

Author's response to reviews

Title: Near-highway exposure to motor vehicle pollutants: Emerging evidence of cardiac and pulmonary health risks

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Version: 3 **Date:** 15 June 2007

Author's response to reviews: see over

Reviewer 1

Title: Near-highway exposure to motor vehicle pollutants: Emerging evidence of cardiac and pulmonary health risks

Version: 2 Date: 30 January 2007

Reviewer: Gregory Howard

Reviewer's report:

General

Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)

Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

Discretionary Revisions (which the author can choose to ignore)

1. In page 3 para 2 you define UFP as 0.01-0.2 um, but others often refer to 0.1 um as upper limit, e.g. Zhu 2002. In this same paragraph, "Pollutant levels decrease... due to dilution", there are other forces at work including coagulation and settling, although less important.

Both corrections have been made.

2. Reference to Roorda-Knape et al at top of p 5 should be (9), not (1998).

The correction has been made.

3. The Roorda-Knape study found correlation of indoor black smoke with truck traffic, but do not specifically say "diesel" trucks. Consider removing the word "diesel" in p 5 para 1.

Done.

4. In summary paragraph on p 5, it's not clear where the 30 m number comes from, although it seems a reasonable choice. A reminder here that particle size distribution is dependent on distance, leading to risks which may not vary smoothly (or even monotonically) with distance, might be helpful.

This summary was moved to the end of section on Air Pollutant Gradients Near Highways section. So now it is clear that the "30 m" derives from measurements reported in the literature.

5. You cite reference (16) for effects on HRV on p 5. In fact, that study found a specific effect of black smoke, which is probably a better indicator of a traffic source than PM2.5, and makes your case more strongly.

Change made.

6. Reference to Hoek (24) on p 6: "cardiopulmonary mortality was associated with both

pollutants and living near a major road.” This is a bit of an oversimplification of the analysis, which found an association with living near a major road and with modeled, but not measured, levels of pollutants based on location near a major road, and less strong findings for background levels of both pollutants. This could be clarified.

We have modified the language accordingly.

7. Asthma studies p 7 para 1: You should probably reference English 1999 EHP 107(9):761. English found no impact on asthma prevalence but some impact on number of increased number of medical care visits. (You don’t discuss exacerbation of existing asthma by air pollution, although some data is available.)

We have added the citation to those listed as negative findings for traffic intensity.

8. Reference to (43) on p 7: “risk is higher for children who moved next to the highway before they were 2 years of age.” In fact, the study found a result only for those children, and no result for “short-term” children. This should be made clearer.

Good point, the correction has been made.

9. Pediatric lung function, p 8: You may want to add a reference Gauderman WJ in Lancet 2007 (in which case I would add “reduced lung function development” to the abstract). Gauderman found larger effects in boys than in girls, in contrast to (54).

This citation has been added.

10. Reference to (73) on p 10: “at the level of the home”? This phrasing is a bit unclear.

The language has been clarified.

11. You do not mention lung cancer in the first paragraph of the “policy and research recommendations” section on p 11, but it is probably worth reiterating that many of the studies reviewed in the lung cancer literature are less relevant to highways per se, being based on pollutants like PM, O₃, and SO₂.

Good point. A comment to this effect has been added.

12. A clear research gap in my opinion is the somewhat random choice of exposures at home or at school, always neglecting the other exposure. Attempts to integrate total exposure to major highways would help reduce exposure misclassification. Commutes are an obvious source of highway exposure. Day care might be another, especially in light of McConnell’s (43) findings only in children exposed at ages less than 2.

A comment to this effect has also been added.

13. Conclusions, p 12: A mention of the problem of SES, both as a likely confounder and as an environmental justice issue, would be welcome here.

Another helpful point. We have added a line about SES, something we also are interested in.

14. 10% or more of the population of the US may live in mobile “hot spots”: Reference?

In response to the other reviewer, we have added a sourced value for this to the new introduction and deleted the reference to this in the conclusion.

15. Abbreviations list: add SES, PEFr, FVC

Done.

16. Reference (47) should be “spatial” (not “special”).

Thanks.

What next?: Accept after discretionary revisions

Level of interest: An article of outstanding merit and interest in its field

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

Reviewer 2

Title: Near-highway exposure to motor vehicle pollutants: Emerging evidence of cardiac and pulmonary health risks

Version: 2 Date: 19 March 2007

Reviewer: MaryBeth Smuts

Reviewer's report:

General

Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)

Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

Discretionary Revisions (which the author can choose to ignore)

EPA estimates that 35 million people live within 100 meters of a major highway. The understanding of pollutant emissions, exposures and health impacts associated with roadways is a major environmental health research issue. The public health community should be provided with summaries of pollutant concentrations, exposure parameters and health impacts near roadway and transportation centers in order to focus attention on current exposures and potential health impacts of future transportation projects.

