EPA Response to External Peer Review Comments on the EPA Report:

National Analysis of the Populations Residing Near or Attending School Near U.S. Airports

United States Environmental Protection Agency

EPA Response to External Peer Review Comments on the EPA Report:

National Analysis of the Populations Residing Near or Attending School Near U.S. Airports

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

NOTICE

This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments.

EPA United States Environmental Protection Agency

EPA-420-R-20-002
February 2020

Contents

1. Introduction

The United States (US) Environmental Protection Agency (EPA) Office of Transportation and Air Quality (OTAQ) contracted with Eastern Research Group, Inc. (ERG) to organize an independent external peer review of a draft analysis titled "National Analysis of the Population Residing Near or Attending School Near U.S. Airports" to ensure that this analysis has been conducted in a rigorous, appropriate, and defensible way. ERG conducted a search to identify experts who collectively had the expertise in this field and who had no conflict of interest in performing this review. Once selected, ERG provided the reviewers with the draft analysis and charge questions as prepared by EPA. Each reviewer was asked to develop written comments in response to each charge question. A full description on the peer review process can be found in the appendix which includes the full contractor's report.

1.1 Peer Reviewers

ERG selected the following individuals to review the report provided by the EPA. Reviewers are referred to by reviewer number throughout the response document as assigned here alphabetically.

- Reviewer 1: Francine Laden, Harvard Medical School
- Reviewer 2: James R. Roberts, Medical University of South Carolina
- Reviewer 3: George D. Thurston, New York University School of Medicine

2. Charge to Reviewers

The following charge questions were provided to the reviewers to guide their review and highlight specific areas for input and comment.

1. Are the databases used in this analysis appropriate for the analysis conducted? Are you aware of additional databases that EPA should consider in order to supplement or further refine the analysis?

2. Is the description of analytic methods and procedures clear? Do they provide enough detail to allow the reader to understand the steps taken and assumptions made by EPA in developing the runway layers, population layers and educational facility layers and the intersection analyses?

3. Many runways for which runway buffers were developed (categories II through VII) are not in FAA's shapefile data.
    - Are there assumptions used in this analysis (along with the FAA facility level data) appropriate and reasonable for generating runway geospatial data?
    - Please provide a separate response for each of the categories II through VII described in the report.

- Please suggest alternative sets of assumptions that might lead to more reasonable or accurate development of layers for EPA's use in this analysis, if possible.

4. EPA's conclusions about the number of people who live near airports and heliports include uncertainties.
    - Has EPA properly and sufficiently described the uncertainties in the approach they used?
    - Please provide your opinion on the use of the method described in this paper to estimate populations living near airport facilities and whether the method sufficiently captures the relevant population.
    - Please comment on other approaches for estimating this population including use of the dasymetric method population data.
5. EPA's conclusions about the number of children who attend educational facilities near airports include limitations.
    - Has EPA properly and sufficiently addressed the potential uncertainties in the approach used in the analysis?
6. Please provide any additional comments you feel would improve the report/analysis.

3. Response to Peer Reviewer Comments

The following sections provide the full comments as received from each reviewer along with EPA's responses. Small editorial errors present in reviewer's comments (e.g., misspellings, duplicated words) are corrected in this section; the full, uncorrected comments from reviewers are provided in the contractor's report which is an appendix to this document. Full citations to works cited in both this document and the report are available in the References section of the report.

3.1 Response to Comments Received from Reviewer 1: Francine Laden

1. **Are the databases used in this analysis appropriate for the analysis conducted? Are you aware of additional databases that EPA should consider in order to supplement or further refine the analysis?**

To create the airport layers, EPA utilized geospatial linear runway data produced by the FAA Research and Innovative Technology Administration's Bureau of Transportation Statistics, which is part of the National Transportation Atlas Databases 2010 data, and the National Airspace System Resources (NASR) database which is populated by airport submissions of Airport Master Record (5010). These databases appear appropriate, and I am not qualified to determine if there are additional databases available.

In the introduction, weather factors, such as wind direction and wind speed are mentioned as important determinants of dispersion of aircraft emissions. Databases from National Oceanic and Atmospheric Administration (NOAA) are available on weather variables; however, they do not appear to be used in the analysis. Furthermore, amount of aircraft activity is also mentioned in the Introduction. These data also do not appear to be used.

> *EPA Response: The reviewer is correct that for the goals of this analysis, we did not use databases to ascertain prevailing wind directions or airport-specific activity. Wind direction, wind speed and other variables will influence size of the population exposed at any given time, but the consistent 500 m buffer can inform the size of the population exposed on average over a 3-month period of time as meteorology and activity levels change. We use this consistent, uniform buffer distance around runways in this analysis in order to evaluate the size of the population potentially exposed to concentrations of lead that are above background levels for a 3-month period.*

To determine the population layer, EPA used the block data from the US Census Summary File 1. These data are appropriate and should be comprehensive. In the Uncertainty section, EPA refers to a dataset produced by ORD using dasymetric population mapping that is scheduled for release in 2014. Population distribution data obtained by a multi-variable dasymetric modeling approach (LandScan) is available from the Oak Ridge National Laboratory

(http://web.ornl.gov/sci/landscan/index.shtml). Was this dataset considered? How does it differ from the one developed by EPA?

EPA Response: The LandScan data was developed using an approach similar to that used by EPA in developing the dasymetric data. There were several reasons we decided not to use the LandScan data including the coarser spatial resolution (LandScan data was available at a 1 km resolution and EPA's dasymetric approach reslolved population at 30 meters), and the fact that the LandScan data are proprietary, and cannot be made available to the public, while EPA's data is publicly available.

To create the education facility layers, EPA used data on K-12 public and private schools from the US Department of Education's Institute of Education Sciences national Center for Education Statistics (NCES). They also used data for the locations of all Head Start Facilities from the Department of Health and Human Services, Office of Head Start. These data are appropriate and should be comprehensive. However, although early education is covered by NCES, the use of these data or the reasons why it may not be appropriate to use them are not included in the report.

EPA Response: We expanded on the discussion of the uncertainty associated with using school point data to further note that while early education is covered by the NCES, this database is limited to Head Start Facilities and these facilities are a subset of preschools in the US that also include center-based, school-based and in-home early education and care programs serving children and infants. This broader evaluation was not possible due to a lack of data on the facilities that are not Head Start facilities. Children in this age group are clearly of interest for this analysis because they are a highly susceptible population to the uptake and impacts of lead. The absence of information regarding proximity of these facilities to aircraft lead emissions may significantly underestimate this potentially exposed population. This information has been included in the uncertainty discussion in the final report.

2. **Is the description of analytic methods and procedures clear? Do they provide enough detail to allow the reader to understand the steps taken and assumptions made by EPA in developing the runway layers, population layers and educational facility layers and the intersection analyses?**

In general, the description of the analytic methods and procedures used to develop the airport layers is not clear. The terms need to be better described. For example, the definition of the X and Y coordinates in the equation should be clearly described and the axes in the figures should be labeled. The equations in Figure 2 do not appear to be self-consistent. Also, the description of going from runway ids (based on the magnetic coordinates) to the geographic coordinates is confusing and the table is not consistent with the definitions provided. There is an overuse of footnotes. Perhaps if details that are provided in this way are moved to the main text then the

description could be clarified. It is not clear why EPA chose to use semicircles instead of circles at the ends for the "End of Runway Buffers."

The assumptions made by EPA in developing the population layers and educational facility layers and the intersection analyses are clear.

> *EPA Response: We have revised the description of the analytic methods, procedures, and data used to develop the airport layers in order to clarify and improve understanding and readability of these methods. These changes included incorporation of information previously provided in footnotes into the descriptions provided in the main body of the report where such a change was determined to improve context and linkages among the steps used. We have also added more descriptive labels to the airport figures to improve clarity and we identified the inconsistency in the equations in Figure 2; we appreciate the reviewers attention to these details. The end of runway buffers were identified using semicircles to encompass the area of maximum impact from ground-based emissions of lead from piston-engine aircraft. A more complete discussion of this has been added to the report.*

3. **Many runways for which runway buffers were developed (categories II through VII) are not in FAA's shapefile data.**

- **Are the assumptions used in this analysis (along with the FAA facility-level data) appropriate and reasonable for generating runway geospatial data?**
- **Please provide a separate response for each of the categories II through VII described in the report.**
- **Please suggest alternative sets of assumptions that might lead to more reasonable or accurate development of layers for EPA's use in this analysis, if possible.**

Taking into account the comments to Charge Question 2, the assumptions used in this analysis and the FAA facility-level data are appropriate and reasonable for generating runway geospatial data. Separate responses for each category are below:

II: Adequate information is provided describing the start and endpoints of the runways.

III. The concepts described for this category appear to be appropriate; however, as mentioned for Charge Question 2, there are some inconsistencies that should be cleared up.

EPA Response: See response to Charge Question 2 above.

IV. The concepts described for this category appear to be appropriate; however, as mentioned for Charge Question 2, there are some inconsistencies that should be cleared up.

EPA Response: See response to Charge Question 2 above.

V. It is not clear why (as it says in footnote 30) it was assumed that the runway length represented the distance from East to West and the width represented the distance from North to South. The uncertainty associated with this decision is mentioned in the "Uncertainty" section; but perhaps alternative orientations should be discussed here, or would a circular buffer be appropriate in this case where orientation is unknown and aircraft can take off and land in many different directions?

EPA Response: We made this assumption in the absence of information and recognize that alternative assumptions could be made regarding the runway buffer. Since many of these facilities are seaports, it is plausible, as noted by the reviewer, that a circular buffer would be appropriate to consider. Alternatively, since population census blocks do not extend into the water, it is also plausible that the method EPA used intersects with the same census blocks that a circular buffer would intersect. We made the determination that since this method was applied to 41 facilities and accounted for only 1% of the total population reported in this analysis, that our assumption does not impart a significant source of uncertainty in the overall results of the analysis presented in this report. In response to the reviewers comment, we have added additional context about our assumption in the report.

VI. The concepts described for this category appear to be appropriate.

VII. The concepts described for this category appear to be appropriate for all heliports with only 1 helipad. More detail is needed for the smaller number with more than 1 helipad.

EPA Response: We have added text to the discussion in the report describing the selection of the method used to create airport layers for the 202 heliports with more than one helipad. These facilities comprise 4% of all helipad facilities for which method VII was used and, as noted in the report, visual inspection of a subset of the 202 heliports using GoogleEarth software suggested that there is no

standard layout for the location of helipads at airfields with multiple helipads and they were largely removed from densely populated areas by significant setbacks or because the facility is in a rural area. There may be instances when the selection of a single centroid for these facilities may exclude relevant populations from this analysis, and therefore, the simplification selected for this subset of facilities is expected to result in an underestimate of the population in this analysis.

4. **EPA's conclusions about the number of people who live near airports and heliports include uncertainties.**

- **Has EPA properly and sufficiently described the uncertainties in the approach they used?**
- **Please provide your opinion on the use of the method described in this paper to estimate populations living near airport facilities and whether the method sufficiently captures the relevant population.**
- **Please comment on other approaches for estimating this population including use of the dasymetric method population data.**

EPA has properly qualitatively described the uncertainties in the approach that they used to identify the number of people who live near airports and heliports. However, a more quantitative discussion may have been more appropriate. EPA mentions dasymetric mapping methods, that data will be available for use in 2014, and performed a sensitivity analysis using this technique in California. More detail defining the dasymetric approach would be appropriate in the main body of the text, as well as a comparison with the LandScan data developed by Oak Ridge National Laboratory. Also, there is no mention of the uncertainties inherent to the Census and other databases.

EPA Response: We have included a description of the approach used by EPA to create the dasymetric data used in this report (see Section 2.0 under the description of the census block population layer approach), and we have noted that other such databases are available (e.g., the Oak Ridge National Labs LandScan data). A discussion of the differences between EPA's dasymetric approach and that of Oak Ridge National Labs is provided in response to the comment provided above under Question 1. In addition, we added text to Section 4 to note inherent uncertainties in the census data and other population databases.

The methods described in this paper for estimating populations living near airport facilities are appropriate. If anything, it is likely to be conservative and overestimate the numbers exposed. It is not clear why some of the alternative approaches described in the Uncertainty section (e.g. considering a different orientation of the Type V runways, or extending the buffers 14 m in all directions to take into account the width of the runway) were not incorporated into the primary

analyses. Weather information, particularly wind direction and activity data from the airports may also have added to refining the estimations of the populations at risk.

EPA Response: In Section 4.0 we described parameters that could influence the results of the analysis in order to be as complete and transparent as possible. We determined that for parameters such as runway width, small changes in the perimeter analyzed (e.g., extending the buffer by an additional 14 m beyond the 500 m), would not substantively impact the assessment conducted. We elected to conduct a more detailed analysis for cases that improve the understanding of the approach and may impact the quantification of the population (e.g., evaluating the potential impact of having included census blocks that overlap the 500 m buffer in urban versus rural areas).

5. **EPA's conclusions about the number of children who attend educational facilities near airports include limitations.**

- **Has EPA properly and sufficiently addressed the potential uncertainties in the approach used in the analysis?**

EPA has sufficiently addressed the potential uncertainties to their approach for identifying the number of children attending educational facilities near airports; however, there is an omission of information about the uncertainties of the data itself. Information on the accuracy and comprehensiveness of the data sources should be described and included. Also, as pointed out in earlier sections of the report, the NCES data include information on preschools. However, these data are not used and no explanation is provided.

EPA Response: We added information regarding the accuracy and comprehensiveness of the school and preschool data sources. The reviewer likely missed our presentation of the data regarding Head Start facilities which was provided in the report; we noted that among the 16,794 preschool facilities, 92 were located in the whole perimeter buffers and 37 were located in the end-of-runway buffers. Our analysis is limited to understanding the number of facilities near runways because data regarding enrollment was not available.

6. **Please provide any additional comments you feel would improve the report/analysis.**

It would be helpful to add rows for the US population under 5 to tables 1 and 3, thus providing information on the racial distribution of this age group. Would it be possible to include

information on the distribution of other Census variables relevant to socioeconomic status – e.g., median family income or median home value?

EPA Response: The data provided in the 2010 US Census does not include race by age, and information relevant to socioeconomic status is available only at geographic levels larger than the census block level that was used in this analysis.

3.2 Response to Comments Received from Reviewer 2: James R. Roberts

I have prepared this review in order of the Charge questions that were provided. For convenience, I used the Charge Question document to begin the review and have included the original questions provided and my answer to each follows.

1. **Are the databases used in this analysis appropriate for the analysis conducted? Are you aware of additional databases that EPA should consider in order to supplement or further refine the analysis?**

The databases appear to be appropriate for this analysis. I am not aware of any specific databases that would supplement the analysis. However, I would consider whether Housing and Urban Development (HUD) has some available data. Particularly, I would consider the following:

1) As the attempt is to correlate airborne lead from planes as a cause of childhood lead exposure, I would think it important to control for exposure to well-known causes of lead paint—residences in houses built before 1950. I think HUD may have data on age of housing;

2) Another possible source for age of housing data is County tax assessor data. For our Geographic information systems (GIS) study in Charleston, we used local tax assessor data for age of housing. This would be a big undertaking, but it would allow you to control for the most common exposure and allow other exposures to be identified in the GIS system.

> *EPA Response: In this report, EPA is providing an estimate of the number of people who may potentially be exposed to lead from aircraft emissions due to the proximity of their residence or school to a runway where aircraft operating on leaded fuel are expected to operate. We agree with the reviewer that if we were endeavoring to conduct an epidemiological study or a correlation analysis to evaluate the potential impact of aircraft lead emissions on blood lead in children, we would need to consider other significant sources of lead exposure among this population, including lead from paint in older homes.*

2. **Is the description of analytic methods and procedures clear? Do they provide enough detail to allow the reader to understand the steps taken and assumptions made by EPA in**

developing the runway layers, population layers and educational facility layers and the intersection analyses?

The description of the analytic methods and procedures is mostly clear. However regarding the second question above, there are two overall issues I think could use additional detail. I have also numbered these.

1) At the conference call, I asked about the intended audience for this document. Some of the intended audience, namely those in the aviation industry should have no problem understanding it, particularly the aeronautical terms, specific terms for ends of runways (base and reciprocal), magnetic heading, and centroid. Those are the terms that stood out to me. Some of the other intended audience, such as public health groups and advocacy groups, may be at a distinct disadvantage in trying to understand the document. As a pediatrician, and not someone familiar with airport runway configuration, it took several readings before I understood it. I think the paper would benefit from a brief glossary of terms.

2) Even though it was mentioned in the introduction in the second paragraph, I also asked a question about more detail why a 500 meter buffer was used. To my disappointment, the response I received was pretty much the same 2-sentence answer in the introduction, basically that impact of aircraft lead emissions can extend to almost 1000 meters downwind from the runway, but that when averaged over a 3-month period, concentrations return to background levels at 500 meters. What does the author mean by "local background levels"? Did they consider soil deposition from airborne plumes? How frequent are those 1000 meter "down-wind days"? It seems that the 500 meters is possibly over simplified, and I would challenge that there should be consideration of a buffer zone of greater than 500 meters. I do find it troubling that I see no discussion of soil lead concentrations, nor an attempt to measure that, even if it is in a small pilot study such as what they did in some of the California airports.

EPA Response: In response to comment 1 above, where industry-specific terminology was used, we have added definitions in the text. We also added further clarity to the description of the methods to improve readability.

To address the question regarding local background concentrations: local background concentrations are defined in this report as the lead concentrations that would be expected in the absence of a localized source such as aircraft emissions of lead. Air monitors that are sited to assess local background concentrations are referred to as non-source oriented monitors. EPA summarized the lead concentrations from non-source oriented monitors in the most recent Integrated Science Assessment for lead; the median non-source oriented concentration of lead was 0.01 ug/m^3. [U.S. EPA Integrated Science Assessment for Lead, 2013, Section 2. Available at: https://www.epa.gov/isa/integrated-science-assessment-isa-lead].

We have added additional explanation to the report to describe the rationale for the selection of the 500 meter buffer and we provide additional context here. As

noted in the report, the purpose of this analysis is to estimate the number of people whom, based on available data, may be exposed to elevated air concentrations of lead due to piston-engine aircraft activity at airports with differences in activity levels, aircraft types, and meteorological conditions over a 3-month period. As noted in the Introduction to the report, the available data suggest that 500 meters reasonably represents the distance at which these exposures occur.

We selected 500 meters as the buffer distance because the concentrations averaged over 3-months (the form of the National Ambient Air Quality Standard for lead) suggest lead concentrations from aircraft return to background at approximately 500 meters at these highly active airports. We acknowledge that using this buffer distance will underestimate the number of people potentially exposed to ground-based lead emissions on individual days out to 1,000 meters from a runway at a very active airport; we also acknowledge that using a 1,000 meter distance around airports nationwide would likely overestimate the number of people potentially exposed to ground-based lead emissions at the less active airports.

We agree with the reviewer that selection of the 500 meter buffer is a simplified approach. The goal of this analysis is to conduct a screening level assessment of the number of people potentially exposed to elevated lead concentrations over the duration of the averaging time of EPA's National Ambient Air Quality Standard for Lead which is 3 months. We acknowledge that the precise distance of a potential elevation in exposure to lead attributable to lead emissions from piston-engine aircraft will vary by airport based on a number of factors. Air quality modeling of lead from piston-engine aircraft has demonstrated that the distances over which aircraft emissions increase lead concentrations above local background levels varies depending on the intensity of piston-engine aircraft activity and whether those aircraft are single- or multi-engine, the lead concentration in the gasoline used, and other operational factors such as the length of time a pilot conducts pre-flight checks during which the engine is run at a high rate of power at a single location, typically near the end of the take-off runway. Meteorological factors also impact the ground-level lead concentrations, such as consistency in wind direction, and magnitude of the wind speed. EPA has modeled daily events during which lead concentrations from aircraft exhaust extend almost 1,000 meters downwind. This occurs at the most active general aviation airports when wind speeds are low and wind is consistent from one direction over the course of the day. [See the document titled "Development and Evaluation of an Air Quality Modeling Approach for Lead Emissions from Piston-Engine Aircraft Operating on Leaded Aviation Gasoline" available at: https://www.epa.gov/regulations-emissions-vehicles-and-engines/airport-lead-monitoring-and-modeling]

In addition to the modeling and monitoring data discussed above, a study published in 2011 by Miranda et al., informed our choice of the 500 meter buffer distance.

Miranda et al., studied blood lead in children living within 500 meters, 1,000 meters, 1,500 meters and farther from runways where piston-engine aircraft operate. In a categorical analysis, Miranda reported a statistically significant increase in the concentration of lead in children's blood for those who resided within 500 meters of airport runways compared with those living between 500 meters and 1,000 meters. [Miranda et.al., 2011 A Geospatial Analysis of the Effects of Aviation Gasoline on Childhood Blood Lead Levels. Environmental Health Perspectives 119:1513-1516.]

*While the analysis presented in this report is focused on air-related, near-field exposure to lead from piston-engine aircraft, EPA is concerned about any exposure to lead (see additional information in response to question 4 from Reviewer 3). We agree with the reviewer that when considering the potential human health impacts of lead emissions to air, consideration needs to be given to the potential for deposition of lead to soil because soil uptake by young children is a dominant pathway for their exposure to air-related lead sources. As the reviewer notes, EPA collected soil samples at and near one airport in California and analyzed several metals in the samples (see the EPA report "Development and Evaluation of an Air Quality Modeling Approach for Lead Emissions from Piston-Engine Aircraft Operating on Leaded Aviation Gasoline" referenced above in this response). Soil samples collected on airport property did not show elevated lead concentrations above typical background levels. The highest lead concentration in soil was observed in samples collected near a road and at homes where external home renovation had been conducted. Others have evaluated lead concentrations in soil at and near airports where piston-engine aircraft operate and have reported average or typical lead concentrations in soil [*Environment Canada, 2000. Airborne Particulate Matter, Lead and Manganese at Buttonville Airport. Environment Canada, Toronto, Ontario, Canada. Conor Pacific Environmental Technologies for Environmental Protection Service, Ontario Region and Heiken, J., et al. (2014). *Quantifying Aircraft Lead Emissions at Airports.* ACRP Report 133. http://www.nap.edu/catalog/22142/quantifying-aircraft-lead-emissions-at-airports*].*

I also noticed one additional, yet minor item. Under I. (runway layers from FAA geospatial data), there is one item that could be reworded for clarity. The authors first mention 6090 runways, but in the next sentence say the data contain 6159 runways. I'd suggest something trying to spell out

how you went from 6159 runways to 6090 (6159 runways minus x closed runways minus y runways in US territories = 6090 runways).

EPA Response: We modified this section as suggested to improve clarity.

3. Many runways for which runway buffers were developed (categories II through VII) are not in FAA's shapefile data.

- **Are the assumptions used in this analysis (along with the FAA facility-level data) appropriate and reasonable for generating runway geospatial data?**

For all of these methods II-VII, as well as I, I will still include my point that I remain unconvinced that the 500 meters is the best measure and question if 1000 meters is better.

II. This method sounds fine. It took me several readings but I finally got it. While the method is okay, I wonder if it can be revised to read more clearly. Earlier I mentioned how a glossary of terms might be helpful, and it may be that if the glossary is included, this statement would be a little easier to understand.

EPA Response: We modified the text to improve flow and clarity and we added additional definitions to terminology used in the report in lieu of a glossary of terms.

III. This method sounds fine. The only question I had for clarity was whether anyway the data report the length and direction of the runway. If this is there, please state; and if not in the data, please state that information is not available.

EPA Response: We have clarified in the report that the magnetic heading of the runway and the runway length were provided in the FAA database.

IV. This method sounds fine. I would suggest the following minor sentence structure revisions for clarity: For 8,597 runways at 8,597 airports, the airport centroid (which is the center of the runway on the runway centerline) were used to create… Again, the glossary can help, but as I tried to read it, the terminology distracted me until the 4th line.

EPA Response: This edit has been made to the report.

I will add that for III and IV, I am not a math person, so I can't comment if the mathematical equation is correct, and I will defer to your geocoding review experts.

V. My only concern is that this method seems more arbitrary than the others with some significant assumptions; namely that the facility latitude and longitude is really located at the center of the runway. Might it be that the runway is located on one side of the airport facility? If this is the case, than a larger buffer zone should be used. The figure the author uses for this

clearly demonstrate that for some runways, the buffer chosen is clearly too small, as in the example, one end of one of the runways is much closer to the edge of the buffer zone, and certainly less than 500 meters from the edge of the runway.

> *EPA Response: We acknowledge that the method used to create the airport layer for category V facilities has several significant assumptions given the lack of data regarding these facility types. It is important to focus the relevance of the uncertainty on these airports given that many are seaports where aircraft are taking off and landing on the water and given this situation, there are not people living in the 500 meter buffer area of this activity. One could, if there were specific facilities of interest in this category, evaluate them individually to ascertain which census blocks closest to the shore are potentially impacted by the exhaust from piston-engine aircraft operating at each facility. This type of individualized analysis was not considered necessary for this national-scale evaluation for which these category V facilities comprise less than 1% of the total number of airports evaluated.*

VI. I have more questions about this one. It really sounds, as I read this, that the authors really don't know where the runways are located on these airports and that only using a centroid coordinate will significantly underestimate the true buffer of the runways. Again, with this much uncertainty of location of the runways (as least as I read this section), a larger buffer zone should be used. If I am incorrect about my reading of this section, then it is more likely that other public health professionals and child advocates will also misunderstand this section.

> *EPA Response: We have provided additional description of the potential implications and uncertainties associated with the use of the airport centroid and a 1,000 meter buffer distance around the centroid to estimate the people living near these airport facilities. In brief here, the selection of this buffer from the centroid of these airport facilities has the potential to over- or under-estimate population residing within a 500 meter buffer of the runways, depending on the runway configuration and length for these facilities. Of the 856 facilities in this category, 789 (92%) are in areas defined as rural by the U.S. Census Bureau and therefore have low population densities.[1] As such, we anticipate the use of this buffer*

[1] The U.S. Census Bureau defines urban areas as densely settled core areas of census tracts with a density of more than 1,000 persons per square mile (ppsm) as well as census tracts that are contiguous to the core area and that have a population density of at least 500 ppsm; all remaining territory not included within an urban area is classified as rural. (from: "Urban Area Criteria for the 2010 Census" Department of Commerce Bureau of the Census, 76 FR 53030 – 53043 (August 24, 2011)).

distance for these facilities is a reasonable approach for the purpose of conducting a national estimate of people living near airport facilities.

VII. I think this is okay, however I wonder if it would be reasonable to estimate the size of the helipad (the full square) as opposed to a single point, and then create the buffer zone around the full square as opposed to the single, centroid point?

EPA Response: Our air quality modeling of lead concentrations from the exhaust of helicopters operating on leaded aviation gasoline suggests that when considering three-month average concentrations of lead and the potential for aircraft emissions to cause lead concentrations about local background levels, it is reasonable to evaluate a buffer zone around the point of helicopter landing and take-off. In addition, estimating the dimensions of helipads would introduce significant uncertainty into this analysis since helipads are not uniform across facility types and are designed for the size of the helicopters utilizing each facility. [See https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentnumber/150_5390-2*].*

- **Please suggest alternative sets of assumptions that might lead to more reasonable or accurate development of layers for EPA's use in this analysis, if possible.**

Where I had questions about clarity of the methods, I did include alternative possibilities.

4. **EPA's conclusions about the number of people who live near airports and heliports include uncertainties.**

- **Has EPA properly and sufficiently described the uncertainties in the approach they used?**

They have done a good job with this section.

- **Please provide your opinion on the use of the method described in this paper to estimate populations living near airport facilities and whether the method sufficiently captures the relevant population.**

I think the overall methods used are good; although, I have two concerns.

1) In several places in tables and text, there is a misuse of the "less than" property with respect to age. Sometimes the phrase "less than 5 years" is used, and other times "5 years or less" or another equivalent is used. Less than 5 years means kids who are 4 years and younger are considered. The way some of the phrases read, the authors are also using 5 year olds. This needs to be consistent.

EPA Response: We identified the text to which the reviewer alerted us where we inadvertently used the terminology "under 5 years of age" when we intended to

communicate "5 years of age and under." We have corrected the text in the report accordingly.

2) I question why 5 years (and here I am assuming the authors meant for all statements to be "5 years or younger") is used? Even so, most lead poisoning data, or at least the screening guidance, considers kids 6 years or younger as being the high risk age group.

EPA Response: We reported the age breakdown as supplied by the 2010 US Census. Population counts for each age group above age 5 are not reported in annual increments. EPA agrees with the reviewer that the susceptible population for children includes those under age 7; EPA includes this age group when conducting reviews of the National Ambient Air Quality Standard for lead.

- **Please comment on other approaches for estimating this population including use of the dasymetric method population data.**

I am not familiar with dasymetric method population data. Having just looked up the definition, I think this is a good approach to use, but I would defer to the GIS experts who are reviewing this, rather than myself as the childhood lead poisoning expert.

5. EPA's conclusions about the number of children who attend educational facilities near airports include limitations.

- **Has EPA properly and sufficiently addressed the potential uncertainties in the approach used in the analysis?**

I don't think so. For the most part, I am satisfied, but I don't think a single point should be used for the location of the school, with the buffer around the center of the school. I think the school perimeter should be used, with the buffer zone around that. The primary reason I say this is that the authors won't have the information of where on the school property any playgrounds or other sports facilities may be located. Some playgrounds may be on the edge of the school grounds. In this case, with the center point being at the center of the school itself, the buffer zone will be less than 500 meters from the playground, the area where kids would most likely be exposed.

EPA Response: We agree with the reviewer and acknowledge the limitation of having only the school centroid information on which to evaluate the potential for children attending school to be in the 500 meter buffer zone of a runway. To understand the potential for our analysis to have excluded schools, we investigated the guidance for school grounds size. For example, in the State of California, a Guide to School Site Analysis and Development includes a rule-of-thumb area for schools ranges from 10 acres (40,500 square meters) for elementary schools to 40 acres (162,000 square meters) for high schools (available at: https://www.cde.ca.gov/ls/fa/sf/guideschoolsite.asp#Section1). These areas, if assumed to be a perfect square, are approximately 200- and 400-meters along

each side for an elementary school grounds, and high school grounds, respectively. Assuming the centroid of the school is in the center of this area, there could be up to 200 meters of school property that is inside the 500 meter buffer area of a runway, and the school would potentially not be included in this analysis. This information supports the reviewers concern as well as the statements EPA provided in the report regarding uncertainty of this analysis.

We find that given the complexity and nonuniformity for the shape and size of school grounds, and the fact that these shape files are not publicly available (and likely change over time), the assumptions made for the purposes of this national estimate are appropriate. However, for specific community analyses, one would collect specific information about a school and proximity of children to runways, particularly in regard to the area of maximum impact typically located at a runway end.

Also, it is unclear why the authors are looking at schools with reduced lunch costs are included. It is not clear how they are used in any analysis. However, unless they are trying to control for socioeconomic purposes, as an additional risk factor for lead, the school lunch program doesn't seem relevant to the analysis. Kids who go to high end private schools are just as susceptible to airborne lead hazards as are kids in the lower socioeconomic schools. Since the school lunch program was brought up, I think this needs either clarification of how the authors will treat the data, or it should be deleted.

EPA Response: We have added to text to the report to clarify the role of this analysis. In this analysis, EPA was seeking to evaluate whether there is a socioeconomic disparity among the children attending schools near airports compared with the US school population generally.

6. Please provide any additional comments you feel would improve the report/analysis.

For the most part, with the exception of the descriptions of age in some of the tables and text that I had already alluded to, I think this paper is well written. One thing I did notice however, is a couple of places where a singular verb was used with the plural noun "data"; as in "Data is…". It should be "data are", or another corresponding plural verb. A few times the authors got that correct, so it stood out for the times it was incorrect.

EPA Response: EPA acknowledges this comment and has updated the report with the corrected language.

I also wasn't sure where to address this, so I am putting it in here. On the page of the "creation of airport buffer layer", I think the whole perimeter buffer allows for a graded assessment of risk, with those in the ends of the buffer being at highest risk, but those along the mid side of the

perimeter also at risk, just less than the ends of the runway. However, it was not clear to me why the authors would use one of these buffers sometimes, and the other buffer other times.

EPA Response: EPA is providing this analysis for informational purposes, in acknowledgement of the likelihood for greater exposure to lead for those living in the Ends of Runway buffers compared with the areas along the sides of the runway.

Another issue, and again, I apologize that it is tacked on at the end, but I noticed this towards the end of my review in the discussion of weaknesses. I think the use of the center line of the runway only, with the buffer drawn around the center line is too narrow. I think the buffer should be around the rectangle of the runway.

EPA Response: As noted in the report, the runways at airports used in this analysis had an average width of 92 feet. Therefore, on average, the buffers would have extended an additional 14 m in all directions if they had been drawn relative to the edges of runway polygons as opposed to the runway centerline. We consider this a small source of uncertainty.

3.3 Response to Comments Received from Reviewer 3: George D. Thurston

1. Are the databases used in this analysis appropriate for the analysis conducted? Are you aware of additional databases that EPA should consider in order to supplement or further refine the analysis?

