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 6, 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 Absolute Modeled and Model-Adjusted Estimates of Fine Particulate Matter for Selected Years

This memorandum summarizes the results of analyses of absolute modeled and model-adjusted air quality estimates of fine particulate matter 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 previously prepared and submitted to the docket an analysis of the number of people living in monitored counties in 1999 in which annual average concentrations of fine particulate matter (measured as particulate matter having an aerodynamic diameter less than or equal to 2.5 micrometers, or PM2.5) equaled or exceeded certain specified values. ("Summary of 1999 Ambient concentrations of Fine Particulate Matter," Eric O. Ginsburg, November 15, 2000).

In order to provide an estimate of current air quality across the entire U.S., not just in monitored areas, we used the Regulatory Modeling System for Aerosols and Deposition (REMSAD) to estimate 1996 annual average PM2.5 air quality nationwide, using the 1996 emission inventory 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, which was placed in the docket for the heavy duty engine and vehicle standards and highway diesel fuel sulfur control requirements rulemaking. Because future exposures to PM2.5 are also relevant to this rulemaking, we have used REMSAD, using the projected emission inventories described in the above technical document to develop relative reduction factors, which were then applied to 1999 ambient PM2.5 monitoring data to estimate annual average PM2.5 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 2030, 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 R-1 provides a summary of absolute predicted results, based on U.S. Bureau of Census county-based estimated population and model-predicted 1996 PM2.5 annual average concentrations. Based on this table, approximately 76 million people (29% of the total U.S. population) lived in areas in 1996 where long term ambient fine particulate matter levels were predicted to be at or above 16 ug/m3, which is the low end of the range of long term average PM2.5 concentrations in cities where statistically significant associations were found with serious health effects, including premature mortality (Staff Paper, EPA, 1996).[1]

Table P-1 provides a summary of results, based on U.S. Bureau of Census county-based estimated population and model-adjusted ambient PM2.5 annual average concentrations for the 2030 base case. Based on this table, approximately 86 million people (59% of the U.S. population living in monitored counties) will live in areas in 2030 where long term ambient fine particulate matter levels are predicted to be at or above 16 ug/m3..

Table P-2 provides a summary of results, based on U.S. Bureau of Census county-based estimated population and model-adjusted PM2.5 annual average concentrations for the 2030 control case. Based on this table, approximately 72 million people (49% of the total U.S. population) will live in areas in 2030 where long term ambient fine particulate matter levels are predicted to be at or above 16 ug/m3 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 PM2.5 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 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

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[1]To protect public health with an adequate margin of safety, EPA established national ambient air quality standards for PM2.5 in 1997 at levels of 15.0 ug/m3, annual average, and 65 ug/m3, 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 PM2.5 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 PM2.5 NAAQS in light of ongoing litigation, we believe that it remains appropriate to recognize the scientific evidence of health effects associated with PM10 and the fine fraction of PM10 in other rulemaking proceedings.

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 PM2.5 concentrations are predicted to occur at levels which have been associated with premature mortality and other adverse effects.

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Attachments

Table R-1
1996 Population Living in REMSAD Grid Cells with
Modeled Annual Average $PM_{2.5}$ Concentrations at or Above Levels Shown[a, b, c]

Modeled Annual Average $PM_{2.5}$ Concentration (µg/m3)	1996 Population Living in Grid Cells With This Average Concentration or Higher Concentration (Millions, 1996 Census Estimates of Population)[c]	Percent of 1996 Population Living in a Grid Cells With This Average Concentration or a Higher Concentration[c, d]
21	30	11%
20	34	13%
19	39	15%
18	53	20%
17	61	23%
16	76	29%
15	100	38%
14	119	45%
13	133	50%
12	152	58%
11	163	62%
10	178	68%
5	235	89%

a 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>.

b 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

c <http://www.census.gov/population/www/estimates/countypopulation>.

d Total 1996 population in all REMSAD grid cells is 263 million.

Table P-1
2030 Population Living in Monitored Counties With Predicted Annual Average $PM_{2.5}$ Concentrations at or Above Levels Shown[a, b, c, d]

2030 Baseline Predicted Annual Average $PM_{2.5}$ Concentration (µg/m3) Without HD Engine/Diesel Fuel Controls	2030 Population Living in Monitored Counties With This Average Concentration or Higher Concentration (Millions, Forecasted Estimates of Population)[a, d, e]	Percent of Monitored 2030 Population Living in Monitored Counties With This Average Concentration or a Higher Concentration[d, e, f]
21	41	28%
20	44	30%
19	55	37%
18	60	41%
17	72	49%
16	86	59%
15	98	67%
14	111	76%
13	121	83%
12	131	90%
11	137	94%
10	141	97%
5	146	100%

a 2030 annual average $PM_{2.5}$ concentrations predicted by multiplying 1999 highest annual average observed monitor $PM_{2.5}$ in a county by the ratio of 2030 REMSAD modeled annual average $PM_{2.5}$ to 1996 REMSAD modeled annual average $PM_{2.5}$.

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 $PM_{2.5}$ 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 2030 population in monitored counties is 146 million. Total forecasted 2030 population is 346 million.

Table P-2
2030 Population Living in Monitored Counties With Predicted Annual Average $PM_{2.5}$ Concentrations at or Above Levels Shown[a, b, c, d]

2030 Predicted Annual Average $PM_{2.5}$ Concentration (µg/m3) With HD Engine/Diesel Fuel Controls	2030 Population Living in Monitored Counties With This Average Concentration or Higher Concentration (Millions, Forecasted Estimates of Population)[a, d, e]	Percent of Monitored 2030 Population Living in Monitored Counties With This Average Concentration or a Higher Concentration [d, e, f]
21	35	24%
20	41	28%
19	44	30%
18	56	38%
17	60	41%
16	72	49%
15	91	63%
14	106	73%
13	115	79%
12	127	87%
11	136	93%
10	140	96%
5	146	100%

a 2030 annual average $PM_{2.5}$ concentrations predicted by multiplying 1999 highest annual average observed monitor $PM_{2.5}$ in a county by the ratio of 2030 REMSAD modeled annual average $PM_{2.5}$ to 1996 REMSAD modeled annual average $PM_{2.5}$.

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>.

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