

April 21, 2010

California Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, CA 95812
<http://www.arb.ca.gov/>

Re: Update Regarding CARB Off-Road and On-Road Diesel Vehicle Regulations
(<http://www.arb.ca.gov/regact/nonreg/inuseoffroad10.pdf>)

Dear Board Members:

The purpose of these comments is to summarize the most recent and most relevant epidemiologic evidence on the relationship between PM_{2.5} and total mortality in California. This California-specific evidence must be given primary consideration in the estimation of “premature deaths” associated with PM_{2.5} in California and in the overall assessment of the current health effects of PM_{2.5}. Most of this evidence was not used in the October 24, 2008 CARB Final Staff Report “Methodology for Estimating Premature Deaths Associated with Long-term Exposure to Fine Airborne Particulate Matter in California” (http://www.arb.ca.gov/research/health/pm-mort/pm-mort_final.pdf).

These comments add to my December 10, 2008 CARB comments (http://www.arb.ca.gov/lists/truckbus08/897-carb_enstrom_comments_on_statewide_truck_regulations_121008.pdf), my May 27, 2009 CARB comments (http://www.arb.ca.gov/lists/gmove09/1-carb_enstrom_comments_re_pm2.5_and_life_expectancy_052709.pdf) and my December 8, 2009 CARB comments (http://www.arb.ca.gov/lists/dec09update/181-carb_enstrom_comments_reviewer_conflicts_of_interest_120809.doc).

California-specific epidemiologic evidence was presented and discussed at the February 26, 2010 CARB Symposium on "Estimating Premature Deaths from Long-term Exposure to PM_{2.5}" (<http://www.cal-span.org/cgi-bin/archive.php?owner=CARB&date=2010-02-26>). In particular, evidence that there is NO current relationship between PM_{2.5} and total mortality in California is shown in slides 20-25 of my PPT presentation (<http://www.arb.ca.gov/research/health/pm-mort/enstrom.pdf>) and in slides 12 and 26 of the PPT presentation by Michael L. Jerrett (<http://www.arb.ca.gov/research/health/pm-mort/jerrett.pdf>).

Special consideration must be given to the following three primary sources of California-specific evidence, particularly to the adjusted relative risk (RR) of death from all causes associated with a 10 µg/m³ increase in PM_{2.5} contained in each of these sources:

- 1) December 15, 2005 *Inhalation Toxicology* paper, "Fine Particulate Air Pollution and Total Mortality Among Elderly Californians, 1973-2002," by James E. Enstrom (Enstrom 2005) (http://www.arb.ca.gov/planning/gmerp/dec1plan/gmerp_comments/enstrom.pdf). This paper is based on 36,000 elderly California residents in the California Cancer Prevention Study (CA CPS I) and Table 7 shows the relationship between PM_{2.5} and total mortality is RR = 0.997 (0.978-1.016) for 1983-2002.
- 2) February 26, 2010 unpublished results from the ongoing analysis of 95,000 California residents in the 1982 ACS Cancer Prevention Study (CPS II) by Michael L. Jerrett (Jerrett 2010) (<http://www.arb.ca.gov/research/health/pm-mort/jerrett.pdf>). These results were presented at the February 26, 2010 CARB Symposium cited above. As best as can be interpreted from slides 12 and 26 of the Jerrett PPT presentation, the relationship between PM_{2.5} and total mortality is RR ~ 0.994 (0.965-1.025) during 1982-2000.
- 3) March 2010 *Environmental Health Perspectives* paper, "Long-Term Exposure to Constituents of Fine Particulate Air Pollution and Mortality: Results from the California Teachers Study," by Bart Ostro, Michael Lipsett, Peggy Reynolds, Debbie Goldberg, Andrew Hertz, Cynthia Garcia, Katherine D. Henderson, Leslie Bernstein (Ostro 2010) (<http://ehsehplp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.0901181>). Key results on 45,000 female California teachers from this paper were presented at the February 26, 2010 CARB Symposium by Michael L. Jerrett (<http://www.arb.ca.gov/research/health/pm-mort/jerrett.pdf>). As best as can be interpreted from slide 26 of the Jerrett PPT presentation, the relationship between PM_{2.5} and total mortality is RR ~ 1.8 (1.6–2.0) during 2002-2007. This RR, which is specific to this cohort of female teachers, is unusually large for PM_{2.5} relationships and requires further examination and explanation.

The Enstrom 2005 and Jerrett 2010 results have by far the largest statistically weight and when these results are combined by the standard meta-analysis procedure the summary relationship between PM_{2.5} and total mortality is RR = 0.996 (0.980–1.012). The meta-analysis procedure is described and illustrated in my March 1, 2006 *Inhalation Toxicology* paper (<http://www.scientificintegrityinstitute.org/IT030106.pdf>). Including the Ostro 2010 results with the Enstrom 2005 and the Jerrett 2010 results in the meta-analysis slightly increases the summary relationship between PM_{2.5} and total mortality to RR = 1.008 (0.992 – 1.024). The Ostro 2010 results have little influence on the RR because they comprise only about 2% of the statistical weight relative of the three studies. Both of the summary RRs are consistent with NO relationship between PM_{2.5} and total mortality in California.

These findings are supported by one additional source of largely California-specific evidence: December 2008 *Environmental Health Perspectives* paper, "Mortality in the Medicare Population and Chronic Exposure to Fine Particulate Air Pollution in Urban Centers (2000-2005)," by Scott L. Zeger, Francesca Dominici, Aidan McDermott, and Jonathan M. Samet (Zeger 2008) (<http://www.ehponline.org/members/2008/11449/11449.pdf>). The results for the western region [California, Oregon, and Washington] are dominated by those for California, since 468 (73%) of the 640 zip codes for the western region are in California. This paper is based on the 13.2 million participants in the Medicare Cohort Air Pollution Study (MCAPS) and Table 3 shows the adjusted relationship between PM_{2.5} and total mortality in the western region

is $RR = 0.989$ (0.970-1.008) for 2000-2005. This result is almost identical to the summary relationship for the Enstrom 2005 and Jerrett 2010 results: $RR = 0.996$ (0.980–1.012).

In summary, three major studies (Enstrom 2005, Jerrett 2010, and Zeger 2008) have produced results indicating NO relationship between $PM_{2.5}$ and total mortality in California since 1982. These results must be given primary consideration in the estimation of “premature deaths” associated with $PM_{2.5}$ in California and in the overall assessment of the current health effects of $PM_{2.5}$ and diesel particulate matter in California. These results have direct relevance to the public health justification for CARB off-road and on-road diesel vehicle regulations.

Thank you very much for your consideration of my public comments above.

Sincerely yours,

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