The databases used are appropriate to their application, but I would think that the additional consideration of airport wind rose data layer files (e.g., from data provided by NOAA or FAA for specific airports) would allow a consideration of the predominant wind direction in assessing the affected perimeter around each airport. As it is, the buffer distance is assumed constant in all directions, but published papers indicate that the emissions reach further in the downwind direction, vs. upwind or crosswind (e.g., Carr et al, Atmospheric Environment 45 (2011) 5795-5804). Since we are considering seasonal averages in this case, the long-term wind rose information would seem very relevant to defining the proper buffer distance (i.e., further in the predominantly downwind direction), if it could be incorporated into the definition of the buffer distance.

EPA Response: We agree with the reviewer and our air quality modeling supports the point made that the aircraft emissions plume extends farther downwind than laterally. It is the work of Carr et al., 2011 that the reviewer references that we used to select the 500 m buffer distance since the air quality modeling in that study indicated that peak lead concentrations attributable to piston-engine aircraft reach local background concentrations at a distance of 500 m. The averaging time for these concentrations is 3-months, in alignment with the EPA National Ambient Air Quality Standard for lead.

Additional modeling at a second general aviation airport confirmed 500 m as the distance at which the aircraft-related concentrations return to levels at or below most local background concentrations (e.g., at or below 0.01 ug/m^3 of Pb).

Since airport runways are purposefully oriented so that aircraft can take off into and land into the wind, our selection of a 500 m buffer is anticipated to capture the majority of people for whom aircraft lead emissions might contribute to an elevation in concentrations of lead in air where they live or attend school. The uniform application of the 500 m buffer was selected because it is too computationally intensive to develop individual airport buffers for over 13,000 facilities. In addition to prevailing wind direction, an airport-specific analysis of the potentially exposed population would also need to include an assessment of the location of run-up areas where aircraft are parked for pre-flight engine checks that have been determined to cause the ground-based peak concentration of lead at airports. Such an airport-specific evaluation is beyond the scope of this assessment.

2. Is the description of analytic methods and procedures clear? Do they provide enough detail to allow the reader to understand the steps taken and assumptions made by EPA in

developing the runway layers, population layers and educational facility layers and the intersection analyses?

The description of the analytical methods is logical, quite clear, and well presented.

3. **Many runways for which runway buffers were developed (categories II through VII) are not in FAA's shapefile data.**

   - **Are the assumptions used in this analysis (along with the FAA facility-level data) appropriate and reasonable for generating runway geospatial data?**
   - **Please provide a separate response for each of the categories II through VII described in the report.**
   - **Please suggest alternative sets of assumptions that might lead to more reasonable or accurate development of layers for EPA's use in this analysis, if possible.**

Overall, the described approach presented is a plausible and efficient use of the data available for each of the Categories II through VII described in the report. However, the specific choices made are not always well enough documented, and more uncertainty analyses are needed in some cases. Importantly, the original key choice of 500 meters as the airport buffer distance is not well enough validated. As noted above, it would seem a variable distance, based on wind direction, might be more appropriate. (Also, the uncertainty analysis should have evaluated this specific choice for effect on the population size and characteristics. How different a result would come from an alternate choice of 250m or 1000m, for example?)

> *EPA Response: We added to the report additional discussion on the choice of a 500 m buffer for this assessment. The additional text notes the points made in response to Reviewer 2, Question 2.*
>
> *The reviewer suggested evaluating a variable distance based on wind direction. Runways are oriented such that the ability of aircraft to take off into the prevailing wind is maximized; this is particularly true for runways servicing piston-engine aircraft. This simplifies the analysis of the maximum impact area and is the rationale for why EPA elected to analyze "End of Runway" buffers. These buffers are expected to include areas downwind from where the most lead emitted by piston-engine aircraft occur given shifts in wind direction. The reviewer is, of course, correct in noting that different distances of analysis are relevant to considering the potentially exposed population; we consider this a screening analysis and variations tailored to individual airport types, activity rates and lead concentration averaging times (to name a few), would be useful for more refined analyses.*

Regarding the specific categories, Category II airports had FAA 5010 runway reports available, which include latitude and longitude coordinates for both the runway base and reciprocal ends, providing appropriate means for estimating a buffer around runway line. Category III's FAA 5010 runway report had latitude/longitude coordinates for either the runway base or reciprocal end

(not both), but the use of runway length, the available runway end coordinates, and the magnetic heading of the runway to calculate the latitude/longitude coordinates of the opposite runway end still seems adequate (especially since this category only included < .02% of facilities, and some .01% of estimated affected population, so the effect of any uncertainties introduced would be very small on the estimated population estimates). Given the percentages of population potentially affected by each category, Category IV is a most critical category to address appropriately (accounting for some 37% of facilities considered, and 42% of the estimated affected population). Although these are airports with FAA 5010 runway reports lacking latitude and longitude coordinates for both the runway base and reciprocal ends, they have only one runway, so the use of runway length, facility centroid coordinates, and the magnetic heading of the runway are appropriate to calculate the latitude/longitude coordinates of both runway ends. Category V only had centroid coordinate, along with the runway width and length, to use to calculate the four coordinate pairs of the rectangle representing the runway, but this was only 0.2% of facilities (and 1% of estimated population) to be considered, so any uncertainties introduced by this approach would not be significant. Category VI facilities are multi-runway facilities with no runway specific coordinates, so the facility centroid coordinates were employed, but with a larger buffer. However, runway direction is not known, and this could introduce significant error. Since this category accounts for some 8% of facilities and 7% of the estimated affected population, it should get more attention in the uncertainty analysis, perhaps using various runway directions to come up with a variety of possible answers to provide an assessment of possible range in estimates. Lastly, Category VII (heliports) utilized centroid coordinates to estimate the buffer, which is appropriate for this type of facility (i.e., without runways).

EPA Response: We acknowledge the reviewer's point that sensitivity analysis could be conducted with Category VI airports utilizing assumptions regarding a range of runway configurations to evaluate specific 500 meter buffers around each runway at these facilities. We note in the report that the majority of these facilities (92%) are located in rural areas and that our analysis suggests that this category of facilities makes up 7% of the population in this analysis. We expect that in rural environments, changes in runway configurations would have a small impact on the population estimate, in part due to the larger size of census blocks in rural areas, which would likely be less than the level we are using to round results. We also note that this screening-level assessment is fit for the purpose of creating a national estimate of people living in close proximity to airports, and we

acknowledge that an airport-specific approach would need to be conducted to refine these estimates by understanding specific runway headings.

4. **EPA's conclusions about the number of people who live near airports and heliports include uncertainties.**

   - **Has EPA properly and sufficiently described the uncertainties in the approach they used?**
   - **Please provide your opinion on the use of the method described in this paper to estimate populations living near airport facilities and whether the method sufficiently captures the relevant population.**
   - **Please comment on other approaches for estimating this population including use of the dasymetric method population data.**

As noted in the report, for methods II, III and IV, the data provided in the 5010 airport data report and 5010 runway data report were assumed to provide an accurate record of the data elements needed to draw the runway line. It is asserted that the uncertainty in the creation of these runway layers is limited to the accuracy of the data provided to FAA for runway length, base and/or reciprocal end coordinates, airport centroid coordinates, and magnetic heading. While these might well be expected to be small compared to the overall estimates, the potential effects of these uncertainties are not quantified. It would be desirable for the report to conduct an uncertainty analysis to quantify how large these errors might actually be. One method to come up with such an uncertainty estimate might be to employ the Category I facilities (for which complete information is available), and apply only the portion of the data used in Methods II through IV to those same facilities, and then determine how different the population estimates are for those facilities vs. the original Category I method population estimates, to give estimates of the potential uncertainties introduced in the Category II though IV facility population estimates.

In my opinion, the proposed methods may not sufficiently capture the relevant population. As noted above, it does not consider wind direction prevalence at each facility. In addition, the choice of 500m for a buffer is not well enough documented, and the affected zone may be larger. For example, results in Figure 4 of Steve et al. (Atmospheric Environment 67 (2013) 184-192) suggest effects potentially ranging much further downwind of such facilities. Also, quantitative uncertainty analyses should include estimates of the uncertainty introduced by the choice of a buffer distance by trying various buffer distances and comparing estimates of the affected population size for each Category. However, the approach of including any census block intercepted by the buffer zone does seem appropriate, given the comparison presented using the dasymetric method population data.

EPA Response: The reviewer proposes a meaningful method for evaluating the uncertainties involved in using increasingly minimal data in Methods II through IV by using these methods on Category I facilities and comparing our results from an analysis with complete runway data to that derived from less than complete data. We appreciate this suggestion and we agree with the reviewer that the uncertainty in the estimates of population obtained might well be expected to be small. In

addition, the airports for which the least amount of data is available, also represent the airports where the lowest amount of aircraft activity occurs. These airports with low amounts of activity are predominantly in rural areas (i.e., less densely populated), which further supports the expectation that the uncertainty on the national analysis presented here is likely to be small. As such, we have elected not to pursue this quantitative uncertainty analysis.

We agree with the reviewer that, as described by Yim et al., (referred to by the reviewer as Steve et al.,) the lead plume from piston-engine aircraft can extend farther than 500 meters at airports with a highly active piston-engine fleet. We note in the introduction to the report that EPA has also modeled this behavior of the aircraft-induced lead plume. We further note that for the purposes of this report, we are focusing our evaluation on the people who are potentially exposed to lead concentrations from aircraft that are above background levels over a three-month period, the averaging time of EPA's National Ambient Air Quality Standard for lead. The reviewer is correct in highlighting the potential for people living downwind from the maximum impact areas to be exposed to emissions of lead from piston-engine aircraft above background levels on individual days or multiple days. This analysis is not intended to quantify the number of people potentially exposed to any lead from piston-engine aircraft; we have also not quantified the potential population exposed to lead that is emitted during flight that eventually reaches ground-level. The number of people exposed to lead from any piston-engine aircraft emissions would of course be larger than the estimates provided in this report. The goal of the analysis presented in the report is to estimate the size of the population experiencing elevated airborne lead concentrations from piston-engine aircraft emissions over a 3-month period due to living or attending school in close proximity to airports where piston-engine aircraft operate. [Yim et al., (2011) Air quality and public health impacts of UK airports. Part II: Impacts and policy assessment Atmospheric Environment 67 (2013) 184-192.*]*

It is important to note that EPA is concerned about any exposure to lead. The analysis presented in this report, by design, is confined to air-related, near-field exposures from the exhaust of aircraft operating on leaded fuel. A more comprehensive evaluation of the impacts of leaded aviation gasoline, would consider transport and deposition of lead beyond the near-airport environment. Such an assessment would include an evaluation of where and how this source contributes to adult and children's blood lead levels, given that emissions from aircraft can impact not just air, but also soil, water and food. Consideration of the

impacts of lead from piston-engine aircraft could also include evaluation of occupational exposures (e.g., dermal, inhalation, and ingestion).

5. EPA's conclusions about the number of children who attend educational facilities near airports include limitations.

- **Has EPA properly and sufficiently addressed the potential uncertainties in the approach used in the analysis?**

As noted in the report, school campuses have multiple sports fields and/or playground areas that can cover large areas of land. The results of the school population analyses are therefore subject to uncertainty, since inclusion of a school facility is dependent on where the school coordinates fall within the school's actual campus. However, no estimate is provided as to how large this uncertainty might be, relative to other potential sources of uncertainty. Assuming a typical range of the potential sizes of such facilities and surrounding properties, it would be possible to come up with a range in the school property coordinates considered by multiple model runs with randomly varying coordinates for each facility, potentially allowing an estimate to be made of the associated uncertainty in the population estimate.

EPA Response: Please see response to Reviewer 1, Question 3.

6. Please provide any additional comments you feel would improve the report/analysis.

While the report provides a useful analysis of the potentially affected population, its assumptions (e.g., buffer distance) need to be better documented, and the uncertainties and possible range of the true exposure population size from this report's estimates are not sufficiently quantified.

EPA Response: We have added to the report and in the responses above, additional documentation for the selection of the 500 m buffer. We have further clarified that the analysis presented in this report is focused on the immediate area around runways where modeling data suggest that aircraft emissions of lead could result in 3-month average lead concentrations that are elevated above a typical background level. This approach excludes people who live in areas downwind from the most active airports where piston-engine aircraft emissions of lead can cause levels to be elevated above background on individual days. Conversely, the choice of the 500 m buffer includes populations living near less active airports where 3-month average lead concentrations are expected to return to local background levels before 500 m. A more refined analysis could consider airport-specific characteristics, such as the amount of piston-engine activity. The analysis presented here is a scoping evaluation intended to understand the potential scale of the near-field impact of emissions of lead from aircraft engines. Quantifying the "true exposure population size", as noted in response to Reviewer 3 (question 4), such an analysis would

include evaluating the transport and deposition of lead to water, crops used for food, soil, and occupational exposures.

Appendix

External Peer Review Comments
on EPA's Draft Report,
"National Analysis of the Populations
Residing Near or Attending School
Near U.S. Airports"

EPA United States
Environmental Protection
Agency

External Peer Review Comments on EPA's Draft Report, "National Analysis of the Populations Residing Near or Attending School Near U.S. Airports"

Contract No. EP-C-12-017
Work Assignment 2-16

Submitted to:

U.S. Environmental Protection Agency
Office of Transportation & Air Quality
Assessment & Standards Division
2000 Traverwood Drive
Ann Arbor, Michigan 48105

Submitted by:

Eastern Research Group, Inc.
110 Hartwell Avenue
Lexington, MA 02421-3136

April 23, 2014

Printed on Recycled Paper

Contents

Introduction

Background

In October 2006, the U.S. Environmental Protection Agency (EPA) received a petition from Friends of the Earth (FoE) requesting that the Agency find that aircraft lead emissions may reasonably be anticipated to endanger the public health or welfare, and to take action to control lead emissions from piston-engine aircraft. FoE also requested that if there was insufficient information, EPA should commence a study of the issue.

Since receiving the petition from FoE, EPA's Office of Transportation and Air Quality (OTAQ) has been actively studying this issue and generating and evaluating data to determine whether aircraft lead emissions may reasonably be anticipated to endanger public health or welfare. The demographic analysis report subject of this external peer review is one such analysis; it evaluates the number of people that reside in census blocks which intersect 500 meters of all U.S. airports and runways and the number of U.S. private and public schools (and enrollment) of schools which intersect 500 meters of all U.S. airports and runways.

Tetraethyl lead is used as an additive in gasoline that is used in piston-engine powered aircraft. EPA estimates in the 2011 National Emissions Inventory that emissions of lead from these aircraft account for 58% of the lead emitted to the atmosphere. While a substantial portion of this lead is emitted in-flight, air quality modeling and monitoring indicate that concentrations of lead in air at and near airports can be significantly elevated compared with local background lead levels.[1] There are almost 20,000 airport facilities in the U.S. at which piston-engine aircraft operate, some of which are surrounded by densely populated neighborhoods, educational, and recreational facilities.

The results of this analysis will be used by EPA to understand the potential magnitude of the population living near airports or attending schools near airports that may experience an increase in exposure to lead from piston-engine aircraft emissions.

Peer Review

Under an existing contract, EPA tasked Eastern Research Group, Inc. (ERG) with organizing an independent external peer review of a draft analysis titled, "National Analysis of the Populations Residing Near or Attending School Near U.S. Airports," to ensure that it has been conducted in a rigorous, appropriate, and defensible way. ERG conducted a search to identify experts who collectively had the following expertise and who had no conflict of interest (COI) in performing this review (as verified in a signed confidential and detailed COI analysis form):

- Environmental exposure assessments
- GIS geospatial analysis of air pollution and community exposure
- Research or analysis of lead air emissions
- Knowledge of data sources for demographic data
- Experience analyzing demographic studies

ERG screened the pool of interested candidates against these selection criteria. From the set of candidates who met these criteria, ERG selected three who collectively provided the optimal overall balance to identify

[1] See information posted at http://www.epa.gov/otaq/aviation.htm including the following: https://nepis.epa.gov/Exe/ZyPDF.cgi/P100GNLC.PDF?Dockey=P100GNLC.PDF, and https://nepis.epa.gov/Exe/ZyPDF.cgi/P1007H4Q.PDF?Dockey=P1007H4Q.PDF.

and address all significant issues. Upon EPA confirmation that the pool of proposed reviewers met the technical selection criteria, ERG contracted with the following experts to perform the review:

- Francine Laden, Harvard Medical School
- James R. Roberts, Medical University of South Carolina
- George D. Thurston, New York University School of Medicine

ERG provided reviewers with the review materials (draft analysis) and a charge prepared by EPA. At the beginning of the review period ERG organized and facilitated a briefing teleconference with reviewers and EPA. This briefing provided EPA an opportunity to present background on and objectives for analysis, and provided reviewers the opportunity to receive any clarifications on the review materials, technical charge, or goals for the peer review. Each reviewer was asked to develop written comments in response to the charge questions and to conduct their review individually, without consulting or sharing the materials with anyone else. Reviewers were given approximately three weeks to conduct their review. They provided their individual written comments to ERG who forwarded them to EPA. This report provides:

- Reviewers' comments organized by reviewer (pages 5 to 23)
- Peer Reviewer Resumes (Appendix A)
- Peer Reviewer Conflict of Interest Certification (Appendix B)

Individual Reviewer Comments

PEER REVIEW COMMENTS FROM

Francine Laden, Sc.D.

External Peer Review Comments on Draft Report, "National Analysis of the Populations Residing Near or Attending School Near U.S. Airports"

Responses to Charge Questions from Dr. Francine Laden

1. **Are the databases used in this analysis appropriate for the analysis conducted? Are you aware of additional databases that EPA should consider in order to supplement or further refine the analysis?**

To create the airport layers, EPA utilized geospatial linear runway data produced by the FAA Research and Innovative Technology Administration's Bureau of Transportation Statistics, which is part of the National Transportation Atlas Databases 2010 data, and the National Airspace System Resources (NASR) database which is populated by airport submissions of Airport Master Record (5010). These databases appear appropriate, and I am not qualified to determine if there are additional databases available.

In the introduction, weather factors, such as wind direction and wind speed are mentioned as important determinants of dispersion of air craft emissions. Databases from National Oceanic and Atmospheric Administration (NOAA) are available on weather variables; however, they do not appear to be used in the analysis. Furthermore, amount of aircraft activity is also mentioned in the Introduction. These data also do not appear to be used.

To determine the population layer, EPA used the block data from the US Census Summary File 1. These data are appropriate and should be comprehensive. In the Uncertainty section, EPA refers to a dataset produced by ORD using dasymetric population mapping that is scheduled for release in 2014. Population distribution data obtained by a multi-variable dasymetric modeling approach (LandScan) is available from the Oak Ridge National Laboratory (http://web.ornl.gov/sci/landscan/index.shtml). Was this dataset considered? How does it differ from the one developed by EPA?

To create the education facility layers, EPA used data on K-12 public and private schools from the US Department of Education's Institute of Education Sciences national Center for Education Statistics (NCES). They also used data for the locations of all Head Start Facilities from the Department of Health and Human Services, Office of Head Start. These data are appropriate and should be comprehensive. However, although early education is covered by NCES, the use of these data or the reasons why it may not be appropriate to use them are not included in the report.

2. **Is the description of analytic methods and procedures clear? Do they provide enough detail to allow the reader to understand the steps taken and assumptions made by EPA in developing the runway layers, population layers and educational facility layers and the intersection analyses?**

In general the description of the analytic methods and procedures used to develop the airport layers is not clear. The terms need to be better described. For example, the definition of the X and Y coordinates in the equation should be clearly described and the axes in the figures should be labeled. The equations in Figure 2 do not appear to be self consistent. Also the description of going from runway ids (based on the magnetic coordinates) to the geographic coordinates is confusing and the table is not consistent with the definitions provided. There is an overuse of footnotes. Perhaps if details that are provided in this way are moved to the

main text then the description could be clarified. It is not clear why EPA chose to use semicircles instead of circles at the ends for the "End of Runway Buffers."

The assumptions made by EPA in developing the population layers and educational facility layers and the intersection analyses are clear.

3. **Many runways for which runway buffers were developed (categories II through VII) are not in FAA's shapefile data.**
    - **Are the assumptions used in this analysis (along with the FAA facility-level data) appropriate and reasonable for generating runway geospatial data?**
    - **Please provide a separate response for each of the categories II through VII described in the report.**
    - **Please suggest alternative sets of assumptions that might lead to more reasonable or accurate development of layers for EPA's use in this analysis, if possible.**

Taking into account the comments to Charge Question 2, the assumptions used in this analysis and the FAA facility-level data are appropriate and reasonable for generating runway geospatial data. Separate responses for each category are below:

II: Adequate information is provided describing the start and endpoints of the runways.

III. The concepts described for this category appear to be appropriate; however, as mentioned for Charge Question 2, there are some inconsistencies that should be cleared up.

IV. The concepts described for this category appear to be appropriate; however, as mentioned for Charge Question 2, there are some inconsistencies that should be cleared up.

V. It is not clear why (as it says in footnote 30) it was assumed that the runway length represented the distance from East to West and the width represented the distance from North to South. The uncertainty associated with this decision is mentioned in the "Uncertainty" section; but perhaps alternative orientations should be discussed here, or would a circular buffer be appropriate in this case where orientation is unknown and aircraft can take off and land in many different directions?

VI. The concepts described for this category appear to be appropriate.

VII. The concepts described for this category appear to be appropriate for all heliports with only 1 helipad. More detail is needed for the smaller number with more than 1 helipad.

4. **EPA's conclusions about the number of people who live near airports and heliports include uncertainties.**

   - **Has EPA properly and sufficiently described the uncertainties in the approach they used?**
   - **Please provide your opinion on the use of the method described in this paper to estimate populations living near airport facilities and whether the method sufficiently captures the relevant population.**
   - **Please comment on other approaches for estimating this population including use of the dasymetric method population data.**

EPA has properly qualitatively described the uncertainties in the approach that they used to identify the number of people who live near airports and heliports. However, a more quantitative discussion may have been more appropriate. EPA mentions dasymetric mapping methods, that data will be available for use in 2014, and performed a sensitivity analysis using this technique in California. More detail defining the dasymetric approach would be appropriate in the main body of the text, as well as a comparison with the LandScan data developed by Oak Ridge National Laboratory. Also, there is no mention of the uncertainties inherent to the Census and other databases.

The methods described in this paper for estimating populations living near airport facilities are appropriate. If anything it is likely to be conservative and overestimate the numbers exposed. It is not clear why some of the alternative approaches described in the Uncertainty section (e.g. considering a different orientation of the Type V runways, or extending the buffers 14 m in all directions to take into account the width of the runway) were not incorporated into the primary analyses. Weather information, particularly wind direction and activity data from the airports may also have added to refining the estimations of the populations at risk.

5. **EPA's conclusions about the number of children who attend educational facilities near airports include limitations.**

   - **Has EPA properly and sufficiently addressed the potential uncertainties in the approach used in the analysis?**

EPA has sufficiently addressed the potential uncertainties to their approach for identifying the number of children attending educational facilities near airports; however, there is an omission of information about the uncertainties of the data itself. Information on the accuracy and comprehensiveness of the data sources should be described and included. Also, as pointed out in earlier sections of the report, the NCES data include information on preschools. However, these data are not used and no explanation is provided.

6. **Please provide any additional comments you feel would improve the report/analysis.**

It would be helpful to add rows for the US population under 5 to tables 1 and 3, thus providing information on the racial distribution of this age group. Would it be possible to include information on the distribution of other Census variables relevant to socioeconomic status – e.g., median family income or median home value?

PEER REVIEW COMMENTS FROM

James R. Roberts, MD, MPH

External Peer Review Comments on Draft Report, "National Analysis of the Populations Residing Near or Attending School Near U.S. Airports"

Responses to Charge Questions from Dr. James R. Roberts

I have prepared this review in order of the Charge questions that were provided. For convenience, I used the Charge Question document to begin the review and have included the original questions provided and my answer to each follows.

1. **Are the databases used in this analysis appropriate for the analysis conducted? Are you aware of additional databases that EPA should consider in order to supplement or further refine the analysis?**

The databases appear to be appropriate for this analysis. I am not aware of any specific databases that would supplement the analysis. However, I would consider whether Housing and Urban Development (HUD) has some available data. Particularly, I would consider the following:

1) As the attempt is to correlate airborne lead from planes as a cause of childhood lead exposure, I would think it important to control for exposure to well-known causes of lead paint—residences in houses built before 1950. I think HUD may have data on age of housing;

2) Another possible source for age of housing data is County tax assessor data. For our Geographic information systems (GIS) study in Charleston, we used local tax assessor data for age of housing. This would be a big undertaking, but it would allow you to control for the most common exposure and allow other exposures to be identified in the GIS system.

2. **Is the description of analytic methods and procedures clear? Do they provide enough detail to allow the reader to understand the steps taken and assumptions made by EPA in developing the runway layers, population layers and educational facility layers and the intersection analyses?**

The description of the analytic methods and procedures is mostly clear. However regarding the second question above, there are two overall issues I think could use additional detail. I have also numbered these.

1) At the conference call, I asked about the intended audience for this document. Some of the intended audience, namely those in the aviation industry should have no problem understanding it, particularly the aeronautical terms, specific terms for ends of runways (base and reciprocal), magnetic heading, and centroid. Those are the terms that stood out to me. Some of the other intended audience, such as public health groups and advocacy groups, may be at a distinct disadvantage in trying to understand the document. As a pediatrician, and not someone familiar with airport runway configuration, it took several readings before I understood it. I think the paper would benefit from a brief glossary of terms.

2) Even though it was mentioned in the introduction in the second paragraph, I also asked a question about more detail why a 500 meter buffer was used. To my disappointment, the response I received was pretty much the same 2-sentence answer in the introduction, basically that impact of aircraft lead emissions can extend to almost 1000 meters downwind from the runway, but that when averaged over a 3 month period, concentrations return to background levels at 500 meters. What does the author mean by "local background

levels"? Did they consider soil deposition from airborne plumes? How frequent are those 1000 meter "down-wind days"? It seems that the 500 meters is possibly over simplified, and I would challenge that there should be consideration of a buffer zone of greater than 500 meters. I do find it troubling that I see no discussion of soil lead concentrations, nor an attempt to measure that, even if it is in a small pilot study such as what they did in some of the California airports.

I also noticed one additional, yet minor item. Under I. (runway layers from FAA geospatial data), there is one item that could be reworded for clarity. The authors first mention 6090 runways, but in the next sentence say the data contain 6159 runways. I'd suggest something trying to spell out how you went from 6159 runways to 6090 (6159 runways minus x closed runways minus y runways in US territories = 6090 runways).

3. Many runways for which runway buffers were developed (categories II through VII) are not in FAA's shapefile data.

- **Are the assumptions used in this analysis (along with the FAA facility-level data) appropriate and reasonable for generating runway geospatial data?**

For all of these methods II-VII, as well as I, I will still include my point that I remain unconvinced that the 500 meters is the best measure and question if 1000 meters is better.

II. This method sounds fine. It took me several readings but I finally got it. While the method is okay, I wonder if it can be revised to read more clearly. Earlier I mentioned how a glossary of terms might be helpful, and it may be that if the glossary is included, this statement would be a little easier to understand.

III. This method sounds fine. The only question I had for clarity was whether anyway the data report the length and direction of the runway. If this is there, please state; and if not in the data, please state that information is not available.

IV. This method sounds fine. I would suggest the following minor sentence structure revisions for clarity: For 8,597 runways at 8,597 airports, the airport centroid (which is the center of the runway on the runway centerline) were used to create… Again, the glossary can help, but as I tried to read it, the terminology distracted me until the 4th line.

I will add that for III and IV, I am not a math person, so I can't comment if the mathematical equation is correct, and I will defer to your geocoding review experts.

V. My only concern is that this method seems more arbitrary than the others with some significant assumptions; namely that the facility latitude and longitude is really located at the center of the runway. Might it be that the runway is located on one side of the airport facility? If this is the case, than a larger buffer zone should be used. The figure the author uses for this clearly demonstrate that for some runways, the buffer chosen is clearly too small, as in the example, one end of one of the runways is much close to the edge of the buffer zone, and certainly less than 500 meters from the edge of the runway.

VI. I have more questions about this one. It really sounds, as I read this, that the authors really don't know where the runways are located on these airports and that only using a centroid coordinate will significantly

underestimate the true buffer of the runways. Again, with this much uncertainty of location of the runways (as least as I read this section), a larger buffer zone should be used. If I am incorrect about my reading of this section, then it is more likely that other public health professionals and child advocates will also misunderstand this section.

VII. I think this is okay, however I wonder if it would be reasonable to estimate the size of the helipad (the full square) as opposed to a single point, and then create the buffer zone around the full square as opposed to the single, centroid point?

- **Please suggest alternative sets of assumptions that might lead to more reasonable or accurate development of layers for EPA's use in this analysis, if possible.**

Where I had questions about clarity of the methods, I did include alternative possibilities.

4. EPA's conclusions about the number of people who live near airports and heliports include uncertainties.

- **Has EPA properly and sufficiently described the uncertainties in the approach they used?**

They have done a good job with this section.

- **Please provide your opinion on the use of the method described in this paper to estimate populations living near airport facilities and whether the method sufficiently captures the relevant population.**

I think the overall methods used are good; although, I have two concerns.

1) In several places in tables and text, there is a misuse of the "less than" property with respect to age. Sometimes the phrase "less than 5 years" is used, and other times "5 years or less" or another equivalent is used. Less than 5 years means kids who are 4 years and younger are considered. The way some of the phrases read, the authors are also using 5 year olds. This needs to be consistent.

2) I question why 5 years (and here I am assuming the authors meant for all statements to be "5 years or younger") is used? Even so, most lead poisoning data, or at least the screening guidance, considers kids 6 years or younger as being the high risk age group.

- **Please comment on other approaches for estimating this population including use of the dasymetric method population data.**

I am not familiar with dasymetric method population data. Having just looked up the definition, I think this is a good approach to use, but I would defer to the GIS experts who are reviewing this, rather than myself as the childhood lead poisoning expert.

5. EPA's conclusions about the number of children who attend educational facilities near airports include limitations.

- **Has EPA properly and sufficiently addressed the potential uncertainties in the approach used in the analysis?**

I don't think so. For the most part, I am satisfied, but I don't think a single point should be used for the location of the school, with the buffer around the center of the school. I think the school perimeter should be used, with the buffer zone around that. The primary reason I say this is that the authors won't have the information of where on the school property any playgrounds or other sports facilities may be located. Some playgrounds may be on the edge of the school grounds. In this case, with the center point being at the center of the school itself, the buffer zone will be less than 500 meters from the playground, the area where kids would most likely be exposed.

Also, it is unclear why the authors are looking at schools with reduced lunch costs are included. It is not clear how they are used in any analysis. However, unless they are trying to control for socioeconomic purposes, as an additional risk factor for lead, the school lunch program doesn't seem relevant to the analysis. Kids who go to high end private schools are just as susceptible to airborne lead hazards as are kids in the lower socioeconomic schools. Since the school lunch program was brought up, I think this needs either clarification of how the authors will treat the data, or it should be deleted.

6. Please provide any additional comments you feel would improve the report/analysis.

For the most part, with the exception of the descriptions of age in some of the tables and text that I had already alluded to, I think this paper is well written. One thing I did notice however, is a couple of places where a singular verb was used with the plural noun "data"; as in "Data is…". It should be "data are", or another corresponding plural verb. A few times the authors got that correct, so it stood out for the times it was incorrect.

I also wasn't sure where to address this, so I am putting it in here. On the page of the "creation of airport buffer layer", I think the whole perimeter buffer allows for a graded assessment of risk, with those in the ends of the buffer being at highest risk, but those along the mid side of the perimeter also at risk, just less than the ends of the runway. However, it was not clear to me why the authors would use one of these buffers sometimes, and the other buffer other times.

Another issue, and again, I apologize that it is tacked on at the end, but I noticed this towards the end of my review in the discussion of weaknesses. I think the use of the center line of the runway only, with the buffer drawn around the center line is too narrow. I think the buffer should be around the rectangle of the runway.

PEER REVIEW COMMENTS FROM

George D. Thurston, Sc.D.

External Peer Review Comments on Draft Report, "National Analysis of the Populations Residing Near or Attending School Near U.S. Airports"

Responses to Charge Questions from Dr. George D. Thurston

1. **Are the databases used in this analysis appropriate for the analysis conducted? Are you aware of additional databases that EPA should consider in order to supplement or further refine the analysis?**

The databases used are appropriate to their application, but I would think that the additional consideration of airport wind rose data layer files (e.g., from data provided by NOAA or FAA for specific airports) would allow a consideration of the predominant wind direction in assessing the affected perimeter around each airport. As it is, the buffer distance is assumed constant in all directions, but published papers indicate that the emissions reach further in the downwind direction, vs. upwind or crosswind (e.g., Carr et al, Atmospheric Environment 45 (2011) 5795-5804). Since we are considering seasonal averages in this case, the long-term wind rose information would seem very relevant to defining the proper buffer distance (i.e., further in the predominantly downwind direction), if it could be incorporated into the definition of the buffer distance.

2. **Is the description of analytic methods and procedures clear? Do they provide enough detail to allow the reader to understand the steps taken and assumptions made by EPA in developing the runway layers, population layers and educational facility layers and the intersection analyses?**

The description of the analytical methods is logical, quite clear, and well presented.