Therefore, the article does address a timely and critical issue.

We have added a brief introduction that notes the large population next to highways and frames the article within the context of the specific exposures and risks that this population might face.

Discretionary Revisions

1. In the authors' Background and methods section that substitute for an introduction the article is described as a review of literature on exposure measurements and health outcomes related to proximity to highways. One, then, expects a critical review of the literature or a complete annotated bibliography on the topic but the authors only provided a very narrow summary of some near roadway studies. It is essential that the authors provide sufficient information on their methods to back up their approach to the topic.

a. There was not enough information in the Background and methods section to evaluate how the literature was selected for review.

The reviewer is correct that we did not attempt a comprehensive review of all relevant studies with regard to near highway exposure and health. However, we do not think that the >90 studies that we did review represent a very narrow part of the literature. Especially with regard to epidemiologic studies that had health outcomes, we think that we reviewed all the major and highest quality studies. We have clarified, both in the methods section and in the title, that we did not attempt a full review of the toxicology and exposure assessment literature.

b. Additional information should be provided on what were the keywords searched for in Medline

We used a large number of criteria to find articles and did not preserve a list of key words that we searched on. We hope that the clarification above helps the reviewer and reader better understand the scope of our review. If the reviewer is aware of any epidemiologic health outcome studies that we missed, we would be happy to include them.

c. How was "bootstrapping" back to older studies done since there is a potential to be misled down only one side of the research is a single's author's references are used.

We spent over a year combing the literature. If we missed any epidemiologic studies they would be few, but if the reviewer is aware of any we would like to include them.

d. The reviews of the papers seemed not to be done in the same format or at least key pieces of information, such as definitions, confounders were not consistency presented. The article would benefit from presenting the literature reviews in a standard way and the format for the review be stated in the Background and methods section.

It is not possible in our view to list the key features of each study that we reviewed in this type of review. We have clarified that we went into more detail for studies that we considered particularly strong methodologically and/or that produced findings that were particularly significant and we have added two tables that summarizes some key features of studies that were explicitly near-highway investigations.

2. The article would also benefit from an introduction or Enhanced Background and methods section that provided an overview of the types of sources and total range of pollutants from the mobile sources and road conditions, the mix of traffic types such as diesel and gas, the range of operating conditions such as speed and braking amounts that can be described the sources and their total range of pollutants. The authors then could present their reasoning for narrowing the literature review to what appears to be a focus on a smaller group of pollutants, mainly the ultra fine particles.

We agree that this discussion is needed and have added a paragraph containing much of the suggested material.

3. Similarly, the article does not provide an operating definition of the range of what highways or high volume roadways are considered in any of the papers reviewed.

We now note that the studies we reviewed have considerable variation in how they defined highways. The new tables that we created list the definitions of highway for each key study..

There is also the same type of absence of describing or mentioning types of monitoring devices. This overview of monitoring devices would aid in the understanding of how emissions are reported and provide a better understanding of black carbon, elemental carbon and particle sizes.

The types of monitoring devices and lab measurements used to gather the air pollutant data is now mentioned in the paper for each pollutant discussed.

The selection of papers relating health effects to traffic proximity is also limited, focusing on coronary and pulmonary effects and adult cancer. Other health impacts have been reported, such as adverse birth outcomes, low birth weight and childhood cancer. I'm uncertain why these are absent, was it due to authors' selectivity or to limited Medline searches?

We choose to limit our analysis to health outcomes that have been most studied and about which we knew the most. We feel that these areas of health outcome are also likely to be the key health policy drivers. We also wanted to keep this review to a moderate length so that it was more readable. That said, we now note in the methods that there are other areas of health outcomes so that readers who are interested will be alerted to this.

Without a key and overview of the complexity of the topic, the selection and summary of the articles appear to be randomly strung together.

We agree that this subject area is complex. We grouped the review by health outcome type in order to make it clearer. We have moved what was the first paragraph of the cardiac section to the end of that section because it did not fit the chronological pattern for the rest of that section. We would contend that the asthma section is well ordered as it is. In the pulmonary health section studies are grouped into paragraphs based on the approach of the study, but, as we note, these studies are quite varied and finding more order to them does not seem possible. We have moved the citation of several minor lung cancer studies from the first paragraph of that section

to near the end so that the major studies are highlighted and the flow is better. As noted previously, key near-highway studies are also now summarized in two new tables.

The authors have mixed studies with urban street traffic with highways/thruway studies; therefore, it is difficult to have confidence in their conclusion on p. 5 that certain pollutants are elevated near high volume roadways without consistent definitions.

This is a good point. We have added two tables which provide definitions of the highways studied. Also, the conclusions have been moved to the end of the section on Air Pollutant Gradients Near Highways. Finally, the conclusions and abstract are more cautiously worded to reflect the reviewer's point.

