Demographic Analysis of Air Quality Improvements from EPA's Recent Heavy-Duty Vehicle 2027 Rule*

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Background: In December 2022, EPA finalized new national standards to cut smog- and soot-forming emissions from heavy-duty trucks beginning with model year 2027. As part of the analysis that accompanied the rule, EPA conducted a three-part environmental justice analysis: a literature review, a novel analysis of populations living near major roads, and a novel demographic analysis of predicted future human exposure to pollution in scenarios without and with the rule in place. The poster presents the results of the demographic analysis.

Methods: EPA conducted full-scale photochemical air quality modeling to estimate the impacts of the rule in 2045 (CMAQv5.3.1, 12km grid resolution). We projected ambient $PM_{2.5}$ and ozone concentration data for a no action scenario (baseline) and a regulatory scenario and used this data as the basis for the demographic analysis. We evaluated grid cells in two air quality concentration groups - the highest 5 percent of baseline concentrations and grid cells in the remaining 95 percent. We chose this approach to track how air quality was distributed by air quality concentration group in the baseline and to observe how the rule impacts air quality in these same air quality concentration groups when in place. The analysis used county-level population projections stratified by race and ethnicity.

Results: For $PM_{2.5}$, the projected baseline concentration at the 95th percentile was 7.76 $\mu g/m^3$ and for ozone it was 49.91 ppb. In 2045, 144 million people were projected to live within the highest 5 percent of grid cells for $PM_{2.5}$ and 39 million were projected to live in areas with the highest concentrations of ozone. While all race and ethnicity categories were projected to experience reductions in $PM_{2.5}$ and ozone exposure because of the rule, we found that the largest improvements were estimated to occur in areas with the worst baseline air quality, where nearly double the number of people of color were projected to reside compared to non-Hispanic white residents. However, underlying exposure disparities were projected to remain. We also found that trends in disparity based on poverty status (above/below 200% of the poverty line) were not as pronounced in areas with the worst air quality as they were for race/ethnicity.

Conclusions: Although the spatial resolution of the air quality modeling is not sufficient to capture very local heterogeneity of human exposures, particularly the pollution concentration gradients near roads, this analysis provided insight into demographic trends in human exposure to air pollution at a national scale. Future research should consider how to conduct similar regulatory analyses at finer spatial resolution.

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