3. **Many runways for which runway buffers were developed (categories II through VII) are not in FAA's shapefile data.**
   - **Are the assumptions used in this analysis (along with the FAA facility-level data) appropriate and reasonable for generating runway geospatial data?**
   - **Please provide a separate response for each of the categories II through VII described in the report.**
   - **Please suggest alternative sets of assumptions that might lead to more reasonable or accurate development of layers for EPA's use in this analysis, if possible.**

Overall, the described approach presented is a plausible and efficient use of the data available for each of the Categories II through VII described in the report. However, the specific choices made are not always well enough documented, and more uncertainty analyses are needed in some cases. Importantly, the original key choice of 500 meters as the airport buffer distance is not well enough validated. As noted above, it would seem a variable distance, based on wind direction, might be more appropriate. (Also, the uncertainty analysis should have evaluated this specific choice for effect on the population size and characteristics. How different a result would come from an alternate choice of 250m or 1000m, for example?)

Regarding the specific categories, Category II airports had FAA 5010 runway reports available, which include latitude and longitude coordinates for both the runway base and reciprocal ends, providing appropriate means for estimating a buffer around runway line. Category III's FAA 5010 runway report had latitude/longitude coordinates for either the runway base or reciprocal end (not both), but the use of runway

length, the available runway end coordinates, and the magnetic heading of the runway to calculate the latitude/longitude coordinates of the opposite runway end still seems adequate (especially since this category only included < .02% of facilities, and some .01% of estimated affected population, so the effect of any uncertainties introduced would be very small on the estimated population estimates). Given the percentages of population potentially affected by each category, Category IV is a most critical category to address appropriately (accounting for some 37% of facilities considered, and 42% of the estimated affected population). Although these are airports with FAA 5010 runway reports lacking latitude and longitude coordinates for both the runway base and reciprocal ends, they have only one runway, so the use of runway length, facility centroid coordinates, and the magnetic heading of the runway are appropriate to calculate the latitude/longitude coordinates of both runway ends. Category V only had centroid coordinate, along with the runway width and length, to used to calculate the four coordinate pairs of the rectangle representing the runway, but this was only 0.2% of facilities (and 1% of estimated population) to be considered, so any uncertainties introduced by this approach would not be significant. Category VI facilities are multi-runway facilities with no runway specific coordinates, so the facility centroid coordinates were employed, but with a larger buffer. However, runway direction is not known, and this could introduce significant error. Since this category accounts for some 8% of facilities and 7% of the estimated affected population, it should get more attention in the uncertainty analysis, perhaps using various runway directions to come up with a variety of possible answers to provide an assessment of possible range in estimates. Lastly, Category VII (heliports) utilized centroid coordinates to estimate the buffer, which is appropriate for this type of facility (i.e., without runways).

4. EPA's conclusions about the number of people who live near airports and heliports include uncertainties.

- **Has EPA properly and sufficiently described the uncertainties in the approach they used?**
- **Please provide your opinion on the use of the method described in this paper to estimate populations living near airport facilities and whether the method sufficiently captures the relevant population.**
- **Please comment on other approaches for estimating this population including use of the dasymetric method population data.**

As noted in the report, for methods II, III and IV, the data provided in the 5010 airport data report and 5010 runway data report were assumed to provide an accurate record of the data elements needed to draw the runway line. It is asserted that the uncertainty in the creation of these runway layers is limited to the accuracy of the data provided to FAA for runway length, base and/or reciprocal end coordinates, airport centroid coordinates, and magnetic heading. While these might well be expected to be small compared to the overall estimates, the potential effects of these uncertainties are not quantified. It would be desirable for the report to conduct an uncertainty analysis to quantify how large these errors might actually be. One method to come up with such an uncertainty estimate might be to employ the Category I facilities (for which complete information is available), and apply only the portion of the data used in Methods II through IV to those same facilities, and then determine how different the population estimates are for those facilities vs. the original Category I method population estimates, to give estimates of the potential uncertainties introduced in the Category II though IV facility population estimates.

In my opinion, the proposed methods may not sufficiently capture the relevant population. As noted above, it does not consider wind direction prevalence at each facility. In addition, the choice of 500m for a buffer is

not well enough documented, and the affected zone may be larger. For example, results in Figure 4 of Steve et al. (Atmospheric Environment 67 (2013) 184-192) suggest effects potentially ranging much further downwind of such facilities. Also, quantitative uncertainty analyses should include estimates of the uncertainty introduced by the choice of a buffer distance by trying various buffer distances and comparing estimates of the affected population size for each Category. However, the approach of including any census block intercepted by the buffer zone does seem appropriate, given the comparison presented using the dasymetric method population data.

5. EPA's conclusions about the number of children who attend educational facilities near airports include limitations.

- **Has EPA properly and sufficiently addressed the potential uncertainties in the approach used in the analysis?**

As noted in the report, school campuses have multiple sports fields and/or playground areas that can cover large areas of land. The results of the school population analyses are therefore subject to uncertainty, since inclusion of a school facility is dependent on where the school coordinates fall within the school's actual campus. However, no estimate is provided as to how large this uncertainty might be, relative to other potential sources of uncertainty. Assuming a typical range of the potential sizes of such facilities and surrounding properties, it would be possible to come up with a range in the school property coordinates considered by multiple model runs with randomly varying coordinates for each facility, potentially allowing an estimate to be made of the associated uncertainty in the population estimate.

6. Please provide any additional comments you feel would improve the report/analysis.

While the report provides a useful analysis of the potentially affected population, its assumptions (e.g., buffer distance) need to be better documented, and the uncertainties and possible range of the true exposure population size from this report's estimates are not sufficiently quantified.

Appendix A: Peer Reviewer Resumes

CURRICULUM VITAE

12/20/2013

NAME: Francine Laden

ADDRESS: Channing Laboratory, 181 Longwood Avenue, Boston MA 02115

EDUCATION:

1988	Biology	A.B.	Princeton University
1993	Environmental Health Management	M.S.	Harvard School of Public Health
1998	Epidemiology	Sc.D.	Harvard School of Public Health

POSTDOCTORAL TRAINING:

Date	Field of Research	Place	Institution
1998-2000	Medicine, Environmental Epidemiology	Channing Laboratory Department of Medicine	Brigham and Women's Hospital

ACADEMIC APPOINTMENTS:

Dates	Title	Department	Institution
2011-	Associate Professor	Medicine	Brigham and Women's Hospital, Harvard Medical School
2009-	Mark and Catherine Winkler Associate Professor	Environmental Health, Epidemiology	Harvard School of Public Health
2007-2009	Mark and Catherine Winkler Assistant Professor	Environmental Health, Epidemiology	Harvard School of Public Health
2004-2007	Assistant Professor	Environmental Health, Epidemiology	Harvard School of Public Health
2002-2011	Assistant Professor	Medicine	Brigham and Women's Hospital and Harvard Medical School
2000-2004	Research Associate	Environmental Health	Harvard School of Public Health
2000-2002	Instructor	Medicine	Brigham and Women's Hospital

HOSPITAL APPOINTMENTS:

Dates	Title	Hospital
2000-	Associate Epidemiologist Department of Medicine	Brigham and Women's Hospital

HONORS AND DISTINCTIONS:

2011	Alice Hamilton Lectureship, Harvard School of Public Health, Committee for Concerns of Women Faculty
2002	Flight Attendants Medical Research Institute Young Investigators Award
1994-1996	National Cancer Institute National Research Award in Cancer Epidemiology
1988-	Sigma Xi, National Scientific Honor Society, Associate Member

MAJOR PROFESSIONAL SERVICE:

Dates	Service
National	
2013-	Environmental Protection Agency Scientific Advisory Board
2012	Institute of Medicine of the National Academies Committee on Review of the Department of Labor's Site Exposure Matrix (SEM) Database
2009	Environmental Protection Agency Clean Air Scientific Advisory Committee, CO panel
2009-2010	Institute of Medicine of the National Academies Committee on Gulf War and Health: Health Effects of Serving in the Gulf War, Update 2009.
2007-2009	Member of the Environmental and Occupational Health (EOH) Program Committee, American Thoracic Society
2007-2009	National Research Council (NRC) Committee on Contaminated Drinking Water at Camp Lejeune
2005-2006	Institute of Medicine of the National Academies Committee on Gulf War and Health: Review of the Medical Literature Relative to Gulf War Veterans' Health
International	
2013	Member of the Working Group for IARC Monographs volume 109; Ambient Air pollution
2013	President Elect, International Society of Environmental Epidemiology (ISEE)
2011	National Institute of Health (NIH) and Chinese Academy of Sciences (CAS) Joint Workshop on Environmental Pollution and Cancer in China and the U.S.
2007-2010	Secretary Treasurer, International Society of Environmental Epidemiology (ISEE)

PROFESSIONAL SOCIETIES:

2007-2009	American Thoracic Society (EOH Program Committee Member)
2003-	Harvard/Dana Farber Cancer Center
1998-	International Society for Environmental Epidemiology (Secretary/Treasurer 2007-2010:President Elect 2013)
1993-	Society for Epidemiologic Research

OTHER PUBLIC SERVICE:

2013	Scientific Reviewer, National Institute of Environmental Health Sciences Career Award Applications
2012-	Expert Member, VA Cooperative Study #595: Respiratory Health and Deployment to Iraq and Afghanistan Planning Committee; VA Cooperative Study Program, Epidemiology and Population Genomics Program
2011	Scientific Reviewer, National Institute of Environmental Health Sciences Environmental Health Sciences Review Committee EHS(P3), NIH
2011, 2012	Scientific Reviewer, Environment and Health Fund, Israel
2010	Scientific Reviewer, the Congressionally Directed Medical Research Programs (CDMRP) Review Committee
2010, 2011	Scientific Reviewer, CBCRP Environmental Exposures Cohort Review, California Breast Cancer Research Program
2010	Scientific Reviewer for NIH Neurological, Aging and Musculoskeletal Epidemiology (NAME) Grant Panel
2008, 2010	Scientific Reviewer EPA STAR Research Grant Peer Review Panel
2007	Scientific Reviewer for the NICHD "National Children's Study" – East Coast Review
2006, 2008, 2010	Scientist Reviewer of grants and progress reports for the Flight Attendants Medical Research Institute (FARMI)
2006	Scientist Reviewer for the NIOSH NORA Peer Review
2004	External reviewer for Institute of Medicine's report "Gulf War and Health Phase III"
2003	Workshop on Breast Cancer and the Environment, Department of Health and Human Services, Office on Women's Health, Washington, DC
2002	International Summit on Breast Cancer the Environment. Santa Cruz, CA
2000	National Breast Cancer Coalition (NBCC) Environmental Advisory Board

DEPARTMENT AND SCHOOL SERVICE:

2012-	Faculty Council, Harvard School of Public Health
2012-	Chair, Curriculum Committee, Department of Environmental Health
2008-	Curriculum Committee, Department of Environmental Health
2007	Population Sciences Allston Committee
2004-2011	Training Committee, Exposure, Epidemiology and Risk Program, Department of Environmental Health

EDITORIAL BOARDS:

2010-	Environmental Health Perspectives, Associate Editor
2008-2010	Environmental Health Perspectives, Editorial Review Board
2007-	Cancer, Causes and Control, Associate Editor
2005-	Journal of Women's Health, Ad Hoc Reviewer
2004-	Journal of the National Cancer Institute, Ad Hoc Reviewer
2003-	American Industrial Hygiene Journal, Ad Hoc Reviewer
2003-	Clinical Chemistry, Ad Hoc Reviewer
2001-	American Journal of Epidemiology, Ad Hoc Reviewer
2001-	Epidemiology, Ad Hoc Reviewer
2001-	Journal of Environmental Epidemiology and Exposure Assessment, Ad Hoc Reviewer
2001-	Oncology Research, Ad Hoc Reviewer
2000-	Journal of the Air & Waste Management Association, Ad Hoc Reviewer
1999-	Cancer, Epidemiology, Biomarkers and Prevention, Ad Hoc Reviewer
1999-	International Journal of Epidemiology, Ad Hoc Reviewer
1999-	Annals of Epidemiology, Ad Hoc Reviewer
1998-	Environmental Health Perspectives, Ad Hoc Reviewer
1998-	Cancer, Causes and Control, Ad Hoc Reviewer

MAJOR RESEARCH INTERESTS:

Environmental risk factors of chronic diseases, including cancer, cardiovascular and respiratory diseases. Specific interests in exposure assessment and epidemiology of air pollution and factors influencing the geographic variation of risk (e.g. the built environment).

Exploratory analyses of modification of inflammatory response to vehicle exhaust in a population of trucking industry workers.

RESEARCH SUPPORT (PI or Co-PI):

Years	Funding Source	PI/or Co-PI	Grant Title
Past Funding			
2009-2010	Harvard Catalyst NIH UL1 RR025758-01	Co-PI	The effect of air pollution on morbidity and mortality in end-stage renal disease
2007-2008	NIEHS Center Pilot Project Grant	PI	Exploratory analyses of modification of inflammatory response to vehicle exhaust in a Population of trucking industry workers
2003-2009	NCI R01 CA98122	PI	Exposure to organochlorines, EBV, and the risk of NHL
2003-2008	EPA R83-0545-010	PI	Chronic exposure to particulate matter and cardiopulmonary disease
2002-2008	FAMRI (Flight Attendants Medical Research Institute)	PI	SHS exposure and health in a blue-collar population
Current Funding			
2013-2015	Susan J Komen For the Cure	Co-PI	Environmental Exposures, Early Proliferative Changes and Breast Cancer Risk
2013-2014	NIEHS Center Pilot Project Grant	PI	Metabolomics to Identify Novel Biomarkers of Exposure to Traffic Exhaust
2009-2014	NIEHS R01 ES017017	PI	Diet, Physical Activity, and the Relationship Between Air Pollution and CVD
2008-2014	NIEHS R01 ES016284,	PI	Biomarkers of Exposure and Effect in a Traffic Exposed Population

TEACHING EXPERIENCE:

Date	Title	Institution	Experience
2006-2013	Environmental Exposure, Epidemiology and Risk Practicum	Harvard School of Public Health	Course Instructor
2005-2013	Environmental and Occupational Epidemiology, spring	Harvard School of Public Health	Course Instructor
2004-2013	Environmental and Occupational Epidemiology, summer	Harvard School of Public Health	Course Instructor
2006	Epidemiology of Environment and Occupational Health Regulations	Harvard School of Public Health	Course Lecturer

2005	Applied Biomarkers in Cancer Epidemiology	Harvard School of Public Health	Course Lecturer
2001-2004	Environmental and Occupational Epidemiology, spring	Harvard School of Public Health	Course Lecturer
1999-2012	Epidemiology of Cancer	Harvard School of Public Health	Course Lecturer
1998, 2003- 2006 2010- 2012	Cancer Prevention	Harvard School of Public Health	Course Lecturer
1998, 2000	Environmental and Occupational Epidemiology, summer	Harvard School of Public Health	Course Lecturer
1995-1996	Environmental and Occupational Epidemiology, spring	Harvard School of Public Health	Teaching Assistant
1993-1995	Introduction to Epidemiology	Harvard School of Public Health	Teaching Assistant
1992-1994	Advance Seminar Program of the Master of Public Health Program	Harvard School of Public Health	Teaching Assistant
2007, 2011-2012	Critical Thinking on Issues of Env. And Public Health	Harvard Extension School	Lecturer
1995-1997	Introduction to Epidemiology	Harvard Extension School	Teaching Assistant
2000-2005, 2010-2013	Analyzing Risk: Science, Assessment and Management	Harvard Center for Risk Analysis	Course Lecturer
2000-2003	Critical Reading of the Medical Literature	Harvard Medical School	Tutor

ADVISING/MENTORING:

	Name	Department/Program
Postdoctoral Fellows		
Completed	Nitin Jain	Channing Laboratory
	Sharon Sagiv	OH Program, Environmental Health
	Robin Puett	EER Program, Environmental Health
	Jaime Hart	EER Program, Environmental Health
	Natalia Palacios	Department of Nutrition
Current	Peter James	Department of Epidemiology
Thesis Research Advisor		
Completed	Shakira Franco Suglia	Departments of Environmental Health and Epidemiology
	Jaime Hart	EER Program, Environmental Health

	Yueh-Hsiu Chiu	EER Program, Environmental Health
	Kimberly Bertrand	Department of Epidemiology
	Peter James	Departments of Environmental Health and Epidemiology
	Andreas Neophytou	Departments of Environmental Health and Epidemiology
Current	Erica Walker	EER Program, Environmental Health
	Rachel Banay	EER Program, Environmental Health
	Feiby Nassan	EER Program, Environmental Health

Thesis Advisory Committees

Completed	Lisa Baxter	EER Program, Environmental Health
	Nicole Middaugh	Epidemiology

Oral Examination Committees

Completed	Lisas Baxter	EER Program, Environmental Health
	Melanie Pickett	EER Program, Environmental Health
	Jennifer Nguyen	EER Program, Environmental Health
	Marie-Abele Bine	EER Program, Environmental Health
	Nicole Middaugh	Epidemiology
	Mi-hye Lee	EER Program, Environmental Health
	Ryan Seals	EOME Program, Environmental Health

Masters students

Completed	Yueh-Hsiu Chiu	EER Program, Environmental Health
	David Powers	EER Program, Environmental Health
	Eric Apeagyei	EER Program, Environmental Health
	Ceren Barlas	EER Program, Environmental Health
	Nancy Diao	EER Program, Environmental Health
	Matthew Grespin	EER Program, Environmental Health
	Amelia Geggel	EER Program, Environmental Health
Current	Kelsey Gleason	EER Program, Environmental Health
	Ana Sandoval	EER Program, Environmental Health
	Jina Kim	EER Program, Environmental Health

INVITED PRESENTATIONS:

2013 "Chronic Exposure to Fine Particles and Lung Cancer"/Presenter
Scientific Symposium: Links Between Environmental and Occupational Particles in Neoplasia, American Thoracic Society Annual Meeting, Philadelphia PA

2012 "Place Matters: Best Practices for Measuring the Built Environment and Assessing Neighborhood Characteristics"/Co-Presenter
Harvard Catalyst, Gene-Environment and Disparities Workshop, Boston MA

2012 "Air Pollution and Built Environment: How Where You Live Affects Your Health" / Presenter, Frontiers in Spatial Epidemiology: International Symposium, Imperial College, London

2012 "Built Environment and Obesity and Physical Activity"/Presenter
Annual Conference: Harvard Trans disciplinary Research in Energetics and Cancer Center, Boston MA

2011 "Environmental Risk Factors and Breast Cancer: Examples from the Nurses' Health Study"/Presenter, Cancer and Environmental Exposures, International Symposium December 12, 2011, Paris France; The French Agency for Food, Environmental and Occupational Health & Safety (ANSES) and the French National Cancer Institute (INCa)

2011 "Walkability and Access to Healthy Food"/ Presenter
Workshop: Conceptualizing Gene-Environment Interactions in Obesity Research: Complex Pathways to Health Disparities, Harvard/MGH Center on Genomics, Vulnerable Populations, and Health Disparities. Boston MA

2011 "Location, Location, Location: Where You Live in the US Affects Your Health" / Presenter, Neighborhood Effects on Health: Is the Grass Healthier on the Other Side? The Porter School of Environmental Studies, The School of Public Health, Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv Israel

2011 "Environmental Health Policy: The Case of Air Pollution and Morbidity/Mortality"
Environmental Pollution Respects No Boundaries, Van Leer Jerusalem Institute, Jerusalem, Israel

2011 "Challenges and Opportunities in Environmental Epidemiology of Cancer"
The Haifa Bay Municipal Association for Environmental Protection, Haifa, Israel

2011 "Organochlorines and Cancer", Brown University, Providence RI

2010 "Challenges and Opportunities in Environmental Epidemiology of Cancer"
National Institute of Health (NIH) and Chinese Academy of Sciences (CAS) Joint Workshop on Environmental Pollution and Cancer in China and the U.S, Guangzhou China

2007 "Challenges and Opportunities in Environmental Epidemiology of Cancer"
National Cancer Institute, National Institutes of Health. Washington D.C.

2006 2006 "Update of Harvard Six Cities Study"
Air & Waste Management Association Annual Conference, New Orleans LA

2003 "Air Pollution and Health in Prospective Cohort Studies"
Proceedings of the Society (Proc Soc), Channing Laboratory, Boston MA

2001 Organizer and chair of session at ISEA annual meeting: Source Apportionment of Particulate Matter and its Application to Health Studies, Charleston SC

2001 "Further Analyses of Mortality and Air Pollution in the Harvard Six Cities Study" Division of Preventive Medicine, University of Southern California Medical School, Los Angelos CA

2001 "Fine Particles and Risk: Is Diesel Different?" World Truck Conference, California Trucking Association, Monterey CA

2000 "Organochlorines and Breast Cancer" Department of Epidemiology, School of Public Health, University of North Carolina, Chapel Hill NC

1999 "Environment and Cancer" Beta Omicron Chapter of Sigma Theta Tau International and The Medical College of Georgia School of Nursing, Augusta GA

1999 "Organochlorines and Breast Cancer", Harvard Center for Cancer Prevention, Boston MA

1999 "DDE, PCBs and Breast Cancer", Harvard Symposium on Persistent Organic Pollutants (POPs) Boston MA

1997 "The Environment and Breast Cancer", The Nurses' Health Study Twentieth Anniversary - Update on Women' Health, Boston MA

1997 "Environment and Cancer", Massachusetts Department of Public Health, Boston MA

BIBLIOGRAPHY

PEER-REVIEWED PUBLICATIONS

1. **Laden F**, Wolff MS, Niguidula NJ, Spiegelman D, Hankinson SE, Hunter DJ. Reduced aliquot size for a plasma organochlorine assay for use in epidemiological studies. Cancer Epidemiology Biomarkers Prev 1997 May; 6(5):333-8. PMID: 9149893.

2. **Laden F**, Spiegelman D, Neas LM, Colditz GA, Hankinson SE, Manson JE, Byrne C, Rosner BA, Speizer FE, Hunter DJ. Geographic variation in breast cancer incidence rates in a cohort of U.S. women. J Nat'l Cancer Inst 1997 Sept 17;89:1373-8. PMID: 9308708.

3. Hunter DJ, Hankinson S, **Laden F**, Colditz GA, Manson JE, Willett WC, Speizer FE, Wolff MS. Plasma organochlorine levels and the risk of breast cancer. N Engl J Med 1997 Oct 30;337:1253-8. PMID: 9345073.

4. **Laden F**, Neas LM, Spiegelman D, Hankinson SE, Willett WC, Ireland K, Wolff MS, Hunter DJ. Predictors of plasma concentrations of DDE and PCBs in a group of U.S. women. Environ Health Perspect 1999 Jan;107:75-81. PMCID: PMC1566315. PMID: 9872720.

5. **Laden F**, Neas LM, Tolbert PE, Holmes MD, Hankinson SE, Spiegelman D, Speizer FE, Hunter DJ. Electric blanket use and breast cancer in the Nurses' Health Study. Amer J Epidemiol 2000 Jul 1;52:41-49. PMID: 10901328.

6. **Laden F**, Neas LM, Dockery DW, Schwartz J. Association of fine particulate matter from different sources with daily mortality in six U.S. cities. Environ Health Perspect. 2000 Oct;108(10):941-7. PMCID: PMC1240126. PMID: 11049813.

7. **Laden F**, Hankinson SE, Wolff MS, Colditz GA, Willett WC, Speizer FE, Hunter DJ. Plasma organochlorine levels and the risk of breast cancer: an extended follow-up in the Nurses' Health Study. Int J Cancer 2001 Feb 15;91:568-574. PMID: 11251983.

8. **Laden F**, Collman G, Iwamoto K, Alberg, AJ, Berkowitz GS, Freudenheim JL, Hankinson SE, Helzlsouer KJ, Holford TR, Huang H-Y, Moysich KB, Tessari JD, Wolff MS, Zheng T, Hunter DJ. 1,1-Dichloro-2,2-bis(*p*-chlorophenyl)ethylene and polychlorinated biphenyls and breast cancer: combined analysis of five U.S. studies. J Natl Cancer Inst 2001 May 16;93:768-776. PMID:11353787.

9. Schernhammer ES, **Laden F**, Speizer FE, Willett WC, Kawachi I, Hunter DJ, Colditz GA. Rotating night shifts and risk of breast cancer in women participating in the Nurses' Health Study. J Natl Cancer Inst 2001 Oct 17;93(20):1563-8. PMID: 11604480.

10. Garshick E, Smith TJ, **Laden F**. Quantitative assessment of lung cancer risk from diesel exhaust exposure in the US trucking industry: A feasibility study. In Diesel Epidemiology Working Group. 2002. Research Directions to Improve Estimates of Human Exposure and Risk from Diesel Exhaust. Health Effects Institute, Boston MA.

11. Schwartz J, **Laden F**, Zanobetti A. The concentration-response relation between PM(2.5) and daily deaths. Environ Health Perspect 2002 Oct;110(10):1025-9. PMCID: PMC1241029. PMID: 12361928.

12. **Laden F**, Ishibe N, Hankinson SE, Wolff MS, Gertig DM, Hunter DJ, Kelsey KT. Polychlorinated Biphenyls, Cytochrome P450 1A1, and Breast Cancer Risk in the Nurses' Health Study. Cancer Epidemiol Biomarkers Prev 2002 Dec;11:1560-1565. PMID: 12496044.

13. Schernhammer ES, **Laden F**, Speizer FE, Willett WC, Hunter DJ, Kawachi I, Colditz GA. Night-shift work and risk of colorectal cancer in the Nurses' Health Study. J Natl Cancer Inst 2003 Jun 4;95(11):825-8. PMID: 12783938.

14. Garshick E, **Laden F**, Hart JE, Caron AM. Residence near a major road and respiratory symptoms in U.S. Veterans. Epidemiology. 2003 Nov; 14(6):728-36. PMCID: PMC1242012. PMID: 14569190.

15. Schernhammer ES, Rosner B, Willett WC, **Laden F**, Colditz GA, Hankinson SE. Epidemiology of urinary melatonin in women and its relation to other hormones and night work. Cancer Epidemiol Biomarkers Prev. 2004 Jun;13(6):936-43. PMID: 15184249.

16. Quintana PJ, Delfino RJ, Korrick S, Ziogas A, Kutz FW, Jones EL, **Laden F**, Garshick E. Adipose tissue levels of organochlorine pesticides and polychlorinated biphenyls and risk

of non-Hodgkin's lymphoma. Environ Health Perspect 2004 Jun;112(8):854-61. PMCID: PMC1242012. PMID: 15175172.

17. Lee ML, Whitmore GA, **Laden F**, Hart JE, Garshick E. Assessing lung cancer risk in railroad workers using a first hitting time regression model. Environmetrics. 2004 Aug;15(5):501-512. PMCID: PMC1473034. PMID: 16741563.

18. Garshick E, **Laden F**, Hart JE, Moy ML. Respiratory symptoms and intensity of occupational dust exposure. Inter Arch Occup Environ Health. 2004 Oct; 77(7):515-20. PMCID: PMC1896318. PMID: 15368060.

19. Garshick E, **Laden F**, Hart JE, Rosner B, Smith TJ, Dockery DW, Speizer FE. Lung cancer in railroad workers exposed to diesel exhaust. Environ Health Perspect. 2004 Nov; 112(15):1539-43. PMCID: PMC1247618. PMID: 15531439.

20. Jain NB, **Laden F**, Guller U, Shankar A, Kazani S, and Garshick E. Relation between blood lead levels and childhood anemia in India. Amer J Epidem 2005 May 15; 161(10):968-73. PMID: 15870161.

21. Thurston GD, Kazuhiko I, Mar T, Christensen WF, Eatough DJ, Henry RC, Kim E, **Laden F**, Lall R, Larson TV, Liu H, Neas L, Pinto J, Stolzel M, Suh H, Hopke PK. Workgroup report: Workshop on source apportionment of particulate matter health effects--intercomparison of results and implications. Environ Health Perspect 2005 Dec;113:1768-1774. PMCID: PMC1314918. PMID: 16330361.

22. Schernhammer ES, Kroenke CH, **Laden F**, Hankinson SE. Night work and risk of breast cancer. Epidemiology. 2006 Jan;17(1):108-11. PMID: 16357603.

23. **Laden F**, Schwartz J, Speizer FE, Dockery DW. Reduction in fine particulate air pollution and mortality: Extended follow-up of the Harvard Six Cities study. Am J Respir Crit Care Med. 2006 Mar 15;173(6):667-72. PMCID: PMC2662950. PMID: 16424447.

24. Hopke PK, Ito K, Mar T, Christensen WF, Eatough DJ, Henry RC, Kim E, **Laden F**, Lall R, Larson TV, Liu H, Neas L, Pinto J, Stolzel M, Suh H, Paatero P, Thurston GD. PM source apportionment and health effects: 1. Intercomparison of source apportionment results. J Expo Sci Environ Epidemiol. 2006 May;16(3):275-86. PMID: 16249798.

25. Ito K, Christensen WF, Eatough DJ, Henry RC, Kim E, **Laden F**, Lall R, Larson TV, Neas L, Hopke PK, Thurston GD. PM source apportionment and health effects: 2. An investigation of intermethod variability in associations between source-apportioned fine particle mass and daily mortality in Washington, DC. J Expo Sci Environ Epidemiol 2006 Jul;16(4):300-10. PMID: 16304602.

26. Mar TF, Ito K, Koenig JQ, Larson TV, Eatough DJ, Henry RC, Kim E, **Laden F**, Lall R, Neas L, Stolzel M, Paatero P, Hopke PK, Thurston GD. PM source apportionment and health effects. 3. Investigation of inter-method variations in associations between estimated

source contributions of PM2.5 and daily mortality in Phoenix, AZ. J Expo Sci Environ Epidemiol. 2006 Jul;16(4):311-20. PMID: 16288316.

27. Hart JE, **Laden F**, Schenker MB, Garshick E. Chronic obstructive pulmonary disease mortality in diesel-exposed railroad workers. Environ Health Perspect 2006 Jul;114(7):1013-7. PMCID: PMC1513327. PMID: 16835052.

28. Davis ME, Smith TJ, **Laden F**, Hart JE, Ryan LM, Garshick E. Modeling Particle Exposure in US Trucking Terminals. Environ Sci Technol. 2006 Jul 1;40(13):4226-32. PMCID: PMC1995567. PMID: 16856739.

29. Smith TJ, Davis ME, Reaser P, Natkin J, Hart JE, **Laden F**, Heff A, Garshick E. Overview of particulate exposures in the US trucking industry. J Environ Monit. 2006 Jul;8(7):711-20. PMCID: PMC1899154. PMID: 16826284.

30. **Laden F**, Hart JE, Eschenroeder A, Smith TJ, Garshick E. Historical estimation of diesel exhaust exposure in a cohort study of railroad workers and lung cancer. Cancer Causes and Control. 2006 Sep;17(7):911-9. PMCID: PMC1550353. PMID: 16841258.

31. Garshick E, **Laden F**, Hart JE, Smith TJ, Rosner B. Smoking imputation and lung cancer in railroad workers exposed to diesel exhaust. Am J Ind Med. 2006 Sep;49(9):709-18. PMCID: PMC1945043. PMID: 16767725.

32. Jain NB, Hart JE, Smith TJ, Garshick E, **Laden F**. Smoking behavior in trucking industry workers. Am J Ind Med. 2006 Dec;49(12):1013-20. PMCID: PMC1945044. PMID: 17096359.

33. Garcia R, Hart JE, Davis ME, Reaser P, Natkin J, **Laden F**, Garshick E, Smith TJ. Effects of wind on background particle concentrations at truck freight terminals. J Occup Environ Hyg. 2007 Jan;4(1):36-48. PMCID: PMC2000817. PMID: 17162479.

34. Engel LS, **Laden F**, Andersen A, Strickland PT, Blair A, Needham LL, Barr DB, Wolff MS, Helzlsouer K, Hunter DJ, Lan Q, Cantor KP, Comstock GW, Brock JW, Bush D, Rothman N. Polychlorinated biphenyl levels in peripheral blood and non-Hodgkin's lymphoma: a report from three cohorts. Cancer Res. 2007 Jun 1;67(11):5545-52. PMID: 17545638.

35. Baxter LK, Clougherty JE, **Laden F**, Levy JI. Predictors of concentrations of nitrogen dioxide, fine particulate matter, and particle constituents inside of lower socioeconomic status urban homes. J Expo Sci Environ Epidemiol. 2007 Aug;17(5):433-44. PMID: 17051138.

36. **Laden F**, Hart JE, Smith TJ, Davis ME, Garshick E. Cause-specific mortality in the unionized U.S. trucking industry. Environ Health Perspect 2007 Aug;115(8):1192-6. PMCID: PMC1940099. PMID: 17687446.

37. Davis ME, Blicharz AP, Hart JE, **Laden F**, Garshick E and Smith TJ. Occupational Exposure to Volatile Organic Compounds and Aldehydes in the US Trucking Industry. Environ Sci Technol. 2007 Oct 15; 41(20): 7152-58. PMCID: PMC2386139. PMID: 17993162.

38. Davis ME, Smith TJ, **Laden F**, Hart JE, Blicharz AP, Reaser, P, and E Garshick. Driver exposure to combustion particles in the US trucking industry. J Occup Environ Hyg. 2007 Nov; 4(11): 848-54. PMCID: PMC2292342. PMID: 17885912.