4. A lengthier introduction to the selection and format of the review would eliminate the minor criticisms relating to mentioning a term or observation without relating its importance in context to the near roadway emissions to exposure to health effects complexity found throughout the article.

See responses above.

On p. 3, the introduction of only a small set of traffic related pollutants: nitrogen oxides, carbon monoxide, black carbon and ultra fine and other sized particles gives the reader a limited view of pollutants associated with highways and/or vehicles. A general overview of what definitions are available for highways and what pollutants are associated with highway traffic would correct this deficiency.

We have edited the beginning of the Background section to address this point.

5. Although there is a listing of abbreviations at the end on p.12, the authors should still follow the convention of using the complete term with its abbreviation with the first introduction of the term.

We agree and have made the changes.

6. Careful editing should be done to avoid errors in sentence construction that confuses the descriptions.

a. Is Shi et al's measurement of UFP number and mass concentration and size distribution the same as in Zhu et al's UFP number concentration and size distribution?

Shi et al., did not measure mass concentration. This misstatement was corrected. Thus, the two sets of measurements – from Zhu et al. and Shi et al. – are consistent.

b. Also with the review of Shi et al's findings, did the particle number concentration decrease 5 – fold with every 30 m or within 30 meter of roadways.

It should have read "within 30 meters" not "with 30 meters". This was corrected.

7. Several of the literature summaries are too abbreviated and provide statements that do need clarification. An example of a too edited summary is on page 4 of Hitchins et al and Morawaska et al's observations that wind speed and directions and confounding roadway inputs are important in measuring highway gradients leaves the reader with questions about what are the other confounders. The whole paragraph underscores the complexity of the scientific problem and does emphasis my point that in summaries of near highway research, there is a need for consistency in measurements and reporting conditions being included.

“Confounding roadway inputs” is confusing and this wording was removed from the revised MS in favor of more descriptive language. The confounding inputs refer to pollutants in exhaust from automobiles traveling on local roadways nearby the major highway.

8. In the summaries of the health studies there appears to be a confusing mix of exposure and concentration studies that allude to increase risk but the level and potential health impact isn't well described, such as the second paragraph on page 6. Sometimes, the authors haven't made the clear link that some of the pollutants are linked to traffic, such as on page 6, Hoek et al study on nitrogen dioxide and black smoke. Again, if the introduction provided an overview of traffic related pollutants and some of the measuring confusion in terminology, this lapse would be avoided.

We hope that changes earlier in the manuscript, as the reviewer suggested, have largely addressed this issue.

9. The review of the Gauderman et al asthma study should be the standard for the authors' summaries of research findings. This summary included the confounders and the risk boundaries and provided the strength of the research findings. The summaries of the other asthma studies should have more detail than a statement that the general risk is higher as in the descriptions of studies on p.7, paragraph 2.

We respectfully disagree. The article would become very long if every study were reported in the same depth as Gauderman. We clarified in the methods that we put more emphasis on studies that were more rigorous or that had highly significant findings. We seek here to produce a relatively readable review rather than a comprehensive (and very long) report that might be of interest only to those who are deeply involved in the issue.

10. On page 8, there is the statement that elevation of the residence is an important factor but there is no backup reason for this statement.

Elevation was in fact studied in the article referenced. The text was corrected to reflect this point.

11. In order for this paper to contribute to useful policy development, there is a need to characterize what high volume roadways are and characterize the vehicle type and alterations in speed in relationship to health impacts.

As noted above, the new tables list highway volumes for key studies.

12. The health sections reviews of associated pediatric lung function and cancer did provide more details in the literature summaries and enabled the reader to see the strength and weaknesses of the associations and study parameters.

a. Although the review of Brunekreef paper raises more questions from its lengthier description, such as what were the distances measured if largest decrements found a within 300 m. This was the first summary that included a traffic number with the phrase “major roadway”.

Again we hope that the new tables which provide details on vehicle volumes for key studies resolve this issue.

b. In the summary of the Dutch study, there is no description of how the children were classified; for example if children’s homes were close to highway but their school was further away, would misclassification led to weak associations observed as was the case.

Good question. We have revised the section on this study to note that when the analysis was restricted to children living within 500 m of highways the ORs were increased.

13. These sections with more critical review of the scientific findings underscored the incomplete details and lack of critical reviews found in the other sections. One would have liked throughout the article a summary of each of the studies uncertainties. This type of listing of strengths and weaknesses of the research findings, using definitions of traffic density and highway volumes, would allow for better policy and future research development.

We feel that this is a general review article rather than an annotated bibliography. We hope others will produce the sort of report that the reviewer seeks and note that the Health Effects Institute is starting work in that direction.

What next?: Accept after discretionary revisions

Level of interest: An article of importance in its field

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.