

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
Emissions, Monitoring, and Analysis Division  
Office of Air Quality Planning and Standards  
79 T.W. Alexander Drive, Research Triangle Park, North Carolina 27711

December 11, 2000

**TECHNICAL MEMORANDUM**

TO: EPA Air Docket A-99-06

FROM: Eric O. Ginsburg, Senior Program Advisor  
Emissions Monitoring and Analysis Division, OAQPS

SUBJECT: Summary of Model-Adjusted Estimates of Fine Particulate Matter for 2020 Base and Control Cases

This memorandum summarizes the results of analyses of model-adjusted air quality estimates of fine particulate matter concentrations (measured as particulate matter having an aerodynamic diameter less than or equal to 2.5 micrometers, or PM<sub>2.5</sub>) and the anticipated air quality impact of reductions in emissions expected to result in the year 2020 from implementation of the heavy duty engine and vehicle standards and highway diesel fuel sulfur control requirements. We previously prepared and submitted to the docket analyses of:

(1) the number of people living in monitored counties in 1999 in which annual average concentrations of fine particulate matter equaled or exceeded certain specified values (“Summary of 1999 Ambient concentrations of Fine Particulate Matter,” Eric O. Ginsburg, November 15, 2000), and

(2) the number of people estimated to live in modeled grid cells in which annual average concentrations of fine particulate matter are predicted to equal or exceed certain specified values in the 1996 base case, and in monitored counties in which annual average concentrations of fine particulate matter are predicted to equal or exceed certain specified values in the 2030 base and control cases (“Summary of Absolute Modeled and Model-Adjusted Estimates of Fine Particulate Matter for Selected Years,” Eric O. Ginsburg, December 6, 2000).

We have used the Regulatory Modeling System for Aerosols and Deposition (REMSAD), using the projected emission inventories described in the technical documents contained in the docket at the time this rule was proposed,<sup>1</sup> to develop relative reduction factors, which were then

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<sup>1</sup> These inventories and procedures used to generate them are further 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 previously placed in the docket for this rule.

applied to 1999 ambient PM<sub>2.5</sub> monitoring data to estimate annual average PM<sub>2.5</sub> concentrations for both the base case (i.e., without considering the impact of expected reductions produced from the rule) and the control case (i.e., taking into account the expected emission reductions produced from the rule) in the year 2020, along with the estimated populations living in counties predicted to experience these concentrations. This analysis is described more fully in the Technical Memorandum, “Air Quality Analyses to Accompany the Final Rule for Heavy Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements,” which was also previously placed in the docket.

Table P-3 provides a summary of results, based on U.S. Bureau of Census county-based estimated population and model-adjusted ambient PM<sub>2.5</sub> annual average concentrations for the 2020 base case. Based on this table, approximately 63 million people (47% of the U.S. population living in monitored counties) will live in areas in 2020 where long term ambient fine particulate matter levels are predicted to be at or above 16 ug/m<sup>3</sup>, which is the low end of the range of long term average PM<sub>2.5</sub> concentrations in cities where statistically significant associations were found with serious health effects, including premature mortality (Staff Paper, EPA, 1996).<sup>2</sup>

Table P-4 provides a summary of results, based on U.S. Bureau of Census county-based estimated population and model-adjusted PM<sub>2.5</sub> annual average concentrations for the 2020 control case. Based on this table, approximately 56 million people (42% of the total U.S. population) will live in areas in 2020 where long term ambient fine particulate matter levels are predicted to be at or above 16 ug/m<sup>3</sup> after taking emission reductions from the rule into account.

Several considerations are important to a proper understanding of this analysis. First, the analysis of future air quality only includes those same counties in which there were PM<sub>2.5</sub> monitors recording at least eleven valid samples in each of four calendar quarters, thus limiting our consideration to counties containing 107.3 million people, of a total of 272.7 million estimated by the U.S. Bureau of Census (1999). Second, because this analysis is incomplete in that it does not consider populations in counties in which no monitors are located or where the