39. Schwartz J, Coull B, **Laden F**, Ryan L. 2007. The effect of dose and timing of dose on the association between airborne particles and survival. Environ Health Perspect. 2008, Jan;116(1):64-9. PMCID: PMC2199297. PMID: 18197301.

40. Suglia SF, Ryan L, **Laden F**, Dockery DW, Wright RJ. Violence Exposure, a Chronic Psychosocial Stressor, and Childhood Lung Function. Psychosom. Med. 2008 Feb;70(2):160-9. PMID: 18158365.

41. Qureshi, AA, **Laden F**, Colditz GA, Hunter DJ. Geographic Variation and Risk of Skin Cancer in US Women Differences Between Melanoma, Squamous Cell Carcinoma, and Basal Cell Carcinoma. Arch Intern Med. 2008 Mar 10;168(5):501-7. PMID: 18332296.

42. Sheesley RJ, Schauer JJ, Smith TJ, Garshick E, **Laden F**, Marr LC, Molina LT. Assessment of diesel particulate matter exposure in the workplace: freight terminals. J. Environ. Monit. 2008 Mar 10(3):305-14. PMCID: PMC2628448. PMID: 18392272.

43. Yanosky J, Paciorek C, Schwartz J, **Laden F**, Puett R, Suh H. Spatio-temporal modeling of chronic PM10 exposure for the Nurses' Health Study. Atmos Environ. 2008 June;42(18): 4047-4062. PMCID: PMC2705904. PMID: 19584946.

44. Costenbader KH, Chang SC, **Laden F**, Puett R, Karlson EW. Geographic Variation in Rheumatoid Arthritis Incidence among Women in the United States. Arch Intern Med. 2008 Aug 11;168(15):1664-70. PMCID: PMC2732358. PMID: 18695080.

45. Garshick E, **Laden F**, Hart JE, Rosner B, Davis ME, Eisen EA, Smith TJ. Lung cancer and vehicle exhaust in trucking industry workers. Environ Health Perspect. 2008 Oct; 116(10):1327-32. PMCID: PMC2569090. PMID: 18941573.

46. Puett RC, Schwartz J, Hart JE, Yanosky J, Speizer FE, Suh H, Paciorek C, Neas L, **Laden F**. Chronic particulate exposure, mortality, and coronary heart disease in the Nurses' Health Study. Am J Epidemiol. 2008 Nov 15;168(10):1161-8. PMCID: PMC2732957. PMID:18835862.

47. Lee ML, Whitmore GA, **Laden F**, Hart JE, Garshick E. A Case-Control Study Relating Railroad Worker Mortality to Diesel Exhaust Exposure Using a Threshold Regression Model. J Stat Plan Inference. 2009; 139(5):1633-1642. PMCID: PMC2642623. PMID: 19221608.

48. Chiu YH, Hart JE, Smith TJ, Hammond SK, Garshick E, **Laden F**. Nicotine contamination in particulate matter sampling. Int. J. Environ. Res. Public Health. 2009 Feb; 6(2):601-7. PMCID: PMC2672355. PMID: 19440403.

49. Sobus JR, Waidyanatha S, McClean MD, Herrick RF, Smith TJ, Garshick E, **Laden F**, Hart JE, Zheng Y, Rappaport SM. Urinary naphthalene and phenanthrene as biomarkers of occupational exposure to polycyclic aromatic hydrocarbons. Occup Environ Med. 2009 Feb; 66(2):99-104. PMCID: PMC2633650. PMID: 19017700.

50. Sheesley RJ, Schauer JJ, Garshick E, **Laden F**, Smith TJ, Blicharz AP, Deminter JT. Tracking personal exposure to particulate diesel exhaust in a diesel freight terminal using organic tracer analysis. J Expo Sci Environ Epidemiol. 2009 Feb 19(2):172-86. PMCID: PMC2628448. PMID: 18322451.

51. Hart JE, **Laden F**, Eisen EA, Smith TJ, Garshick E. Chronic obstructive pulmonary disease mortality in railroad workers. Occup Environ Med. 2009 Apr; 66(4):221-6. PMCID: PMC2658724. PMID: 19039098.

52. Paciorek CJ, Yanosky JD, Puett RC, **Laden F**, Suh HH. Practical Large-Scale Spatio-Temporal Modeling of Particulate Matter Concentrations. Annals Appl Stats. 2009; 3(1): 370-397.

53. Davis ME, **Laden F**, Hart JE, Garshick E, Blicharz AP, Smith TJ. Predicting changes in PM exposure over time at US trucking terminals using structural equation modeling techniques. J Occup Environ Hyg. 2009 Jul; 6(7):396-403. PMCID: PMC2719815. PMID: 19367483.

54. Hart JE, **Laden F**, Puett RC, Costenbader KH, Karlson EW. Exposure to Traffic Pollution and Increased Risk of Rheumatoid Arthritis. Environ Health Perspect. 2009 Jul; 117(7): 1065-9. PMCID: PMC2717131. PMID: 19654914.

55. Puett RC, Hart JE, Yanosky JD, Schwartz J, Paciorek CJ, Suh H, Speizer FE, **Laden F**. Chronic Fine and Coarse Particulate Exposure, Mortality and Coronary Heart Disease in the Nurses' Health Study. Environ Health Perspect. 2009 Nov;117(11):1697-701. PMCID: PMC2801178. PMID: 20049120.

56. Hart JE, Yanosky JD, Puett RC, Ryan LM, Dockery DW, Smith TJ, Garshick E, **Laden F**. Spatial Modeling of PM10 and NO2 in the Continental US, 1985-2000. Environ Health Perspect. 2009 Nov;117(11):1690-6. PMCID: PMC2801201. PMID: 20049118.

57. Bertrand KA, Spiegelman D, Aster JC, Altshul LM, Korrick SA, Rodig SJ, Zhang SM, Kurth T, **Laden F**. Plasma organochlorine levels and risk of non-Hodgkin lymphoma in a cohort of men. Epidemiology. 2010; 21(2):172-180. PMCID: PMC2957873. PMID: 20087190.

58. Baxter LK, Wright RJ, Paciorek CJ, **Laden F**, Suh HH, Levy JI. Effects of exposure measurement error in the analysis of health effects from traffic-related air pollution. J Expo Sci Environ Epidemiol. 2010 Jan;20(1):101-11. PMID: 19223939.

59. Chiu YH, Hart JE, Spiegelman D, Garshick E, Smith TJ, Dockery DW, Hammond SK, **Laden F**. Workplace secondhand smoke exposure in the US trucking industry. Environmental Health Perspectives. 2010 Feb;118(2):216-21. PMCID: PMC2831920. PMID: 20123606.

60. Weisskopf MG, Knekt P, O'Reilly EJ, Lyytinen J, Reunanen A, **Laden F**, Altshul L, Ascherio A. Persistent organochlorine pesticides in serum and risk of Parkinson disease. Neurology. 2010 Mar 30;74(13):1055-61. PMCID: PMC2848105. PMID: 20350979.

61. Davis ME, **Laden F**, Hart JE, Garshick E, Smith TJ. Economic activity and trends in ambient air pollution. Environ Health Perspect. 2010 May;118(5):614-9. PMCID: PMC2866675. PMID: 20056563.

62. **Laden F**, Bertrand KA, Altshul L, Aster J, Korrick S, Sagiv SK. Plasma organochlorine levels and risk of non-Hodgkin lymphoma in the Nurses' Health Study. Cancer Epidemiol Biomarkers Prev. 2010 May;19(5):1381-4. PMCID: PMC2866053. PMID: 20406963.

63. Helzlsouer KJ; **VDPP Steering Committee**. Overview of the Cohort Consortium Vitamin D Pooling Project of Rarer Cancers. Am J Epidemiol. 2010 Jul 1;172(1):4-9. PMCID: PMC2892542.

64. Purdue MP, Freedman DM, Gapstur SM, Helzlsouer KJ, **Laden F**, Lim U, Maskarinec G, Rothman N, Shu X, Stevens VL, Zeleniuch-Jacquotte A, Albanes D, Bertrand K, Weinstein SJ, Yu K, Irish L, Horst RL, Hoffman Bolton J, Giovannucci EL, Kolonel LN, Snyder K, Willett W, Arslan AA, Hayes RB, Zheng W, Bing Xiang Y, Hartge P. Circulating 25-hydroxyvitamin D and Risk of non-Hodgkin Lymphoma: Cohort Consortium Vitamin D Pooling Project of Rarer Cancers. Am J Epidemiol. 2010 Jul 1;172(1):58-69. PMCID: PMC2892540. PMID: 20562184.

65. Gallicchio L, Helzlsouer KJ, Chow W-H, Freedman DM, Hankinson SE, Hartge P, Hartmuller V, Harvey C, Hayes RB, Horst RL, Koenig KL, Kolonel LN, **Laden F**, McCullough ML, Parisi D, Purdue MP, Shu X, Snyder K, Stolzenberg-Solomon RZ, Tworoger SS, Varanasi A, Virtamo J, Wilkens LR, Xiang Y, Yu K, Zeleniuch-Jacquotte A, Zheng W, Abnet CC, Albanes D, Bertrand K, Weinstein SJ. Circulating 25-hydroxyvitamin D and the Risk of Rarer Cancers: Design and Methods of the Cohort Consortium Vitamin D Pooling Project of Rarer Cancers. Am J Epidemiol. 2010 Jul 1;172(1):10-20. PMCID: PMC2892539. PMID: 20562188.

66. McCullough ML, Weinstein SJ, Freedman DM, Helzlsouer K, Flanders WD, Koenig K, Kolonel L, **Laden F**, Le Marchand L, Purdue M, Snyder K, Stevens VL, Stolzenberg-Solomon R, Virtamo J, Yang G, Yu K, Zheng W, Albanes D, Ashby J, Bertrand K, Cai H, Chen Y, Gallicchio L, Giovannucci E, Jacobs EJ, Hankinson SE, Hartge P, Hartmuller V, Harvey C, Hayes RB, Horst R, Shu X. Correlates of circulating 25-hydroxyvitamin D:

Cohort Consortium Vitamin D Pooling Project of Rarer Cancers. Am J Epidemiol. 2010 Jul 1;172(1):21-35. PMCID: PMC2892536. PMID: 20562191.

67. Vieira VM, Hart JE, Webster TF, Weinberg J, Puett R, **Laden F**, Costenbader KH, Karlson EW. Association between Residences in U.S. Northern Latitudes and Rheumatoid Arthritis: A Spatial Analysis of the Nurses' Health Study. Environ Health Perspect. 2010 Jul;118(7):957-61. PMCID: PMC2920915. PMID: 20338859.

68. Kim D, Masyn KE, Kawachi I, **Laden F**, Colditz GA. Neighborhood socioeconomic status and behavioral pathways to risks of colon and rectal cancer in women. Cancer. 2010 Sep 1;116(17):4187-96. PMCID: PMC2962923. PMID: 20544839.

69. Abel GA, Bertrand KA, Earle CC, **Laden F**. Outcomes for lymphoid malignancies in the Nurses' Health Study (NHS) as compared to the Surveillance, Epidemiology and End Results (SEER) Program. Hematol Oncol. 2010 Sep;28(3):133-6. PMCID: PMC2946462. PMID: 19866451.

70. Bertrand KA, Birmann BM, Chang ET, Spiegelman D, Aster JC, Zhang SM, **Laden F.** A prospective study of Epstein-Barr virus antibodies and risk of non-Hodgkin lymphoma. Blood 2010 Nov 4;116(18):3547-53. PMCID: PMC2981477. PMID: 20647565.

71. Hart JE, Garshick E, Dockery DW, Smith TJ, Ryan LM, **Laden F**. Long-term ambient multipollutant exposures and mortality. Am J Respir Crit Care Med. 2011 Jan;183(1): 73–8. PMCID: PMC3040395. PMID: 20656944.

72. Puett RC, Hart JE, Schwartz J, Hu FB, Liese AD, **Laden F**. Are Particulate Matter Exposures Associated with Risk of Type 2 Diabetes? Environ Health Perspect. 2011 Mar;119(3):384-9. PMCID: PMC3060003. PMID: 21118784.

73. Davis ME, Hart JE, **Laden F**, Garshick E, Smith TJ. A retrospective assessment of occupational exposure to elemental carbon in the US trucking industry. Environ Health Perspect. 2011 Jul;119(7):997-1002. PMCID: PMC3222985. PMID: 21447452.

74. Puett RC, Hart JE, Suh H, Mittleman M, **Laden F**. Particulate matter exposures, mortality, and cardiovascular disease in the Health Professionals Follow-up Study. Environ Health Perspect. 2011 Aug;119(8):1130–5. PMCID: PMC3237347. PMID: 21454146.

75. Chiu YH, Spiegelman D, Dockery DW, Garshick E, Hammond SK, Smith TJ, Hart JE, **Laden F**. Secondhand Smoke Exposure and Inflammatory Markers in Non-smokers in the Trucking Industry. Environ Health Perspect. 2011 Sep;119(9):1294-300. PMCID: PMC3230397. PMID: 21628108.

76. Troped PJ, Tamura K, Whitcomb H, **Laden F**. Perceived Built Environment and Physical Activity in U.S. Women by Sprawl and Region. Am J Prev Med. 2011 Nov;41(5):473-9. PMID: 22011417.

77. Bertrand KA, Chang ET, Abel GA, Zhang SM, Spiegelman D, Qureshi AA, **Laden F**. Sunlight exposure, vitamin D, and risk of non-Hodgkin lymphoma in the Nurses' Health Study. Cancer Cause & Control. 2011 Dec;22(12):1731-41. PMCID: PMC3240999. PMID: 21987081.

78. Weuve J, Puett RC, Schwartz J, Yanosky JD, **Laden F***, Grodstein F*. Exposure to particulate air pollution and cognitive decline in older women. Arch Intern Med. 2012 Feb 13;172(3):219-27. PMCID: PMC3622279. PMID: 22332151 (*contributed equally)

79. Wei-Passanese EX, Han J, Lin W, Li T, **Laden F**, Qureshi AA. Geographical variation in residence and risk of multiple nonmelanoma skin cancers in US women and men. Photochem Photobiol. 2012 Mar-Apr;88(2):483-9. PMID: 22211791.

80. Lepeule J, **Laden F**, Dockery DW, Schwartz J. Chronic exposure to fine particles and mortality: an extended follow-up of the Harvard Six cities Study from 1974 to 2009. Environ Health Perspect. 2012 Jul;120(7):965-70. PMCID: PMC3404667 PMID: 22456598.

81. Garshick E, **Laden F**, Hart JE, Davis ME, Eisen EA, Smith TJ. Lung Cancer and Elemental Carbon Exposure in Trucking Industry Workers. Environ Health Perspect. 2012 Sept;120(9):1301-6. PMCID: PMC3440130. PMID:22739103.

82. Hart JE, Wu T, **Laden F**, Garshick E. Plasma fluorescent oxidation products and short-term occupational particulate exposures. Am J Ind Med. 2012 Oct;55(10):953-60. PMCID: PMC3439587. PMID: 22618714.

83. Bertrand KA, Giovannucci E, Liu Y, Malspeis S, Eliassen AH, Wu K, Holmes MD, **Laden F**, Feskanich D. Determinants of plasma 25-hydroxyvitamin D and development of prediction models in three US cohorts. Br J Nutr. 2012 Nov 28;108(10):1889-96. PMCID: PMC3346859. PMID: 22264926.

84. Weisskopf MG, Knekt P, O'Reilly EJ, Lyytinen J, Reunanen A, **Laden F**, Altshul L, Ascherio A. Polychlorinated biphenyls in prospectively collected serum and Parkinson's disease risk. Mov. Disord. 2012 Nov;27(13):1659-65. PMCID: PMC3510340. PMID: 23044514.

85. Smith TJ, Davis ME, Hart JE, Blicharz A, **Laden F**, Garshick E; HEI Health Review Committee. Potential Air Toxics Hot Spots in Truck Terminals and Cabs. Res Rep Health Eff Inst. 2012 Dec;(172):5-82. PMID: 23409510.

86. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, Ezzati M, Shibuya K, Salomon JA, Abdalla S, Aboyans V, Abraham J, Ackerman I, Aggarwal R, Ahn SY, Ali MK, Alvarado M, Anderson HR, Anderson LM, Andrews KG, Atkinson C, Baddour LM, Bahalim AN, Barker-Collo S, Barrero LH, Bartels DH, Basáñez MG, Baxter A, Bell ML, Benjamin EJ, Bennett D, Bernabé E, Bhalla K, Bhandari B, Bikbov B, Bin Abdulhak A, Birbeck G, Black JA, Blencowe H, Blore JD, Blyth F, Bolliger I, Bonaventure A, Boufous S, Bourne R, Boussinesq M, Braithwaite T, Brayne C, Bridgett L, Brooker S, Brooks P,

Brugha TS, Bryan-Hancock C, Bucello C, Buchbinder R, Buckle G, Budke CM, Burch M, Burney P, Burstein R, Calabria B, Campbell B, Canter CE, Carabin H, Carapetis J, Carmona L, Cella C, Charlson F, Chen H, Cheng AT, Chou D, Chugh SS, Coffeng LE, Colan SD, Colquhoun S, Colson KE, Condon J, Connor MD, Cooper LT, Corriere M, Cortinovis M, de Vaccaro KC, Couser W, Cowie BC, Criqui MH, Cross M, Dabhadkar KC, Dahiya M, Dahodwala N, Damsere-Derry J, Danaei G, Davis A, De Leo D, Degenhardt L, Dellavalle R, Delossantos A, Denenberg J, Derrett S, Des Jarlais DC, Dharmaratne SD, Dherani M, Diaz-Torne C, Dolk H, Dorsey ER, Driscoll T, Duber H, Ebel B, Edmond K, Elbaz A, Ali SE, Erskine H, Erwin PJ, Espindola P, Ewoigbokhan SE, Farzadfar F, Feigin V, Felson DT, Ferrari A, Ferri CP, Fèvre EM, Finucane MM, Flaxman S, Flood L, Foreman K, Forouzanfar MH, Fowkes FG, Fransen M, Freeman MK, Gabbe BJ, Gabriel SE, Gakidou E, Ganatra HA, Garcia B, Gaspari F, Gillum RF, Gmel G, Gonzalez-Medina D, Gosselin R, Grainger R, Grant B, Groeger J, Guillemin F, Gunnell D, Gupta R, Haagsma J, Hagan H, Halasa YA, Hall W, Haring D, Haro JM, Harrison JE, Havmoeller R, Hay RJ, Higashi H, Hill C, Hoen B, Hoffman H, Hotez PJ, Hoy D, Huang JJ, Ibeanusi SE, Jacobsen KH, James SL, Jarvis D, Jasrasaria R, Jayaraman S, Johns N, Jonas JB, Karthikeyan G, Kassebaum N, Kawakami N, Keren A, Khoo JP, King CH, Knowlton LM, Kobusingye O, Koranteng A, Krishnamurthi R, **Laden F**, Lalloo R, Laslett LL, Lathlean T, Leasher JL, Lee YY, Leigh J, Levinson D, Lim SS, Limb E, Lin JK, Lipnick M, Lipshultz SE, Liu W, Loane M, Ohno SL, Lyons R, Mabweijano J, MacIntyre MF, Malekzadeh R, Mallinger L, Manivannan S, Marcenes W, March L, Margolis DJ, Marks GB, Marks R, Matsumori A, Matzopoulos R, Mayosi BM, McAnulty JH, McDermott MM, McGill N, McGrath J, Medina-Mora ME, Meltzer M, Mensah GA, Merriman TR, Meyer AC, Miglioli V, Miller M, Miller TR, Mitchell PB, Mock C, Mocumbi AO, Moffitt TE, Mokdad AA, Monasta L, Montico M, Moradi-Lakeh M, Moran A, Morawska L, Mori R, Murdoch ME, Mwaniki MK, Naidoo K, Nair MN, Naldi L, Narayan KM, Nelson PK, Nelson RG, Nevitt MC, Newton CR, Nolte S, Norman P, Norman R, O'Donnell M, O'Hanlon S, Olives C, Omer SB, Ortblad K, Osborne R, Ozgediz D, Page A, Pahari B, Pandian JD, Rivero AP, Patten SB, Pearce N, Padilla RP, Perez-Ruiz F, Perico N, Pesudovs K, Phillips D, Phillips MR, Pierce K, Pion S, Polanczyk GV, Polinder S, Pope CA 3rd, Popova S, Porrini E, Pourmalek F, Prince M, Pullan RL, Ramaiah KD, Ranganathan D, Razavi H, Regan M, Rehm JT, Rein DB, Remuzzi G, Richardson K, Rivara FP, Roberts T, Robinson C, De Leòn FR, Ronfani L, Room R, Rosenfeld LC, Rushton L, Sacco RL, Saha S, Sampson U, Sanchez-Riera L, Sanman E, Schwebel DC, Scott JG, Segui-Gomez M, Shahraz S, Shepard DS, Shin H, Shivakoti R, Singh D, Singh GM, Singh JA, Singleton J, Sleet DA, Sliwa K, Smith E, Smith JL, Stapelberg NJ, Steer A, Steiner T, Stolk WA, Stovner LJ, Sudfeld C, Syed S, Tamburlini G, Tavakkoli M, Taylor HR, Taylor JA, Taylor WJ, Thomas B, Thomson WM, Thurston GD, Tleyjeh IM, Tonelli M, Towbin JA, Truelsen T, Tsilimbaris MK, Ubeda C, Undurraga EA, van der Werf MJ, van Os J, Vavilala MS, Venketasubramanian N, Wang M, Wang W, Watt K, Weatherall DJ, Weinstock MA, Weintraub R, Weisskopf MG, Weissman MM, White RA, Whiteford H, Wiebe N, Wiersma ST, Wilkinson JD, Williams HC, Williams SR, Witt E, Wolfe F, Woolf AD, Wulf S, Yeh PH, Zaidi AK, Zheng ZJ, Zonies D, Lopez AD. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012 Dec 15;380(9859):2197-223. PMID: 23245608.

87. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, Amann M, Anderson HR, Andrews KG, Aryee M, Atkinson C, Bacchus LJ, Bahalim AN, Balakrishnan K, Balmes J, Barker-Collo S, Baxter A, Bell ML, Blore JD, Blyth F, Bonner C, Borges G, Bourne R, Boussinesq M, Brauer M, Brooks P, Bruce NG, Brunekreef B, Bryan-Hancock C, Bucello C, Buchbinder R, Bull F, Burnett RT, Byers TE, Calabria B, Carapetis J, Carnahan E, Chafe Z, Charlson F, Chen H, Chen JS, Cheng AT, Child JC, Cohen A, Colson KE, Cowie BC, Darby S, Darling S, Davis A, Degenhardt L, Dentener F, Des Jarlais DC, Devries K, Dherani M, Ding EL, Dorsey ER, Driscoll T, Edmond K, Ali SE, Engell RE, Erwin PJ, Fahimi S, Falder G, Farzadfar F, Ferrari A, Finucane MM, Flaxman S, Fowkes FG, Freedman G, Freeman MK, Gakidou E, Ghosh S, Giovannucci E, Gmel G, Graham K, Grainger R, Grant B, Gunnell D, Gutierrez HR, Hall W, Hoek HW, Hogan A, Hosgood HD 3rd, Hoy D, Hu H, Hubbell BJ, Hutchings SJ, Ibeanusi SE, Jacklyn GL, Jasrasaria R, Jonas JB, Kan H, Kanis JA, Kassebaum N, Kawakami N, Khang YH, Khatibzadeh S, Khoo JP, Kok C, **Laden F**, Lalloo R, Lan Q, Lathlean T, Leasher JL, Leigh J, Li Y, Lin JK, Lipshultz SE, London S, Lozano R, Lu Y, Mak J, Malekzadeh R, Mallinger L, Marcenes W, March L, Marks R, Martin R, McGale P, McGrath J, Mehta S, Mensah GA, Merriman TR, Micha R, Michaud C, Mishra V, Hanafiah KM, Mokdad AA, Morawska L, Mozaffarian D, Murphy T, Naghavi M, Neal B, Nelson PK, Nolla JM, Norman R, Olives C, Omer SB, Orchard J, Osborne R, Ostro B, Page A, Pandey KD, Parry CD, Passmore E, Patra J, Pearce N, Pelizzari PM, Petzold M, Phillips MR, Pope D, Pope CA 3rd, Powles J, Rao M, Razavi H, Rehfuess EA, Rehm JT, Ritz B, Rivara FP, Roberts T, Robinson C, Rodriguez-Portales JA, Romieu I, Room R, Rosenfeld LC, Roy A, Rushton L, Salomon JA, Sampson U, Sanchez-Riera L, Sanman E, Sapkota A, Seedat S, Shi P, Shield K, Shivakoti R, Singh GM, Sleet DA, Smith E, Smith KR, Stapelberg NJ, Steenland K, Stöckl H, Stovner LJ, Straif K, Straney L, Thurston GD, Tran JH, Van Dingenen R, van Donkelaar A, Veerman JL, Vijayakumar L, Weintraub R, Weissman MM, White RA, Whiteford H, Wiersma ST, Wilkinson JD, Williams HC, Williams W, Wilson N, Woolf AD, Yip P, Zielinski JM, Lopez AD, Murray CJ, Ezzati M, AlMazroa MA, Memish ZA. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study of 2010. Lancet. 2012;380(9859):2224-60. PMID: 23245609.

88. Ben-Joseph E, Lee JS, Cromley EK, **Laden F**, Troped PJ. Virtual and actual: Relative accuracy of on-site and web-based instruments in auditing the environment for physical activity. Health Place. 2013 Jan;19:138-50. PMID: 23247423. [PubMed – in process]

89. Wu H, Bertrand KA, Choi AL, Hu FB, **Laden F**, Grandjean P, Sun Q. Persistent Organic Pollutants and Type 2 Diabetes: A Prospective Analysis in the Nurses' Health Study and Meta-analysis. Env Health Perspect 2013 Feb; 121(2):153-61. PMCID: PMC3569682. PMID: 23131992.

90. James P, Troped PJ, Hart JE, Joshu CE, Brownson RC, Ewing R, **Laden F**. Urban sprawl, physical activity, and body mass index: Nurses' Health Study and Nurses' Health Study II. Am J Public Health. 2013 Feb;103(2):369-75. PMCID: PMC3558772. PMID 22698015.

91. **Laden F**, Chiu Y-H, Garshick E, Hammond SK, Hart JE. A cross-sectional study of secondhand smoke exposure and respiratory symptoms in non-current smokers in the U.S.

trucking industry: SHS exposure and respiratory symptoms. BMC Public Health. 2013 Feb 1;13:93. PMCID: PMC3655928. PMID: 23368999

92. Arkema EV, Hart JE, Bertrand KA, **Laden F**, Grodstein F, Rosner B, Karlson EW, Costenbader KH. Exposure to Ultraviolet-B and risk of developing rheumatoid arthritis among women in the Nurses' Health Study. Annals of the Rheumatic Diseases. 2013 Apr;72(4):506-11. PMCID: PMC3678095. PMID: 23380431.

93. Neophytou AM, Yiallouros P, Coull BA, Kleanthous S, Pavlou P, Pashiardis S, Dockery DW, Koutrakis P, **Laden F**. Particulate matter concentrations during desert dust outbreaks and daily mortality in Nicosia, Cyprus. J Expo Sci Environ Epidemiol 2013 May-Jun;23(3):275-80. PMID: 23423218

94. Hart JE, Kallberg H, **Laden F**, Bellander T, Costenbader KH, Holmqvist M, Klareskog L, Alfredsson L, Karlson EW. Ambient air pollution exposures and risk of rheumatoid arthritis: results from the Swedish EIRA case–control study. Ann Rheum Dis. 2013 Jun;72(6):888-94. PMCID: PMC3659202. PMID: 22833374.

95. Roberts AL, Lyall K, Hart JE, **Laden F**, Just AC, Bobb JF, Koenen KC, Ascherio A, Weisskopf MG. 2013. Perinatal air pollutant exposures and autism spectrum disorder in the children of Nurses' Health Study II participants. Environmental Health Perspectives. 2013 Jun:121:978–984. PMID: 23803416 [PubMed – in process]

96. Hart JE, Källberg H, **Laden F**, Costenbader KH, Yanosky JD, Klareskog L, Alfredsson L, Karlson EW. Ambient air pollution exposures and risk of rheumatoid arthritis. Arthritis Care Res (Hoboken). 2013 Jul; 65(7):1190-6. PMID: 23401426

97. Berndt SI, Skibola CF, Joseph V, Camp NJ, Nieters A, Wang Z, Cozen W, Monnereau A, Wang SS, Kelly RS, Lan Q, Teras LR, Chatterjee N, Chung CC, Yeager M, Brooks-Wilson AR, Hartge P, Purdue MP, Birmann BM, Armstrong BK, Cocco P, Zhang Y, Severi G, Zeleniuch-Jacquotte A, Lawrence C, Burdette L, Yuenger J, Hutchinson A, Jacobs KB, Call TG, Shanafelt TD, Novak AJ, Kay NE, Liebow M, Wang AH, Smedby KE, Adami HO, Melbye M, Glimelius B, Chang ET, Glenn M, Curtin K, Cannon-Albright LA, Jones B, Diver WR, Link BK, Weiner GJ, Conde L, Bracci PM, Riby J, Holly EA, Smith MT, Jackson RD, Tinker LF, Benavente Y, Becker N, Boffetta P, Brennan P, Foretova L, Maynadie M, McKay J, Staines A, Rabe KG, Achenbach SJ, Vachon CM, Goldin LR, Strom SS, Lanasa MC, Spector LG, Leis JF, Cunningham JM, Weinberg JB, Morrison VA, Caporaso NE, Norman AD, Linet MS, De Roos AJ, Morton LM, Severson RK, Riboli E, Vineis P, Kaaks R, Trichopoulos D, Masala G, Weiderpass E, Chirlaque MD, Vermeulen RC, Travis RC, Giles GG, Albanes D, Virtamo J, Weinstein S, Clavel J, Zheng T, Holford TR, Offit K, Zelenetz A, Klein RJ, Spinelli JJ, Bertrand KA, **Laden F**, Giovannucci E, Kraft P, Kricker A, Turner J, Vajdic CM, Ennas MG, Ferri GM, Miligi L, Liang L, Sampson J, Crouch S, Park JH, North KE, Cox A, Snowden JA, Wright J, Carracedo A, Lopez-Otin C, Bea S, Salaverria I, Martin-Garcia D, Campo E, Fraumeni JF Jr, de Sanjose S, Hjalgrim H, Cerhan JR, Chanock SJ, Rothman N, Slager SL. Genome-wide association study identifies multiple risk loci for chronic lymphocytic leukemia. Nat Genet. 2013 Aug;45(8):868-76. PMCID: PMC3729927. PMID: 23770605.

98. Bertrand KA, Giovannucci E, Zhang SM, **Laden F**, Rosner BA, Birmann BM. A prospective analysis of body size during childhood, adolescence, and adulthood and risk of non-Hodgkin lymphoma. Cancer Prev Res (Phila). 2013 Aug;6(8):864-73. PMID: 23803416. [PubMed – in process]

99. Hart JE, Garshick E, Smith TJ, Davis ME, **Laden F**. Ischaemic heart disease mortality and years of work in trucking industry workers. Occup Environ Med. 2013 Aug;70(8):523-8. PMID: 22992341.

100. Link MS, Luttmann-Gibson H, Schwartz J, Mittleman MA, Wessler B, Gold DR, Dockery DW, **Laden F**. Acute Exposure to Air Pollution Triggers Atrial Fibrillation. J Am Coll Cardiol. 2013 Aug 27;62(9):816-25. PMID: 23770178 [PubMed – in process]

101. Hart JE, Rimm EB, Rexrode, KM, **Laden F**. Changes in Traffic Exposure and the Risk of Incident Myocardial Infarction and All-Cause Mortality. Epidemiology. 2013 Sep;24(5):734-42. PMID: 23877047. [PubMed - in process]

102. Troped PJ, Starnes HA, Puett RC, Tamura K, Cromley EK, James P, Ben-Joseph E, Melly SJ, **Laden F.** Relationships Between the Built Environment and Walking and Weight Status Among Older Women in Three U.S. States. J Aging Phys Act. 2013 Mar 26. [Epub ahead of print]. PMID: 23538637

103. Mahalingaiah S*, Hart JE*, **Laden F**, Missmer SA. Association of air pollution exposures and risk of endometriosis in the Nurses' Health Study II. Enviro Health Perspect 2013 Nov 13. [Epub ahead of print]. (*Co-first authors). PMID: 24225723

104. Nguyen J, **Laden F**, Link M, Schwartz J, Luttman-Gibson H, Dockery D. Weather and Triggering of Ventricular Arrhythmias in Patients with Implantable Cardiovascular-Defibrillators. J Expo Sci Environ Epidemiol. 2013 Oct 30. [Epub ahead of print]. PMID: 24169878

105. Neophytou AM, Hart JE, Cavallari JM, Smith TJ, Dockery DW, Coull BA, Garshick E, **Laden F.** Traffic-related exposures and biomarkers of systemic inflammation, endothelial activation and oxidative stress: a panel study in the US trucking industry. Environ Health. 2013 Dec 7;12(1):105. [Epub ahead of print] PMID: 24314116

106. Palacios N, Fitzgerald K, Roberts AL, Weisskopf M, Schwarzschild MA, **Laden F**, Ascherio A. Exposure to Airborne Metals and Risk of Parkinson Disease in a Prospective Study of US Women. Environ Health Perspect (provisionally accepted)

107. Wu S, Han J, Vleugels R, Puett R, Laden F, Hunter D, and Qureshi A. Cumulative ultraviolet radiation flux in adulthood and risk of incident skin cancers in women. BJ Cancer (in press)

108. Kioumourtzoglou MA, Spiegelman S, Szpiro AA, Sheppard L, Kaufman JD, Yanosky JD, Williams R, Laden F, Hong B, and Suh HH. Exposure Measurement Error in PM2.5 Health Effects Studies: A Pooled Analysis of Eight Personal Exposure Validation Studies. Environ Health. 2014 [Epub ahead of print]

- OTHER NON-PEER REVIEWED PUBLICATIONS

1. **Laden F**. Occupational exposure: fluorescent in spotlight. Indoor Pollution Law Report 1992;6:1,5.

