAQS

Area Name	1997 - 1999 Ambient 1-Hr DVs (ppb)	Projected 2030 Control 1-Hr DVs (ppb)	1999 Population (Million)
Baton Rouge	123	116	0.6
Beaumont-Port Arthur	130	120	0.4
Chicago	126	121	8.9
Detroit	126	120	5.5
Lake Charles	124	116	0.2
Longview, TX	134	113	0.2
Louisville	127	113	1.0
Memphis	126	115	1.1
Milwaukee	134	122	1.6
New London	137	122	0.3

Sheboygan, WI	134	121	0.1
Springfield, MA	128	115	0.6