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<sup>2</sup>To protect public health with an adequate margin of safety, EPA established national ambient air quality standards for PM<sub>2.5</sub> in 1997 at levels of 15.0 ug/m<sup>3</sup>, annual average, and 65 ug/m<sup>3</sup>, 24-hour average. Further information about these standards, including an explanation of their scientific basis and methods for calculating attainment or nonattainment of the standards, can be found at 62 FR 38711, July 18, 1997. These standards are codified at 40 CFR 50.8, and the method for determining when the standards are met is codified at 40 CFR Part 50, Appendix N. The revised standards are now in litigation; however, the scientific evidence that supported the establishment of new PM<sub>2.5</sub> NAAQS was not challenged in the U.S. District Court of Appeals decision; in fact, the panel of judges stated that this evidence “amply justifies establishment of new fine particle standards.” (May 14, 1999, p. 47) While EPA is not implementing the PM<sub>2.5</sub> NAAQS in light of ongoing litigation, we believe that it remains appropriate to recognize the scientific evidence of health effects associated with PM<sub>10</sub> and the fine fraction of PM<sub>10</sub> in other rulemaking proceedings.

number of valid samples is insufficient for our analyses, we have not been able to consider the air quality in counties in which an additional 165.4 million people live. Finally, as noted above, these analyses of future air quality are based on projected population growth and projected increases 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. However, despite these limitations and qualifications, without additional reductions from this rulemaking and/or other controls, we can reasonably conclude that millions of people may in the future live in areas in which PM<sub>2.5</sub> concentrations are predicted to occur at levels which have been associated with premature mortality and other adverse effects.

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Attachments

Table P-3  
 2020 Population Living in Monitored Counties With Predicted Annual Average PM<sub>2.5</sub>  
 Concentrations at or Above Levels Shown<sup>a, b, c, d</sup>

2020 Predicted Annual Average PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> ) Without HD Engine/Diesel Fuel Controls	2020 Population Living in Monitored Counties With This Average Concentration or Higher Concentration (Millions, Forecasted Estimates of Population) <sup>a, d, e</sup>	Percent of Monitored 2020 Population Living in Monitored Counties With This Average Concentration or a Higher Concentration <sup>d, e, f</sup>
21	32	24%
20	38	28%
19	40	30%
18	44	33%
17	55	41%
16	63	47%
15	80	60%
14	93	70%
13	104	78%
12	114	85%
11	123	92%
10	127	95%
5	134	100%

a 2020 annual average PM<sub>2.5</sub> concentrations predicted by multiplying 1999 highest annual average observed monitor PM<sub>2.5</sub> in a county by the ratio of 2030 REMSAD modeled annual average PM<sub>2.5</sub> to 1996 REMSAD modeled annual average PM<sub>2.5</sub>.

b The REMSAD model was peer reviewed in 1999 for EPA as reported in "Scientific Peer-Review of the Regulatory Modeling System for Aerosols and Deposition" REMSAD source code and user's guide are available at <http://www.epa.gov/scram001/t26.htm>.

c Emission inventories are described in Procedures for Developing Base Year and Future Year Mass and Modeling inventories for the Heavy Duty Diesel (HDD) Rulemaking. EPA 420-R-00-020, October, 2000.

d Memo from Kenneth Davidson, Abt Associates to Lisa Conner. Derivation of 2030 Estimates for the Tier II Analysis. September 2, 1999.

e Population living in monitored counties with average annual PM<sub>2.5</sub> concentration data described above result from modeled air quality, emission projections, and population projections, and thus reflect uncertainties in those models and projections.

f Total forecasted 2020 population in monitored counties is 134 million. Total forecasted 2020 population is 321 million.

Table P-4  
 2020 Population Living in Monitored Counties With Predicted Annual Average PM<sub>2.5</sub>  
 Concentrations at or Above Levels Shown<sup>a, b, c, d</sup>

2020 Predicted Annual Average PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> ) With HD Engine/Diesel Fuel Controls	2020 Population Living in Monitored Counties With This Average Concentration or Higher Concentration (Millions, Forecasted Estimates of Population) <sup>a, d, e</sup>	Percent of Monitored 2020 Population Living in Monitored Counties With This Average Concentration or a Higher Concentration <sup>d, e, f</sup>
21	32	24%
20	33	24%
19	40	30%
18	41	31%
17	47	35%
16	56	42%
15	69	52%
14	87	65%
13	99	74%
12	108	81%
11	120	90%
10	126	94%
5	134	100%

a 2020 annual average PM<sub>2.5</sub> concentrations predicted by multiplying 1999 highest annual average observed monitor PM<sub>2.5</sub> in a county by the ratio of 2030 REMSAD modeled annual average PM<sub>2.5</sub> to 1996 REMSAD modeled annual average PM<sub>2.5</sub>.

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