2. **Laden F**, Gray GM. Toxic use reduction: pros and cons. Risk: Issues in Health and Safety 1993; 4:213-34.

3. **Laden F**, Hunter DJ. Environmental risk factors and female breast cancer. Ann Rev Pub Health 1998;19:101-23. PubMed PMID: 9611614.

4. **Laden F**. Book review: The Melatonin Hypothesis: Breast Cancer and Use of Electric Power" (RG Stevens, BW Wilson, LE Anderson, eds). The Physiologist 1999; 42:155.

5. **Laden F**. Electric and Magnetic Fields. In: Colditz GA, Hunter DJ eds. Cancer Prevention - Cancer Causes. Dordrecht, the Netherlands: Kluwer Academic Publishers 2000.

6. **Laden F**, Stampfer MJ, Walker AM. Lung Cancer and Mesothelioma among male automobile mechanics: a review. Reviews on Env Health. 2004;19(1):39-61. PubMed PMID: 15186039.

7. Megdal SP, Kroenke CH, **Laden F**, Pukkala E, Schernhammer ES. Night work and breast cancer risk: a systematic review and meta-analysis. Eur J Cancer. 2005;41(13):2023-32. PubMed PMID: 16084719.

8. Costenbader K, **Laden F**. What do pesticides, farming, and dose effects have to do with the risk of developing connective tissue disease? Arthritis Care Res (Hoboken). 2011;63(2):175-7. PubMed PMID: 20890975.

9. **Laden F**, Winkelmayer WC. Editorial: Air Pollution and Coronary Risk in Kidney Transplant Recipients. Am J Kidney Dis. 2011;58(4):506-507. PubMed PMID: 21944961.

10. **Laden F,** Neas LM. Current State of the Evidence: Air Pollution Impacts on Human Health. EM Magazine 2011 Nov.:8-13.

11. Hart JE, Eisen EA, **Laden F**. Occupational diesel exhaust exposure as a risk factor for chronic obstructive pulmonary disease. Curr Opin Pulm Med. 2012;18(2):151-4. PubMed PMID: 22234274.

12. James P, Troped PJ, **Laden F**. The Impact of the Built Environment on Health. In: Goldman MB, Troisi R, Rexrode KM eds. Women and Health, Second Edition. Waltham MA: Academic Press.

SELECTED ABSTRACTS

1. James P, Hart JE, Subramanian SV, Dominici F, Troped PJ, Spengler JD, **Laden F**. Urban sprawl and the risk of overweight and obesity in the Nurses' Health Study. Society for Epidemiologic Research 2011, Montreal, Canada.

2. Liao X, Spiegelman D, Hart JE, Hong B, Puett RC, Suh H, **Laden F**. An application of a risk set calibration method to a study of air pollution effects on all cause mortality in the Nurses' Health Study. International Society for Environmental Epidemiology 2011 Conference, Barcelona, Spain.

3. Hart JE, Feskanich D, Puett RC, Yanosky JD, **Laden F**. Is the association of air pollution with incident coronary heart disease or all-cause mortality modified by a healthy lifestyle? International Society for Environmental Epidemiology 2011 Conference, Barcelona, Spain.

4. **Laden F**, Hart JE, Puett RC, Schwartz J, Speizer FE, Dockery DW. Exposure to $PM_{2.5}$ and cause-specific mortality risk in additional follow-up of the Harvard Six Cities Study: Identification of susceptible sub-populations. International Society for Environmental Epidemiology 2011 Conference, Barcelona, Spain.

5. Tamura K, Puett RC, Whitcomb HA, Hart JE, **Laden F**, Troped PJ. Are obesity and overweight clustered? Spatial examination of older women in three states. International Society for Environmental Epidemiology 2011 Conference, Barcelona, Spain.

6. James P, Hart JE, Troped PJ, **Laden F**. Urban sprawl and body mass index: A fixed-effects analysis in two cohorts of older women in the United States. International Society for Environmental Epidemiology 2011 Conference, Barcelona, Spain.

7. Tamura K, Puett RC, Starnes HA, Hart JE, **Laden F**, Troped PJ. Does physical activity spatially cluster? Preliminary findings from an analysis of older women living in three US states. American Public Health Association 2011 Conference, Washington, DC.

8. Hart JE, Feskanich D, Puett RC, Yanosky JD, **Laden F**. The association of PM2.5 and all-cause mortality and possible effect modification by diet, alcohol, and physical activity. Epidemiology. 22(5S): S-727, 2012. (Winner of an ISEE New Investigator Conference Abstract Award)

9. Hart JE, Brookhart MA, Winkelmayer WC, **Laden F.** The effect of air pollution on hemoglobin levels in patients with end-stage renal disease. Epidemiology. 22(5S):S-726, 2012.

10. James P, Hart JE, Dominici F, Mukamal KJ, Rimm EB, Subramanian SV, Troped PT, **Laden F**. Impact of sprawl on chronic disease risk in a cohort of older women. Epidemiology. 22(5S): S-575, 2012.

11. Neophytou A, Hart JE, Cavallari J, Smith TJ, Garshick E, **Laden F.** Short-term personal traffic-related exposures and biomarkers of systemic inflammation and endothelial activation. Epidemiology. 22(5S): S-427, 2012.

12. Tamura K, Puett RC, Hart JE, Starnes HA, **Laden F**, Troped PJ. Comparisons of Built Environment Characteristics Inside and Outside Spatial Clusters of Physical Activity and Obesity in Older U.S. Women. American Heart Association Epidemiology, Nutrition, and Prevention (EPI-NAM) Conference 2012, New Orleans, LA.

13. James P, Berrigan D, Hart JE, Hoehner CM, Kerr J, Major JM, Oka M, **Laden F**. Effects of buffer size and shape on associations between the built environment and energy balance. Active Living Research 2013 Annual Conference, San Diego, CA.

14. James P, Hart JE, **Laden F**, Subramanian SV. Neighborhood self-selection: The role of pre-move health status on the post-move socioeconomic environment. Society for Epidemiologic Research 2013 Conference, Boston, MA.

15. James P, Hart JE, Subramanian SV, **Laden F**. Neighborhood self-selection: The role of pre-move health status on the post-move built environment. Society for Epidemiologic Research 2013 Conference, Boston, MA.

16. Palmer V, Hart JE, Garshick E, Smith TJ, **Laden F.** Trace metal exposure and inflammatory biomarkers in a cohort of US trucking industry workers. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

17. Hart JE, Prescott J, De Vivo I, **Laden F**. A cross-sectional assessment of ambient air pollution exposure and leukocyte telomere length in US women. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

18. Hart JE, Rexrode KM, Prescott J, De Vivo I, **Laden F**. Exposure to Ambient Air Pollution and Changes in Leukocyte Telomere Length in US Women. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

19. Hart JE, Chiuve SE, **Laden F**, Albert CM. Roadway Proximity and the Risk of Myocardial Infarction, Nonsudden Fatal Coronary Heart Disease, and Sudden Cardiac Death. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor

Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

20. Puett RC, Hart JE, Yanosky JD, Speigelman D, **Laden F**. Chronic particulate matter exposures and lung cancer in the Nurses' Health Study cohort. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

21. James P, Hart JE, **Laden F**. Prospective effects of the built environment on walking and weight gain. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

22. James P, Hart JE, **Laden F**. The association between walkability and particulate air pollution. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

23. Palacios N, Fitzgerald K, Hart JE, Munger K, Ascherio A, **Laden F**. Particulate matter air pollution and risk of multiple sclerosis in a large study of female nurses. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

24. Neophytou AM, Hart JE, Chang Y, Zhang J, Smith TJ, Garshick E, **Laden F**. Short-term personal traffic-related exposures and biomarkers of nitro-PAH exposure and oxidative DNA damage. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

25. Neophytou AM, Hart JE, Eisen EA, Garshick E, **Laden F**. A structural approach to analyzing occupational cohorts: The healthy-worker survivor effect and an application in the Trucking Industry Cohort. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

26. Raz R, Roberts AL, Lyall K, Hart JE, Just AC, **Laden F,** Ascherio A, Weisskopf MG. Exposure to particulate matter air pollution during pregnancy is associated with increased risk for autism spectrum disorder. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ), August 19–23, 2013, Basel, Switzerland. 2013. Environ Health Perspect; http://dx.doi.org/10.1289/ehp.ehbasel13.

Curriculum Vitae

James Russell Roberts MD, MPH

Work Address:

Division of General Pediatrics
135 Rutledge Avenue, PO Box 250561
Charleston, SC 29425
843-876-8512
843-876-8709 (fax)
robertsj@musc.edu

Citizenship: USA

Education

1984-1988	Bachelor of Science, summa cum laude, Biology; 1988. McMurry College, Abilene, Texas
1988-1992	Doctor of Medicine; 1992. Texas Tech University Health Sciences Center, Lubbock, Texas
1992-1995	Pediatric Internship and Residency, Medical College of Georgia, Augusta, Georgia
1995-1997	General Academic Pediatrics Fellow. University of Alabama at Birmingham School of Medicine, Birmingham, Alabama
1995-1997	Master of Public Health, Maternal and Child Health. University of Alabama at Birmingham School of Public Health, Birmingham, Alabama

Board Certification

1995-Present	American Board of Pediatrics

Licensure

11/92-Present	Texas State Board of Medical Examiners, Physicians Permit, J4482
5/97- Present	State Board of Medical Examiners of South Carolina, Physician's License, 19217

Faculty Appointment:

1995-1997	Instructor, University of Alabama at Birmingham School of Medicine, Birmingham, Alabama
1997-2003	Assistant Professor of Pediatrics, Medical University of South Carolina
2003-2011	Associate Professor of Pediatrics, Medical University of South Carolina
2012-Present	Professor of Pediatrics with Tenure, Medical University of South Carolina

Administrative Appointments:

2008-Present	Director, South Carolina Pediatric Practice Research Network
2008-Present	Director, Frontiers in Pediatrics, Annual CME Course
2000-2005	Medical Director, 8D Infant and Toddler Unit
2003-Present	Faculty Advisor, Public Health Student Interest Group
2012-Present	Appointments, Promotion, and Tenure Committee, MUSC Col. of Medicine

Hospital Privileges:

1997-Present	Active	Medical University of South Carolina Hospital
1997-Present	Active	Charleston Memorial Hospital
1995-1997	Inactive	Children's Hospital of Alabama
1995-1997	Inactive	University of Alabama at Birmingham Hospital

Other Professional Experience

State/Local:

1996-1997	State Lead Consultant, University of Alabama at Birmingham, Birmingham, Alabama
1998- Present	Consultant to South Carolina Lead Poisoning Prevention Program, Charleston, South Carolina
1999-2006	South Carolina Lead Poisoning Advisory Committee
2000-2006	Medical Director, Infant/Toddler Unit, Medical University of South Carolina, Charleston, South Carolina

National:

1997-2002	Children's Environmental Health Network, Education Committee
2002-Present	Children's Environmental Health Network, Science Committee
2011-Present	Chair, Children's Environmental Health Network, Science Committee
2011-Present	Member of Board of Directors, Children's Environmental Health Network
2004-2010	Ex-officio Board Member, National Environmental Education Foundation (NEEF)
2003-2005	Chair, Steering Committee for National Environmental Education Training Foundation, Environmental Management of Asthma
2005-Present	Environmental Protection Agency, Pesticide Program Dialogue Committee (Federal Advisory Committee)

Professional Society Memberships

National/Regional:

1997-Present	American Academy of Pediatrics (AAP), Fellow
2002-2009	AAP, National Committee on Environmental Health,
2003-2009	AAP, Chair, Nexus (Section) on Environmental Health
2003-2009	Chair, Education subcommittee on Environmental Health
1997-Present	Ambulatory Pediatric Association (now known as Academic Pediatric Association)
1999-2004	Co-Chair, Environmental Health Special Interest Group (SIG),
2008-present	Region VIII Co-Chair
1999-Present	American Academy of Clinical Toxicology

Local:

1997- 1998	Charleston Lead Poisoning Program Advisory Committee,
2000-2008	South Carolina Lead Poisoning Prevention Advisory Committee, Data Usage, Policy, and Outreach Subcommittees
1997- Present	South Carolina Medical Association,
1997-Present	Charleston County Medical Society,
1997-Present	South Carolina Chapter of American Academy of Pediatrics

Journal Reviewer
Academic Pediatrics
Archives of Diseases in Childhood
Clinical Pediatrics
Environmental Health Perspectives
International Journal of Pediatrics
Journal of Toxicology/Clinical Toxicology
Journal of Urban Health
Pediatrics
Vaccine

Grant Support
Extramural Funded:

Introduction of environmental medicine in to the curriculum of the Medical University of South Carolina, part of the Sustainable Universities Initiative,
V. Kahn Rassmussen Foundation, $120,000 for period of July 1998-June 2002. PI, 20% salary time.

Development content and completing competencies for the educational curricula and practice guidelines to educate and train health care providers on pesticide related health outcomes. Environmental Protection Agency and the National Environmental Education Training Foundation. $10,000, January 2000-December 2000.

Developing a lead poisoning screening strategy for South Carolina. South Carolina Childhood Lead Poisoning Prevention Program, through Centers for Disease Control and Prevention. $42,000/year, July 1999 to 2002. PI, 20% salary.

Improving physician outreach for childhood lead poisoning. South Carolina Childhood Lead Poisoning Prevention Program, through Centers for Disease Control and Prevention. $10,000/yr July 2002- 2005.

Incorporating environmental management of asthma into pediatric practice. National Environmental Education Training Foundation. $26,250. July 2004 – October 2005.

Using a geographic information system (GIS) in combination with a hand-held lead testing device to provide cost-effective efficient identification of children with elevated blood lead levels. Environmental Protection Agency $93,664. Role on Project:PI Aug 2005 – Feb 2007.

Integrating Environment Management of Pediatric Asthma into Health Care: Creating Faculty Champions at Medical Schools and Outreach to the Health Care Community and Developing a Power point presentation. National Environmental Education Training Foundation. Role on Project: Principal Investigator, October 2006-September 2011. $55,000 for total period.

Providers Reminders: Improving Vaccine Delivery in Office Practice.
National Center for Immunization and Respiratory Diseases: Centers for Disease Control and Prevention. Role on project: PI, $400,000 (25% time) 09/1/07-8/31/10.

Evaluation of the Effect of the Faculty Champion Asthma Initiative. National Institute of Health/National Environmental Education Foundation. $43,500 Role on Project: PI. 4/1/10-5/31/11.

6th Edition of Recognition and Management of Pesticide Poisonings Manual. US Environmental Protection Agency. $200,000
Role on project: Principal Investigator 8/1/08- 7/31/11.

Health Resources and Services Administration (HRSA) 1 R40MC21522-01-00, 4/1/2011-3/31/2014. Communication Intervention for Adolescent Immunizations: Cluster Randomized Trial. Role on Project: Co-Investigator.

D54HP05448. 9/01/2011- 08/31/2016. HRSA/BHP/MEDICINE Academic Administrative Units in Primary Care. This grant will form a collaborative among the SCPPRN, 4 MUSC Family Medicine Practices, and the OQUIN network to incorporate automated data downloading and quality reporting. Total award $800,000. Role: Project Director. 10% time on grant.

Select Health of South Carolina. 7/1/2012-6/30/2013. Initiating Controller Medications in the Emergency Department and Improving Follow-up Visit Rates via the South Carolina Pediatric Practice Research Network (SCPPRN). This is a quality improvement project aimed at improving prescribing rates of ED physicians and tracking asthma follow up visits in SCPPRN practices. Role on Project: Mentor/Co-Investigator/Mentor

Children's Environmental Health Network. October 2012-June 2013. Revision of Children's Environmental Health Training Manual. Role on Project: PI/ Editor-in-Chief.10% time.

Intramural Funded:

Validation of a lead poisoning educational intervention: A pilot study. Sustainable Universities Initiative (SUI) Small Grants Program. $10,000, May 2002 to April 2003.

Contracts:

Novartis Vaccines. A Phase 3b, Open-Label, Randomized, Parallel-Group, Multi-Center study to Evaluate the Safety of Novartis MenACWY Conjugate Vaccine When Administered with Routine Infant Vaccinations to Healthy Infants. Principal Investigator, May 28, 2009 – June 28, 2010.

Sanofi Pasteur Vaccines. Exploratory Evaluation of a Two-dose Schedule Versus a One-dose Schedule of Menactra (Meningococcal [Groups A,C,Y,W-135] Polysaccharide Diphtheria Toxoid Conjugate Vaccine) in Children in the US. Principal Investigator, June 24 2008-September 3, 2009.

Novartis Vaccines. A Phase 3, Open-Label, Randomized, Multi-Center Study to Evaluate the Safety and Immunogenicity of ProQuad(TM) Vaccine When Administered Concomitantly with Novartis Meningococcal ACWY Conjugate Vaccine to Healthy Toddlers. Principal Investigator November 1, 2008 – January 21, 2010.

Nestle Nutrition. Happy Growth: Assessment of Growth of Infants Fed Formula With Probiotics. Principle Investigator, April 2011-Dec 2013.

Awards, Honors

1989-1992	Texas Tech University Health Science Center Scholarship
June 1992	Outstanding Student in Pediatrics
March 1994	Selected to attend Frontiers in Science, Annual meeting of Pediatric Department Chairman and selected pediatric residents
1998	Certificate of Appreciation, Trident Health District South Carolina, Charleston Lead Poisoning Prevention Program
2001	Finalist, Robert Wood Johnson Faculty Scholars Program
April 2002	Thomas A. and Shirley W. Roe Award, South Carolina Medical Association, Outstanding article in *J SC Med Assoc* of 2000-2001
July 2002	Mitchel I.Rubin Award, Outstanding Junior Faculty Researcher, Pediatrics
2002, 2003, 2005, & 2011	Nominee, Golden Apple Award Professor at MUSC
2008	Pediatric Housestaff Award, Best Clinic Attending
2010	College of Medicine, Nominee teacher of the month, September, and October

Academic Committee Activities

University:

1997-1998	Co-Chair, Health Promotion/Disease Prevention Working Group to develop guidelines to incorporate issues of prevention into every day teaching activities

Department:

2000-2001	Children's Hospital Executive Committee
1997-Present	Resident Recruitment Committee
2004-2008	Children's Hospital Quality and Safety Committee
2008-Present	Asthma Committee
2008-Present	MUSC Department of Pediatrics, Academy of Mentors
2009-Present	Faculty Development Initiative Committee
2011-Present	Faculty Compensation Committee
2013-Present	Research Advisory Committee

Teaching Experience

Undergraduate Medical Education

1997-Present	Preceptor, third year medical students on inpatient and outpatient portions of third year Pediatric Core Clerkship, MUSC, Charleston
1997-Present	Faculty Advisor to medical students, MUSC
1998	Preceptor, 1st Year Parallel Curriculum Physical Diagnosis Course, MUSC, Charleston, South Carolina

1998	1st Year Doctoring Curriculum, MUSC, Charleston, South Carolina
1998-2000	Lecturer on "Environmental aspects of asthma", Third year medical student noon lecture series, MUSC, Charleston, South Carolina
2001- Present	Lecturer on "Environmental hazards", and "Dermatitis", Third year medical student noon lecture series, MUSC, Charleston, South Carolina
2001	Curriculum Development; Foundations of Clinical Medicine, Wrote case of child with diarrhea secondary to organophosphate toxicity, MUSC, Charleston, South Carolina
2001- 2011	Small Group Facilitator, Foundations of Clinical Medicine, MUSC, Charleston, South Carolina

Graduate Medical Education

1997-Present	Direct supervision and education of pediatric residents on inpatient and outpatient rotations with general pediatrics, including weekly continuity clinic experience
1997-Present	Faculty Advisor/Academic Mentor Program for pediatric residents, MUSC Brett MacLean, Mark Roque, Jimmy McElligott, Rita Chen, Maya Eady, Jason Buckley, Poneh Davoodi, Becky Cafiero
1998- Present	Pediatric house staff noon conference series, MUSC, Charleston, South Carolina Lecturer on "Childhood Lead Poisoning", "Pesticide Poisoning and Other Environmental Hazards", "Environmental History Taking" and "Practical Parenting", Rashes, Constipation, "Managing Environmental Triggers in Pediatric Asthma"

Graduate Medical and Graduate Studies Education

1999	Lecturer, Pediatric and Medicine Fellows Seminar, Medical University of South Carolina, Charleston, South Carolina
2000-2001	Research mentor and member of Graduate Committee for Lea Schwab. Analysis of Lead Poisoning in an area with point source contamination. Department of Pediatrics, and Epidemiology. Supervisor; Thomas C. Hulsey, ScD, MS awarded 2001.
2002-2004	Research mentor and member of Graduate Committee for Jennifer Shearer, PhD candidate for School of Nursing. Lead poisoning education tools for parents. Medical University of South Carolina, School of Nursing, PhD received July 2004.
2007-2008	Research mentor for Shannon Kennedy, Department of Pediatrics, General Pediatric Fellowship
2008-Present	Research mentor for Jimmy McElligott, Department of Pediatrics, General Pediatric Fellowship, continuing as Clinical Instructor and Assistant Professor
2009-2010	Member of Graduate Committee for Kristina Gustafson, MSCR program, Department of Pediatrics, General Pediatric Fellowship
2008-Present	Research mentor for Resident Research Projects: Kimberly Sudheimer, Shilpa Shah, Eliza Varardi, Frank Osei, Sarah Majstoravich, Kelli Wong Williams, Lauren Walker, Emma Carter, Claire MacGeorge.

Major Clinical Interests and Responsibilities
Primary care and faculty practice general pediatric clinics
Inpatient pediatric wards
Childhood lead poisoning
Children's environmental health
Clinical toxicology
Immunization delivery and Quality Improvement

Published Abstracts/ Submitted Presentations: (Names in italics are Trainees (Student, resident, or fellow), * denotes mentored junior faculty)

1. **Roberts JR,** Spooner SA. Pediatric resources on the Internet: Creation and growth of PEDINFO index. *J Invest Med* 1996;44:44A. Presented at the Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 1996.

2. **Roberts JR**, Spooner SA. Intermediate Internet: Providing information via web pages and mailing lists. Presented as a Workshop at the Pediatric Academic Societies, Washington DC, May 1996.

3. **Roberts JR**, Oh MK, Thomas MH, Boker J, and Florence R. Male adolescents' communication with partners about STD/HIV and family planning. *J Invest Med* 1997:45:37A. Presented at the Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 1997.

4. **Roberts JR**, Spooner SA. Medical informatics curriculum in pediatric residency training. *Ambulatory Child Health* 1997;3:166. Presented at the Pediatric Academic Societies, Washington DC, 1997.

5. **Roberts JR**, Ratlif DR, Reigart JR. Prevalence of lead poisoning in the Charleston area. *J Invest Med* 1998;46:6A. Presented at the Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 1998.

6. **Roberts JR**, Hulsey TC, Reigart JR. Natural progression of blood lead levels in non-chelated children. J Invest Med 1999;47:130A. Presented at the Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 1999

7. **Roberts JR**, Reigart JR. Environmental history taking in the third year medical school curriculum. *Invest Med* 1999;47:139A. Presented as the Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 1999. Pediatric Academic Societies Meeting, San Francisco, CA, May 1999. J Invest Med 1999;47:139A.

8. **Roberts JR**, Reigart JR, Ebeling M, Hulsey TC. Natural reduction of blood lead in non-chelated chldren. XIX International Congress of the European Association of Poison Control Centres and Clinical Toxicologists, Dublin Ireland, 1999. J Tox Clin Tox 1999;37:401.

9. **Roberts JR**, Gitterman B. Environmental health education in pediatric residency programs. Southern Regional Academic Societies Meeting, New Orleans, LA, March 2001. Pediatric Academic Societies Meeting, Baltimore MD, May 2001. J Invest Med 2001;49:127A.

10. *Schwab LT,* **Roberts JR**, Reigart JR. The age of home question for lead risk assessment: Do caretakers answer accurately? Southern Regional Academic Societies Meeting, New Orleans Feb 2001. Pediatric Academic Societies Meeting, Baltimore MD, May 2001. J Invest Med 2001;49:138A.

11. **Roberts JR**, Curtis GB, Reigart JR, Ebeling M, Hulsey TC. Determining risk for lead poisoning using a geographic information system. Southern Regional Academic Societies Meeting, New Orleans Feb 2001. Pediatric Academic Societies Meeting, Baltimore MD, May 2001. J Invest Med 2001:49:138A.

12. **Roberts JR**, Hulsey TC, Curtis GB, Reigart JR. Using geographic information systems to define point source lead contamination. *J Invest Med* 2002;50:139A. Oral presentation at Southern Regional Academic Societies Meeting, New Orleans, Feb 2002.

13. **Roberts JR**, Hulsey TC, Curtis GB, Reigart JR. Using a geographic information system to define point source lead contamination. *Pediatric Research* 2002;51:133A. Presented as a Poster Symposium at Pediatric Academic Societies Meeting, Baltimore, MD, May 2002.

14. **Roberts JR**, *Shearer JE,* Stuart G, Reigart JR. Can we assess changes in parental knowledge of lead poisoning? A Pilot study. *J Invest Med* 2003;51: In Press. Poster presentation at Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 2003.

15. Reigart JR, **Roberts JR**, Hulsey, TC. Blood Lead Screening by South Carolina Primary Care Providers. *J Invest Med* 2003;51:In Press. Presented at the Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 2003.

16. **Roberts JR**, Reigart JR, Hulsey, TC. Blood Lead Screening by South Carolina Primary Care Providers. *Pediatric Research* 2003: In Press. Oral presentation at Pediatric Academic Societies Meeting, Seattle, WA, May 2003.

17. **Roberts JR**, Hulsey TC, Reigart JR. Home and Food Sources of Environmental Toxicants. *J Invest Med* 2004:In Press. Oral presentation at Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 2004.

18. **Roberts JR,** Balk SJ, Forman J, Shannon M. Teaching about pediatric environmental health: Knowledge and barriers reported by faculty. *Pediatric Research* 2005;In Press. Presented at the Pediatric Academic Societies Meeting, Washington DC, May 2005.

19. **Roberts JR,** Martines J, Battaglia R, White S, Darden PM. Improving delivery of care. Palivizumab in a primary care clinic. J Invest Med 2006;54(1):S306. Oral presentation at Southern Regional Academic Societies Meeting, Atlanta GA, Feb 2006.

20. **Roberts JR**, Reigart JR, Hulsey TC. Association between pesticide metabolite levels and exposure from the home and diet. J Invest Med 2007;55:S294. Oral presentation at Southern Regional Academic Societies Meeting, New Orleans, LA, Feb 2007.

21. **Roberts JR**, Reigart JR, Hulsey TC. Exposures related to pesticide residues in children. Oral presentation at Pediatric Academic Societies meeting. Toronto, ON, Canada. May 2007.

22. *Kennedy S*, **Roberts JR**, Basco WT, Darden PM. Prevalence of Overweight in a sample of South Carolina Children: Comparison to a National Sample. Presented at the Southern Regional Meeting, New Orleans, La. Feb 22, 2008. *J Invest Med* 2008;56:429.

23. **Roberts JR**, *Allen C*, and Reigart JR. Are children still at risk for lead poisoning? Presented at the Southern Societies Meeting, New Orleans, La. Feb 23, 2008. *J Invest Med* 2008;56:457.

24. **Roberts JR**, Freeland KD, McElligott JT*, O'Brien E, Darden PM. Immunization Procedures in Pediatric Practices: A Study from the South Carolina Pediatric Practice Research Network (SCPPRN). Presented at the Southern Societies Meeting, New Orleans, LA, February 2009. *J Invest Med* 2009;57:334.

25. *Sudheimer K, Shah S*, **Roberts J**. Efficient use of pediatric emergency rooms. Presented at Presented at the Southern Societies Meeting, New Orleans, LA, February 2009. *J Invest Med* 2009;57:334.

26. McElligott JT*, O'Brien ES, **Roberts JR**, Darden PM. Catch-Up Immunizations at 18 Months of Age: Implications for Individual Practices. A Study from the South Carolina Pediatric Practice Research Network (SCPPRN). Southern Societies Meeting, New Orleans, LA, February 2009. *J Invest Med* 2009;57:236. Also presented at 2010 National Immunization Conference, Atlanta, GA.

27. **Roberts JR**, Freeland KD, McElligott JT*, O'Brien E, Kolasa M, Sperry J, Darden PM. Immunization Procedures in Pediatric Practices: A Study from the South Carolina Pediatric Practice Research Network (SCPPRN). Presented at the Pediatric Academic Societies Meeting, Baltimore, MD, May 2009.

28. **Roberts JR**, Freeland KD, McCurdy, LE. Can we Improve Physician Knowledge of Managing Environmental Triggers of Asthma? Presented at the Southern Societies Meeting, New Orleans, LA, February 2010. J Invest Med 2010;58:461A.

29. **Roberts J**, Kolasa M, Freeland K, Hletko P, O'Brien E, Darden P. How well do Practices Incorporate QI Procedures for Vaccine Delivery? A Study from the South Carolina Pediatric Practice Research Network. Presented at the 2010 National Immunization Conference, Atlanta, GA.

30. *Varadi E*, McElligott JT*, Basco Jr, WT, and **Roberts, JR**. Parental Beliefs about Relative Nutritional Value of Fruit Juice v. Fresh Fruit. Presented at the Pediatric Academic Societies Meeting, Vancouver, British Columbia, May 2010.

31. **Roberts JR**, Hulsey TC, Alberg AJ, Obrien ES, Freeland KD, Basco WT. The Prevalence of Secondhand Smoke Exposure and Parental Predictors of Smoking Cessation in the South Carolina Pediatric Practice Research Network (SCPPRN). Presented at the AHRQ Practice Based Research Network Meeting, Bethesda, MD, June 2010.

32. **Roberts, JR,** *Varadi E*, McElligott JT*, Obrien ES, Freeland KD, Basco WT. Variation in Fruit Juice Consumption Among Infants and Toddlers: A Study from the South Carolina Pediatric Practice Research Network. Presented at the AHRQ Practice Based Research Network Meeting, Bethesda, MD, June 2010.

33. **Roberts JR**, Hulsey TC, Basco Jr, WT, O'Brien, B, Alberg AJ. Prevalence of secondhand smoke exposure and predictors of smoking cessation in the South Carolina Pediatric Practice Based Research Network. Presented at the Southern Societies Meeting, New Orleans, LA, February 2011. J Invest Med 2011;59:473A.

34. **Roberts JR**, McElligott JT, Freeland KD, Ang SC, O'Brien ES, Darden PM. Can We Improve Immunization Delivery in Pediatric Practices? A Study from the South Carolina Pediatric Practice Research Network. Presented at the Southern Societies Meeting, New Orleans, LA, February 2011. J Invest Med 2011;59:474-5A.

35. **Roberts JR**, Karr C, Freeland KD, McCurdy LE, Deybarrondo L, and Forman J. Improving Physician Knowledge about Environmental Triggers of Asthma. Oral Presentation at the Pediatric Academic Societies Meeting, Denver, May 2011.

36. *Majstoravich SJ, Osei FA*, **Roberts JR**, McElligott JT*, Martines J, and Bowman CM. Improving guideline adherence in chronic asthma management. Oral Presentation at Pediatric Academic Societies Meeting, Denver, May 2011.

37. Roland VA, McElligott JT, Greenhouse D, LeMay JR, **Roberts JR**. Do physicians follow the AAP Guidelines on the Diagnosis of ADHD? Oral Presentation at the Southern Societies Meeting, New Orleans, LA, February 2012. *J Invest Med* 2012;60:319-320A.

38. **Roberts JR**, Hale JJ, Thompson DM, Darden PM. Vaccine hesitancy among parents of teens. Oral Presentation at the Southern Societies Meeting, New Orleans, LA, February 2013. *J Invest Med* 2013;61:453.

39. Naifeh M, **Roberts J**, Hale J, O'Brien E, and Darden P. Variations in adolescent vaccination rates by practice in South Carolina and Oklahoma. Poster Presentation at the Southern Societies Meeting, New Orleans, LA, February 2013. *J Invest Med* 2013;61:387.

40. Darden P, Naifeh M, **Roberts J**, Hale J, O'BrienE, and Jacobson RM. Variations in adolescent vaccination rates by practice in South Carolina and Oklahoma. Poster Presentation at the National Practice Based Research Network Conference, Bethesda MD, June 18, 2013.

41. **Roberts JR**, Hale JJ, Thompson DM, Jacobson RM, and Darden PM. Vaccine Hesitancy among Parents of Adolescents: A Study from SCPPRN and OCHRN. Poster Presentation at the National Practice Based Research Network Conference, Bethesda MD, June 18, 2013.

42. **Roberts JR**, Hale JJ, Thompson DM, Pope, C, Jacobson RM, and Darden PM. How Often do Adolescents Receive HPV Vaccine on a Time? A Study from SCPPRN and OCHRN. Poster Presentation at the National Practice Based Research Network Conference, Bethesda MD, June 18, 2013.

Invited Presentations:

1. Update on pediatric lead poisoning and screening in Alabama. Presented to the Alabama Chapter of the American Academy of Pediatrics, Orange Beach, AL, Sept 1996.

2. Childhood lead poisoning. Nutrition for infants, children, and adolescents national course, Birmingham, AL, Feb 1997.

3. Overview of children's environmental health issues. Children's Environmental Health Network Workshop for the National Association for Hispanic Nurses Conference, Detroit, July 1998.

4. A perspective on lead poisoning: Past, present, and future. Keynote address for Chatham County Department of Health's Annual Lead Poisoning Conference, Savannah, GA, July 1998.

5. Childhood lead poisoning. Invited panelist at the Children's Environmental Health Conference. Co-sponsored by the University of South Carolina and the Department of Health and Environmental Control. Columbia, SC, Sept 1998.

6. Environmental History-Taking: Exercises for the Here and Now. Children's Environmental Health Network Conference, San Francisco, CA June, 1999.

7. Developmental aspects of pediatric environmental health. Environmental Hazards Assessment Program's Teacher Institute, College of Charleston, Charleston, SC, July 1999.

8. Using GIS to develop a targeted lead screening program. Presented at Centers for Disease Control and Prevention Grantee Meeting, Washington DC, Jan 25, 2000.

9. Pesticide exposure in children: A visit to Mexico. Pediatric Grand Rounds. Medical University of South Carolina, Charleston SC, Feb, 2001.

10. Screening children for lead poisoning. Presented at the Medicaid Targeting Workgroup Meeting of the CDC Lead Poisoning Prevention Advisory Committee, Washington DC, June 22, 2001.

11. Lead Poisoning and Screening in the Charleston area. MUSC Family Medicine noon conference, Trident Medical Center, Charleston, June 2001.

12. Update on childhood lead poisoning. Tulane University, Department of Pediatrics, Noon Conference. New Orleans, LA, February 2002.

13. Common Problems in the First Year of Life. Family Medicine Continuing Education Course, Kiawah Island, June 2001-2004, 2006, 2007.

14. Pediatric Asthma. Family Medicine Continuing Education Course, Kiawah Island, June 2006, 2007.

15. Pesticide Poisoning in Children: Acute and Chronic Effects. The 1st Annual Conference on Children's Health and the Environment, George Washington University Medical Center - Children's National Medical Center and The Mid-Atlantic Center for Children's Health and the Environment (MACCHE). Washington, DC, September 2002.

16. Applying Geographic Information Systems to Primary Care Issues. MUSC Pediatric Grand Rounds, Charleston, October 2002.

17. Teaching Medical Providers about Pesticides: National Strategies for Health Care Providers: Pesticides Initiative. 21st National Pesticides Forum, Toxics in the Age of Globalization, Univ. Texas, Austin TX, April 2003.

18. Pesticides in Children: Controversial Issues. Presented at the APA Mini-Course on Children's Environmental Health. Pediatric Academic Societies Meeting, Seattle, WA, May 2003.

19. Making the Case: The Need to Improve Health Care Provider Education and Practice, Children as a Vulnerable Population. Presented at the National Forum, National Strategies for Health Care Providers Pesticides Initiative. Washington, DC, June 2003.

20. The Environmental History in Pediatric Practice, When is it Useful? Presented at American Academy of Pediatrics National Conference and Exhibition. New Orleans, LA, November 2003.

21. Using an Environmental History in a busy Office Practice. Roper Hospital Grand Rounds for pediatricians in Private Practice in Charleston. Charleston, SC November, 2004.

22. Pesticide Poisoning in Children: Acute and Chronic Effects. Presented at American Academy of Pediatrics National Conference and Exhibition. San Francisco, October 2004.

23. Lead poisoning update and risk factors in the Charleston area. Roper Hospital Grand Rounds, for Charleston community pediatricians. Charleston,SC, September 2002, 2005.

24. Human exposure to pesticides: Exposures, selected effects, and prevention. Pesticide Conference, Maryland Pesticide Network, Baltimore MD, April 2006.

25. Environmental Management of Pediatric Asthma: Guidelines for Health care Providers. Children's Environmental Health Faculty Champions: Train-the-Trainer Workshop. Washington DC, July 2006.

26. Environmental Management of Pediatric Asthma: Guidelines for Health care Providers. Frontiers in Pediatrics Charleston, SC December, 2006.

27. Environmental Management of Pediatric Asthma: Guidelines for Health care Providers. American College of Preventive Medicine. Miami, FL, February, 2007.

28. Exposure of Children to Environmental Toxicants. Research Seminar series, Hollings Marine Lab. Charleston, March 2007.

29. Skin rashes—What, why, and what to do. Presented at 2007 SC Association for School Nurses 7th Annual Conference. Myrtle Beach, SC June 2007.

30. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. Frontiers in Pediatrics. Grand Rounds, University of South Carolina, Columbia, SC March, 2008.

31. Pesticide Exposure and Consequences in Children. Beyond Pesticides Annual National Forum. University of California, Berkeley, CA, March 2008.

32. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. Frontiers in Pediatrics. American Association of Physician Assistants National Meeting, San Antonio, TX, May, 2008.

33. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. SC Association for School Nurses 8th Annual Conference. Myrtle Beach, SC June 2008.

34. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. South Carolina Asthma Summit. Greenville, SC, August 2008.

35. What Hazards are Lurking in the Home? Evaluating the Home for Environmental and Safety Hazards. American Academy of Pediatrics National Conference and Exhibition. Boston, MA, October 2008.

36. Pesticides in Children: Exposures, Health Effects, and Prevention. Plenary Session Speaker, American Academy of Pediatrics National Conference and Exhibition. Boston, MA, October 2008.

37. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. Pediatrics Grand Rounds, Greenville Hospital System. Greenville, SC, October 2009.

38. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. South Carolina Asthma Summit. Greenville, SC, August 2010.

39. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. Pediatrics Grand Rounds, University of South Florida. Tampa, FL, November 2010.

40. Pesticides in Children: Exposures, health effects and prevention. Pediatrics Grand Rounds, Mt. Sinai School of Medicine, New York City, NY, April 2011.

41. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. National Medical Association Annual Meeting. Washington, DC, July 2011.

42. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. South Carolina CATCH meeting, Charleston, SC February 2012.

43. American Academy of Pediatrics National Conference and Exhibition. Food Matters: New meaning to the Phrase 'What's for Dinner?' New Orleans, LA, October 23, 2012.

44. American Academy of Pediatrics National Conference and Exhibition. Pesticide Poisoning: Acute or Chronic, It's not the Same. New Orleans, LA, October 23, 2012.

45. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. Ochsner Pediatrics Grand Rounds, New Orleans, LA November, 2012.

46. Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers. Oklahoma University Health Sciences Center, Pediatric Grand Rounds, March 2013.

Publications: (Names in italics are Trainees (Student, resident, or fellow), * denotes mentored junior faculty))

Peer Reviewed Journal Articles:

1. **Roberts JR**, Benjamin JT, *Fox S*. Crunchy peanut butter: A cause of foreign body aspiration in children. *Clinical Pediatrics* 1996;35:591-2.

2. **Roberts JR**, Spooner SA. Pediatric internet resources: Creation and growth of the PEDINFO index. *Arch Ped Adol Med* 1997;151:592-7.

3. Spooner SA, **Roberts JR**. Characterizing the content of the pediatric Internet with the PEDINFO database. *Ambulatory Child Health* 1997;3:308-318.

4. **Roberts JR**, Landers KM, Fargason CA. An unusual source of lead poisoning. *Clinical Pediatrics* 1998;37:377-9.

5. **Roberts JR**, Spooner SA. Medical informatics curriculum in pediatric residency training. *Medical Education* 1999;33:762-7.

6. **Roberts JR**, Boker JR, Oh MK, and DiClemente RJ. Health care service use and sexual communication: Past experience and future intention of high-risk male adolescents. *J Adol Health* 2000;27:28-301.

7. **Roberts JR**, Reigart JR, Ebeling M, Hulsey TC. Time required for blood lead levels to decline in non-chelated children. *J Tox Clin Tox* 2001;39:153-160.

8. **Roberts JR**, Reigart JR. Environmental Health Education in the medical school curriculum. *Ambulatory Pediatrics* 2001;1:108-111.

9. **Roberts JR**, Reigart JR. Screening for lead poisoning in South Carolina children. *J South Carolina Medical Association* 2001;97:459-64.

10. Reigart JR**, Roberts JR**. Exposure of children to pesticides. *Pediatric Clinics of North America* 2001;48:1185-98.

11. *Sribnick E, Goldblatt M,* Campbell J, **Roberts JR**. Moyamoya disease in a four-month-old: A case study. *Clinical Pediatrics* 2002;42:281-4.

12. **Roberts JR**, Gitterman B. Environmental health education in United States pediatric residency programs. *Ambulatory Pediatrics* 2003;3:57-59.

13. **Roberts JR**, Curtis GB, Hulsey TC, Reigart JR. Using geographic information systems to assess risk for elevated blood lead levels in children. *Public Health Reports* 2003;118:221-9.

14. *Schwab LT*, **Roberts JR**, Reigart JR. Inaccuracy in parental reporting of the age of their home for lead-screening purposes. *Arch Ped Adol Med* 2003;157:584-6.

15. **Roberts JR**, Reigart JR. Insect Repellents: Does Anything Beat DEET? *Pediatric Annals* 2004;33:444-453.

16. McCurdy LE, **Roberts JR**, Rogers B, Love R, Etzel R, Paulson J, Witherspoon NO, and Dearry A. Incorporating environmental health into pediatric and nursing education. *Environmental Health Perspectives* 2004;112:1755-60.

17. *Smith L*, **Roberts JR**, Reigart JR. Resident Rounds: Constipation; Diagnosis: Lead toxicity without acute encephalopathy. *Clinical Pediatrics* 2007;46:83-5.

18. *Cantey JB, Goldblatt M,* Johnson G, **Roberts JR**. Resident Rounds: A flu-like illness. Diagnosis: Acute HIV-1 infection. *Clinical Pediatrics* 2007;46(6):560-2.

19. Balk SJ, Forman JA, Johnson CL, **Roberts JR**. Pediatric environmental health update: What's important in the history and accessing resources. *Contemporary Pediatrics* 2007;24(3):64-80.

20. **Roberts JR**, Hulsey TC, Reigart JR. South Carolina Physicians' knowledge and screening practices for childhood lead poisoning. *The Journal of the South Carolina Medical Association* 2007;103:

21. **Roberts JR**, Balk SJ, Forman J, Shannon M. Teaching about Pediatric Environmental Health: Confidence in Teaching and Barriers Reported by Faculty. *Ambulatory Pediatrics* 2009;9:129-30.

22. Rogers B, McCurdy LE, *Slavin K*, Grubb K, **Roberts JR**. Children's Environmental Health Faculty Champions Initiative: A Successful Model for Integrating Environmental Health into Pediatric Healthcare. *Environmental Health Perspectives* 2009; 117(5):850-855.

23. **Roberts JR**, *Kennedy SA*, Basco WT, Darden PM. Prevalence of Obesity in Children: Comparing Children from the South Carolina Pediatric Practice Research Network to a National Sample. *Clinical Pediatrics* 2010;49:750-5.

24. *Winterbottom K*, McCurdy LE, *Mehta S*, **Roberts JR**. Using Nature and Outdoor Activity to Improve Children's Health. *Current Problems in Pediatric and Adolescent Medicine*. 2010;5:102-117.

25. McElligott, JT*, **Roberts, JR**, O'Brien, ES, Freeland, KD, Kolassa, MS, Stevenson, J, Darden, PM. Improving Immunization Rates at 18 months of Age: Implications for Individual Practices. A Modeling Study from the South Carolina Pediatric Practice Research Network. *Public Health Reports* 2011;126/Suppl 2:33-38.

26. **Roberts JR**, Freeland KD, Kolasa M, *McElligott JT*, Darden PM. Do immunization procedures match provider perception? A study from the South Carolina Pediatric Practice Research Network (SCPPRN). *Quality in Primary Care* 2011;19(3):147-154.

27. McElligott JT, **Roberts JR**, Varadi EA, O'Brien ES, Freeland KD, Basco WT, Jr Variation in Fruit Juice Consumption Among Infants and Toddlers: Associations with WIC Participation. *Southern Medical Journal* 2012;105(7):364-9.

28. **Roberts JR**, Allen CL, Ligon C, Reigart JR. Are children still at risk for lead poisoning? *Clinical Pediatrics* 2013;52:125-130.

29. **Roberts JR**, Karr CK, deYbarrondo, McCurdy LE, Freeland KD, Hulsey TC, and Forman J. Improving Pediatrician Knowledge about Environmental Triggers of Asthma. *Clinical Pediatrics* 2013; 52(6):523 - 530.

30. Darden PM, Thompson DM, **Roberts JR**, Hale JJ, Pope C, Naifeh M, and Jacobson RM. Reasons for not vaccinating adolescents: National immunization survey of teens, 2008-2010. *Pediatrics* 2013; 131(4):645-51.

31. Jacobson RM, **Roberts JR**, and Darden PM. Parents' Perceptions of the HPV Vaccine: A Key Target for Improving Immunization Rates. *Expert Reviews in Clinical Immunology* 2013;9(9):791-3.

Publications with AAP Committee on Environmental Health:

32. American Academy of Pediatrics, Committee on Environmental Health. Pediatric Exposure and Potential Toxicity of Phthalate Plasticizers Balk SJ (Chair) Best D, Johnson CL, Kim JJ, Mazur LJ, Reynolds DW, **Roberts JR**, Shannon MW, Weil WB, Shea KM (lead author), Liaisons: Amler RW, Blackburn E, Linet M, Miller RW, Rogan W Pediatrics, Jun 2003; 111: 1467 - 1474.

33. American Academy of Pediatrics, Committee on Environmental Health. Radiation Disasters in Children. Balk SJ (Chair) Best D, Johnson CL, Kim JJ, Mazur LJ, Reynolds DW, **Roberts JR**,

Shea KM, Shannon MW (lead author), Weil WB, Liaisons: Amler RW, Blackburn E, Linet M, Miller RW, Rogan W Pediatrics, Jun 2003; 111: 1455 - 1466.

34. American Academy of Pediatrics, Committee on Environmental Health, and Committee on Infectious Diseases. Nontherapeutic Use of Antimicrobial Agents in Animal Agriculture: Implications for Pediatrics. Shannon MW (chair), Balk SJ, Best D, Binns HJ, Johnson CL, Kim JJ, Mazur LJ, Reynolds DW, **Roberts JR**, Shea KM (lead author), Weil WB, Liaisons: Amler RW, Blackburn E, Linet M, Miller RW, Rogan W. Pediatrics, Sep 2004; 114: 862 - 868.

35. Committee on Environmental Health. **Ambient Air Pollution: Health Hazards to Children.** Shannon MW (chair), Balk SJ, Best D, Binns HJ, Johnson CL, Kim JJ (lead author), Mazur LJ, Miller M, Reynolds DW, **Roberts JR**, Shea KM, Weil WB, Liaisons: Amler RW, Blackburn E, Linet M, Miller RW, Rogan W. Pediatrics, Dec 2004; 114: 1699 - 1707.

36. Committee on Environmental Health and the Committee on Nutrition. Infant Methemoglobinemia: The Role of Dietary Nitrate in Food and Water. Shannon MW (chair), Balk SJ, Best D, Binns HJ, Greer F (lead author), Johnson CL, Kim JJ, Mazur LJ, Reynolds DW, **Roberts JR**, Shea KM, Weil WB, Liaisons: Amler RW, Blackburn E, Linet M, Miller RW, Rogan W Pediatrics, Sep 2005; 116: 784 - 786.

37. American Academy of Pediatrics, Committee on Environmental Health. Lead exposure in children: Prevention, detection, and management. Shannon MW (Chair), Best D, Binns HJ, Kim JJ, Mazur LJ, Weil WB, Jr., Johnson CL, Reynolds DW, **Roberts JR**. Liaisons: Blackburn E, Johnson RH, Linet M, Rogan WJ (lead author). *Pediatrics* 2005;116:1036-1046.

38. Committee on Environmental Health and Committee on Infectious Diseases. **Chemical-Biological Terrorism and Its Impact on Children**. Shannon MW (chair and lead author), Best D, Binns HJ, Forman JA, Johnson CL, Karr CJ, Kim JJ, Mazur LJ, **Roberts JR**, Liaisons: Johnson RH, Blackburn E, Linet M, Rogan W. *Pediatrics* 2006;118:1267 - 1278.

39. Committee on Environmental Health. Spectrum of Noninfectious Health Effects From Molds**.** Shannon MW (chair), Best D, Binns HJ, Forman JA, Johnson CL, Karr CJ, Kim (co-lead author), JJ, Mazur LJ (co-lead author), **Roberts JR**, Liaisons: Anderson M, Blackburn E, Linet M, Rogan W. *Pediatrics* 2006; 118: 2582 - 2586.

40. Committee on Environmental Health. Global Climate Change and Children's Health. Shannon MW (chair), Best D, Binns HJ, Forman JA, Johnson CL, Karr CJ, Kim JJ (co-lead author), Mazur LJ (co-lead author), **Roberts JR**, Liaisons: Anderson M, Blackburn E, Savage S, Rogan W. *Pediatrics* 2007;120:1149 - 1152.

41. Committee on Environmental Health and Committee on Infectious Diseases. Drinking Water From Private Wells and Risks to Children. Binns HJ (chair), Forman JA, Karr CJ, Osterhoudt K, Paulson JA, **Roberts JR,** Sandel MT, Seltzer JM, Wright RO, Liaisons: Anderson M, Blackburn E, Linet M, Rogan W. *Pediatrics* 2009;123:1599 - 1605.

42. American Academy of Pediatrics, Committee on Environmental Health. The built environment: Designing communities to promote physical activity in children. Committee members: Binns HJ, chair, Forman JA, Karr CJ, Ousterhoudt K, Paulson JA, Sandel MT, **Roberts JR**, Seltzer JM, Wright RO. Past Committee members: Kim JJ. Liason: Anderson M, Blackburn E, Savage S, Rogan WJ. Consultants: Jackson RJ, Testor JM (lead author). Staff: Spire P. *Pediatrics* 2009;123:1591-8.

43. **Roberts JR**, Karr CJ (lead authors), American Academy of Pediatrics, Committee on Environmental Health. Pesticide exposure in children. Policy Statement. Committee members: Paulson JA, chair, Brock-Utne AC, Brumberg HL, Campbell CC, Lanphear BP, Osterhoudt KC, Sandel MT, Trasande L, Wright RO. Past Committee Members: Binns HJ, Forman JA, Selzter JM. Pediatrics 2012;130(6): e1757-1763.

44. **Roberts JR**, Karr CJ (lead authors), American Academy of Pediatrics, Committee on Environmental Health. Pesticide exposure in children. Technical Report. Committee members: Paulson JA, chair, Brock-Utne AC, Brumberg HL, Campbell CC, Lanphear BP, Osterhoudt KC, Sandel MT, Trasande L, Wright RO. Past Committee Members: Binns HJ, Forman JA, Selzter JM. Pediatrics 2012;130(6): e1765-1788.

Peer Reviewed Scholarly Books and Monographs:

1. Reigart JR, **Roberts JR**. Recognition and Management of Pesticide Poisoning, 5th Edition. United States Environmental Protection Agency, Free Hand Press, Inc. Washington DC, March 1999.

2. **Roberts JR**, Reigart JR. Medical assessment and intervention, In: CDC Guidelines for Childhood Lead Poisoning. Centers for Disease Control and Prevention, United States Department of Health and Human Services, Atlanta GA, 2002.

3. **Roberts JR**, Burns C. Developing pesticide toxicology content for medical education curriculum. In: National Strategies for Health Care Providers: Pesticides Initiative. Environmental Protection Agency, Washington DC, 2003.

4. Curtis GB, Braggio JT, Fokum F, **Roberts JR**, Scott R, Staley F, Sweatlock J, and Tobin R. Using GIS to assess and direct childhood lead poisoning prevention: Guidance for state and local childhood lead poisoning prevention programs. Center for Disease Control and Prevention, United States Department of Health and Human Services, Atlanta GA, 2005.

5. **Roberts JR**, McCurdy LE. Environmental Management of Pediatric Asthma; Guidelines for Health Care Providers. National Environmental Education & Training Foundation, Washington DC, 2005.

6. **Roberts JR**, Reigart JR. Recognition and Management of Pesticide Poisoning, 6th Edition. United States Environmental Protection Agency, Free Hand Press, Inc. Washington DC, 2013.

Chapters in Scholarly Books and Monographs:

1. **Roberts JR**. Metal Toxicology. In: Children's environmental Health Network, Training Manual, Washington DC, 1999.

2. **Roberts JR**, Shannon M. Update on Arsenic. American Academy of Pediatrics News, Chicago IL, February 2003.

3. **Roberts JR**. Carbon Monoxide. In: Handbook of Pediatric Environmental Health, 2nd Ed. Ruth Etzel and Sophie Balk, Eds. American Academy of Pediatrics, Chicago, IL, November 2003.

4. Johnson CL, **Roberts JR**. PBDE's are ubiquitous, but effects of exposure are unclear. American Academy of Pediatrics News, Chicago IL, January 2005.

5. **Roberts JR**, Weil WB, Shannon MW. DEET alternatives considered to be effective mosquito repellents. American Academy of Pediatrics News, Chicago IL, June 2005.

6. **Roberts JR**. Carbon Monoxide. In: Handbook of Pediatric Environmental Health, 3rd Ed. Ruth Etzel, Sophie Balk, and Michael Shannon, Eds. American Academy of Pediatrics, Chicago, IL November, 2011.

7. **Roberts JR**, Gustafson KK, McElligott JM. The Play Environment. In: the Oxford Textbook of Children's Environmental Health. Phillip Landrigan and Ruth Etzel, Eds. 2013: In Press.

Extramural Professional Activities:

Curriculum Development; Resident Primary Care Clinic Conferences for use by 11 faculty and 50 residents. Developed sessions for hearing screening, pre-participation sports physical, hyperlipidemia in children, heart murmurs, cerebral palsy, and atopic dermatitis. University of Alabama at Birmingham, 1995-1997

Channel 2 and Channel 4 news. Interviewed regarding recent posting of lead hazard in a local elementary school. Charleston, SC, Segments aired Feb. 9, 2000.

Channel 2 News. Interviewed for two-part news segment on childhood lead poisoning and exposure due to paint and soil. Charleston, SC. Segments aired in Feb. 2001.

Toxic Legacies. Featured in Documentary about children's exposure to pesticides in Mexico. Aired on Canadian Broadcast Company (CBC) in March 2001; and Discovery Health Network, June 15, 2001.

CNN, MSNBC, and Channel 2 (local station) media interviews, "Lead in Fisher-Price Toy Recall'. August, 2, 2007.

Live 5 news (local station). Media Interview. Childhood lead poisoning. Aired August 2011.

Community Service:

Lead Poisoning update. Presented outreach education program to parents of Frazier Elementary School, January, 2002.

Science Fair Judge, Moultrie Middle School 7th, 8th grade. Charleston, SC, Jan. 1999 and Jan. 2000.

Medical aspects of childhood lead poisoning. Spoke to community based environmental protection group of private citizens, April 1999.

November 2013

Curriculum Vitae

GEORGE D. THURSTON
Wk: (845) 731-3564
Fax: (845) 351-5472
Email: george.thurston@nyu.edu
http://www.med.nyu.edu/biosketch/gdt1/research

Education

Degree	**Field**	**Institution**
Diploma	Academic	Barrington High School, RI
Sc.B. (Honors)	Environmental Engineering	Brown University
A.B.	Environmental Studies	Brown University
S.M.	Environmental Health Sciences	Harvard Univ. Schl. of Public Health
Sc.D.	Environmental Health Sciences	Harvard Univ. Schl. of Public Health

Postdoctoral Training

Specialty Mentor Place of Training
Environ. Epidemiology Dr. H. Ozkaynak Harvard Univ., Kennedy Schl. of Gov., Camb., MA

Internships and Residencies: N/A
Clinical and Research Fellowships: N/A
Licensure and Certification: N/A

Academic Appointments

1987-1993	Assistant Professor, Dept. of Environmental Medicine, New York University School of Medicine, New York City, NY.
1993-2006	Associate Professor (Tenured), Dept. of Environmental Medicine, New York University School of Medicine, New York City, NY.
2007-present	Professor (Tenured), Dept. of Environmental Medicine, New York University School of Medicine, New York City, NY.
2007-present	Affiliated Faculty, Environmental Studies Program, College of Arts and Sciences, New York University, New York City, NY.
2012-present	Affiliated Faculty, Marron Institute on Cities and the Urban Environment, New York University, New York City, NY
2012-present	Faculty Mentoring Champion, Dept. of Environmental Medicine, New York University School of Medicine, New York City, NY.

Hospital Appointments: N/A

Other Professional Positions and Visiting Appointments:

Oak Ridge Institute for Science and Education (ORISE) Fellow (2008-2010)

Major Administrative Responsibilities

Year	*Title, Place of Responsibility*
1995-2004	Director, Community Outreach and Environmental Education Program, NYU-NIEHS Center of Excellence, Nelson Inst. of Environ. Med., NYU School of Medicine, Tuxedo, NY
2002-2012	Deputy Director, NYU Particulate Matter Research Center, Nelson Inst. of Environmental Medicine, NYU School of Medicine, Tuxedo, NY
2007-2008	Director, Environmental Epidemiology Core, NYU-NIEHS Center of Excellence, Department of Environmental Medicine, Tuxedo, NY
2010-present	Co-Leader, Metals Research Focus Group, NYU-NIEHS Center of Excellence, Department of Environmental Medicine, Tuxedo, NY.
2012-present	Director, Program in Exposure Assessment and Human Health Effects, Department of Environmental Medicine, NYU School of Medicine.
2012-present	Chair, Appointments and Promotions Committee, Department of Environmental Medicine, NYU School of Medicine.

Teaching Experience

Year	*Name of course*		*Type of Teaching/Contact Hrs.*
1984-1994	Air Poll. Transport Modeling	(G48.2048)	Course Director
2006-present	Weather, Air Pollution, and Health	(G48.1010)	Course Director
1986-present	Aerosol Science	(G48.2033)	Course Director
1984-2010	Environmental Contamination	(G48.2305)	Lecturer
1984-present	Environ. Hygiene Measurements	(G48.2035)	Lecturer/Lab
1990-1998	Environmental Toxicology	(G48.1006)	Lecturer
1993-1995	Environmental Epidemiology I	(G48.2039)	Lecturer
2001-2003	NYU Summer Institute, Wagner School		Lecturer
2006-present	Environmental Epidemiology I	(G48.2039)	Lecturer
2006-present	Science, Health & Envir. Journalism	(G54.1017.0)	Lecturer
2009-2011	Global Environmental Health	(U10.2153.1)	Course Director
2009-2012	Global Issues in Environ. Health	(G48.1011)	Course Director
2009-present	Earth Systems Science (undergrad)	(V36.0200)	Lecturer
2011-present	Principles of Environmental Health	(G48.1004)	Course Director

Awards and Honors

November 1999	Orange Environment Citizens Action Group, OE Award for Excellence in Translating Science to the Public
December 2000	NYU School of Medicine Dean's Research Incentive Award
October 2012	Recipient of the "Haagen Smit Prize" for Best Paper, Atmospheric Environment. https://geo.arc.nasa.gov/sgg/singh/winners12.html
March 2013	Recipient of the "Top Science Paper of the Year – Science" Award from ES&T https://pubs.acs.org/doi/full/10.1021/es400924t

Major Committee Assignments

New York University Committees

2007-present	University Sustainability Task Force
2010-2012	University Faculty Senate Alternate
2012-2013	University Faculty Senator

NYU School of Medicine Departmental Committees

1992-1998 Sterling Forest Library Committee, Member, NYU SOM Dept of Environ. Medicine 1991-1994 Health & Safety Committee, Member, NYU SOM Dept. of Environ. Medicine

1992-2004 Community Outreach and Education Comm., Chairman, NYSOM Dept. of Environ. Med.

1999-2004 Dept. Chairman's Internal Advisory Comm., Member, NYUSOM Dept. of Environ. Med. 2005-present Dept. Academic Steering Committee, Member, NYUSOM Dept. of Environ. Medicine 2007-2012 Dept. Appointments & Promotions Comm., Member, NYUSOM, Dept. of Environ. Medicine 2012-present Dept. Appointments & Promotions Comm., Chair, NYUSOM, Dept. of Environ. Medicine

Advisory Committees

Regional

1983-1984 Massachusetts Acid Rain Advisory Board, Member, Mass. Dept. of Env. Protection 1984-1986 Committee on Environ. And Occup. Health. , NY State American Lung Association 1991-1996 Air Management Advisory Comm., Member of Health Effects Subcom., NY State DEC 1995-1999 Engineering Advisory Board, Member, Tuxedo, NY

1997-1998 Advisory Committee to the Mayor on the Port of Newburgh, Member, Newburgh, NY 1996-1999 CUES Asthma Working Group, Member, New York Academy of Medicine

2008-2010 New York City Community Air Study (NYCCAS) Advisory Panel

National

1995-1999 Comm. on Health Effects of Waste Incineration, Member, National Academy of Sciences 1995-1999 National Air Conservation Commission, Member, American Lung Association 2000-2004 National Action Panel on Environment, Member, American Lung Association 2005-present National Clean Air Committee, Member, American Lung Association

2007-2010 U.S. EPA Clean Air Science Advisory Committee (CASAC) for SOx and NOx

Mar. 2012 EPA Panelist for "Kickoff Workshop to Inform EPA's Review of the Primary NO_2 NAAQS"

International

1996-1997 Sulfur in Gasoline Health and Environment Panel, Chairperson, Health Canada

Sept. 2007 Illness Cost of Air Pollution Expert Committee, Canadian Medical Association

2008-2012 Global Burden of Disease (GBD), Committee on the Human Health Effects of Outdoor Air Pollution, World Health Organization (WHO)

Grant Review Committees (National)

March 1989 EPA Air Chemistry and Physics Extramural Grants Review Panel (*ad hoc member*)

Oct. 1989 NIEHS P30 Center Special Review Panel (*ad hoc member*)

July 1992 NIH R01 Epidemiology & Disease Control Study Section (*ad hoc member*)

Nov. 1992 NIEHS P20 Center Development Grant Special Study Section, (*ad hoc member*)

June 1996 EPA Special Review Panel of the Health Effects Institute (HEI) (*ad hoc member*)

March 1997 EPA Office of Res. and Development External Grant Review Panel (*ad hoc member*)

April 1997 NIEHS Community-Based Participatory Res. R01 Special Study Sect. (*ad hoc member*)

July 1997 EPA National Environ. Research Lab Intramural Research Review Panel (*ad hoc member*)

June 1998 EPA Office of Res. and Development External Grant Review Panel (*ad hoc member*)

July 1998 EPA Climate Policy and Programs Division Grant Application Review (*ad hoc member*)

Oct. 1998 Mickey Leland Center for Air Toxics Grant Review Panel (*ad hoc member*)

April 2000	NIEHS P30 Center Special Review Panel (*ad hoc member*)
July 2001	NIEHS Community-Based Participatory Res. R01 Special Study Sect. (*ad hoc member*)
Dec. 2001	NIEHS Program Project P01 Site Visit Review Panel (*ad hoc member*)
April 2003	NIH R21 Fogarty Health, Env. and Economic Development Study Sect. (*ad hoc member*)
Nov. 2003	U.S. EPA STAR Grant Panel (Epidemiologic Research on Health Effects of Long-Term Exposure to Ambient Particulate Matter and Other Air Pollutants) (*member*)
Oct. 2004	NIEHS Program Project P01 Review Panel (*ad hoc member*)
June 2005	NIH Special Emphasis Panel (ZRG1 HOP Q 90 S) (*ad hoc member*)
Nov. 2005	NIH Infectious Disease, Reproductive Health, Asthma/Allergy, and Pulmonary (IRAP) Conditions Study Section Review Panel (*ad hoc member*)
Feb. 2006	NIH Infectious Disease, Reproductive Health, Asthma/Allergy, and Pulmonary (IRAP) Conditions Study Section Review Panel (*ad hoc member*)
June 2006	NIH Infectious Disease, Reproductive Health, Asthma/Allergy, and Pulmonary (IRAP) Conditions Study Section Review Panel (*ad hoc member*)
Dec. 2006	NIEHS Special Emphasis Panel on Genetics, Air Pollution, and Respiratory Effects (ZES1 TN-E FG P) (*member*)
Nov. 2007	NIH Special Emphasis Panel on Community Participation in Research (ZRG1 HOPS) (*member*)
June 2009	NIH Study Section Review Panel on Challenge Grants in Health & Science Research March 2011 U.S. EPA Science to Achieve Results (STAR) Graduate Fellowship Review Panel – Clean Air Panel (*chair*)
Sept. 2011	NIH Special Epidemiology Study Section (ZRG1 PSE K 02 M) (*member*)
Oct. 2012	NIH Cardiac and Sleep Epidemiology (CASE) Study Section (*ad hoc member*)
June 2013	NIH Special NHLBI Dataset Study Section (ZRG1 PSEQ 56) (*member*)
July 2013	NIH "Career Awards" Study Section (ZES1 LWJ-D, K9) (*member*)
Sept. 2013	Appointed Permanent Member, NIH Cardiac & Sleep Epid. (CASE) Study Section

Memberships, Offices, and Committee Assignments In Professional Societies

Year	*Society/Committees*
1980-1996	Air and Waste Management Association (Comm. on Health Effects and Exposure,)
1992-Present	American Thoracic Society (ATS): Environmental and Occup. Health (EOH) Assembly, 1995-1999, 2012-present: ATS EOH Long Range Planning Committee; 1993-1994, 2002-2004: ATS Program Committee 2006-2007 Chairman of the ATS-EOH Nominating Committee 2010-present: ATS Environmental Health Policy Committee, member 2012-present: ATS Environmental Health Policy Committee, Vice-Chairman
1990-present	International Society of Exposure Analysis
1992-present	International Society for Environmental Epidemiology (Annual Meeting Program Committee: 1998, 2000, 2003, 2004, 2006) (ISEE Conference Planning Committee: 2006-present)
2007-2009	New York Academy of Sciences (membership given in appreciation for a 1/23/07 NYAS forum presentation)

Editorial Positions

Journal Board Membership

Year	*Name of Board*
1993-2008	International Society of Exposure Analysis (J. of Exp. Anal. and Environ. Epid.)

Ad Hoc Manuscript Reviewer

Years	*Journal*
1996-1998	American Journal of Epidemiology
1994	Archives of Environmental Health
1995-present	Atmospheric Environment
1995-present	Environmental Health Perspectives
1994-present	Environmental Research
2004-present	Environmental Science and Technology
2011-present	Epidemiology
1993-present	Journal of Exposure Analysis and Environmental Epidemiology
1994-present	Journal of the Air and Waste Management Association
1996-present	Journal of the American Medical Association
1997-present	Journal of Occupational and Environmental Medicine
1997-present	Journal of Respiratory and Critical Care Medicine
2006-present	Thorax

Scientific Report Reviewer

August, 1986	Reviewer for the National Academy of Sciences, Board on Environmental Studies and Toxicology report "The Airliner Cabin Environment: Air Quality and Safety"
October, 2002	Reviewer for the NAS, Board on Environmental Studies and Toxicology report "Estimating the Public Health Benefits of Proposed Air Pollution Regulations"

Mentoring of Graduate Students, Residents, Post-Doctoral Fellows in Research

Under direct supervision:

Student Name	*Type of Position*	*Time Period*	*Present Position*
Mark Ostapczuk	Masters	1984-1986	Industrial Hyg., Barr Labs, Pomona, NJ
Kazuhiko Ito	Masters/Doctoral	1984-1990	Scientist, NYC Dept. of Health, NYC, NY
Peter Jaques	Masters/Doctoral	1988-1998	Assoc. Prof., Clarkson Univ., Potsdam, NY
R. Charon Gwynn	Masters/Doctoral	1992-1999	Epidemiologist, Columbia Univ., NY
Ramona Lall	Masters/Doctoral	2000-2007	Research Sci. IV, NYC Dept. of Health, NY
Ariel Spira-Cohen	Masters/Doctoral	2003-2009	Research Sci. III, NYC Dept. of Health, NY
Kevin Cromar	Masters/Doctoral	2008-2012	Assistant Professor, NYU School Of Medicine
Lital Yinon	Doctoral	2011-present	Doctoral Candidate, NYU School of Medicine

In advisory function (thesis committee):

Student Name	*Advisory Role*	*Time Period*	*Student's Supervisor*
Shao-Keng Liang	Doctoral Committee member	1990-1994	Dr. J. Waldman, UMDNJ, Rutgers
Jerry Formisano	Doctoral Committee member	1997-2000	Dr. M. Lippmann, NYU SOM
Yair Hazi	Doctoral Committee member	1993-2001	Dr. B. Cohen, NYU SOM
Samantha Deleon	Doctoral Committee member	1997-2003	Dr. K Ito, NYU SOM
Chun Yi Wu	Doctoral Committee member	2000-2004	Dr. L.C. Chen, NYU SOM
Carlos Restrepo	Doctoral Committee member	2002-2004	Dr. R. Zimmerman, Wagner, NYU
Shaou-I Hsu	Doctoral Committee member	2000-2009	Dr. M. Lippmann, NYU-SOM
Steven Schauer	Doctoral Committee member	2007-2009	Dr. B. Cohen, NYU-SOM
Christine Ekenga	Doctoral Committee Chair	2009-2011	Dr. G. Friedman-Jimenez, NYU-SOM
Rebecca Gluskin	Doctoral Committee Chair	2009-2012	Dr. Kazuhiko Ito, NYU SOM
Jiang Zhou	Doctoral Committee Chair	2008-2012	Dr. Kazuhiko Ito, NYU SOM

Teaching Awards Received: N/A

Major Research Interests

1) Air Pollution Epidemiology: Real-world air pollution exposures and human health effects in the general population and study cohorts of suspected susceptible individuals (e.g., children).

2) Aerosol Science: Ambient particulate matter aerosol exposures, including designing and implementing air monitoring equipment to collect human exposures to air pollution.

3) Environmental Exposure Assessment: Methods to assess human exposures and health effects from air pollution, especially the development of source apportionment models to separate human effects on the basis of pollution source. Design of epidemiological models/methods that better incorporate potential air pollution confounders/effect modifiers (e.g., weather and genetic influences).

Grants Received

Prior:

Agency	Title	Grant #	Period	Total Direct Costs	Role	% Effort
USEPA	Effects of Acute Exposure to Summertime Haze Episodes on the Health of Humans	R811563	05/01/84-09/30/87	$538,586	CO-I	50%
NIH	Acid Aerosol Exposure: Effect on Respiratory Morbidity	R01 ES04612	09/25/87-08/31/92	$846,966	PI	30%
USEPA	Acid Aerosol Chamber Experiments	OD2524AEX	7/2/90-7/31/90	$5,810	PI	9%
USEPA	Analysis of Acid Aerosol Experiments	00422248NAEX	8/1/90-9/30/90	$3,364	PI	5%
USEPA	Air Pollutants and Human Health	R814023	05/18/87-05/17/91	$690,921	CO-I	50%
USEPA	Development and Field Applic. of an Automated Sequential Weekly Average H+ Sampler	Subcontract to EPA Grant CR816740-03	6/1/92-2/28/93	$13,156.	PI	15%
NIH	Acid Aerosol Exposure: Effect on Respiratory Morbidity	R01 ES04612	09/01/92-08/31/95	$377,298.	PI	30%
HEI	Retrospective Characterization of Ozone Exposures	Health Effects Institute Grant	11/1/93-10/31/94	$98,238	CO-I	10%
NIH	Temperature and Air Pollution Effects on Human Mortality	R01 ES05711	6/1/92-5/31/9	5 $371,993	PI	30%
NYUSOM	Environmental Effects on Human Mortality and Morbidity	Bridge Grant	9/1/95-8/31/96	$48,400	PI	-
USEPA	Effects of Exposure to Ambient Air Pollutants on Human Health	R808325	10/1/91-09/30/96	$870,565	CO-I	50%
USEPA	Investigation of Acid Aerosol Exposures in Metropolitan Settings	Subcontract to Grant No. CR822050	11/1/93-10/31/96	$200,499	PI	10%
USEPA	An Evaluation of Potential Confounders in PM10 Mortality Associations	R825271	11/25/96-11/24/01	$219,410	CO-I	10%
USEPA	Acidic PM and Daily Human Mortality in Three U.S. Cities	#R825264	11/25/96-11/24/00	$232,671	PI	15%

NYS-ERDA	Environmental Monitoring, Evaluation, and Protection Program	6084-ERTER-ES00	12/01/99-11/30/02	$341,926	PI	20%
HEI	Children's Asthma Incidence and Personal Exposures to Diesel Particles and Traffic in NYC		01/01/02-12/31/02	$154,800	PI	30%
USEPA	Influence of Alternate Indicator of Exposure to PM and PM Components in Statistical Associations with Mortality and Hospital Admissions	s R827358	03/01/99-02/28/03	$183,089	PI	30%
NIH	NIEHS Center Supplement: Health Issues Related to the World Trade Center Disaster, Outreach Project	ES00260-S1	04/01/02-03/31/03	Total=$ 936,487 Outreach=$172,031	CO-PI PI	10% 15%
NIH	Effects of Ambient Air Pollutants on Annual Mortality	RO1 ES09560	9/15/99-8/31/03	$471,408	PI	30%
USEPA	Particle Exposures of High-Risk Sub Populations	R827164	10/01/98-09/30/03	$1,327,240	CO-I	10%
USEPA	A Source Oriented Evaluation o the Combined Effects of Fine Particles and Co-pollutants	R827997	02/01/00-01/31/04	$291,407	CO-I	15%
NIH	NIEHS Center Grant: Outreach and Education Program	ES00260	04/01/00-03/31/05	Total=$5,000,000 Outreach=$240,365	CO-I PI	5% 5%
USEPA	EPA PM Health Effects Center Project 6: "A Prospective Study of Asthma Susceptibility to PM Epidemiologic Investigations of Key PM Components and Biomarkers of Effects & Community Outreach Project	R827351 :	06/01/99-05/31/05	Total=$6,000,000 Project 6=$134,923 Outreach=$77,779	CO-PI PI PI	15% 10% 10%
NIH	Genetic/Epigenetic Susceptibility to Superfund Chemicals: Outreach Project	ES010344	05/08/00-03/31/06	$156,812	CO-I	5%
USEPA	Env. Issues in the South Bronx. Thurston Project: S. Bronx Backpack Study	X1982152	08/01/00-09/30/06	Total=$921,922 Project=$307,131	CO-I PI	5% 15%
NIH	NIEHS Center Supplement: Health Issues Related to the World Trade Center Disaster, Source Attribution (Project 4) & Community Outreach	ES00260-S2	04/01/02-03/31/04	Total=$660,000 Project 4=$69,999 Outreach=$172,03	Co-PI PI PI	10% 10% 15%
USEPA	The role of traffic-related pollution in PM health effects associations among inner-city children with asthma	16511	09/01/06-08/31/09	$51,516	PI	-
California Air Resources Board (CARB)	Spatio-temporal Analysis of Air Pollution and Mortality in California Based Upon the ACS Cohort (Thurston: Consulting Project)		06/01/07-5/31/10	Project=$13,634	Co-I	4%

USEPA	Real time modeling of weather, air pollution, health outcome indicators in NYC.	RD-83362301-0	12/07-11/10	$130,496	Co-I	5%
NIH	Fine Particles and Out-of-Hospital Cardiac Arrest in New York City	R01ES014387-01A2	04/09-12/11	$200,000	C0-I	10%
Health Effects Institute (HEI)	Characteristics of PM Associated with Health Effects. *Thurston Project*: "Study Of PM Components and U.S. Human Mortality In The ACS Cohort.	4750	01/01/07-3/31/11	Total=$3,247,567 Project=$355,920	Co-I PI	5% 20%

Current:

Agency	Title	Grant #	Period	Total Direct Costs	Role	% Effort
New York State DOT	Mobile Source Air Toxics (MSATs) Mitigation Measures		09/01/10 06/31/13	SubProject=$89,062	Co-I	10%
Robert Wood Johnson Foundation	The Effect of Peak-Shaving Regulations on the Activity, Toxic Emissions, and Health Impacts of Local Power Plants	Public Health Law Research	1/12-7/13	$151,500	Co-I	10%
NIH	Long-term Air Pollution Exposure and Mortality in the NIH-AARP Cohort.	R01ES019584-01A1	1/01/12-6/30/16	$1,221,253	MPI (Contact PI)	20%
The Public Health Research Institute of Abu Dhabi	Development of a Public Health Research Institute in Abu Dhabi. *Thurston Project*: "Air Pollution in Abu Dhabi".		3/2012-2/2017	$9,993,960	Co-I	10%
NIH	Dietary Influence on Mortality from Air Pollution Exposure in the NIH-AARP Cohort (R21)	1R21ES021194-01	7/12-6/14	$150,000	MPI (Contact PI)	8%

Patents

None

Boards and Community Organizations

1990-1995 St. Mary's Episcopal Church, Tuxedo, NY, Vestry member
1992-present Monroe-Woodbury Soccer Club, Coach (Board Member: 1999-2000)

1994-present Orange County Citizen's Foundation, Member

1999-2009 Y2CARE Monroe-Woodbury, NY School District Residents Action Group, Founder 2005-present St. Mary's Episcopal Church, Tuxedo, NY, Community Outreach Committee, Member 2006-present EPISCOBUILD-Newburgh, NY Habitat for Humanity Advisory Board, Member 2012-present St. Mary's Episcopal Church, Tuxedo, NY, Vestry member

Military Service
None

International Scientific Meetings Organized

May 28-30, 2003 "Workshop on the Source Apportionment of PM Health Effects." U.S. EPA PM Centers, Harriman, NY.

Aug. 1-4, 2004 "Sixteenth Conference of the International Society for Environmental Epidemiology," Kimmel Conference Center, Washington Square, New York University, New York City, NY.

Scientific Forums for the Public Organized

June 2001 "Science and Community Interaction Forum on the Environment." Held at Hostos Community College, Bronx, , New York City, NY.

October 2001 "Forum on Environmental Health Issues Related to the World Trade Center Disaster." Held at NYU Law School, Washington Square, New York City, NY.

October 2002 "2nd Annual Forum on the Environmental Health Issues Related to the World Trade Center Disaster." Held at Manhattan Borough Community College, New York City, NY.

October 2003 "3nd Annual Forum on the Environmental Health Issues Related to the World Trade Center Disaster." Held at NYU Lower Manhattan Campus, New York City, NY.

Invited U.S. House and Senate Congressional Testimony

Feb. 5, 1997 "Human Health Effects of Ambient Ozone Exposures" Statement before the Committee on Environment and Public Works, Subcommittee On Clean Air, Wetlands, Private Property, And Nuclear Safety, U.S. Senate, Washington, DC. https://epw.senate.gov/105th/thurston.htm

April 16, 1997 "Human Health Effects of Ambient Ozone and Particulate Matter Exposures." Statement before the Government Reform and Oversight Committee of the U.S. House of Representatives, Washington, D.C.

May 8, 1997 "Human Health Effects of Ambient Ozone and Particulate Matter Exposures." Statement before the Subcommittee on Health and Environment, Committee on Commerce of U.S. House of Representatives, Washington,. D.C.

July 29, 1997, "The Human Health Effects of Ambient Ozone And Particulate Matter Air Pollution." Statement before the Subcommittee on Commercial and Administrative Law of the Judiciary Committee of the U.S. House of Representatives, Washington, D.C.
https://judiciary.house.gov/legacy/commercial.htm

October 22, 1997 "Ozone and Particulate Matter Air Pollution Health Effects." Statement before the U.S. Senate Committee on Environment and Public Works Subcommittee on Clean Air, Wetlands, Private Property, and Nuclear Safety. Washington, DC. https://epw.senate.gov/105th/thursto2.htm

July 15, 1999: "The Mandated Release of Government-Funded Research Data." Statement before the Committee On Government Reform, Subcommittee on Government Management, Information And Technology, U.S. House of Representatives

July 26, 2001 "The Human Health Effects Of Air Pollution From Utility Power Plants." Statement before the Committee on Environment and Public Works, U.S. Senate, Washington, D.C.
https://www.c-spanvideo.org/program/PlantE

Feb 11, 2002:	"The Air Pollution Effects of The World Trade Center Disaster." Statement before the Committee On Environment And Public Works, Subcommittee On Clean Air, Wetlands, And Climate Change. United States Senate, New York, NY. https://www.c-spanvideo.org/program/Qualitya
March 5, 2002	"The Use of the Nationwide Registries to Assess Environmental Health Effects." Statement before the Committee On Health, Education, Labor, And Pensions, Subcommittee On Public Health, U.S. Senate, Washington, DC.
Sept. 3, 2002	"The Clean Air Act and The Human Health Effects of Air Pollution from Utility Power Plants." Statement before the U.S. Senate Committee on Health, Education, Labor, and Pensions, Subcommittee on Public Health, Washington, D.C. https://www.c-spanvideo.org/program/AirStand
April 1, 2004	"The Human Health Benefits Of Meeting the Ambient Ozone And Particulate Matter Air Quality Standards." Statement before the Committee on Environment and Public Works, Subcommittee on Clean Air, Climate Change, and Nuclear Safety, U.S. Senate, Washington, D.C. http://epw.senate.gov/epwmultimedia/epw040104.ram
July 19, 2006	"The Science And Risk Assessment Of Particulate Matter (PM) Air Pollution Health Effects." Statement before the Committee on Environment and Public Works, U.S. Senate, Washington, D.C. http://epw.senate.gov/hearingstatements.cfm?id=258766
May 7, 2008	"Science And Environmental Regulatory Decisions." Statement before the Committee On Environment And Public Works of The U.S. Senate, Subcommittee on Public Sector Solutions to Global Warming, Oversight, and Children's Health Protection, U.S. Senate, Washington, D.C. http://www.c-spanvideo.org/program/RegulatoryD http://epw.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&HearingID=a1954f70-802a-23ad-4192-fc2995dda7f4
October 4, 2011	"The Science of Air Pollution Health Effects and the Role of CASAC in EPA Standard Setting" Statement before the Subcommittee on Energy and the Environment, Committee on Science, Space and Technology, U.S. House Of Representatives, Washington, DC. http://science.house.gov/hearing/energy-and-environment-subcommittee-–-hearing-quality-science-quality-air

Other Invited Presentations

Regional Presentations

April 21, 1993	"Summertime Smog and Hospital Admissions for Respiratory Illness", Environmental and Occupational Health Sciences Institute Seminar Series Lecture, UMDNJ-Robert Wood Johnson Medical School, Piscataway, NJ.
Dec .14, 1995	"Health Effects of Acidic Aerosols", NY State Dept. of Health, Wadsworth Center Seminar, Albany, NY
Jan. 18, 1996	"Outdoor Air Pollution and Asthma in Children " American Lung Association Press Briefing, New York, NY.
June 1, 1996	"Asthma and Urban Air Pollution", WHEACT, Harlem Hospital, New York, NY.
July17, 1996	"Asthma and Outdoor Air Pollution", Making the Connection: Urban Air Toxics & Public Health. Northeast States for Coordinated Air Use Management (NESCAUM), Roxbury, MA
Feb. 11, 1997	"Outdoor Air Pollution and Asthma", Bellevue Hospital Asthma Clinic *Grand Rounds*. New York City, NY.
Feb. 26, 1998	"Scientific Research for Ozone and Fine Particulate Standards ", Pace University School of Law, White Plains, NY

Nov. 30, 1998	"Outdoor Air Pollution and Asthma", Center for Urban and Environmental Studies (CUES), NY Academy of Medicine,, New York, NY
Feb. 22, 1999	"Asthma and Air Pollution", Cornell University, Ithaca, NY
April 28, 2001	"Asthma and Air Pollution in New York City", NYC Council Environmental Candidate School, NY League of Conservation Voters, New York, NY.
Nov. 1, 2001	"Air Quality and Environmental Impacts Due to the World Trade Center Disaster", Testimony before the Comm. on Environ. Protection, NYC Council, New York, NY.
Nov. 13, 2001	"WTC Pollution Impacts in Lower Manhattan", Stuyvesant High School Parents Association General Meeting, Stuyvesant High School, New York, NY
Feb. 28, 2002	"Lung Cancer Effects of Long-Term Exposure to Ambient Fine Particulate Matter", Mailman School of Public Health, Columbia University, New York, NY.
April 5, 2002	"Air Pollution Impacts of the WTC Disaster", 23rd Annual Scientific Conference of the NY/NJ Education and Research Center: "Worker Health and Safety: Lessons Learned in the Aftermath of Sept. 11, 2001," Mt. Sinai School of Medicine, NYC, NY
April 21, 2002	"Adverse Health Effects of Power Plant Air Pollution on Children" Earth Day 2002, 14th Street Y, New York City, NY.
May 23, 2002	"Human Health Effects of Power Plant Pollution", Rockland County Conservation Association, Suffern, NY
May 31, 2002	"Environmental Health Impacts of the World Trade Center Disaster", University of Rochester Medical School, Rochester, NY.
Sept. 19, 2002	"Community Air Pollution Related to the World Trade Center Disaster". NYC Council Forum: The Environmental Health Consequences of 9/11: Where Do We Stand One Year Later? Borough of Manhattan Community College, New York City, NY.
Oct. 3, 2002	"Community Exposures to Particulate Matter Air Pollution from the World Trade Center Disaster", Mount Sinai School of Medicine *Grand Rounds*, New York City, NY.
April 11, 2003	"Environmental Impacts of the World Trade Center Disaster", NIEHS Public Interest Liaison Group, New York City, NY.
April 21, 2003	"Asthma and Air Pollution", Airborne Threats to Human Health, NIEHS Town Hall Meeting, Syracuse, NY.
May 7, 2003	"Asthma and Air Pollution in NY City" Environmental Candidate School for New York City Council Candidates, Wagner School, NYU, New York City, NY.
July 21, 2003	"Health Effects of Particulate Matter Air Pollution", Ozone Transport Commission, Philadelphia, PA.
Nov. 18, 2004	"Ambient Air Pollution Particulate Matter (PM): Sources and Health Impacts". U.S. Environmental Protection Agency, Region 2, New York City, NY.
Feb. 17, 2005	"Community Air Pollution Aspects Of The Demolition Of 9-11 Contaminated Buildings". Testimony before the Committee On Lower Manhattan Redevelopment, New York City Council, New York City, NY.
Oct. 19, 2005	Air Pollution Health Effects: Consideration of Mixtures. Fall Meeting of the Mid-Atlantic Chapter of the Society of Toxicology (MASOT), East Brunswick, NJ.
Dec.7, 2006	Asthma and Air Pollution Effects in the South Bronx. New York City Child Health Forum, The Children's health Fund, Harlem, NYC, NY.
Jan. 18, 2007	Air Pollution Effects in New York City. NYU Environmental Sciences Seminar Lecture, Washington Square, NYC, NY.
Jan. 23, 2007	The South Bronx Backpack Study: Asthma and Air Pollution in NYC. Presented at the forum "High Asthma Rates in the Bronx: What Science Now Knows and Needs to Learn." New York Academy of Sciences, 7 World Trade Center, NYC, NY.

Oct. 2, 2009	"Diesel Air Pollution and Asthma in New York City". Brown Superfund Research Program. https://www.brown.edu/Research/SRP/thurston%20oct%202.pdf , Brown University, Providence, RI.
June 19, 2012	"The Backpack Study of Asthma and Diesel Air Pollution in the South Bronx". Region 1 U.S. EPA, Citizen Science Workshop, New York City, NY.

National Presentations

Oct. 20, 1987.	NIEHS Symposium on the Health Effects of Acid Aerosols: "Re-examination of London, England, Mortality in Relation to Exposure to Acidic Aerosols During 1963- 1972 Winters" RTP, NC.
Aug. 13, 1991	"Kuwait Mortality Risks from SO_2 and Particles: Insights from the London Fogs"' The Kuwait Oil Fires Conf., American Academy of Arts and Sciences, Cambridge, MA.
Jan. 24, 1994	"Air Pollution Epidemiology: Is the Model the Message?" The First Colloquium on Particulate Air Pollution and Human Morbidity and Mortality". Beckman Center of the NAS, Irvine, CA.
May 23, 1994	" Epidemiological and Field Studies". American Thoracic Society Annual Meeting, Boston, MA.
May 25, 1994	"Epidemiological Evidence Linking Outdoor Air Pollution and Increased Hospital Admissions for Respiratory Ailments" American Thoracic Society Annual Meeting, Boston, MA.
May 6, 1996	"Associations Between PM_{10} & Mortality in Multiple US Cities". Second Colloquium on Particulate Air Pollution and Health. Park City, Utah.
Sept. 5, 1996	"Particulate Matter Exposure Issues for Epidemiology" U.S. EPA Particulate Matter Workshop, RTP, NC
April 3, 1997	"Health Effects of Ambient Ozone & Particulate Matter" Air and Waste Assoc. Regional Conference On Impacts of EPA's Proposed Changes to Ozone and PM Standards, Oak Brook, IL
April 22, 1998	"The New EPA Standards for Ambient PM and Ozone" American Lung Association Annual Meeting, Chicago, IL.
Dec. 21, 1999	"Global Overview of Human Death and Illness due to Air Pollution". California Air Resources, Sacramento, CA.
March 24, 2000	"Estimating Ancillary Impacts, Benefits and Costs Of Proposed GHG Mitigation Policies For Public Health" Resources for the Future, Wash., DC.
June 24, 2002	"Investigations Into the Environmental Health Impacts Related to the WTC Disaster" Air And Waste Management Annual Meeting, Baltimore, MD.
July 15, 2002	"Air Pollution and Human Health" NIEHS Built Environment Conference, RTP, NC
July 26, 2002	"The Human Health Effects of Power Plant Emissions and Associated Air Pollution", The Environment & Health Forum, Physicians for Social Responsibility, Washington, DC.
October 7, 2002	"Community Exposures to Particulate Matter Air Pollution from the World Trade Center Disaster" Plenary Speaker at the American Association for Aerosol Research, Charlottesville, North Carolina.
Nov. 11, 2002	"Characterization of Community Exposures to World Trade Center Disaster Airborne and Settled Dust Particulate Matter Air Pollution", American Public Health Association Annual Meeting, Philadelphia, PA.
Dec. 5, 2002	"Susceptibility of Older Adults to Air Pollution", EPA Workshop on Differential Susceptibility of Older People to Environmental Hazards. National Academy of Sciences, Washington, DC.
Feb. 3, 2003	"Health Effects of Particulate Matter Air Pollution", National Air Quality Conference, U.S. EPA, San Antonio, Texas

May 17, 2003 "Assessing the Influence of Particle Sources and Characteristics on Adverse Health Effects of PM", PG18 - New Tools to Evaluate the Health Effects of Air Pollution in Epidemiologic Studies. American Thoracic Society Annual Meeting, Seattle, WA.

Sep. 10, 2003 "Nature and impact of World Trade Center Disaster fine particulate matter air pollution at a site in Lower Manhattan after September 11." Annual Meeting of the American Chemical Society, New York, NY.

October 20, 2003 "Translating Air Pollution Risks to the Community" Annual Meeting of the NIEHS Center Directors, Baltimore, MD.

May 18, 2004 "The Health Imperative for Implementation of the Clean Air Act" State and Territorial Air Pollution Program Administrators/ Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) National Conference, Point Clear, Alabama.

Oct. 18, 2004 "NIEHS Centers' Investigations of the World Trade Center Collapse Pollution Exposures and Effects: A Public Health Collaboration" National Institute of Environmental Health Sciences Center Directors' Meeting, Research Triangle Park, NC.

May 25, 2005 "PM/Sulfate and Coal Combustion Particle Effects: Epidemiologic and Toxicologic Evidence", American Thoracic Society Annual Meeting, San Diego, CA

Oct. 24, 2005 "The Science Behind the Particulate Matter (PM) Standards" State and Territorial Air Pollution Program Administrators/ Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) National Conference, Alexandria, Virginia.

Oct. 14, 2008 "Diesel Air Pollution and Asthma Exacerbations in a Group of Children with Asthma" Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Pasadena, California.

Feb. 26, 2010 "What studies are appropriate to use to estimate health impacts from specific sources such as diesel PM?" CARB Symposium: "*Estimating Premature Deaths from Long-term Exposure to* $_{PM2.5}$". Sacramento, CA.

May 6, 2011 "Lung Cancer Risks from Exposure to Fine Particle Air Pollution" NYU Cancer Institute Symposium: "Cancer and the Environment", NYC, NY.

May 16, 2012 "The Human Health Effects of Air Pollution" The Air We Breathe: Regional Summit on Asthma and Environment at Allegheny General Hospital, Pittsburgh, PA.

June 20, 2013 "Particles in our Air: A Global Health Risk", Northeastern University, Research Seminar. Boston, MA.

International Presentations

May 1, 1987 "Acid Aerosols: Their Origins, Occurrence, and Possible Health Effects", Canadian Environmental Health Directorate Seminar, Health and Welfare Canada, Ottawa, Canada

July 2, 1987 "Health Effects of Air Pollution in the US", University of Sao Paulo, Sao Paulo, Brasil

Feb. 5, 1991 "Results from the Analysis of Toronto Summer Sulfate and Aerosol and Acidity Data", Workshop on Current Use and Future Directions of Hospital-Based Data in the Assessment of the Effects of Ambient Air Pollution on Human Health. Health and Welfare Canada, Ottawa, Canada.

April 23, 1997 "An Evaluation of the Role of Acid Aerosols in Particulate Matter Health Effects", Conference on the Health Effects of Particulate Matter in Ambient Air. Air & Waste Management Association, Prague, Czech Republic.

May 12, 1998 "The Health Effects of PM and Ozone Air Pollution", Air Pollution: Effects on Ontario's Health and Environment. Ontario Medical Association, Toronto, Canada

Nov. 1, 1999	"Climate Change and the Health Impacts of Air Pollution". The Public Health Opportunities and Hazards of Global Warming Workshop at the U.N. Framework Convention on Climate Change, Conference of Parties (COP5), Bonn, Germany.
August 31, 2000	"Particulate Matter Air Pollution and Health in three Northeastern Cities", World Congress on Lung Health, Florence, Italy
January 29, 2001	"PM Exposure Assessment and Epidemiology", NERAM International Colloquia: Health and Air Quality: Interpreting Science for Decision Makers. Ottawa, Canada.
Feb. 4-5, 2002:	"Air Pollution Exposure Assessment Approaches in U.S. Long-Term Health Studies", Workshop on Exposure Assessment in Studies on the Chronic Effects of Long-term Exposure to Air Pollution, World Health Organization, Bonn, Germany
May 2, 2002	"Health Effects of Sulfate Air Pollution" Air Pollution as a Climate Forcing Workshop, East-West Center, Honolulu, Hawaii
Sept. 24, 2003	"Identification and Characterization of World Trade Center Disaster Fine Particulate Matter Air Pollution at a Site in Lower Manhattan Following September 11." Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Perth, Australia.
Dec. 1, 2003	"Terrorism and the Pulmonary Effects of the World Trade Center Disaster Particulate Matter Air Pollution", British Thoracic Society, London, England.
Sept 14, 2005	"Results And Implications of The Workshop on the Source Apportionment of PM Health Effects", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Johannesburg, South Africa.
Sept. 4, 2006	"A Source Apportionment of U.S. Fine Particulate Matter Pollution for Health Effects Analysis", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Paris, France.
Sept. 4, 2007	"Applying Attributable Risk Methods to Identify Susceptible Subpopulations", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Mexico City, Mexico.
Aug. 27, 2009	"Ischemic Heart Disease Mortality Associations with Long-Term Exposure to $PM_{2.5}$ Components", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Dublin, Ireland.
Dec. 1, 2010	"The Hidden Air Quality Health Benefits of Climate Change Mitigation". The Energy and Resources Institute (TERI), Lodhi Road, New Delhi, India.
July 17, 2012	"Recent Findings on the Mechanisms and Health Risks of Particulate Matter Air Pollution", European Centre for Environment & Human Health, Truro, England.
Aug. 29, 2012	"Health Effects of PM Components: NYU NPACT Epidemiology Results and their Integration with Toxicology Results", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Columbia, SC.
May 20, 2013	"Long-term $PM_{2.5}$ Exposure and Mortality in the NIH-AARP Cohort", Annual Meeting of the American Thoracic Society (ATS). Philadelphia, PA.
Oct. 27, 2013	"Human Health Effects and Global Implications of Particle Air Pollution", Center of Excellence in Exposure Science and Environ. Health, Technion University, Haifa, Israel.

Scientific Meeting Sessions Chaired

May 1, 1996	"Epidemiological Findings", 2nd Colloquium on Particulate Air Pollution & Health. Park City, UT.
May 14, 1996	"Particulate Toxicity", American Thoracic Society Annual Meeting, New Orleans, LA.
Jan. 30, 1998	"Evaluation of PM Measurement Methods". $PM_{2.5}$: A Fine Particulate Standard Specialty Conference. Los Angeles, CA.

August 18, 1998	"Communities and Airports: How to Co-Exist?", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Boston, MA.
April 28, 1998	"Clean Air Act Update", American Thoracic Society Annual Meeting, Chicago, IL.
Oct. 21, 1998	"Health Effects and Regulatory Issues in PM", Particulate Methodology Workshop,. U.S. EPA Center, for Statistics and the Env., Univ. of Washington, Seattle, WA.
April 26, 1999	"Pulmonary Smoking and Air Pollution Epidemiology." American Thoracic Society Annual Meeting, San Diego, CA
Sept. 6, 1999	"Personal exposures to Gases and Particles", Annual Conference of the International Society for Environmental Epidemiology (ISEE), Athens, Greece.
March 31, 2000	"Epidemiology: Particles, Co-pollutants & Morbidity and Mortality", Workshop on Inhaled Environmental/Occupational Irritants and Allergens: Mechanisms of Cardiovascular Responses, American Thoracic Society, Scottsdale, AZ
Jan. 26, 2000	"Epidemiology of Particulate Matter Air Pollution", PM2000 Specialty Conference, Air & Waste Management Assoc., Charleston, SC
May 8, 2000	"Outdoor Air Pollution: Epidemiologic Studies", American Thoracic Society Annual Meeting, Toronto, Canada
Sept. 5, 2001	"Mortality Epidemiology Studies", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Garmisch, Germany.
May 20, 2002	"After September 11: Bio-terrorism and The Environmental Health Aftermath of The World Trade Center Disaster", Plenary Session. American Thoracic Society Annual Meeting, Atlanta, GA.
April 1, 2003	"Epidemiology: Short-Term and Long-Term Health Effects", Conference on Particulate Matter: Atmospheric Sciences, Exposure, and the Fourth Colloquium on PM and Human Health, Pittsburgh, PA
May 19, 2003	"Particulate Air Pollution and Diseases in Adults", American Thoracic Society Annual Meeting, Seattle, WA.
May 21, 2003	"Air Pollution as a Cause of Childhood Asthma and Chronic Airway Disease", American Thoracic Society Annual Meeting, Seattle, WA.
Sept. 2003	"Unexplained Medical Symptoms", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Perth, Australia.
Sept. 25, 2005	"Technology and Health", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Johannesburg, South Africa.
June 22, 2006	"Characteristics of PM and Related Considerations", Annual Meeting of the Air and Waste Management Association, New Orleans, LA.
Sept. 3, 2006	"Air Pollution Mechanisms", Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Paris, France.
Sept. 20, 2006	"Linkage and Analysis of Air Quality and Health Data", EPA & CDC Symposium on Air Pollution Exposure and Health, RTP, NC
Sept. 5, 2007	"Radiation Exposures and Health Risks", 2007 Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Mexico City, Mexico
Aug. 26, 2009	"Exploring the Range of Methodological Approaches Available for Environmental Epidemiology." 2009 Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Dublin, Ireland
March 23, 2010	"Exposure to and Health Effects of Traffic Pollution", 2010 American Association for Aerosol Research Conference on Air Pollution and Health, San Diego, CA.
Sept. 16, 2011	"Susceptibility to Air Pollution", 2011 Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Barcelona, Spain.
Aug. 27, 2012	"Source Apportionment Of Outdoor Air Pollution: Searching For Culprits". 2012 Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Columbia, SC.

Aug. 21, 2013 "Source-specific health effects of air pollution". 2013 Annual Meeting of the International Society for Environmental Epidemiology (ISEE). Basel, Switzerland.

Bibliography

Invited Journal Editorials

Thurston GD and Bates DM, Air Pollution as an Underappreciated Cause of Asthma Symptoms, 2003. JAMA, 290:14, pp. 1915-1916 (2003).

Thurston G.D. (2006). Hospital admissions and fine particulate air pollution. JAMA. Oct 25; 296(16):1966.

Thurston G. (2007). Air pollution, human health, climate change and you. Thorax. 2007 Sep; 62 (9): 748-9.

Thurston GD, Balmes JR; Particulate matter and the environmental protection agency: setting the right standard. Environmental Health Policy Committee of the American Thoracic Society. Am J Respir Cell Mol Biol. 2012 Dec;47(6):727-8. doi: 10.1165/rcmb.2012-0414ED.

Book Chapters

Thurston, G.D. and Leber, M. The relationship between asthma and air pollution. In: *Emergency Asthma* (ed.: B. Brenner), pp. 127-144. Marcel-Dekker, New York, NY (1999).

Thurston, G.D. and Ito, K. Epidemiological studies of ozone exposure effects. In: *Air Pollution and Health* (ed.: S. Holgate and H. Koren). Academic Press. London. pp. 485-510 (1999).

Chen, LC, Thurston, G, and Schlesinger, RB. Acid Aerosols as a Health Hazard. In: *Air Pollution and Health* (ed.: J. Ayres, R. Maynard, and R. Richards). Air Pollution reviews: Vol. 3. Imperial College Press. London. pp. 111-161 (2006).

Thurston, G.D. and Wallace, L. Air Pollution: Outdoor and Indoor Sources. In: *Environmental and Occupational Medicine*, 4th Edition (Eds.: W. Rom and S. Markowitz). Lippincott, Williams, and Wilkins, Philadelphia (2006).

Thurston, G.D. Air Pollution. In: *Encyclopedia of Public Health* (ed. K. Heggenhougen) Elsevier Press. (2007).

Thurston, G.D and Bell, M. Aerosols, global climate, and the human health co-benefits of climate change mitigation. In *Aerosol Handbook* (2nd edition, in press) (eds.: Lev S. Ruzer and Naomi H. Harley). CRC Press (2012)

National Academy Committee Books Co-Authored

National Research Council (NRC), *Waste Incineration & Public Health.* Committee on Health Effects of Waste Incineration. Board on Environmental Studies and Toxicology. National Academy Press, Washington, DC (2000).

International Reports Co-Authored

Health Canada, *Health and Environmental Impact Assessment Panel Report*, "Joint Industry/Government Study: Sulfur in Gasoline and Diesel Fuels". Ottawa, Canada. (1997).

World Health Organization (WHO), Exposure assessment in studies on the chronic effects of long-term exposure to air pollution. Report EUR/03/5039759. Geneva, Switzerland (2003).

Peer Reviewed Journal Articles/Letters

Thurston, G.D. General Discussion: Atmospheric dispersion modeling - A critical review. J. Air Pollut. Control Assoc. 29: 939 (1979).

Thurston, G.D. Discussion of multivariate analysis of particulate sulfate and other air quality variables by principal components - part I. Annual data from Los Angeles and New York. Atmos. Environ. 15: 424-425 (1981).

Thurston, G.D., J.D. Spengler and P.J. Samson. An assessment of the relationship between regional pollution transport and trace elements using wind trajectory analysis. Receptor Models Applied to Contemporary Pollution Problems, Ed. E. Frederick, Air Pollution Control Association, Pittsburgh, PA (1982).

Spengler, J.D. and G.D. Thurston. Mass and elemental composition of fine and coarse particles in six U.S. cities. J. Air Poll. Control Assoc. 33: 1162-1171 (1983).

Currie, L., R. Gerlach, C. Lewis, W.D. Balfour, J. Cooper, S. Dattner, R. DeCesar, G. Gordon, S. Heisler, P. Hopke, J. Shah and G. Thurston. Inter-laboratory comparison of source apportionment procedures: Results for simulated data sets. Atmos. Environ. 18: 1517-1537 (1984).

Thurston, G.D. and J.D. Spengler. A quantitative assessment of source contributions to inhalable particulate matter in metropolitan Boston, Massachusetts. Atmos. Environ. 19: 9-25 (1985).

Thurston, G.D. and N.M. Laird. Letters: Tracing aerosol pollution. Science 227: 1406-1407 (1985).

Thurston, G.D. and J.D. Spengler. A multivariate assessment of meteorological influences on inhalable particle source impacts. J. Clim. and Appl. Met. 24: 1245-1256 (1985).

Ozkaynak, H., J.D. Spengler, A. Garsd and G.D. Thurston. Assessment of population health risks resulting from exposures to airborne particles. Aerosols: Second U.S.-Dutch International Symposium, Lewis Publishing Co., December 1985 (Peer Reviewed).

Ozkaynak, H., A.D. Schatz, G.D. Thurston, R.G. Isaacs and R.B. Husar. Relationships between aerosol extinction coefficients derived from airport visual range observations and alternative measures of airborne particle mass. J. Air Pollut. Control Assoc. 35: 1176-1185 (1985).

Thurston, G.D. and P.J. Lioy. Receptor modeling and aerosol transport. Atmos. Environ. 21: 687-698 (1987).

Ozkaynak, H., and G.D. Thurston. Associations between 1980 U.S. mortality rates and alternative measures of airborne particle concentration. Risk Analysis 7: 449-460 (1987).

Lioy, P.J., D. Spektor, G. Thurston, N. Bock, F. Speizer, C. Hayes and M. Lippmann. The design considerations for ozone and acid aerosol exposure and health investigation: The Fairview Lake Summer Camp-Photochemical Smog Case Study. Environ. Int'l. 13: 27-83 (1987).

Spektor, D.M., M. Lippmann, P.J. Lioy, G.D. Thurston, K. Citak, D.J. James, N. Bock, F.E. Speizer and C. Hayes. Effects of ambient ozone on respiratory function in active normal children. Am. Rev. Resp. Dis. 137: 313-320 (1988).

Lippmann, M. and G.D. Thurston. Exposure Assessment - Input into risk assessment. Arch. Environ. Health 43: 113-123 (1988).

Spektor, D.M., M. Lippmann, G.D. Thurston, P.J. Lioy, J. Stecko, G. O'Connor, E. Garshick, F.E. Speizer, and C. Hayes. Effects of ambient ozone on respiratory function in healthy adults exercising outdoors. Am. Rev. Resp. Dis. 138: 821-828 (1988).

Ito, K. and G.D. Thurston. Characterization and reconstruction of historical London England acidic aerosol concentrations. Environ. Health Presp. 79: 35-42 (1989).

Thurston, G.D., K. Ito, M. Lippmann, and C. Hayes. Re-examination of London mortality in relation to exposure to acidic aerosols during 1962-1973 winters. Environ. Health Persp. 79: 73-82 (1989).

Waldman, J.M., P.J. Lioy, G.D. Thurston and M. Lippmann. Spatial and temporal patterns in summertime sulfate aerosol acidity and neutralization within a metropolitan area. Atmos. Environ. 24B: 115-126 (1990).

Echalar, E., P. Artaxo and G.D. Thurston. Source apportionment of aerosols in the industrial area of Cubatao, Brazil. In: Aerosols: Science, Industry, Health and Environment (S. Masuda and K. Takahashi, Eds.), pp. 942-945, Pergamon Press (1990).

Spektor, D.M., V.A. Hofmeister, P. Artaxo, J. Brague, F. Echelar, D.P. Nogueria, C. Hayes, G.D. Thurston and M. Lippmann. Effects of heavy industrial pollution on respiratory function in the children of Cubatao, Brazil: A preliminary report. Environ. Health Persp. 94: 51-54 (1991).

Waldman, J.M., S.K.C. Liang, P.J. Lioy, G.D. Thurston, and M. Lippmann. Measurements of sulfate aerosol and its acidity in the SO2 source region of Chestnut Ridge, PA. Atmos. Environ. 25A: 1327-1333 (1991).

Spektor, D.M., G.D. Thurston, J. Mao, D. He, C. Hayes, and M. Lippmann. Effects of single and multiday ozone exposures on respiratory function in active normal children. Environ. Res. 55: 107-122 (1991).

Thurston, G.D. and H. Ozkaynak. Letters: Air pollution and mortality. Science 225: 382-383 (1992).

Thurston, G.D., J.F. Gorczynski Jr., P. Jaques, J. Currie and D. He. An automated sequential sampling system for particulate acid aerosols: Description, characterization and field sampling results. J. Exposure Anal. Environ. Epidemiol. 2: 415-428 (1992).

Thurston, G.D., K. Ito, P. Kinney and M. Lippmann. A multi-year study of air pollution and respiratory hospital admissions in three New York State metropolitan areas: Results for 1988 and 1989 summers. J. Exposure Anal. and Environ. Epidemiol. 2: 429-450 (1992).

Jaques, P.A., G.D. Thurston, P.L. Kinney, and J.E. Gorczynski, Jr. Precision of an ambient sequential acid aerosol sampling system. Appl. Occup. Environ. Hyg. 8: 313-316 (1993).

Kinney, P.L. and G.D. Thurston. Field evaluation of instrument performance: Statistical considerations. Appl. Occup. Environ. Hyg. 8: 267-271 (1993).

Ito, K., G.D. Thurston, C. Hayes, and M. Lippmann. Associations of London, England daily mortality with particulate matter, sulfur dioxide, and acidic aerosol pollution. Arch. Environ. Health 48: 213-220 (1993).

Thurston, G.D., K. Ito, M. Lippmann and D.V. Bates. Respiratory hospital admissions and summertime haze air pollution in Toronto, Ontario: Consideration of the role of acid aerosols. Environ. Res. 65: 271-290 (1994).

Thurston, G.D., J.E. Gorczynski, J.H. Currie, D. He, K. Ito, M. Lippmann, J. Waldman and P. Lioy. The nature and origins of acid aerosol pollution measured in Metropolitan Toronto, Ontario. Environ. Res. 65:254-270 (1994).

Kinney, P.L., Ito, K., and Thurston, G.D. A sensitivity analysis of mortality/PM10 associations in Los Angeles. Inhal. Toxicol. 7:59-69 (1995).

Thurston, G.D. and Kinney, P.L. Air pollution epidemiology: Considerations in time-series modeling. Inhal. Toxicol. 7:71-83 (1995).

Ito, K., Kinney, P., Christie, E., and Thurston, G.D. Variations in PM10 concentrations within two metropolitan areas and their implications to health effects analyses. Inhal. Toxicol. 7:735-745 (1995).

Waldman, J. M., Koutrakis, P., Allen, G.A., Thurston, G.D., Burton, R.M., and Wilson, W.E. Human Exposures to Particle Strong Acidity. Inhal. Toxicol. 7:657-670 (1995).

Thurston, G. Measurement methods to determine compliance with ambient air quality standards for suspended particles: Discussant. J. Air & Waste Manage. Assoc. 45:667-668 (1995).

Kinney, P.L., Thurston, G.D., and Raizenne, M. (1996) The effects of ambient ozone on lung function in children: a reanalysis of six summer camp studies. Environ. Health Perspect. 104:170-174.

Thurston, G.D. A critical review of PM10-mortality time-series studies. J. Exposure Anal. and Environ. Epidemiol. 6:3-22 (1996).

Ozkaynak, H., Xue, J., Zhou, H., Spengler, J.D., and Thurston, G.D. Intercommunity Differences in Acid Aerosol (H+)/Sulfate (SO4+) Ratios. J. Exposure Anal. and Environ. Epidemiol. 6:57-78 (1996).

Ito, K. and Thurston, G.D. Daily PM10/mortality associations: An investigation of at-risk subpopulations. J. Exposure Anal. and Environ. Epidemiol. 6:79-96 (1996).

Lippmann, M. and Thurston, G.D. Sulfate concentrations as an indicator of ambient particulate matter air pollution for health risk evaluations. J. Exposure Anal. and Environ. Epidemiol. 6:123-146 (1996).

Thurston, G. D., Lippmann, M., Scott, M.B., and; Fine, J.M. Summertime haze air pollution and children with asthma. Am. J. Respir. and Crit. Care Med. 155:654-660 (1997).

Thurston, G.D. Mandating the release of health research data: issues and implications. *Tulane Environmental Law Journal.* 11(2):331-354 (1998).

Thurston, G.D. The health benefits of the U.S. EPA clean air standards. *Pace Environmental Law Review*. 16:1 (1998)

Cassino, C., Ito, K., Bader, I., Ciotoli, C., Thurston, G., and Reibman, J. Cigarette smoking and ozone-associated emergency department use for asthma by adults in New York City. *Am. J. Respir. Crit. Care Med*.. 159:1773-1779 (1999).

Gwynn, R.C., Burnett, R.T., and Thurston, G.D. A time-series analysis of acidic particulate matter and daily mortality and morbidity in the Buffalo, New York, region. Environ. Health Perspect. 108(2):125-133 (2000).

Cifuentes, L., Borja-Aburto, V., Gouveia, N., Thurston, G., and Davis, D. Assessment of the urban air pollution benefits of global warming mitigation: Santiago, São Paulo, Mexico City, and New York City. Environ. Health Perspect. 109, Supplement 3:419-425 (2001).

Thurston, G.D. and Ito K. Epidemiological studies of acute ozone exposures and mortality. J. Expo. Anal. Environ. Epidemiol. 11(4):286-294 (2001).

Gwynn, R.C. and Thurston, G.D. The burden of air pollution: Impacts in racial minorities. Environ. Health Perspect. 109 Suppl 4:501-506 (2001).

Cifuentes, L., Borja-Aburto, V.H., Gouveia, N., Thurston, G., and Davis, D.L. Climate change. Hidden health benefits of greenhouse gas mitigation. Science 293(5533):1257-1259 (2001).

Pope, C.A. III, Burnett, R.T., Thun, M.J., Calle, E.E., Krewski, D., Ito, K., and Thurston, G.D. Lung cancer, cardiopulmonary mortality and long-term exposure to fine particulate air pollution. J. Am. Med. Assoc. (JAMA) 287(9):1132-1141 (2002).

Chen LC, Thurston G. World Trade Center Cough. Lancet. 2002 Dec;360 Suppl:s37-38.

Thurston GD, Chen LC. Risk communication in the aftermath of the World Trade Center disaster. Am J Ind. Med. Dec;42(6):543-4 (2002).

De Leon SF, Thurston GD, Ito K. Contribution of respiratory disease to nonrespiratory mortality associations with air pollution. Am J Respir Crit Care Med. Apr 15;167(8):1117-23 (2003).

Pope CA, Burnett R, Thurston, GD, Thun M, Calle E, Krewski, D, Godleski, J. Cardiovascular Mortality and Long-Term Exposure to Particulate Air Pollution: Epidemiological Evidence of General Pathophysiological Pathways of Disease. Circulation Jan 6;109 (1):71-7 (2004).

Landrigan PJ, Lioy PJ, Thurston G, Berkowitz G, Chen LC, Chillrud SN, Gavett SH, Georgopoulos PG, Geyh AS, Levin S, Perera F, Rappaport SM, Small C; NIEHS World Trade Center Working Group. Health and environmental consequences of the World Trade Center disaster. Environ Health Perspect. May;112(6):731-9 (2004).

Ito K, De Leon S, Thurston GD, Nadas A, Lippmann M. Monitor-to-monitor temporal correlation of air pollution in the contiguous US. J Expo Anal Environ Epidemiol. Jun:16 (2004).

Ito K , Xue N, Thurston G. (2004). Spatial variation of $_{PM2.5}$ chemical species and source-apportioned mass concentrations in New York City. Atmos. Environ. 38: 5269–5282.

Lall R, Kendall M, Ito K, Thurston G. Estimation of historical annual $_{PM2.5}$ exposures for health effects assessment. Atmos. Environ. V38:31, pp. 5217-5226 (2004).

Maciejczyk, PB, Offenberg, JH, Clemente J, Blaustein M, Thurston G., Chen LC. Ambient pollutant concentrations measured by a mobile laboratory in South Bronx, NY. Atmospheric Environment. V38:31, pp. 5295-5304 (2004).

Restrepo C, Zimmerman R, Thurston G, Clemente J, Gorczynski J, Zhong M, Blaustein M, and Chen LC. A comparison of ground-level air quality data with New York State Department of Environmental Conservation monitoring stations data in South Bronx, New York. Atmospheric Environment. V38:31, pp. 5283-5294 (2004).

Trasande L, and Thurston, GD. The role of air pollution in asthma and other pediatric morbidity. J. of Allergy & Clinical Immunol. Apr;115(4):689-99 (2005).

Krewski D, Burnett R, Jerrett M, Pope CA, Rainham D, Calle E, Thurston G, Thun M. Mortality and long-term exposure to ambient air pollution: ongoing analyses based on the American Cancer Society cohort. J Toxicol. Environ Health A. Jul 9-23;68(13-14):1093-109 (2005).

Jerrett M, Burnett RT, Ma R, Pope CA 3rd, Krewski D, Newbold KB, Thurston G, Shi Y, Finkelstein N, Calle EE, Thun MJ. Spatial analysis of air pollution and mortality in Los Angeles. Epidemiology. 2005 Nov;16(6):727-36.

Krewski D, Jerrett M, Burnett RT, Ma R, Hughes E, Shi Y, Turner MC, Pope CA 3rd, Thurston G, Calle EE, Thun MJ, Beckerman B, DeLuca P, Finkelstein N, Ito K, Moore DK, Newbold KB, Ramsay T, Ross Z, Shin H, Tempalski B. Extended follow-up and spatial analysis of the American Cancer Society study linking particulate air pollution and mortality. Res Rep Health Eff Inst. 2009 May;(140):5-114

Thurston GD, Ito K, Mar T, Christensen WF, Eatough DJ, Henry RC, Kim E, Laden F, Lall R, Larson TV, Liu H, Neas L, Pinto J, Stolzel M, Suh H, Hopke PK. Workgroup report: workshop on source apportionment of particulate matter health effects--intercomparison of results and implications. Environ Health Perspect. 2005 Dec;113(12):1768-74.

Ito K, Christensen WF, Eatough DJ, Henry RC, Kim E, Laden F, Lall R, Larson TV, Neas L, Hopke PK, Thurston GD. PM source apportionment and health effects: 2. An investigation of intermethod variability in associations between source-apportioned fine particle mass and daily mortality in Washington, DC. J Expo Sci Environ Epidemiol. 2006 Jul;16(4):300-10.

Mar TF, Ito K, Koenig JQ, Larson TV, Eatough DJ, Henry RC, Kim E, Laden F, Lall R, Neas L, Stolzel M, Paatero P, Hopke PK, Thurston GD. PM source apportionment and health effects. 3. Investigation of inter-method variations in associations between estimated source contributions of PM(2.5) and daily mortality in Phoenix, AZ. J Expo Sci Environ Epidemiol. 2006. Jul;16(4):311-20.

Hopke PK, Ito K, Mar T, Christensen WF, Eatough DJ, Henry RC, Kim E, Laden F, Lall R, Larson TV, Liu H, Neas L, Pinto J, Stolzel M, Suh H, Paatero P, Thurston GD., PM source apportionment and health effects: 1. Intercomparison of source apportionment results. J Expo Sci Environ Epidemiol. 2006 May;16(3):275-86.

Lall R and Thurston G. (2006). Identifying and quantifying transported vs. local sources of New York City $PM_{2.5}$ fine particulate matter air pollution. Atmospheric Environment, 40: S333–S346.

Ito K, Thurston GD, Silverman RA. Characterization of PM2.5, gaseous pollutants, and meteorological interactions in the context of time-series health effects models. J Expo Sci Environ Epidemiol. 2007 Dec;17 Suppl 2:S45-60.

Kim JY, Burnett RT, Neas L, Thurston, G.D., Schwartz J, Tolbert PE, Brunekreef B, Goldberg MS, Romieu I. Panel discussion review: session two--interpretation of observed associations between multiple ambient air pollutants and health effects in epidemiologic analyses. J Expo Sci Environ Epidemiol. 2007 Dec;17 Suppl 2:S83-9.

Ross Z, Jerrett M, Ito K, Tempalski, Thurston G. A land use regression for predicting fine particulate matter concentrations in the New York City region. 2007. Atmospheric Environment. 41: 2255-2269.

Jerrett M, Newbold KB, Burnett RT, Thurston G., Lall R., Pope C. A. III, Ma R, De Luca P, Thun M., Calle J, Krewski D. Stoch. Environ. Res. Risk Assess. Geographies of uncertainty in the health benefits of air quality improvements. 2007. Volume 21, No. 5: 511-522.

Ito K, Thurston GD, Silverman RA. Characterization of $PM_{2.5,}$ gaseous pollutants, and meteorological interactions in the context of time-series health effects models. J Expo Sci Environ Epidemiol. 2007 Dec;17 Suppl 2:S45-60.

Bell ML, Davis DL, Cifuentes LA, Krupnick AJ, Morgenstern RD, Thurston GD. Ancillary human health benefits of improved air quality resulting from climate change mitigation. Environ Health. 2008 Jul 31;7:41.

Thurston GD, Bekkedal MY, Roberts EM, Ito K, Arden Pope C 3rd, Glenn BS, Ozkaynak H, Utell MJ. (2009). Use of health information in air pollution health research: Past successes and emerging needs. J Expo Sci Environ Epidemiol. 2009 Jan;19(1):45-58. Epub 2008 Sep 10.

Jerrett M, Burnett RT, Pope C. A. III, Ito K, Thurston G., Krewski D., Shi Y., Calle J, Thun M., The Contribution of Long-Term Ozone Exposure to Mortality. NEJM. 360;11 March 12, 2009.

Ying Z, Kampfrath T, Thurston G, Farrar B, Lippmann M, Wang A, Sun Q, Chen LC, Rajagopalan S. Ambient particulates alter vascular function through induction of reactive oxygen and nitrogen species. Toxicol Sci. 2009 Sep;111(1):80-8. Epub 2009 Jan 30.

McKean-Cowdin R, Calle EE, Peters JM, Henley J, Hannan L, Thurston GD, Thun MJ, Preston-Martin S. Ambient air pollution and brain cancer mortality. Cancer Causes Control. 2009 Nov;20(9):1645-51. Epub 2009 Aug 15.

Smith KR, Jerrett M, Anderson HR, Burnett RT, Stone V, Derwent R, Atkinson RW, Cohen A, Shonkoff SB, Krewski D, Pope CA 3rd, Thun MJ, Thurston G. Public health benefits of strategies to reduce greenhouse-gas emissions: health implications of short-lived greenhouse pollutants. Lancet. 2009 Dec 19;374(9707):2091-103. Epub 2009 Nov 26.

Chen L; Hwang J; Lall, R; Thurston, G; Lippmann, M. Alteration of cardiac function in ApoE-/- mice by subchronic urban and regional inhalation exposure to concentrated ambient PM 2.5. Inhalation toxicology. 2010 Jun;22(7):580-92.

Spira-Cohen A, Chen LC, Kendall M, Sheesley R, Thurston GD. (2010). Personal exposures to traffic-related particle pollution among children with asthma in the South Bronx, NY. J Expo Sci Environ Epidemiol. 2010 Jul;20(5):446-56. Epub 2009 Oct 28.

Ito K, Mathes R, Ross Z, NádasA, Thurston G, and Matte T. Fine Particulate Matter Constituents Associated with Cardiovascular Hospitalizations and Mortality in New York City Environmental Health Perspectives (EHP). 2011 Apr; 119(4):467-73. [Epub Dec. 2010 ahead of print]

Lall R, Ito K, Thurston G. Distributed Lag Analyses of Daily Hospital Admissions and Source-Apportioned Fine Particle Air Pollution. Environmental Health Perspectives (EHP). 2011 Apr; 119(4):455-60. [Epub Dec. 2010 ahead of print].

Zhou J, Ito K, Lall R, Lippmann M, Thurston G. Time-series Analysis of Mortality Effects of Fine Particulate Matter Components in Detroit and Seattle. Environ Health Perspect. 2011 Apr;119(4):461-6. (Epub. Dec. 2010 ahead of print).

Spira-Cohen A, Chen LC, Kendall M, Lall R, Thurston GD. Personal Exposures to Traffic-Related Air Pollution and Acute Respiratory Health Among Bronx School Children with Asthma. Environ Health Perspect. 2011 Apr;119(4):559-65 (Epub. Dec. 2010 ahead of print)

Thurston G., Ito K, and Lall R. A Source Apportionment of U.S. Fine Particulate Matter Air Pollution. Atmospheric Environment. 2011Aug. 45(24): 3924-3936.

Brauer M, Amann M, Burnett RT, Cohen A, Dentener F, Ezzati M, Henderson SB, Krzyzanowski M, Martin RV, Van Dingenen R, van Donkelaar A, Thurston GD. (2012). Exposure Assessment for Estimation of the Global Burden of Disease Attributable to Outdoor Air Pollution. Environ Sci Technol. 2012 Jan 6. [Epub ahead of print] PMID: 22148428.

Restrepo CE, Simonoff JS, Thurston GD, Zimmerman R (2012) Asthma Hospital Admissions and Ambient Air Pollutant Concentrations in New York City. Journal of Environmental Protection, Vol. 3 No. 9, 2012, pp. 1102-1116.

Murray CJ, Vos T, Lozano R, et al. (2012) Disability-adjusted life years (DALYs) for 291 diseases

and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. Dec 15; 380(9859):2197-223.

Lim S, Vos T, Flaxman A, et al. (2012) A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. Dec 15;380(9859):2224-60.

Vos T, Flaxman AD, Naghavi M, Lozano R et al. (2012). Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet Dec 15; 380(9859): 2163-96.

Trasande L, Wong K, Roy A; Savitz D, and Thurston, G (2013) Exploring prenatal outdoor air pollution, birth outcomes and neonatal health care utilization in a nationally representative sample". J Expo Sci Environ Epidemiol. 2013 May-Jun;23(3):315-21. doi: 10.1038/jes.2012.124. Epub 2013 Jan 23.

Jerrett M, Burnett RT, Beckerman BS, Turner MC, Krewski D, Thurston G, Martin R, von Donkelaar A, Hughes E, Shi Y, Gapstur SM, Thun MJ, Pope CA 3rd. (2013) Spatial Analysis of Air Pollution and Mortality in California. Am J Respir Crit Care Med. Sep 1;188(5):593-9.

Murray CJ, Abraham J, Ali MK, Alvarado M, et al. (2013) US Burden of Disease Collaborators. The State of US Health, 1990-2010: Burden of Diseases, Injuries, and Risk Factors. JAMA. 2013 Aug 14;310(6):591-608.

Thurston GD. (2013). Mitigation Policy: Health Co-Benefits. Nature Climate Change. Oct. (3) 863-864.

Appendix B: Peer Reviewer Conflict of Interest Certification

ATTACHMENT E
CONFLICT OF INTEREST CERTIFICATION

Subcontractor:	Francine Laden
EPA Contract No.	EP-C-12-017
EPA Work Assignment No.:	2-16

In accordance with EPAAR 1552.209-71 (Organizational Conflicts of Interest), EPAAR 1552.209-73 (Notification of Conflicts of Interest Regarding Personnel), and this Agreement, Subcontractor makes the following certifications/warranties:

ORGANIZATIONAL AND PERSONAL CONFLICTS OF INTEREST

To the best of my knowledge and belief, no actual or potential organizational conflicts of interest exist. In addition, none of the individuals proposed for work under this work assignment/task order has any personal conflicts of interest.

OR:

To the best of my knowledge and belief, all actual or potential organizational and personal conflicts of interest have been reported to the ERG Project Manager. If applicable, attached is a letter disclosing the conflict of interest.

This is to certify that our personnel who perform work under this work assignment/task order, or relating to this work assignment/task order, have been informed of their obligation to report personal and organizational conflicts of interest.

Subcontractor recognizes its continuing obligation to search for, identify, and report to the ERG Project Manager any actual or potential organizational or personnel conflicts of interests that may arise during the performance of this work assignment/task order or work relating to this work assignment/task order.

Francine Laden
Authorized Signature

Francine Laden
Printed Name

Associate Professor
Title

March 26 2014
Date

ATTACHMENT E
CONFLICT OF INTEREST CERTIFICATION

Subcontractor:	James Russell Roberts
EPA Contract No.	EP-C-12-017
EPA Work Assignment No.:	2-16

In accordance with EPAAR 1552.209-71 (Organizational Conflicts of Interest), EPAAR 1552.209-73 (Notification of Conflicts of Interest Regarding Personnel), and this Agreement, Subcontractor makes the following certifications/warranties:

ORGANIZATIONAL AND PERSONAL CONFLICTS OF INTEREST

To the best of my knowledge and belief, no actual or potential organizational conflicts of interest exist. In addition, none of the individuals proposed for work under this work assignment/task order has any personal conflicts of interest.

OR:

To the best of my knowledge and belief, all actual or potential organizational and personal conflicts of interest have been reported to the ERG Project Manager. If applicable, attached is a letter disclosing the conflict of interest.

This is to certify that our personnel who perform work under this work assignment/task order, or relating to this work assignment/task order, have been informed of their obligation to report personal and organizational conflicts of interest.

Subcontractor recognizes its continuing obligation to search for, identify, and report to the ERG Project Manager any actual or potential organizational or personnel conflicts of interests that may arise during the performance of this work assignment/task order or work relating to this work assignment/task order.

Authorized Signature

James Russell Roberts
Printed Name

M.D.
Title

3/22/14
Date

ATTACHMENT E
CONFLICT OF INTEREST CERTIFICATION

Subcontractor:	George D. Thurston
EPA Contract No.	EP-C-12-017
EPA Work Assignment No.:	2-16

In accordance with EPAAR 1552.209-71 (Organizational Conflicts of Interest), EPAAR 1552.209-73 (Notification of Conflicts of Interest Regarding Personnel), and this Agreement, Subcontractor makes the following certifications/warranties:

ORGANIZATIONAL AND PERSONAL CONFLICTS OF INTEREST

To the best of my knowledge and belief, no actual or potential organizational conflicts of interest exist. In addition, none of the individuals proposed for work under this work assignment/task order has any personal conflicts of interest.

OR:

To the best of my knowledge and belief, all actual or potential organizational and personal conflicts of interest have been reported to the ERG Project Manager. If applicable, attached is a letter disclosing the conflict of interest.

This is to certify that our personnel who perform work under this work assignment/task order, or relating to this work assignment/task order, have been informed of their obligation to report personal and organizational conflicts of interest.

Subcontractor recognizes its continuing obligation to search for, identify, and report to the ERG Project Manager any actual or potential organizational or personnel conflicts of interests that may arise during the performance of this work assignment/task order or work relating to this work assignment/task order.

G D Thurston
Authorized Signature

George D. Thurston
Printed Name

Environmental Health Consultants
Title

3-17-14
Date